Analysis Report

Data request from the OPTN Liver and Intestinal Organ Transplantation Committee

October 11, 2016

Meeting: April 27, 2016 (In-person meeting)

This report was provided to HRSA by SRTR in support of ongoing policy consideration by the OPTN Liver and Intestinal Organ Transplantation Committee. The analysis described herein was conducted at the specific request of the OPTN Committee and does not represent a full or final analysis related to the policy issue under consideration.

Prepared By:

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Data Request ID#: LI2016_01

Timeline:

Request made: May 12, 2016
Analysis plan submitted: May 25, 2016
Analysis report submitted: October 11, 2016
Next committee meeting: October 24, 2016

Executive Summary

The OPTN Liver and Intestinal Organ Transplantation Committee (the Committee) requested simulation analysis of alternative liver allocation scenarios, including scenarios using 8 districts as the primary geographic unit of allocation with inclusion of 150-mile radius circles around the donor hospital awarding 3 additional MELD/PELD points to candidates within that circle. The Committee requested simulations comparing this 8-district model to 8-district models in which, for livers from adult donors, only candidates with MELD/PELD scores of 35, 29, or 25 would be included in district-wide allocation as a first step (after Status 1A/1B candidates). We refer to these MELD/PELD cutoffs as "thresholds" for district-wide allocation. In this report, these simulations are also compared with a simulation of current policy including Share 35.

- Variance in median allocation MELD/PELD at transplant notably decreases in all of the 8-district scenarios examined. Variance in transplant rate also decreases in all of the 8-district scenarios compared with the current policy scenario. Variance in overall mortality rate (pretransplant and posttransplant) remains unchanged between current policy and 8-district scenarios.

- All 8-district scenarios are estimated to decrease waitlist deaths somewhat, and they may slightly increase posttransplant deaths or perform similarly to current policy. When considering overall pretransplant and posttransplant deaths, each of the 8-district scenarios shows a modest decrease in overall deaths compared with current policy.
- Waitlist mortality rate is estimated to decrease modestly in all 8-district scenarios compared with current policy, from 8.3 deaths per 100 patient-years under current policy to 7.9 to 8.1 deaths per 100 patient-years in 8-district scenarios. Posttransplant mortality is estimated to increase modestly or remain constant in current policy compared with 8-district scenarios, from 9.2 deaths per 100 patient-years under current policy to 9.2 to 9.3 deaths per 100 patient-years in 8-district scenarios.
- Previous analysis projected a slightly decreased transplant rate in the 8-district no-threshold scenario, due to LSAM's reliance on historical acceptance rates which are low for non-local offers. While there is reason to believe that this acceptance behavior would change in practice, in the current analysis the MELD/PELD threshold scenarios are less impacted by this modeling effect. Transplant rates are projected to remain constant or decrease modestly in 8-district scenarios with M/P 35 and M/P 29 thresholds compared with current policy.
- The effect of the 8-district policy scenario on transport metrics appears to be moderated by the MELD/PELD thresholds, with transport distance and time estimates similar between current policy and higher MELD/PELD threshold scenarios.

Tables showing overall summary results for key metrics designated by the Committee are shown below. Full details of metrics are provided in the following report.

Table 1 Variance and Summative Metrics

Scenario	Variation in median allocation MELD/PELD at transplant	Overall (pre- and posttransplant) deaths prevented	Waitlist mortality rate (waitlist deaths per 100 person-years)	Posttransplant mortality rate (posttransplant deaths per 100 person-years)	Transplant rate (transplants per 100 person-years)
Current	6.2 (5.5, 6.9)	-- (baseline)	8.3 (8.1, 8.4)	9.2 (8.9, 9.3)	32.7 (32.3, 33.1)
8D 3P 150 Mi	2.9 (2.0, 3.6)	52.1 (25.8, 80.2)	7.9 (7.8, 7.9)	9.4 (9.3, 9.6)	31.4 (31.0, 31.8)
8D 3P 150 Mi M/P 35	3.6 (2.9, 4.1)	30.7 (-1.8, 62.2)	8.1 (8.0, 8.2)	9.2 (9.1, 9.4)	32.6 (32.2, 33.1)
8D 3P 150 Mi M/P 29	3.9 (3.2, 4.6)	51.5 (24.4, 69.8)	7.9 (7.8, 8.0)	9.3 (9.0, 9.4)	32.4 (31.9, 32.8)
8D 3P 150 Mi M/P 25	3.1 (2.4, 4.0)	56.0 (35.2, 74.2)	7.9 (7.8, 7.9)	9.3 (9.1, 9.5)	32.0 (31.5, 32.3)

All metrics reported as *mean (min, max)* across the 10 simulation iterations.

Table 2 Transport Metrics

Scenario	Median transport time (hours)	Median transport distance (miles)	% of organs flown	% of local transplants (in recovery DSA)	% of transplants in 150 Mi proximity circle
Current	1.7 (1.7, 1.7)	123.7 (121.4, 127.0)	54.4 (53.8, 54.8)	59.2 (58.3, 60.1)	n/a
8D 3P 150 Mi	1.8 (1.8, 1.8)	199.6 (195.0, 200.5)	68.3 (68.1, 68.7)	33.9 (33.3, 34.2)	49.4 (48.8, 49.9)
8D 3P 150 Mi M/P 35	1.7 (1.7, 1.7)	132.7 (128.5, 136.2)	56 (55.4, 56.7)	55.9 (55.3, 56.3)	59.9 (59.2, 60.3)
8D 3P 150 Mi M/P 29	1.7 (1.7, 1.7)	163.4 (160.6, 166.3)	60.4 (60.2, 61.0)	48.9 (48.3, 49.5)	55.3 (54.5, 55.8)
8D 3P 150 Mi M/P 25	1.8 (1.8, 1.8)	195.8 (192.5, 200.5)	65.9 (65.3, 66.4)	39.7 (38.8, 39.9)	49.6 (48.8, 49.9)

All metrics reported as *mean (min, max)* across the 10 simulation iterations.

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Data request

The full text of the OPTN data request to which this report responds is shown below:

Date Form Submitted to HRSA: 5/13/2016

Requesting Committee: Liver and Intestinal Organ Transplantation Committee

Date Committee Met: 4/27/2016 (Request finalized with Committee leadership 5/12/16)

Date of Next Meeting: TBD

OPTN staff member referring Committee's requests: Erick Edwards

Chair Approval? Yes

ANALYSES REQUESTED:

▪ Descriptive Statistical Requests (responsibility of OPTN contractor)

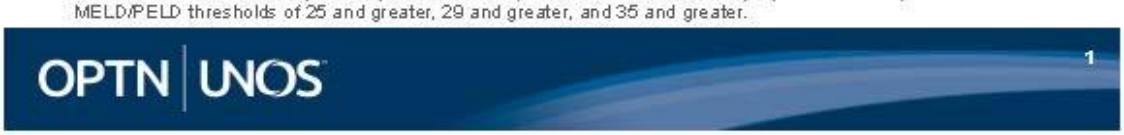
Background:
During the April 27, 2016 meeting, the Committee had a lengthy discussion about the redistricting project. Based on previous work requested by the Committee, a number of potential alternative distribution proposals were developed, including 4 or 8 optimized districts with priority points for candidates within 150/250 miles of the donor hospital, and 500 mile concentric circles, also with priority points for candidates closer to the donor hospital. The Committee requested that LSAM data on the potential impact of each proposal be generated. After extensively studying and discussing these data, the Redistricting Subcommittee brought forth a proposal for the Committee to consider, which was district-wide sharing for adult deceased donors based on 8 districts, with candidates within 150 miles of the donor hospital receiving 3 additional MELD/PELD points. In this proposal, candidates receiving the 3 additional priority points but who fell outside of the district would not be considered for offers within the first tier of distribution (district), but only in the next tier after exhausting the district-wide list (national offers).

The committee voted to send this proposal out for public comment with a modification such that for adult donors, after Status 1A/1B candidates, only candidates with MELD/PELD scores of 29 and above would receive the benefit of the district-wide share as a first step (no sharing threshold was set for pediatric donors).

To inform their decision about where to set this sharing threshold, the Committee asked the OPTN to review current data on distribution of MELD/PELD scores.

Strategic Goal or Committee Project Addressed:
Goal 2: Provide equity in access to transplants

Request:
Request for review of current data to determine the proportions of patients listed and transplanted at various MELD thresholds. Includes a snapshot of patients currently on the waitlist, and what proportion of transplants occur at MELD/PELD thresholds of 25 and greater, 29 and greater, and 35 and greater.



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▪ Inferential STATISTICAL REQUESTS (RESPONSIBILITY OF SRTR CONTRACTOR)

Data Request 1:

Background:
During the April 27, 2016 meeting, the Committee had a lengthy discussion about the redistricting project. Based on previous work requested by the Committee, a number of potential alternative distribution proposals were developed, including 4 or 8 optimized districts with priority points for candidates within 150/250 miles of the donor hospital, and 500 mile concentric circles, also with priority points for candidates closer to the donor hospital. The Committee requested that LSAM data on the potential impact of each proposal be generated. After extensively studying and discussing these data, the Redistricting Subcommittee brought forth a proposal for the Committee to consider, which was district-wide sharing for adult deceased donors based on 8 districts, with candidates within 150 miles of the donor hospital receiving 3 additional MELD/PELD points. In this proposal, candidates receiving the 3 additional priority points but who fell outside of the district would not be considered for offers within the first tier of distribution (district), but only in the next tier after exhausting the district-wide list (national offers).

The committee voted to send this proposal out for public comment with a modification such that for adult donors, after Status 1A/1B candidates, only candidates with MELD/PELD scores of 29 and above would receive the benefit of the district-wide share as a first step (no sharing threshold was set for pediatric donors). The Committee asked the SRTR to model the 8 district model with sharing set at various MELD/PELD thresholds, to study how much of the gains in disparity reduction would be lost when sharing at each threshold.

The attached proposed policy language notes how DSAs are to be assigned to districts, how additional proximity points are to be added, and the allocation sequences for adult and pediatric donors in the 8 District with Threshold policy.

Strategic Goal or Committee Project Addressed:
Goal 2: Provide equity in access to transplants

Request:
Request for Liver Simulated Allocation Modeling of 8-district redistricting scenarios using MELD/PELD thresholds for inclusion within the district level of allocation. The analysis should be focused on informing the questions:

1. Will 8 district sharing (as specified by the Committee) with MELD/PELD thresholds decrease geographic disparities in median MELD/PELD at transplant?
2. How does the impact on geographic disparities differ between 8 district sharing for all candidates as compared to 8 district sharing with thresholds?

Policy scenarios to be modeled include (also shown in tabular format below):

1. Current policy (Share 35)
2. 8 district sharing with proximity circles (in district) awarding 3 additional MELD/PELD points to candidates within a 150 mile radius of the donor hospital, with no sharing threshold
3. 8 district sharing with proximity circles (in district) awarding 3 additional MELD/PELD points to candidates within a 150 mile radius of the donor hospital, with a sharing threshold of MELD/PELD of 35 or greater
4. 8 district sharing with proximity circles (in district) awarding 3 additional MELD/PELD points to candidates within a 150 mile radius of the donor hospital, with a sharing threshold of MELD/PELD of 29 or greater
5. 8 district sharing with proximity circles (in district) awarding 3 additional MELD/PELD points to candidates within a 150 mile radius of the donor hospital, with a sharing threshold of MELD/PELD of 25 or greater

Study Population

The simulation used donor and candidate populations created by the LSAM donor and candidate generators. This software draws on patient data for transplant candidates listed on the liver waiting lists as of December 31, 2006, and candidates added to those waiting lists and organs donated between January 1, 2007 and December 31, 2011. The generators use these real patient data to create independent donor and candidate populations for each of the multiple LSAM iterations involved in simulating each allocation scenario.

Analytical Approach

As noted in the OPTN data request, the Committee requested evaluation of simulation results for liver allocation scenarios using 8 districts as the primary geographic unit of allocation with inclusion of 150-mile radius circles around the donor hospital awarding 3 additional MELD/PELD points to candidates within that circle. The Committee requested that SRTR undertake simulations comparing this 8-district model with models in which, for livers from adult donors, after Status 1A/1B candidates, only candidates with MELD/PELD scores of 25, 29, or 35 and above would receive the benefit of the district-wide share as a first step. In this report, these simulations are also compared with a simulation of current policy including Share 35. None of the simulated scenarios include HCC cap and delay or MELD Na policies.

The policy scenarios simulated to meet this request are shown in Table 3. Appendix C shows the district definitions for this analysis, including the DSAs included in each district. Appendix D shows the allocation order used for each scenario, as specified in the data request.

Table 3 Modeling scenarios used in LI2016_01 data request

Scenario	# of Districts	Proximity Circle Radius	# of Proximity MELD/PELD Points added	Sharing Threshold (Adult candidates with this MELD/PELD included in the first level of district allocation)
1	Current 11 regions	None	None	None
2	8	150	3	None
3	8	150	3	MELD/PELD 35 or greater
4	8	150	3	MELD/PELD 29 or greater
5	8	150	3	MELD/PELD 25 or greater

Research Questions

As specified in the OPTN data request, this analysis focuses on informing the following research questions:

1. Will 8-district sharing (as specified by the Committee) with MELD/PELD thresholds decrease geographic disparities in median MELD/PELD at transplant?
2. How does the impact on geographic disparities differ between 8-district sharing for all candidates compared with 8-district sharing with thresholds?

Outcomes

As specified in the OPTN data request, the outcomes assessed for each scenario include:

1. Variance in median allocation MELD/PELD at transplant
2. Variance in transplant rate
3. Waitlist mortality rate

a. Includes assessment of waitlist mortality rates for patients with MELD/PELD of <15, 15-24, 25-28, 29-34, and 35+

4. Posttransplant mortality rate
5. Transplant rate
    a. Includes assessment of waitlist mortality rates for patients with MELD/PELD of <15, 15-24, 25-28, 29-34, and 35+
6. Median transport time
7. Median transport distance
8. Proportion of organs flown
9. Proportion of transplants within the 150-mile radius proximity circle

All outcome metrics were assessed for the total population and for subgroup populations (Shown in Appendix B):

1. Pediatric (age younger than 18 years)
2. Gender (female)
3. Race/ethnicity (African American, Asian/Pacific Islander, Hispanic)

Results

Results for the simulated scenarios are reported primarily in the form of plots, with each plot displaying the values for a given metric across the 5 scenarios tested. Each scenario was simulated 10 times, and the plot displays the range of results across the 10 simulations as a vertical line extending from the minimum value to the maximum value found for that metric and scenario. A point along that line marks the mean value of the metric across the 10 iterations.

Disparity Metrics

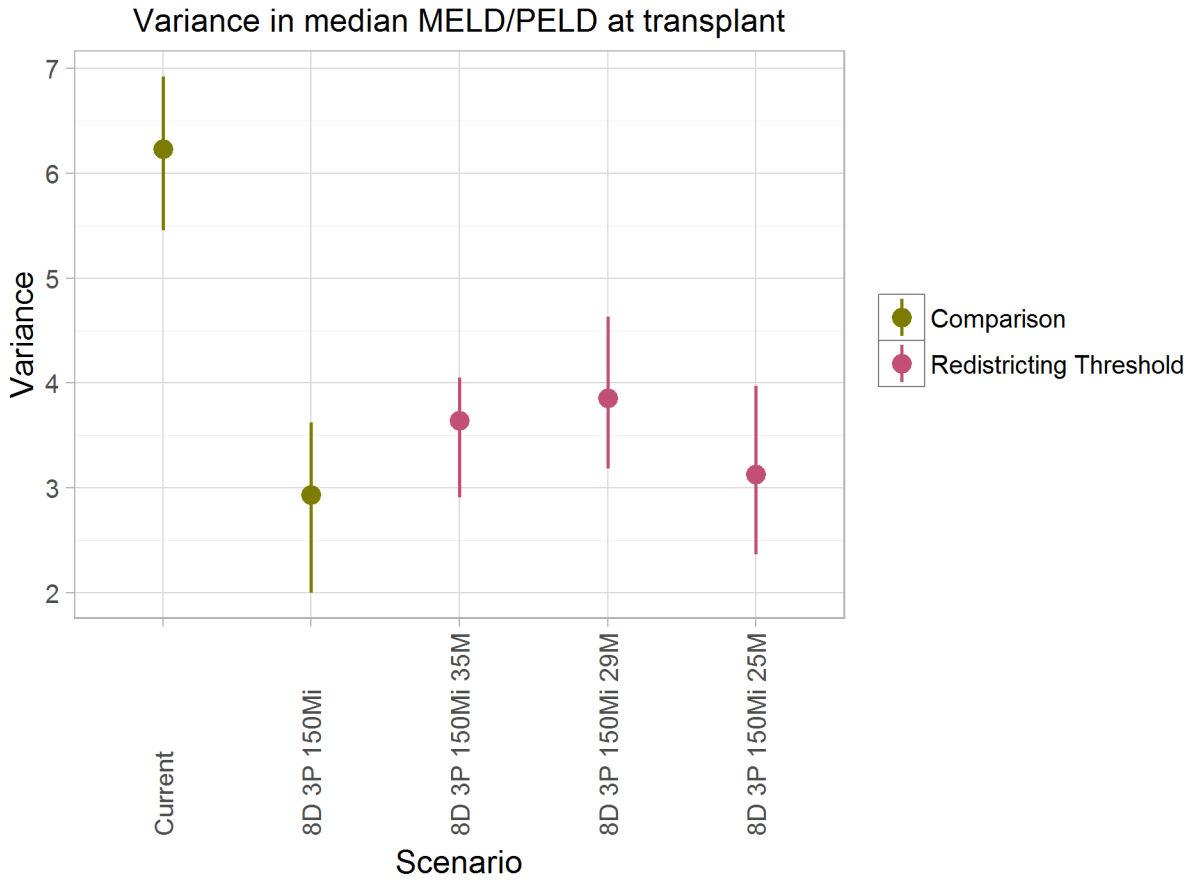

Figure 1 Variance in median allocation MELD/PELD at transplant by DSA

Figure 1 shows the variance in median allocation MELD/PELD at transplant by DSA for the current policy scenario and each of the 8-district scenarios (including scenarios with no threshold for sharing within district, and with sharing thresholds of MELD/PELD 35, 29, and 25).

Variance is a measure of disparity in a metric across DSAs. In this figure, a scenario with higher variance indicates that median MELD/PELD at transplant is more disparate across DSAs within that scenario, and a scenario with lower variance indicates that it is more similar across DSAs.

As shown in Figure 1, variance in median allocation MELD/PELD at transplant is highest in the current policy scenario (variance of 6.2, range 5.5 minimum to 6.9 maximum). Each of the 8-district scenarios notably decreases this variance compared with current policy. Among the 8-district scenarios, variance is lowest for the no-threshold scenario (variance of 2.9) and the M/P 25 scenario (variance of 3.1), followed by the M/P 35 scenario (variance of 3.6) and the M/P 29 scenario (variance of 3.9). Although variance in the M/P 29 scenario is the highest among the 8-district scenarios, it is still notably reduced compared with the current policy scenario.

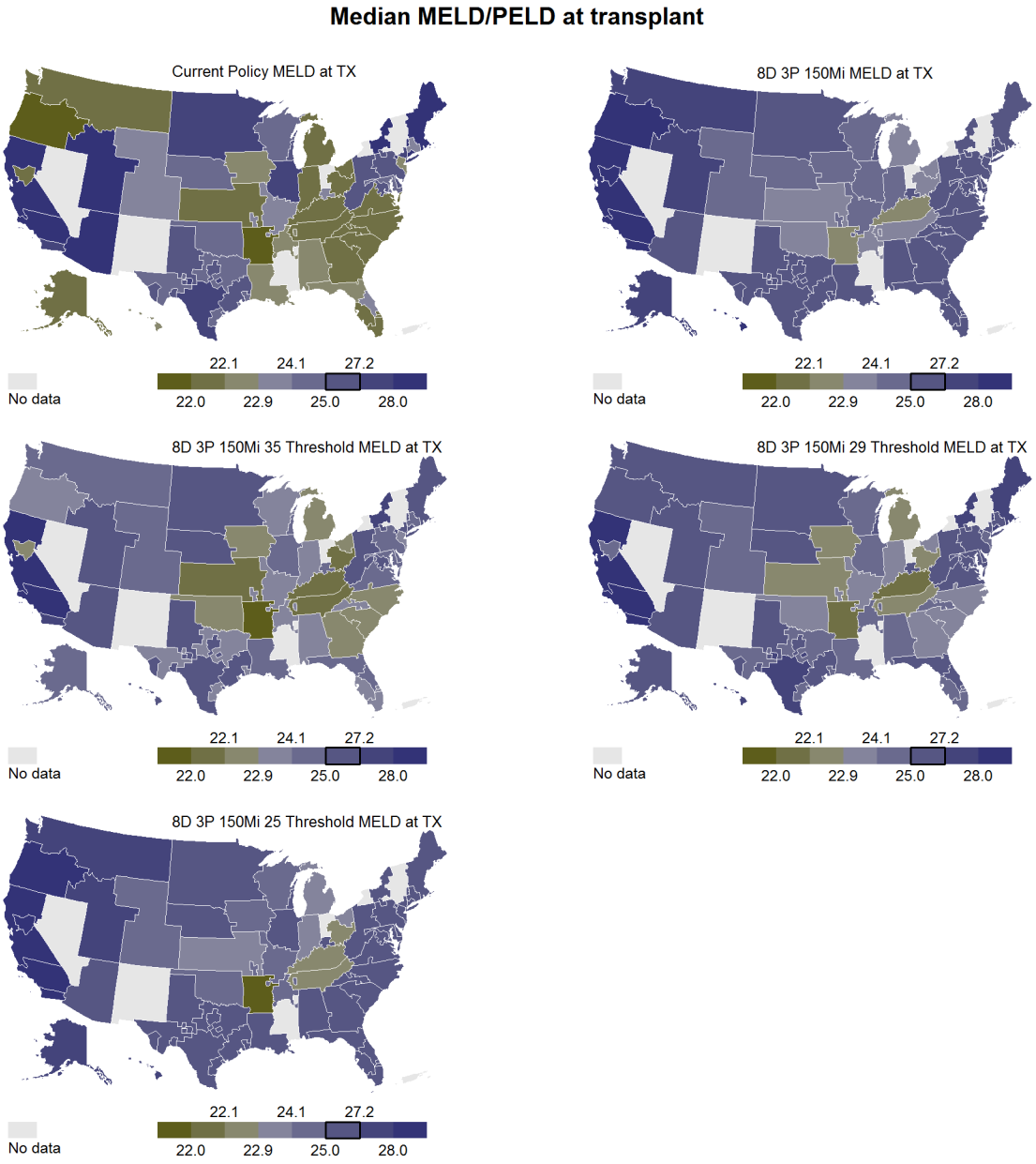

Figure 2 Maps of median MELD at transplant by DSA

Figure 2 displays maps of the United States, showing the median MELD/PELD at transplant for each DSA under each simulated scenario. The outlined box in the key below the maps shows the national median MELD/PELD at transplant value for each scenario. DSAs without active liver waitlist candidates during the LSAM cohort period are shown in grey.

The national median MELD/PELD at transplant is 25 in all 5 of the simulated scenarios. The current policy map in the upper left shows considerable variation in median MELD/PELD at transplant by DSA. The 8-district M/P 35 scenario shows less variation between DSAs, and variation decreases gradually as the M/P threshold decreases.

The 8-district no-threshold map shows the least variation, but variation in median MELD/PELD at transplant is decreased in any of the 8-district scenarios compared with the current policy simulation.

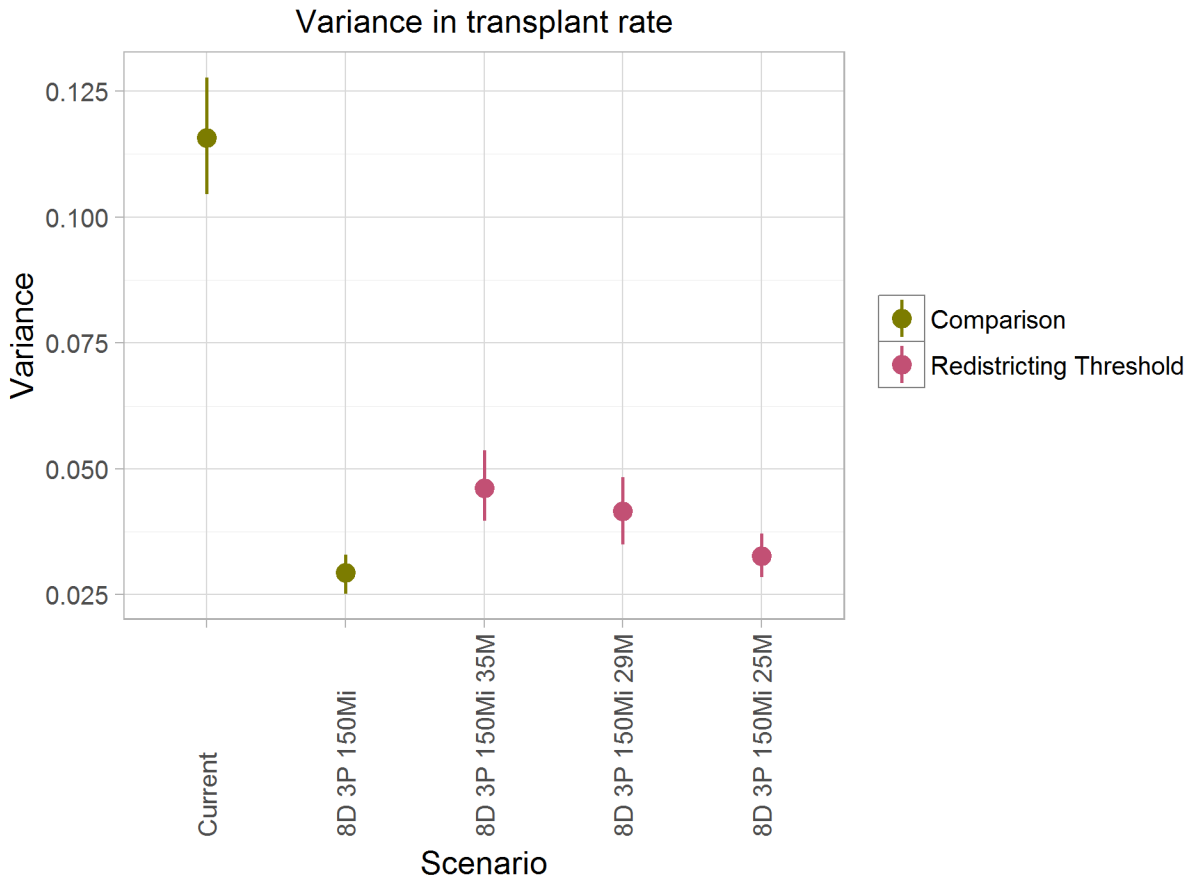

Figure 3 Variance in transplant rates

Figure 3 shows the variance in transplant rates across DSAs among the examined scenarios. Variance decreases notably with any 8-district scenario compared with the current policy scenario. Thus, in any of the 8-district scenarios, transplant rates are predicted to become more equal between DSAs.

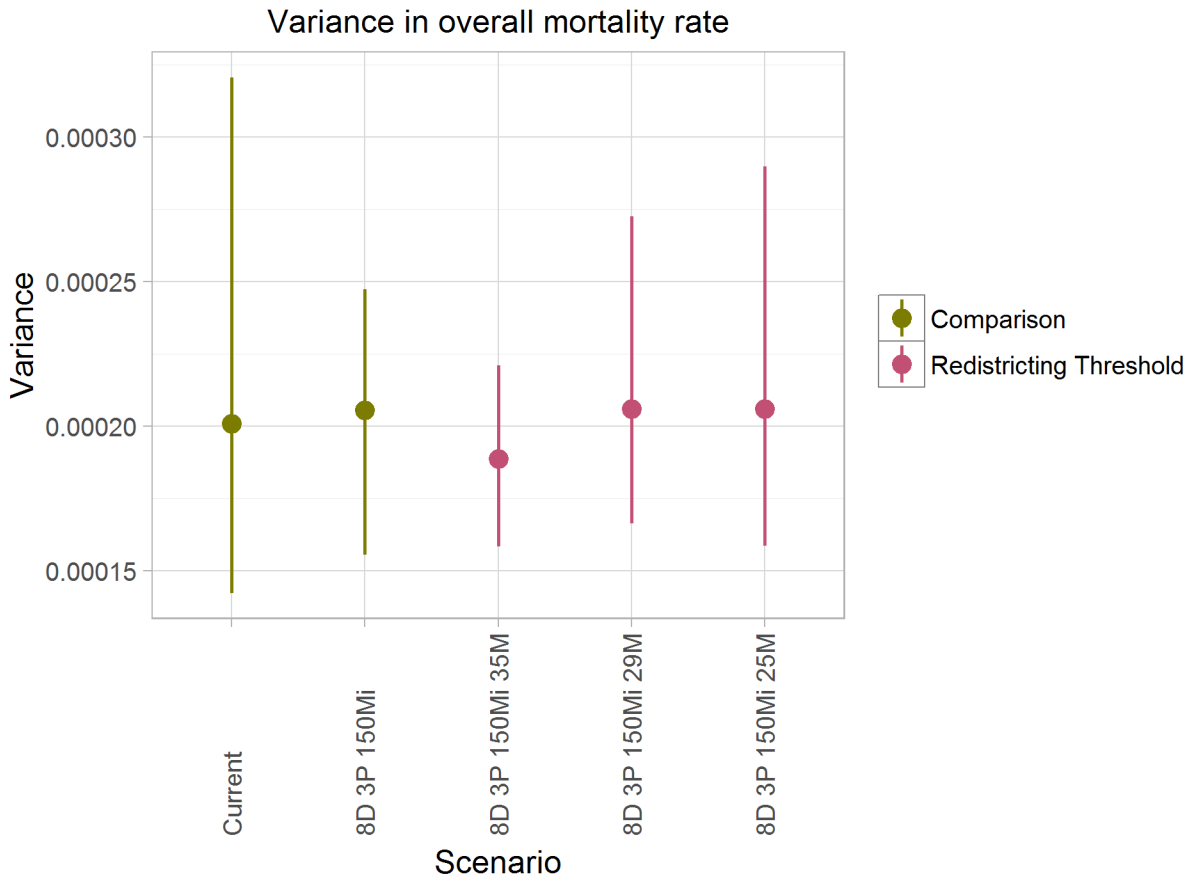

Figure 4 Variance in overall mortality rates (pretransplant and posttransplant)

Figure 4 shows the variance in overall pretransplant and posttransplant mortality rates by DSA in each of the simulated scenarios. There is no notable difference in variance in mortality rates in the current or the 8-district scenarios. Overall mortality is not predicted to change system wide.

Summative Metrics

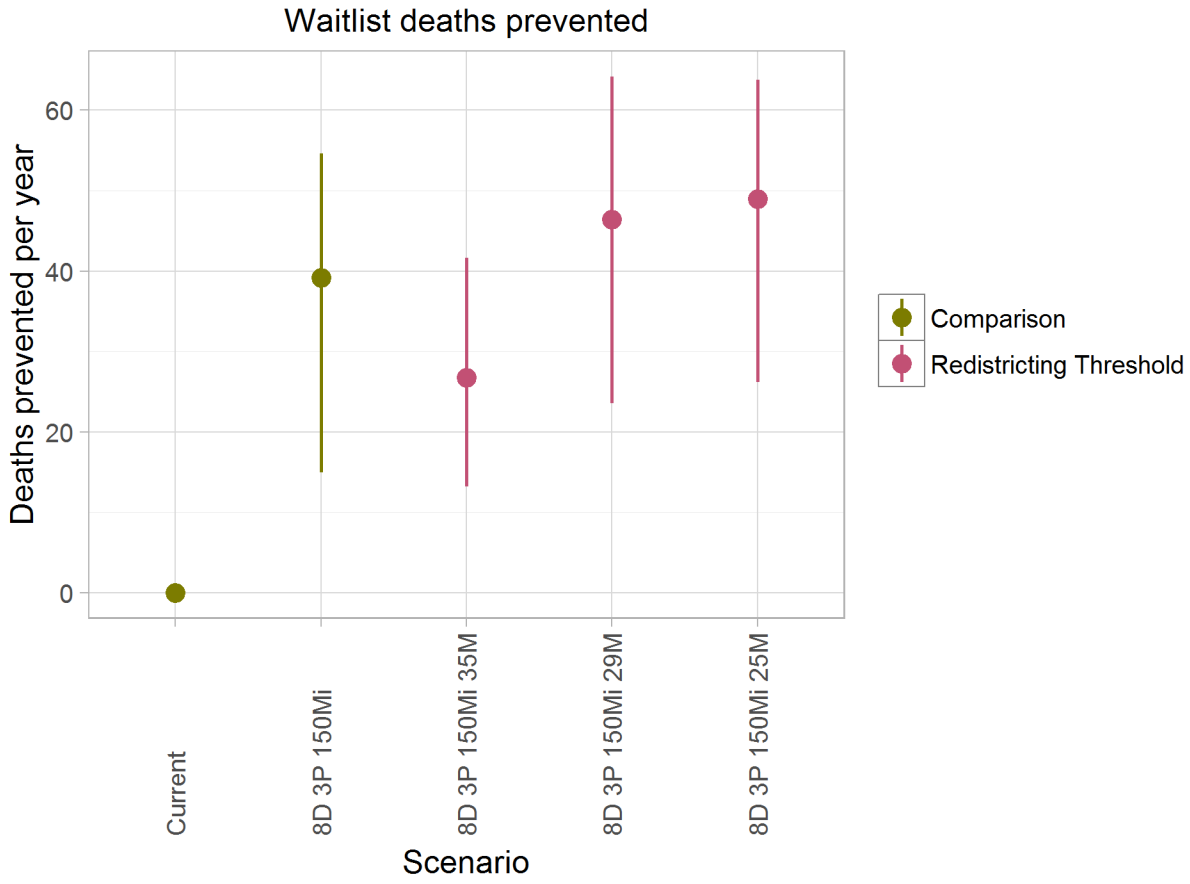

Figure 5 Waitlist deaths prevented per year

Figure 5 shows the number of waitlist deaths prevented per year in each of the simulated scenarios. Each 8-district scenario is predicted to decrease waitlist deaths somewhat. The mean number of waitlist deaths in the M/P 35 scenario is 26.8 fewer per year (range 13.2 to 41.6) than in the current scenario. The mean in the no-threshold scenario is 39.2 fewer (range 15.0 to 54.6), in the M/P 29 scenario is 46.4 fewer (range 23.6 to 64.2), and in the M/P 25 scenario is 49.0 fewer (range 26.2 to 63.8).

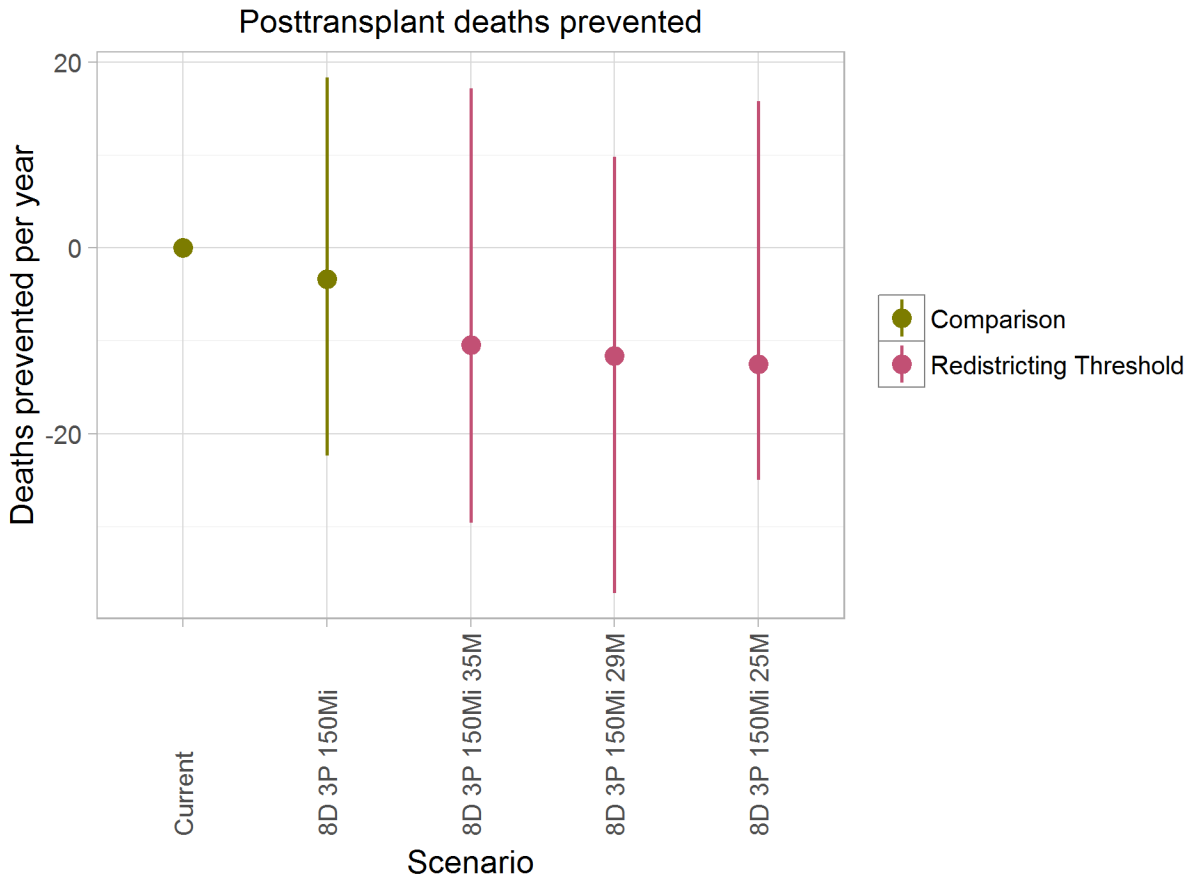

Figure 6 Posttransplant deaths prevented per year

Figure 6 shows posttransplant deaths prevented per year in each of the simulated scenarios. The range of results across the 10 simulations for the 8-district scenarios overlaps with the current policy scenario estimate. This indicates that 8-district scenarios may slightly increase posttransplant deaths or may perform similarly to current policy. Compared with the current policy scenario, the 8-district no-threshold scenario increases posttransplant deaths the least, with a mean of -3.3 deaths prevented (range -22.4 to 18.4). The mean number of deaths prevented in the 8-district M/P 35 scenario is -10.5 (range -29.6 to 17.2), in the M/P 29 scenario is -11.6 (range -37.2 to 9.8), and in the M/P 25 scenario -12.5 (range -25.0 to 9.8).

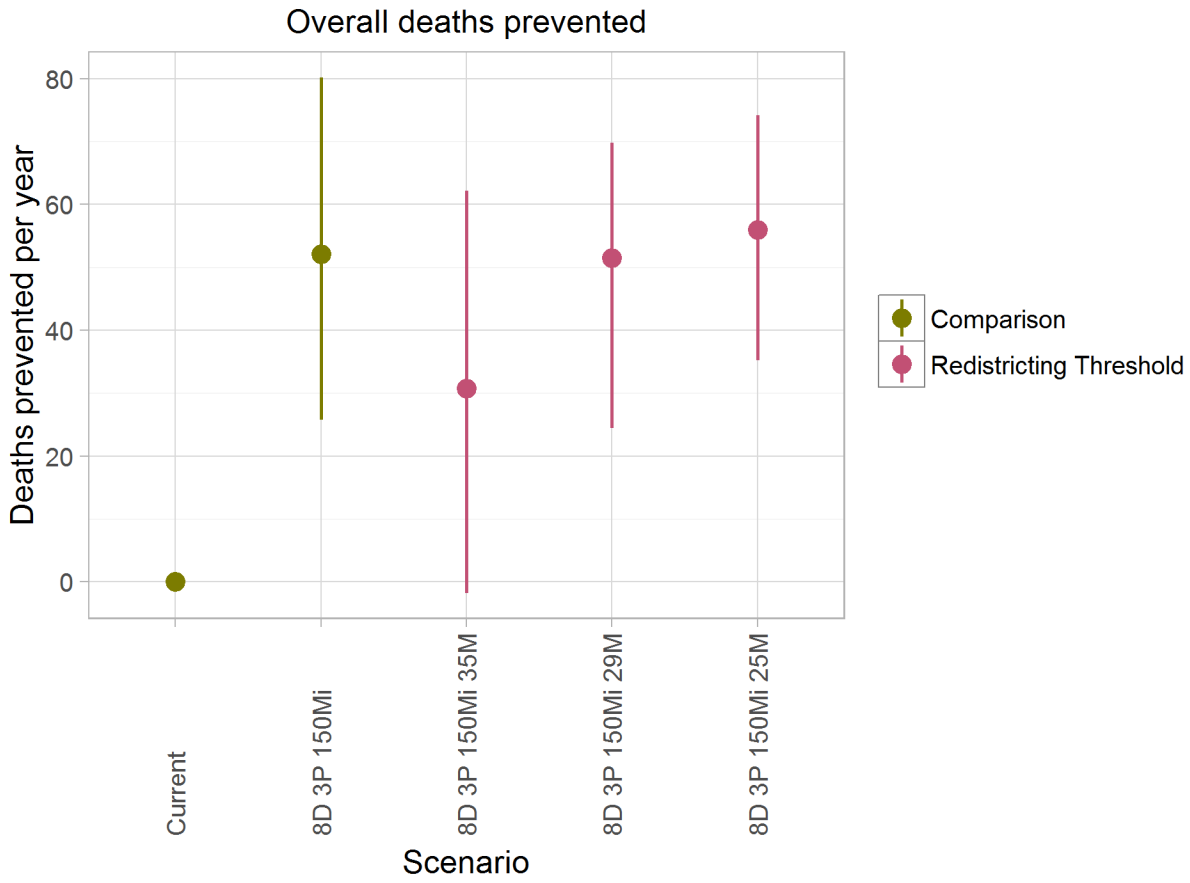

Figure 7 Overall deaths prevented per year

Figure 7 shows overall (pretransplant and posttransplant) deaths prevented per year in each of the simulated scenarios. Compared with the current policy scenario, each of the 8-district scenarios shows an increase in overall deaths prevented per year. The range of estimates across the 10 simulations for the 8-district M/P 35 scenario overlaps slightly with the current policy scenario, indicating a possible increase in deaths prevented per year in this scenario or no change from the current scenario.

Estimates indicate a mean of 52.1 pretransplant and posttransplant deaths prevented per year overall in the 8-district no-threshold scenario compared with current policy (range 25.8 to 80.2), a mean of 30.7 in the M/P 35 scenario (range -1.8 to 62.2), a mean of 51.5 in the M/P 29 scenario (range 24.4 to 69.8), and a mean of 56.0 in the M/P 25 scenario (range 35.2 to 74.2).

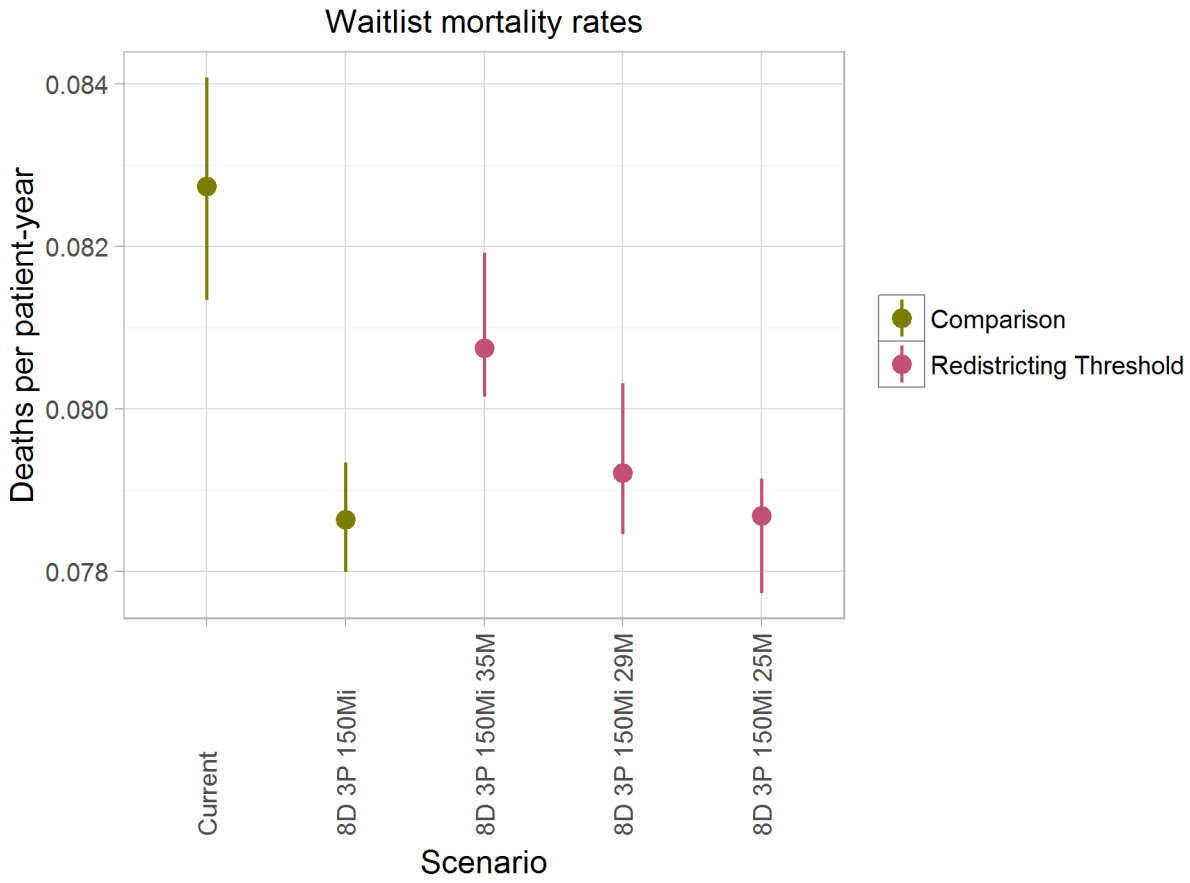

Figure 8 Waitlist mortality rates

Figure 8 shows waitlist mortality rates as deaths per patient-year on the waiting list for each of the simulated scenarios. The mean estimate for the current policy scenario is 0.083 deaths per patient-year, or 8.3 deaths per 100 patient-years. Waitlist mortality rate is predicted to decrease under 8-district scenarios. In the 8-district no-threshold scenario, the waitlist mortality rate decreases to 0.079, in the M/P 35 scenario to 0.081, in the M/P 29 scenario to 0.079, and in the M/P 25 scenario to 0.079.

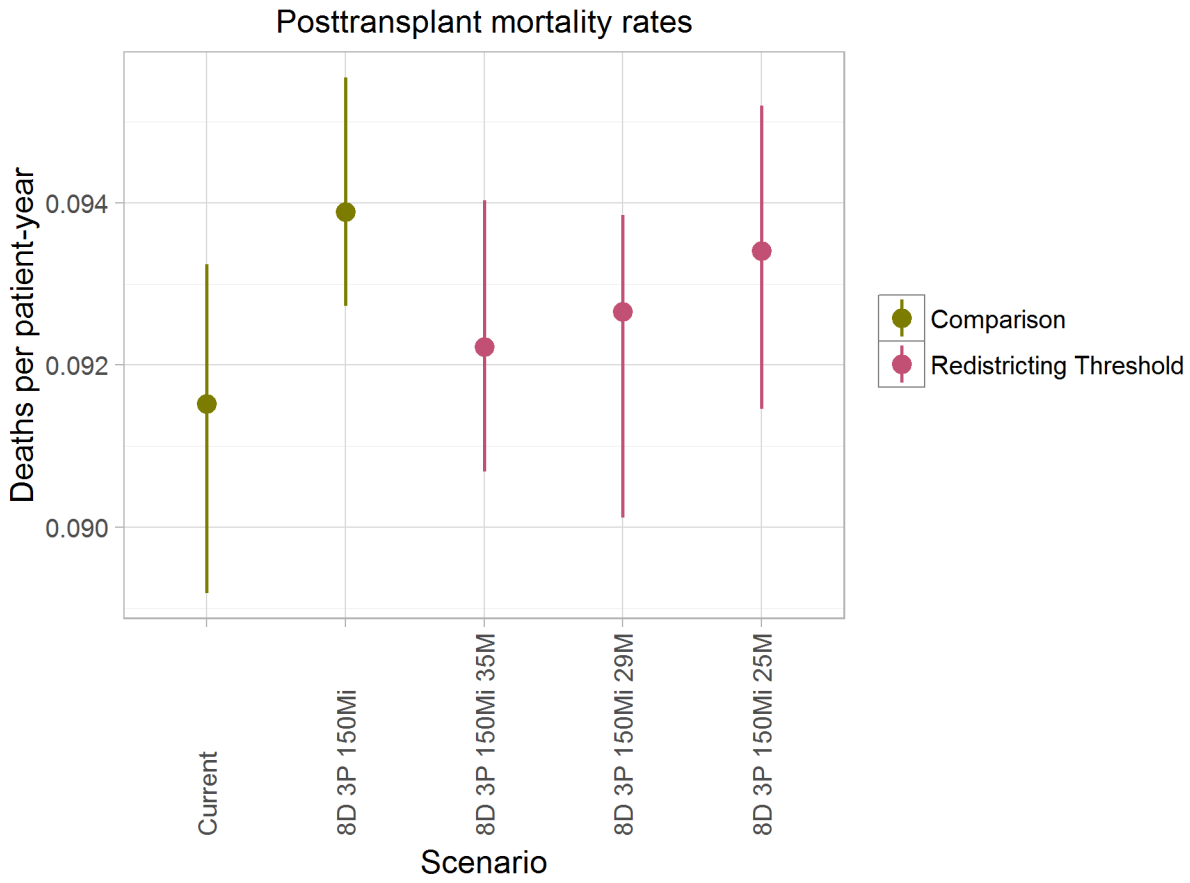

Figure 9 Posttransplant mortality rates

Figure 9 shows posttransplant mortality rates as deaths per patient-year for each of the simulated scenarios. The mean estimate for the current policy scenario is 0.092 deaths per patient-year, or 9.2 posttransplant deaths per 100 patient-years. Posttransplant mortality is predicted to increase slightly or remain consistent under 8-district scenarios, at 0.092 for the M/P 35 scenario, 0.093 for the M/P 29 scenario, 0.093 for the M/P 25 scenario, and 0.094 for the 8-district no-threshold scenario.

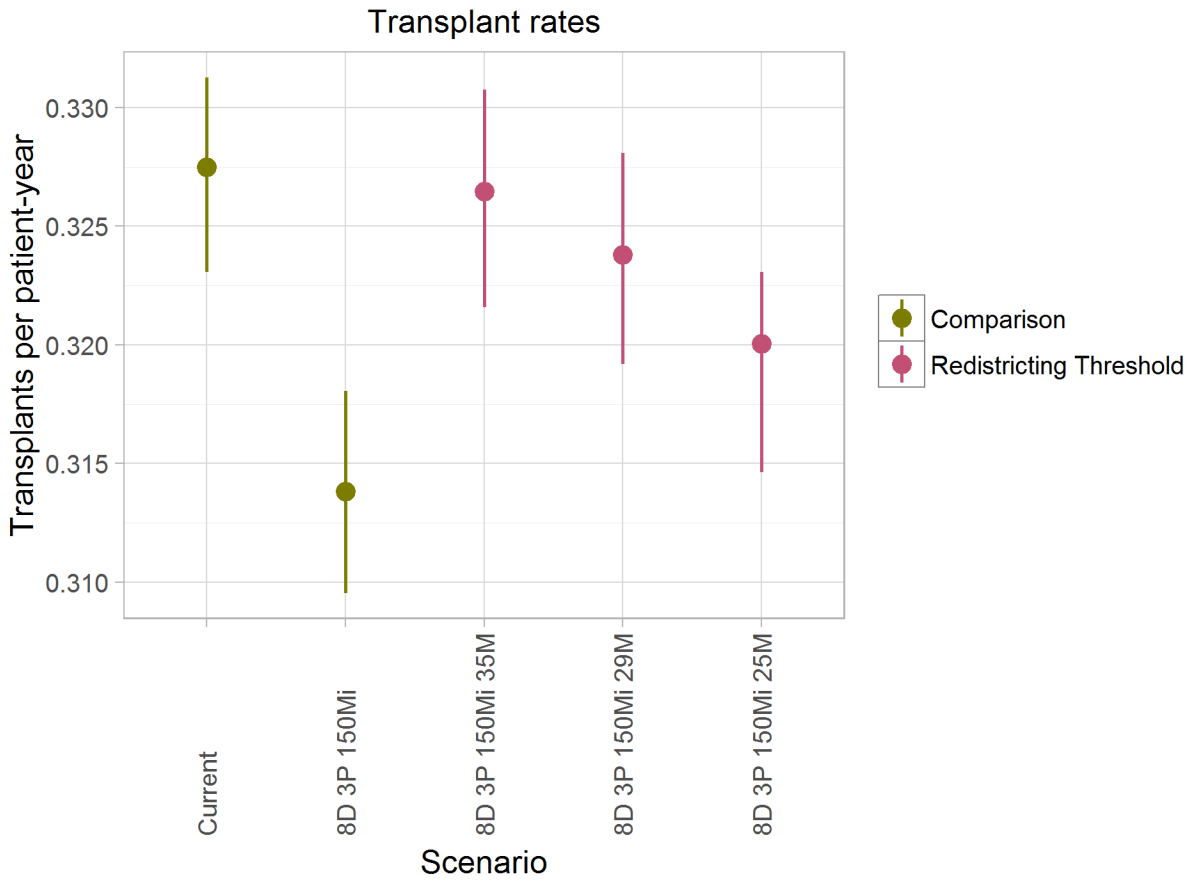

Figure 10 Transplant rates

Figure 10 shows transplant rates per patient-year in each of the simulated scenarios. The median estimate for the current policy scenario is 0.327 transplants per patient-year, or 32.7 transplants per 100 patient-years. The transplant rate is estimated to decrease slightly in the 8-district no-threshold scenario to 0.314 transplants per patient-year (31.4 transplants per 100 patient years). However, the effect on estimated transplant rates for 8-district scenarios with thresholds is less: an estimated 0.326 transplants per patient-year for the M/P 35 scenario, 0.324 for the M/P 29 scenario, and 0.320 for the M/P 25 scenario. Additionally, the 8-district M/P 35 threshold estimates overlap with the current policy estimates (range 0.322 to 0.331), indicating possibly no change between the current policy and the M/P 35 threshold scenario regarding transplant rates.

Importantly, LSAM estimates of transplant rates are based on historical acceptance behavior, including acceptance of local vs. non-local offers, and this is likely causing an underestimate of transplant rates in broader sharing scenarios. Under current practice, non-local offers are accepted at a substantially lower rate, because due to current local-first allocation policy, non-local offers usually imply lower-quality organs. This acceptance behavior may change under 8-district scenarios, which expand regional sharing. With more regional sharing, non-local offers would not necessarily represent lower-quality organs and would have a higher likelihood of acceptance. If this acceptance behavior changes as noted, transplant rates are not expected to decrease in practice.

Transport Metrics

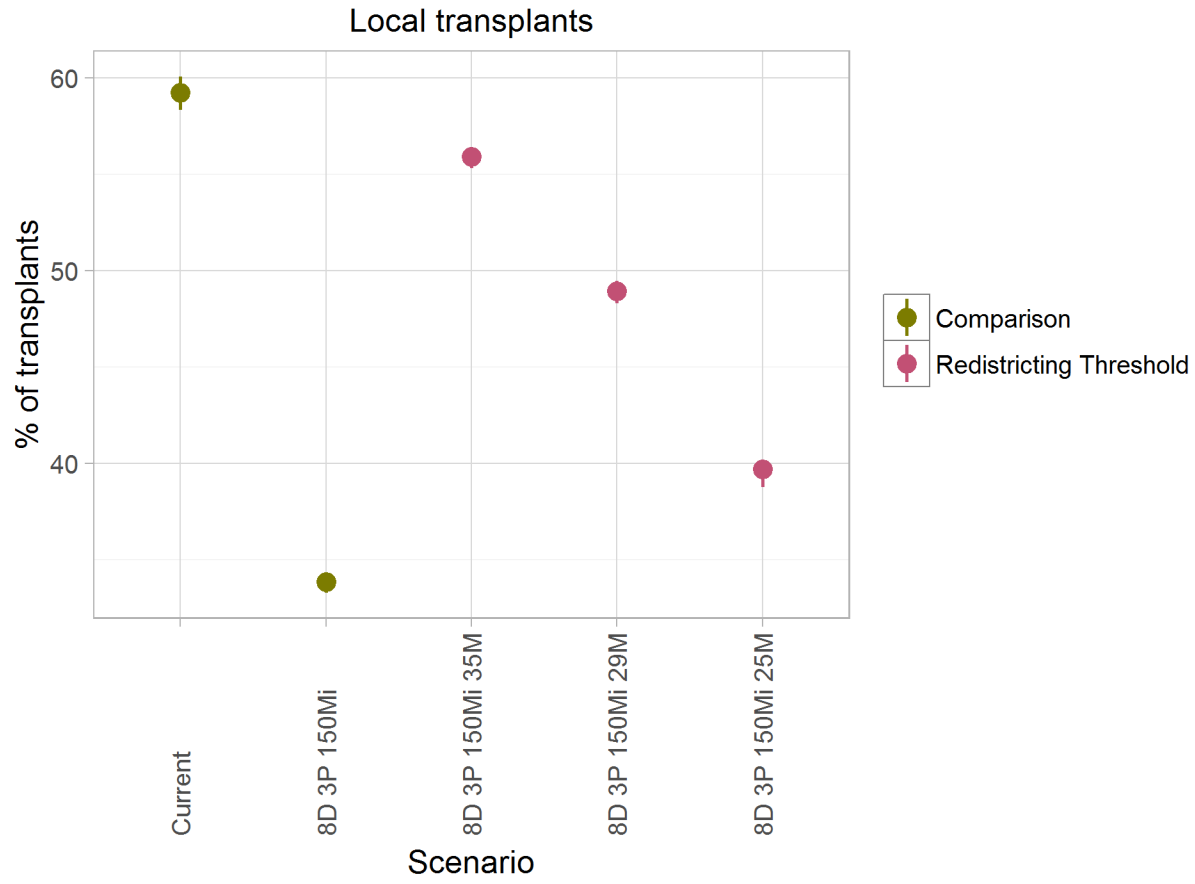

Figure 11 Percentage of transplants performed locally (within DSA)

Figure 11 shows the percentage of transplants performed locally (within the recovery DSA) in a year for each of the simulated scenarios. Note that this measure does not imply that the DSA was the first unit of allocation; the first unit of allocation for the 8-district scenarios was the district. (See details of the allocation order used in simulations in Appendix D.)

The mean estimate for the current policy scenario is 59.2% of transplants performed within the recovery DSA. This decreases only slightly in the 8-district M/P 35 scenario, with 55.9% of transplants performed locally. Decreasing M/P thresholds for broader sharing are associated with decreasing percentages of transplants performed in the local DSA, with 48.9% for the M/P 29 scenario, 39.7% for the M/P 25 scenario, and 33.9% for the 8-district no threshold scenario.

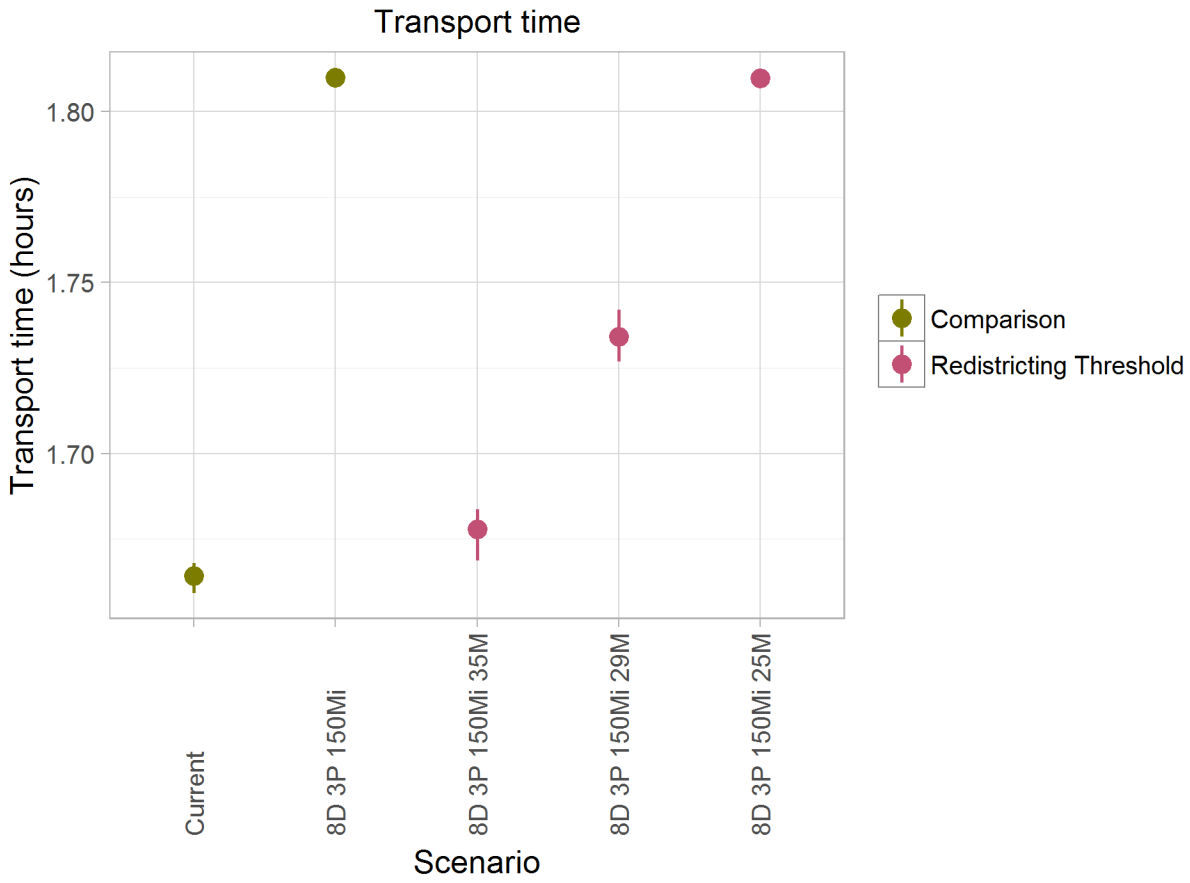

Figure 12 Median transport time (hours)

Figure 12 shows the median organ transport time in hours for each simulated scenario. In the current scenario, the median transport time is 1.66 hours. This increases very slightly in the 8-district M/P 35 scenario to 1.68 hours, to 1.73 hours in the M/P 29 scenario, to 1.81 hours in the M/P 25 scenario, and to 1.81 hours in the no-threshold scenario.

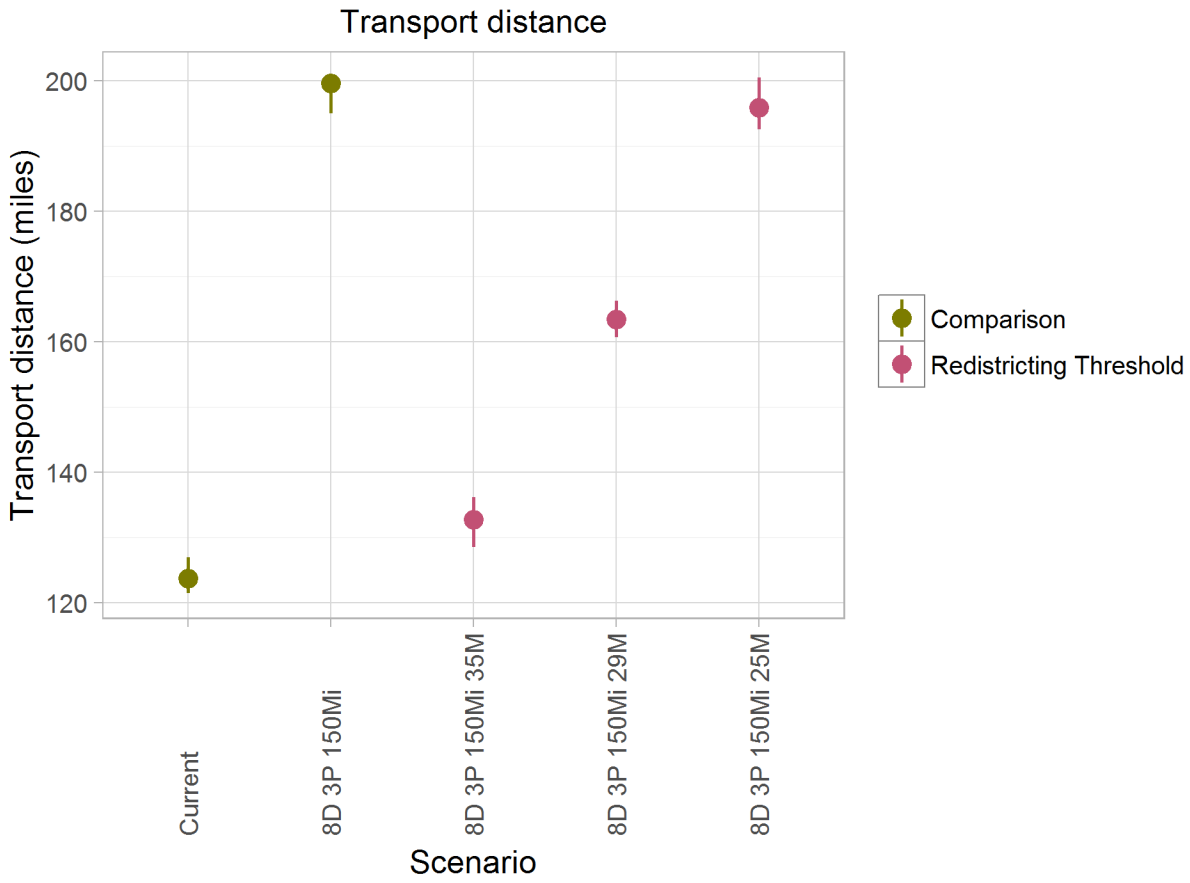

Figure 13 Median transport distance (miles)

Figure 13 shows the median transport distance in miles for each of the simulated scenarios. The pattern is similar to the pattern for median transport time. Median transport distance is 123.7 miles in the current scenario. The 8-district no-threshold scenario increases this to 199.6 miles. The higher the MELD/PELD threshold for district-wide sharing, the less the transport distance increases compared with the current scenario; the median transport distance increases to 132.7 miles in the M/P 35 scenario, to 163.4 miles in the M/P 29 scenario, and to 195.8 miles in the M/P 25 scenario.

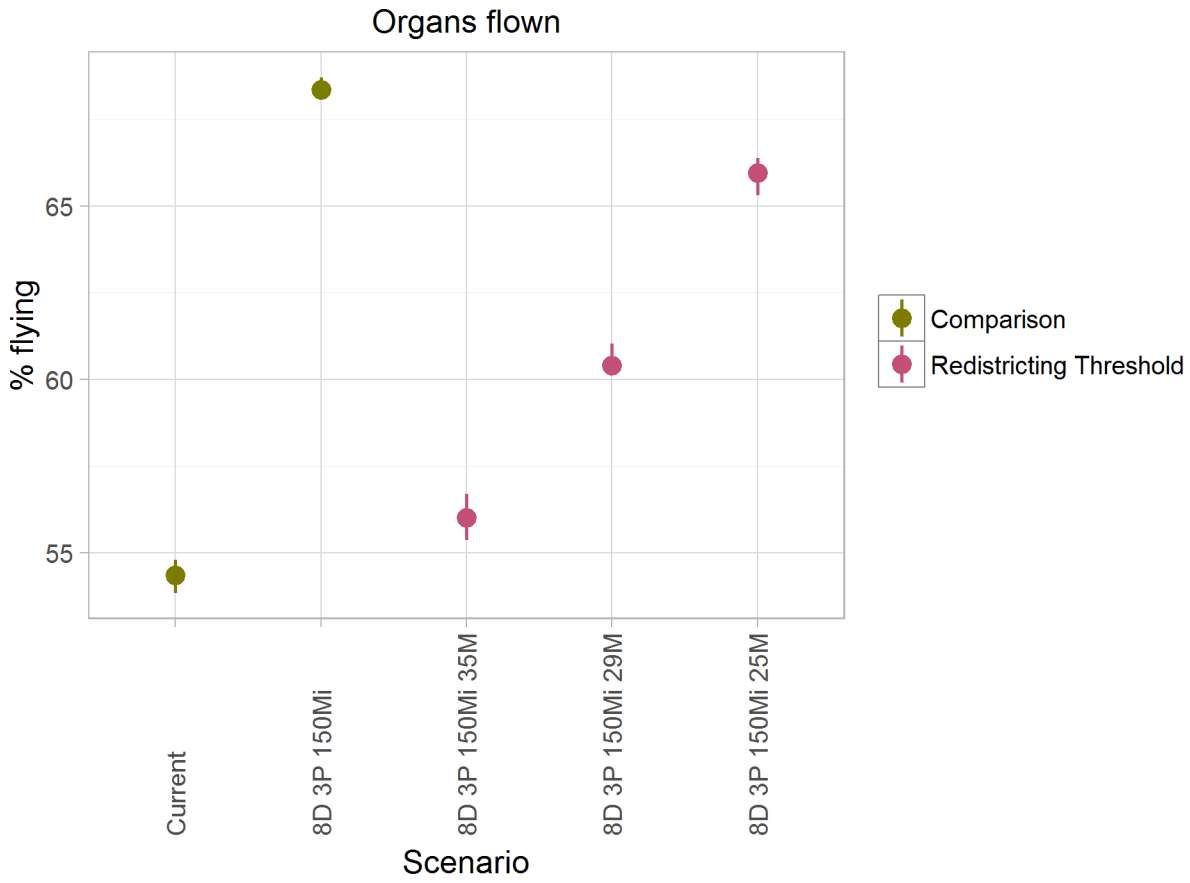

Figure 14 Percentage of organs flown

Figure 14 shows the estimated percentage of organs transported by air for each of the simulated scenarios. In the current scenario, 54.4% of organs are estimated to be flown. This percentage increases only slightly in the 8-district M/P 35 scenario to 56.0%, to 60.4% in the M/P 29 scenario, to 65.9% in the M/P 25 scenario, and to 68.3% in the no-threshold scenario.

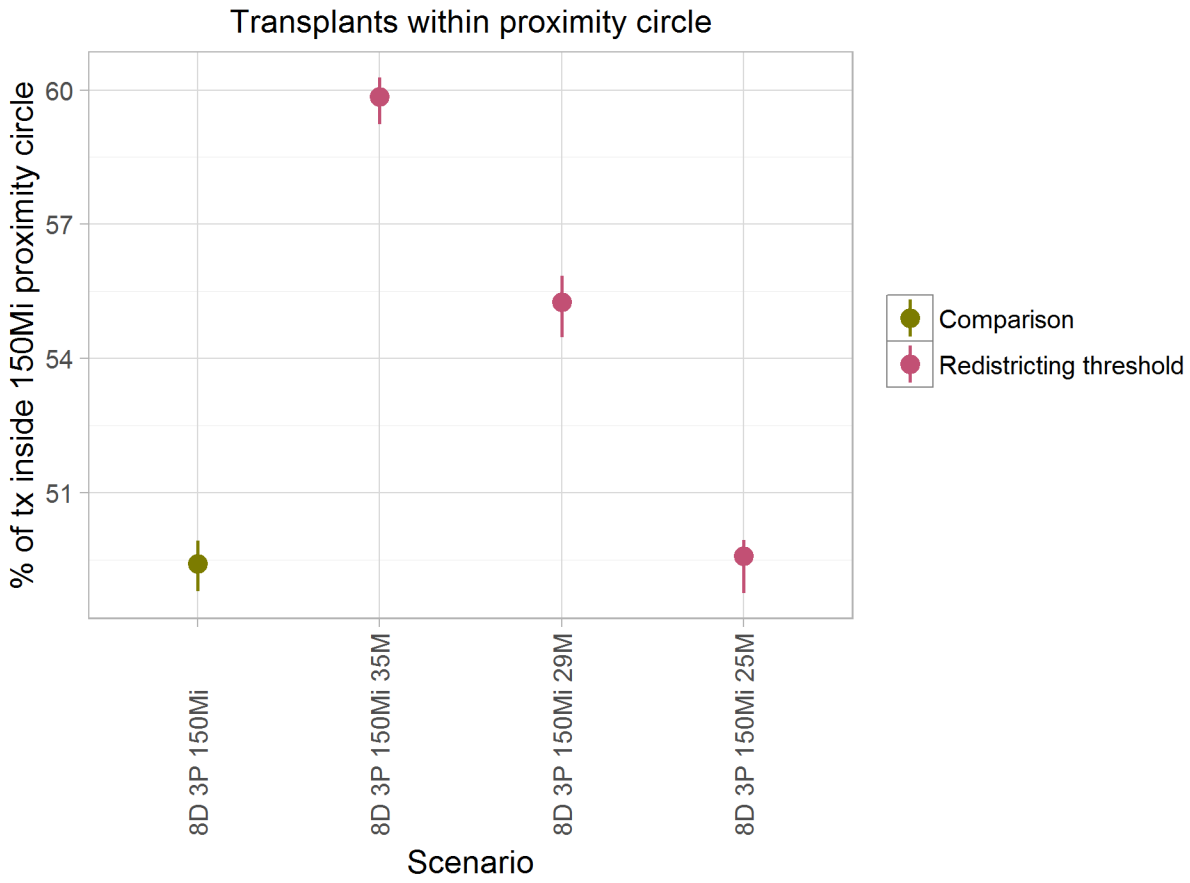

Figure 15 Percentage of transplants performed inside the 150-mile proximity point circle

Figure 15 shows the estimated percentage of transplants performed inside the 150-mile proximity point circle around the donor hospital for 8-district scenarios. In the 8-district no-threshold scenario, an estimated 49.4% of transplants are performed within the 150-mile proximity point circle. The percentage is similar in the M/P 25 scenario, at 49.6%. This percentage increases to 59.9% in the M/P 35 scenario and to 55.3% in the M/P 29 scenario.

Waitlist Mortality graphs by MELD/PELD subgroup

Figures 16 through 20 show waitlist mortality rates as deaths per patient-year on the waiting list for each of the simulated scenarios, by MELD/PELD scores of <15, 15-24, 25-28, 29-34, and 35+. The MELD/PELD cutoffs for these subgroups match the MELD/PELD threshold cutoffs for the scenarios assessed in this report (thresholds of M/P 35, 29, and 25).

Across all MELD/PELD subgroups, waitlist mortality is not projected to increase or decrease in 8-district scenarios compared with to the current policy scenario.

Figure 16 Waitlist mortality rates for MELD/PELD 35+

Figure 16 shows waitlist mortality rate for patients with MELD/PELD of 35 or greater for all simulated scenarios. Compared with waitlist mortality for other MELD/PELD subgroups it is highest overall for the M/P 35+ group, at 1.249 waitlist deaths per patient-year (124.9 deaths per 100 patient-years) under the current policy scenario. Waitlist mortality rate may decrease slightly for patients with M/P 35+ in 8-district scenarios compared with current policy. Estimated waitlist mortality rate is 1.202 per patient-year for the 8-district no-threshold scenario, 1.197 for the M/P 35 threshold scenario, 1.158 for the M/P 29 threshold scenario, and 1.182 for the M/P 25 threshold scenario. However, ranges of estimates overlap, indicating that there may be minimal difference between scenarios.

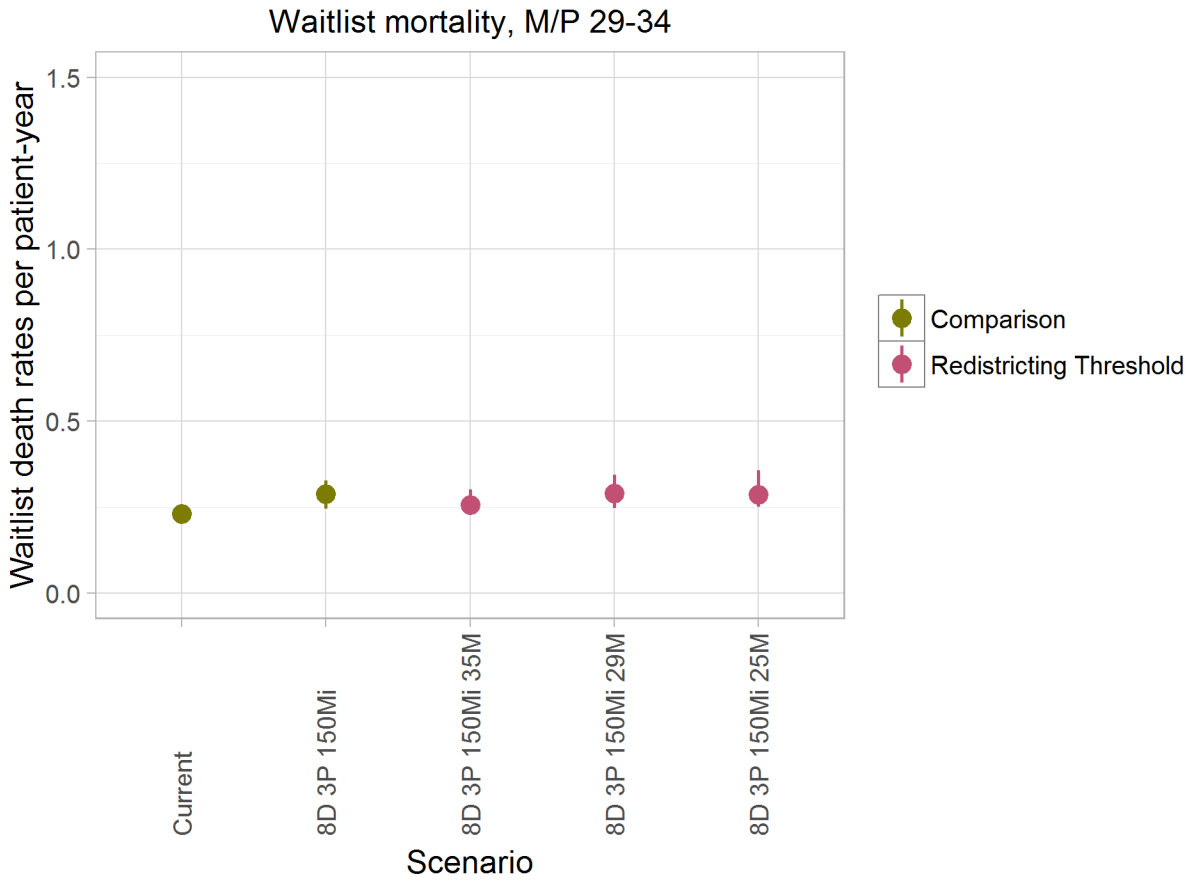

Figure 17 Waitlist mortality rates for MELD/PELD 29-34

Figure 17 shows waitlist mortality rate for patients with MELD/PELD 29-34 for all simulated scenarios. Waitlist mortality is lower overall for the M/P 29-34 group compared with the MELD/PELD 35+, and higher for the MELD/PELD 29-34 subgroup than for those with MELD/PELD of 28 or less. Under the current policy scenario, waitlist mortality is 0.230 deaths per patient-year, or 23 deaths per 100 patient-years. For patients with M/P 29-34, waitlist mortality rates differ minimally between scenarios. Estimated waitlist mortality is 0.289 for the 8-district no-threshold scenario, 0.257 for the M/P 35 scenario, 0.290 for the M/P 29 threshold scenario, and 0.287 for the M/P 25 threshold scenario. Waitlist mortality rates may differ slightly between some scenarios; however, estimates are very close and ranges of estimates across the 10 simulations of each scenario overlap, indicating that there may be minimal difference between scenarios.

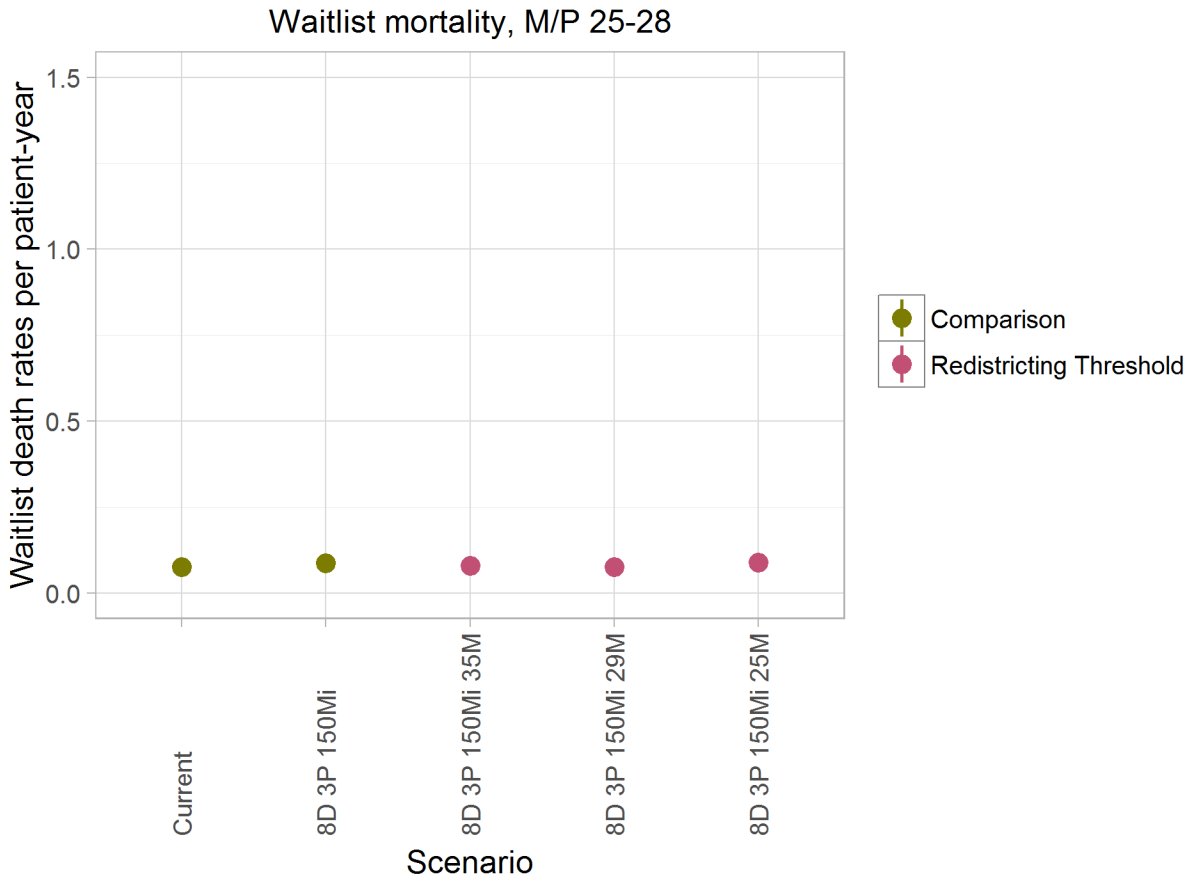

Figure 18 Waitlist mortality rates for MELD/PELD 25-28

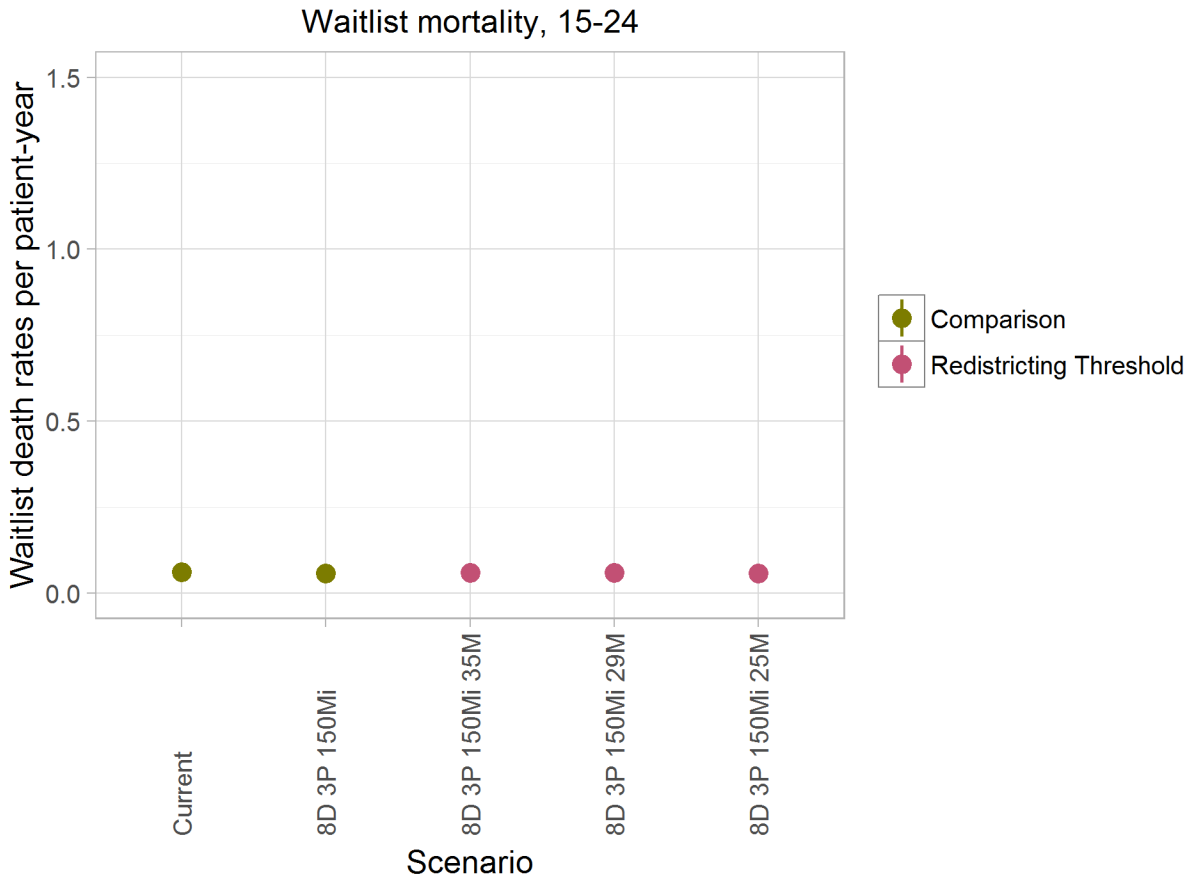

Figure 19 Waitlist mortality rates for MELD/PELD 15-24

Figure 20 Waitlist mortality rates for MELD/PELD < 15

Figures 18 through 20 show waitlist mortality for patients with MELD/PELD 25-28, 15-24, and less than 15 for all simulated scenarios. For patients with M/P <15, 15-24, and 25-28, there is no difference in estimated waitlist mortality rates between the current scenario and any of the 8-district scenarios, and waitlist mortality is low.

Transplant Rate graphs by MELD/PELD subgroup

Figures 21 through 25 show transplant rates for each of the simulated scenarios by MELD/PELD <15, 15-24, 25-28, 29-34, and 35+. The MELD/PELD cutoffs for these subgroups match the MELD/PELD threshold cutoffs for the scenarios assessed in this report (thresholds of M/P 35, 29, and 25).

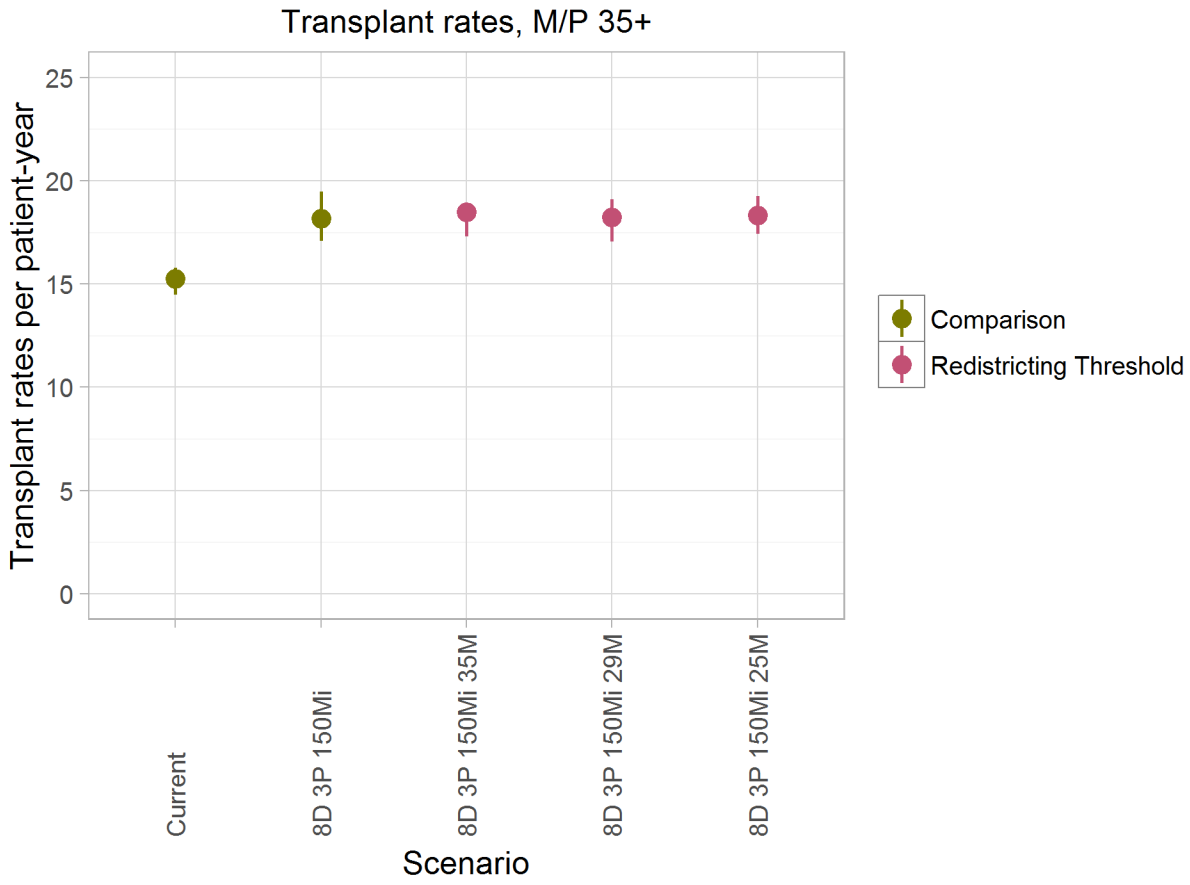

Figure 21 Transplant rates for MELD/PELD 35+

Figure 21 shows transplant rates per patient-year for patients with MELD/PELD of 35 and greater for all simulated scenarios. Transplant rates across all scenarios are highest among the M/P 35+ patients compared with lower-MELD patients. The transplant rate in the current policy scenario is 15.24 transplants per patient-year. Transplant rates increase for M/P 35+ patients in all 8-district scenarios compared with the current policy scenario. The rate is 18.17 transplants per patient-year in the 8-district no-threshold scenario, 18.46 in the M/P 35 scenario, 18.21 in the M/P 29 scenario, and 18.32 in the M/P 25 scenario.

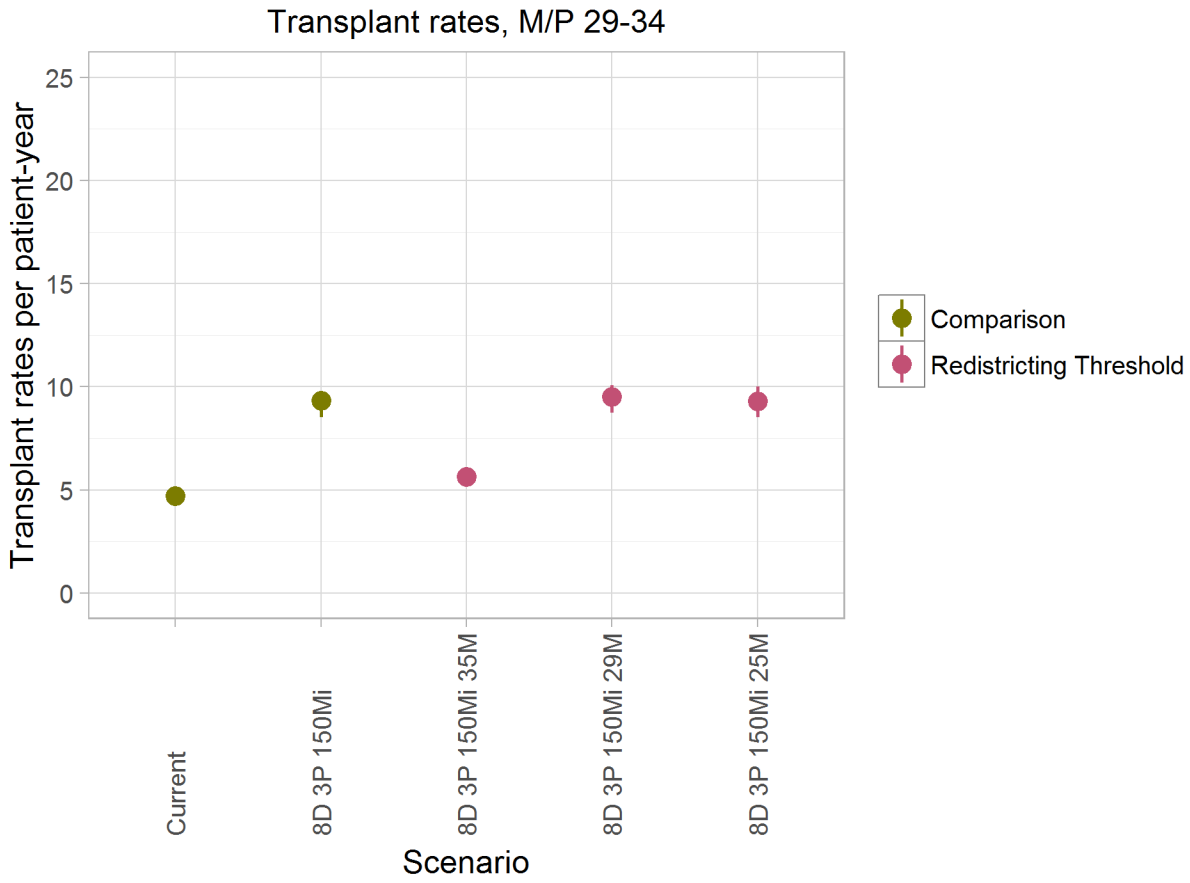

Figure 22 Transplant rates for MELD/PELD 29-34

Figure 22 shows transplant rates per patient-year for patients with MELD/PELD 29-34 for all simulated scenarios. In the current policy scenario, the transplant rate is 4.70 transplants per patient-year. Transplant rates increase compared with current policy for the 8-district no-threshold scenario (9.34 transplants per patient-year), the M/P 29 scenario (9.52 transplants per patient-year), and the M/P 25 scenario (9.31 transplants per patient-year). Transplant rates may increase slightly between the current scenario (4.70 transplants per patient-year) and the M/P 35 scenario (5.64 transplants per patient-year).

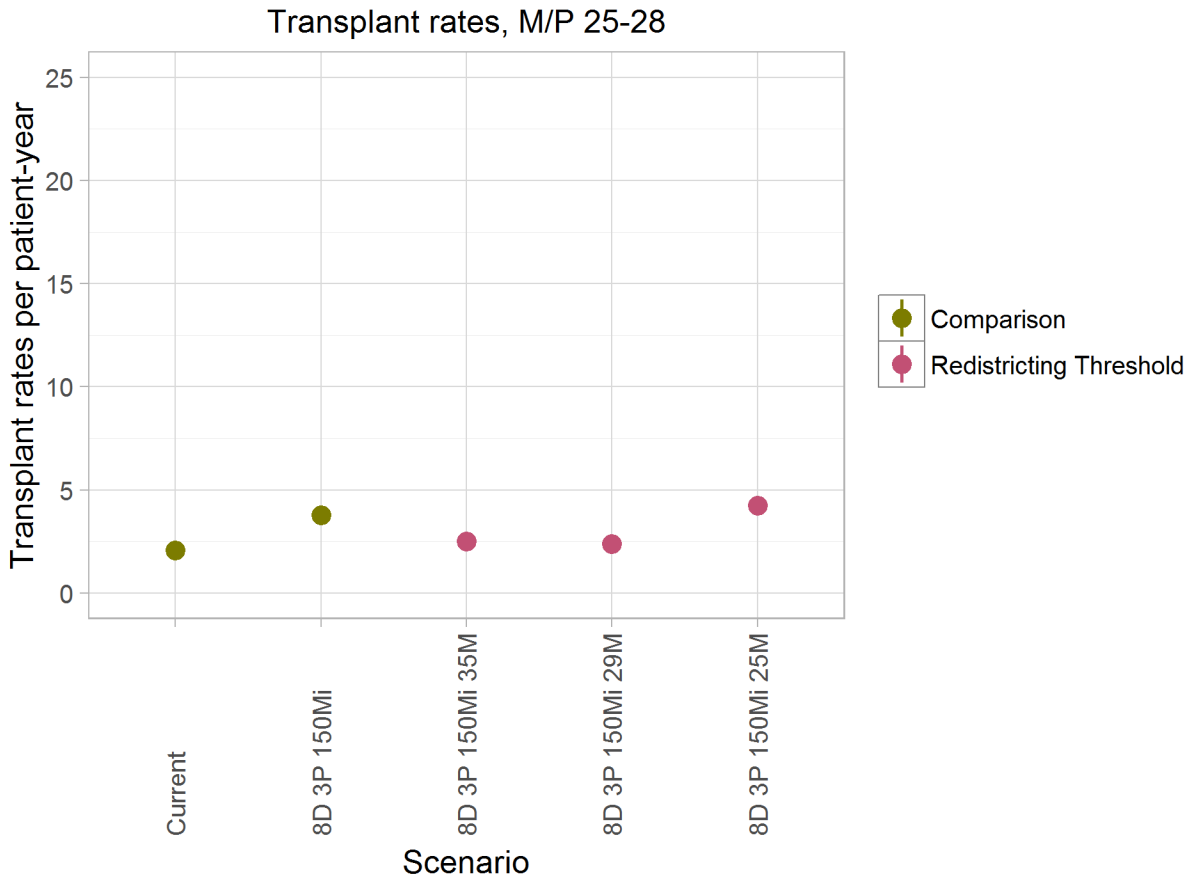

Figure 23 Transplant rates for MELD/PELD 25-28

Figure 23 shows transplant rates per patient-year for patients with MELD/PELD 25-28 for all simulated scenarios. In the current policy scenario, the transplant rate is 2.08 transplants per patient-year. Rates remain unchanged from current policy in the M/P 35 scenario (2.50 transplants per patient-year) and in the M/P 29 scenario (2.38 transplants per patient-year). Rates increase in the 8-district no-threshold scenario (3.78 transplants per patient-year) and in the M/P 25 threshold scenario (4.24 transplants per patient-year), compared with the current policy scenario.

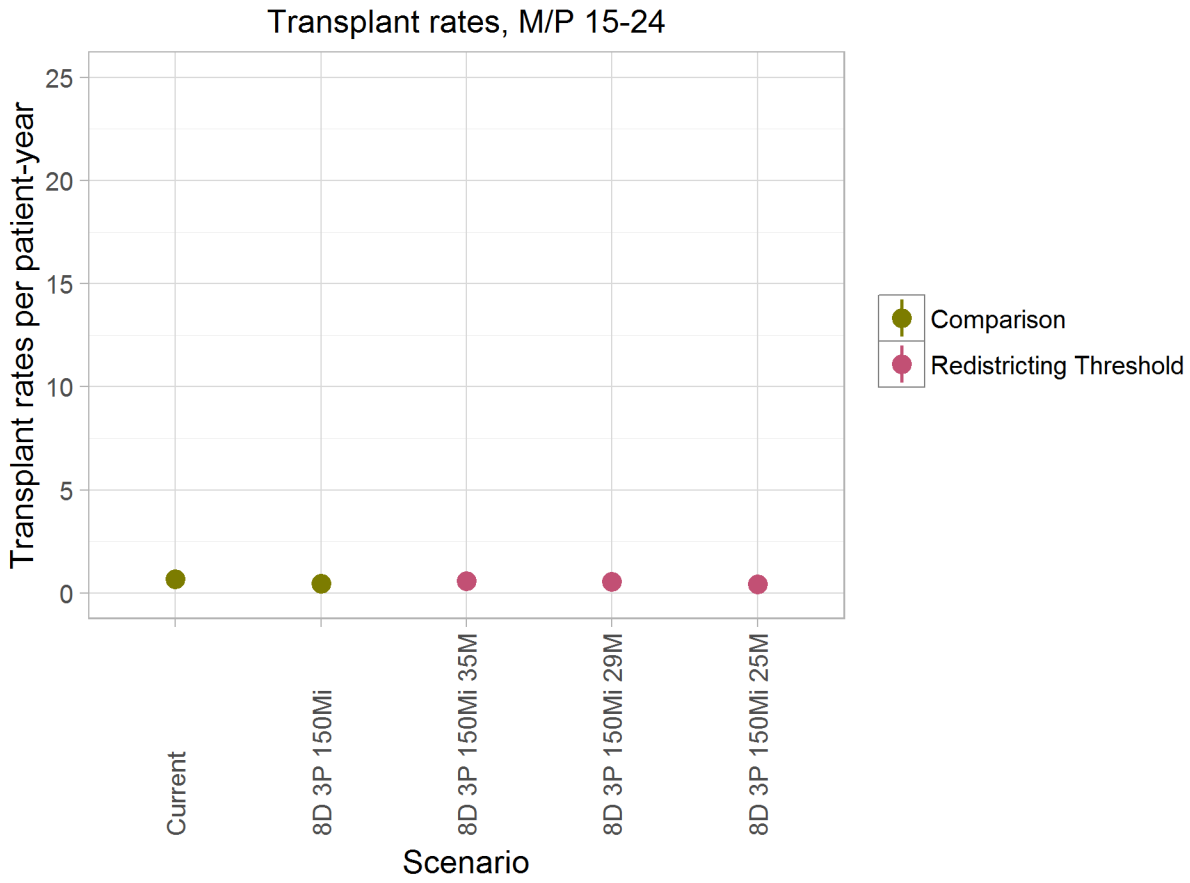

Figure 24 Transplant rates for MELD/PELD 15-24

Figure 24 shows transplant rates per patient-year for patients with MELD/PELD 15-24 for all simulated scenarios. In the current policy scenario, the rate is 0.67 transplants per patient-year. The rate may decrease slightly for patients with M/P 15-24 in 8-district scenarios as compared with the current scenario, with rates of 0.46 transplants per patient-year in the 8-district no-threshold scenario, 0.60 in the M/P 35 scenario, 0.55 in the M/P 29 scenario, and 0.45 in the M/P 25 scenario.

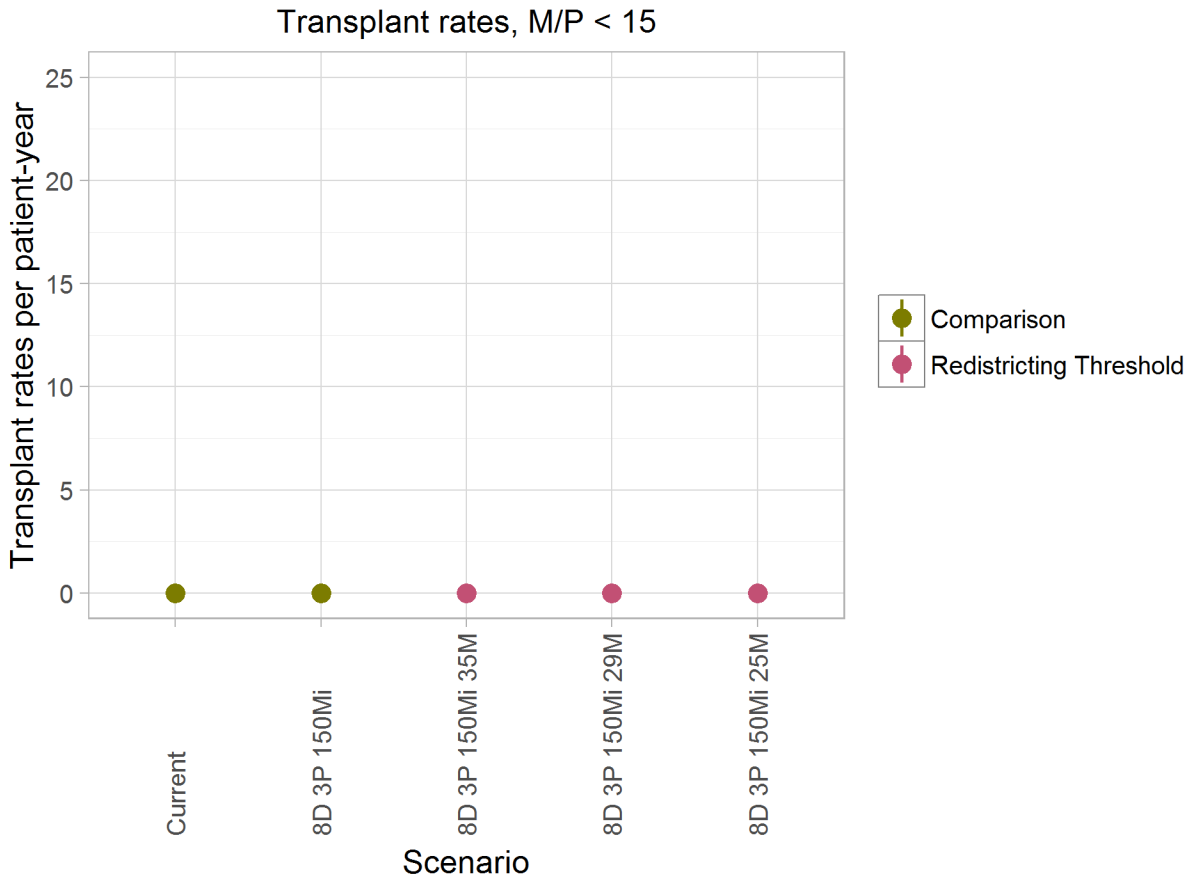

Figure 25 Transplant rates for MELD/PELD < 15

Figure 25 shows transplant rates per patient-year for patients with MELD/PELD <15 for all simulated scenarios. In the current policy scenario, the rate is 0.007 transplants per patient-year. Rates remain unchanged for patients with M/P <15 in 8-district scenarios compared with the current policy scenario, with a rate of 0.008 transplants per patient-year in all 8-district scenarios assessed.

Appendix A: Metrics Tables

All metrics reported as *mean (min, max)* across the 10 simulation iterations.

Table 4 Deaths prevented per year

	Waitlist deaths prevented per year	Posttransplant deaths prevented per year	Overall deaths prevented per year
Current	0 (0,0)	0 (0,0)	0 (0,0)
8D 3P 150Mi	39.2 (15,54.6)	-3.3 (-22.4,18.4)	52.1 (25.8,80.2)
8D 3P 150Mi 35M	26.8 (13.2,41.6)	-10.5 (-29.6,17.2)	30.7 (-1.8,62.2)
8D 3P 150Mi 29M	46.4 (23.6,64.2)	-11.6 (-37.2,9.8)	51.5 (24.4,69.8)
8D 3P 150Mi 25M	49 (26.2,63.8)	-12.5 (-25,15.8)	56 (35.2,74.2)

Table 5 Summative metric counts

	Waitlist death counts per year	Transplant counts per year	Posttransplant death counts per year
Current	1522.5 (1500.4,1549.2)	6025.4 (5952.4,6088.6)	1061.5 (1028.2,1081.2)
8D 3P 150Mi	1483.3 (1472.2,1497.4)	5919.1 (5851.8,5980.8)	1064.9 (1050.6,1078.6)
8D 3P 150Mi 35M	1495.7 (1485.4,1520.8)	6046.1 (5977,6110.4)	1072 (1046.6,1099.6)
8D 3P 150Mi 29M	1476 (1461.2,1501.6)	6033 (5964.2,6098.8)	1073.2 (1045.2,1089.6)
8D 3P 150Mi 25M	1473.5 (1449.8,1493.2)	5992.9 (5917.4,6038)	1074.1 (1051,1101)

Table 6 Transport metrics

	Median transport time (hours)	Median transport distance (miles)	% flying
Current	1.7 (1.7,1.7)	123.7 (121.4,127)	54.4 (53.8,54.8)
8D 3P 150Mi	1.8 (1.8,1.8)	199.6 (195,200.5)	68.3 (68.1,68.7)
8D 3P 150Mi 35M	1.7 (1.7,1.7)	132.7 (128.5,136.2)	56 (55.4,56.7)
8D 3P 150Mi 29M	1.7 (1.7,1.7)	163.4 (160.6,166.3)	60.4 (60.2,61)
8D 3P 150Mi 25M	1.8 (1.8,1.8)	195.8 (192.5,200.5)	65.9 (65.3,66.4)

Appendix B: Subgroup Analyses

Disparity Metrics

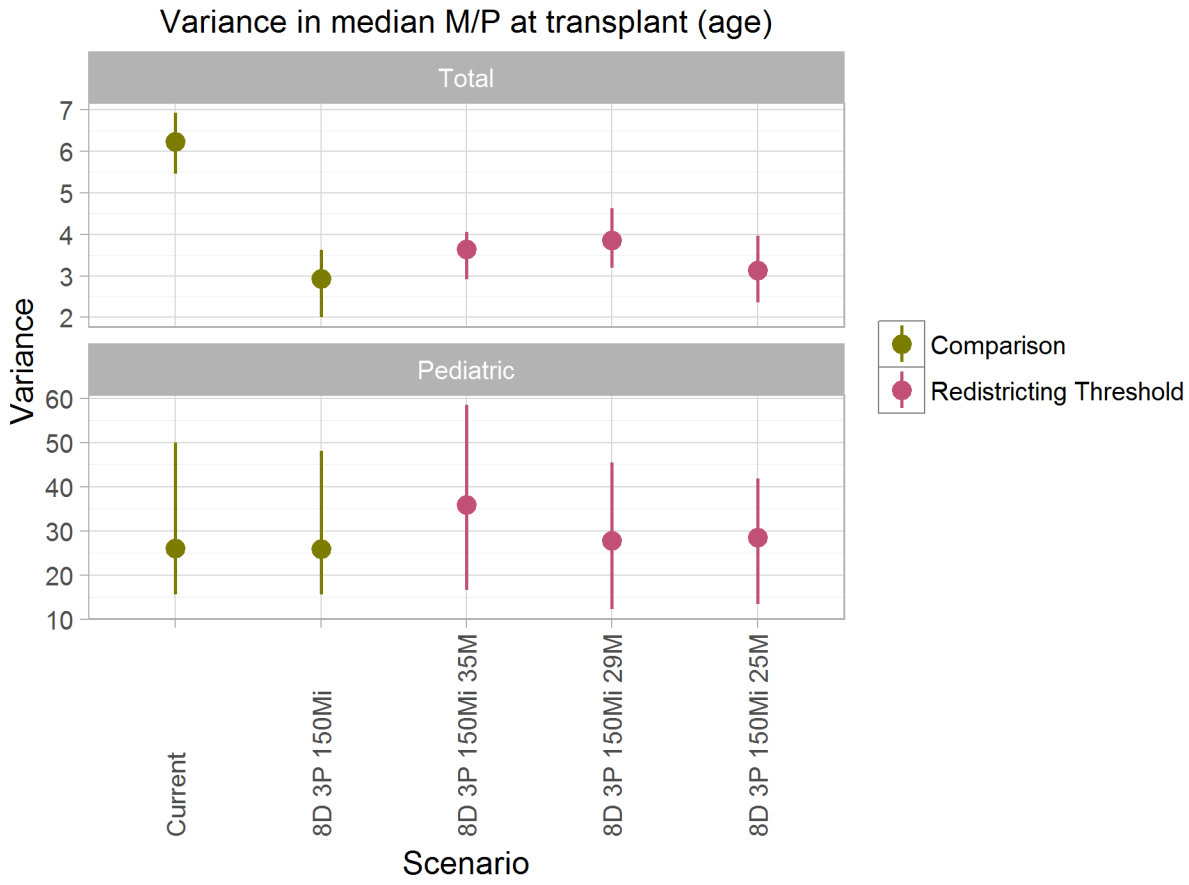

Figure 26 Variance in median allocation MELD/PELD at transplant by DSA (all transplants by pediatric status)

914 SOUTH 8TH STREET SUITE S4.100 MINNEAPOLIS, MN 55404 1.877.970.SRTR WWW.SRTR.ORG

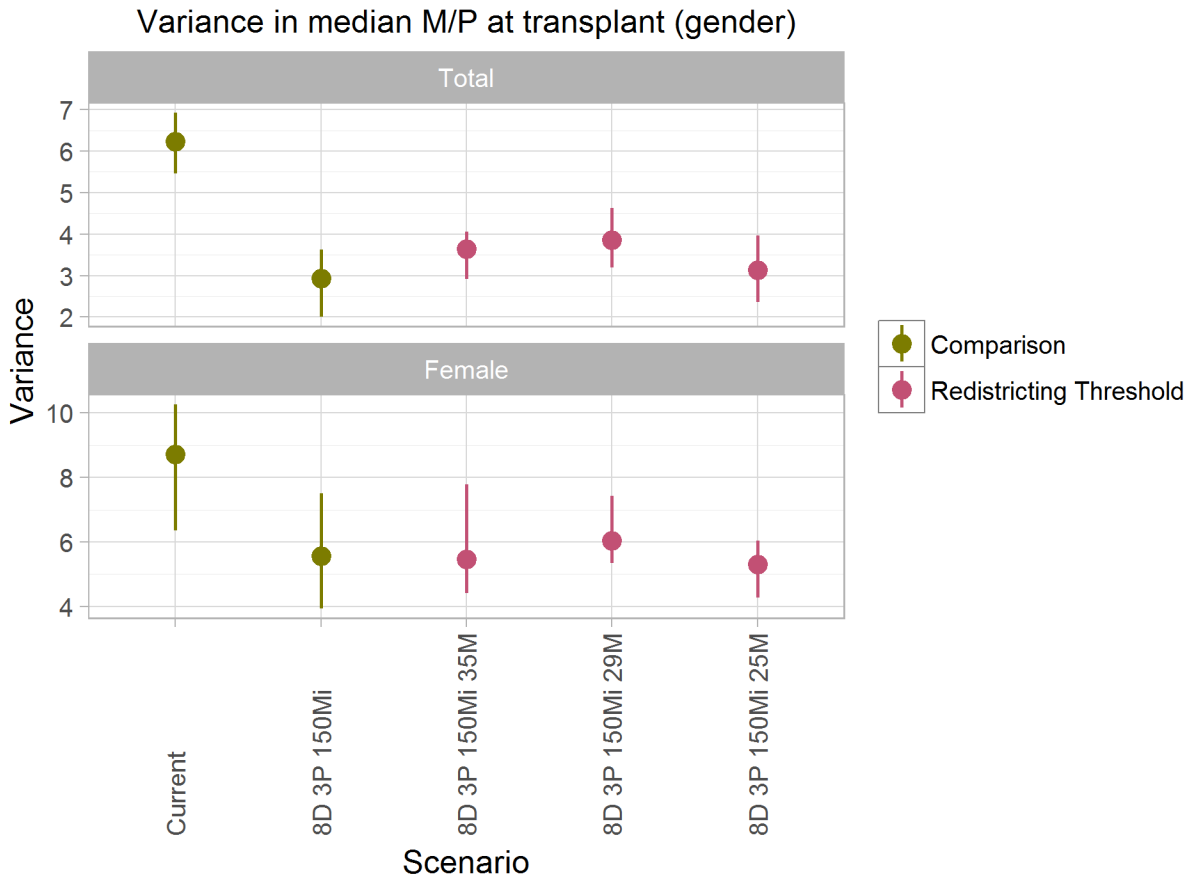

Figure 27 Variance in median allocation MELD/PELD at transplant by DSA (all transplants by gender)

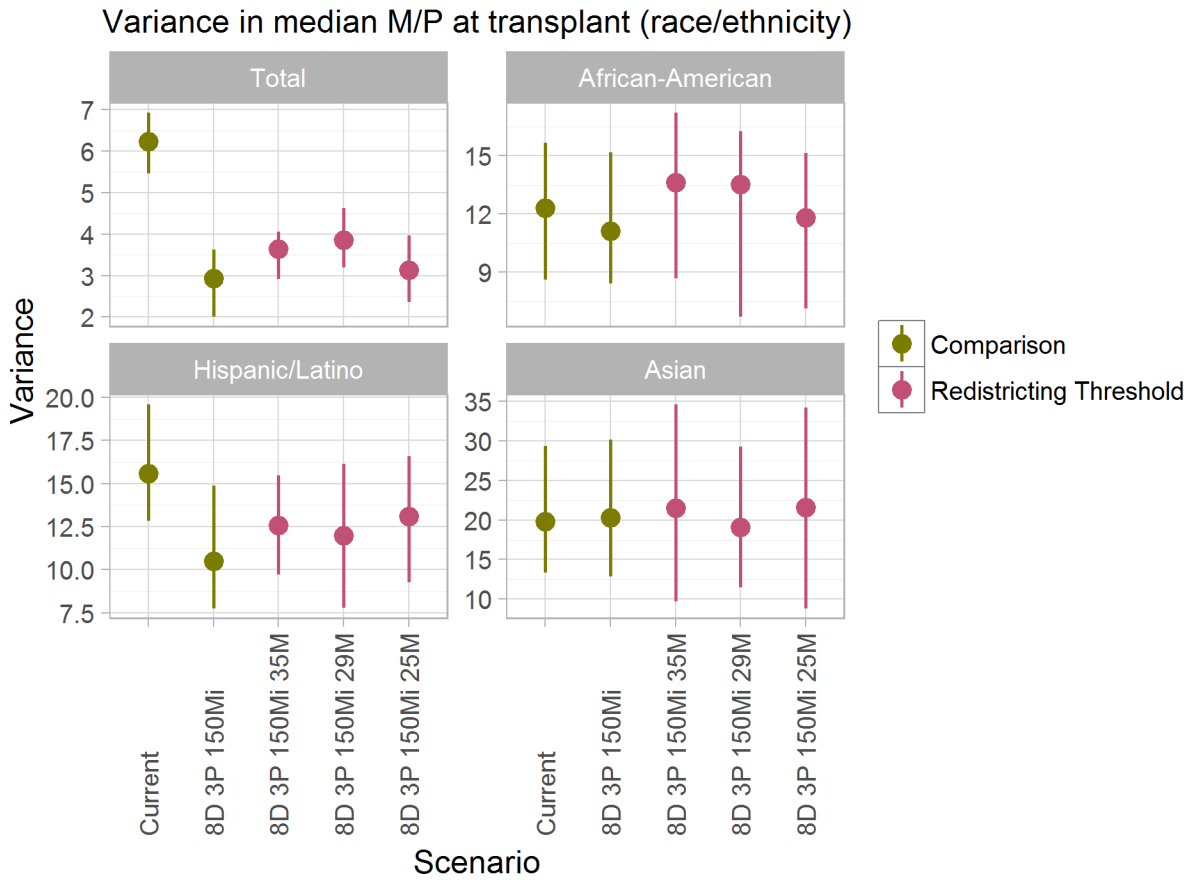

Figure 28 Variance in median allocation MELD/PELD at transplant by DSA (all transplants by race/ethnicity)

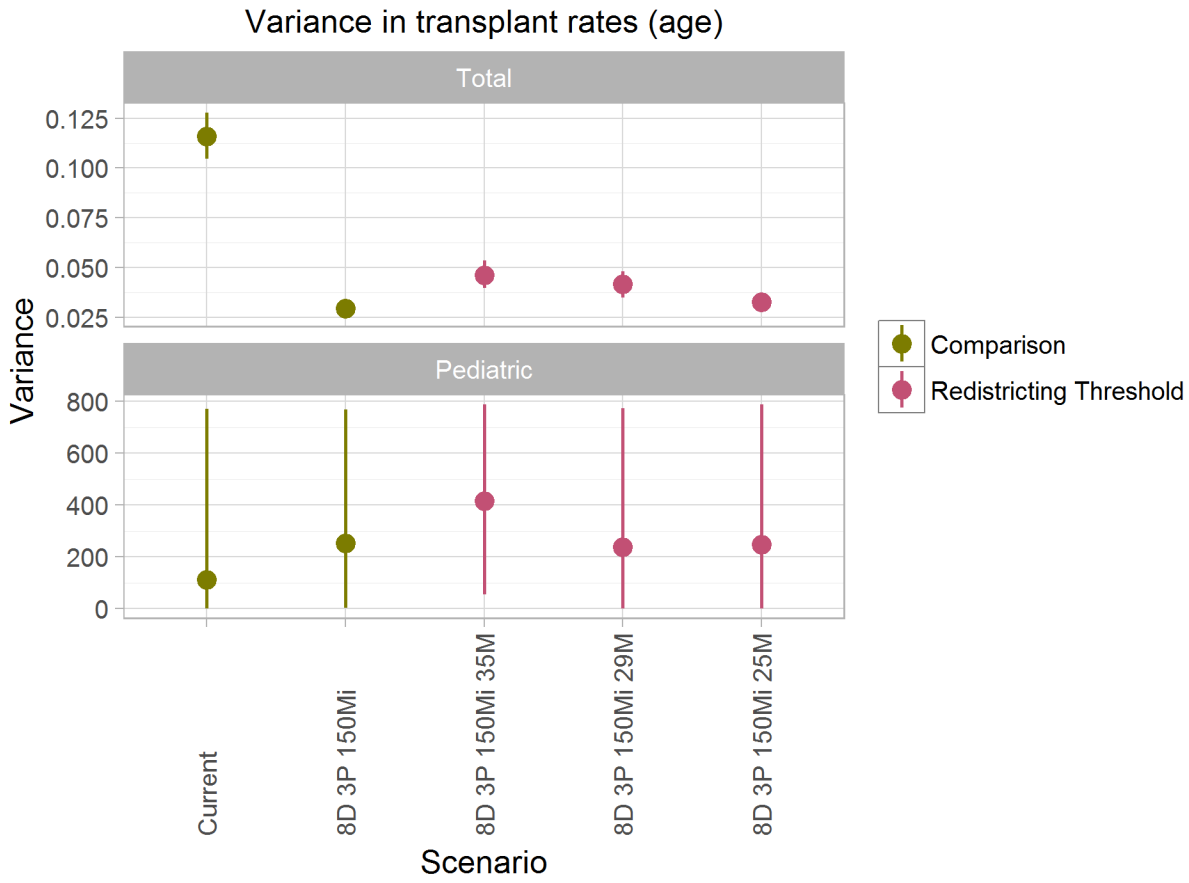

Figure 29 Variance in transplant rates by DSA (all transplants by pediatric status)

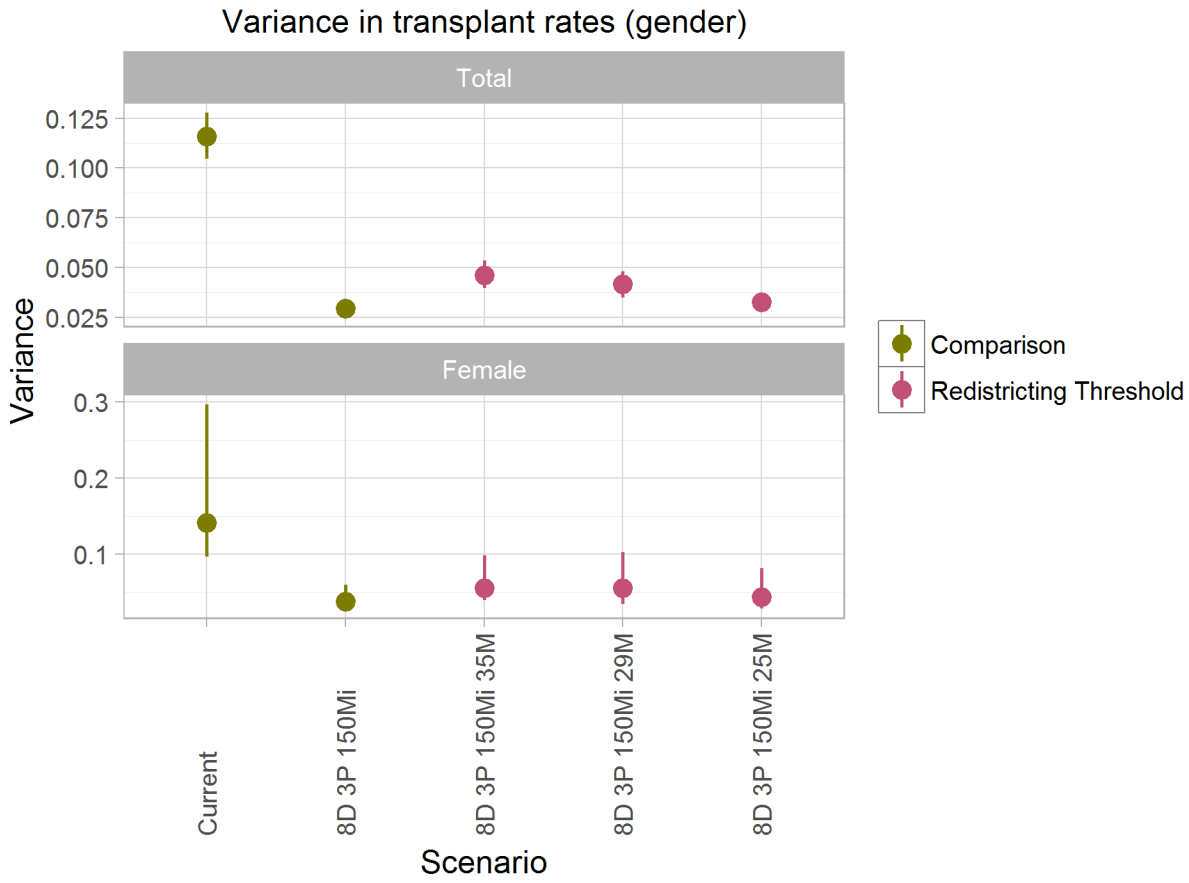

Figure 30 Variance in transplant rates by DSA (all transplants by gender)

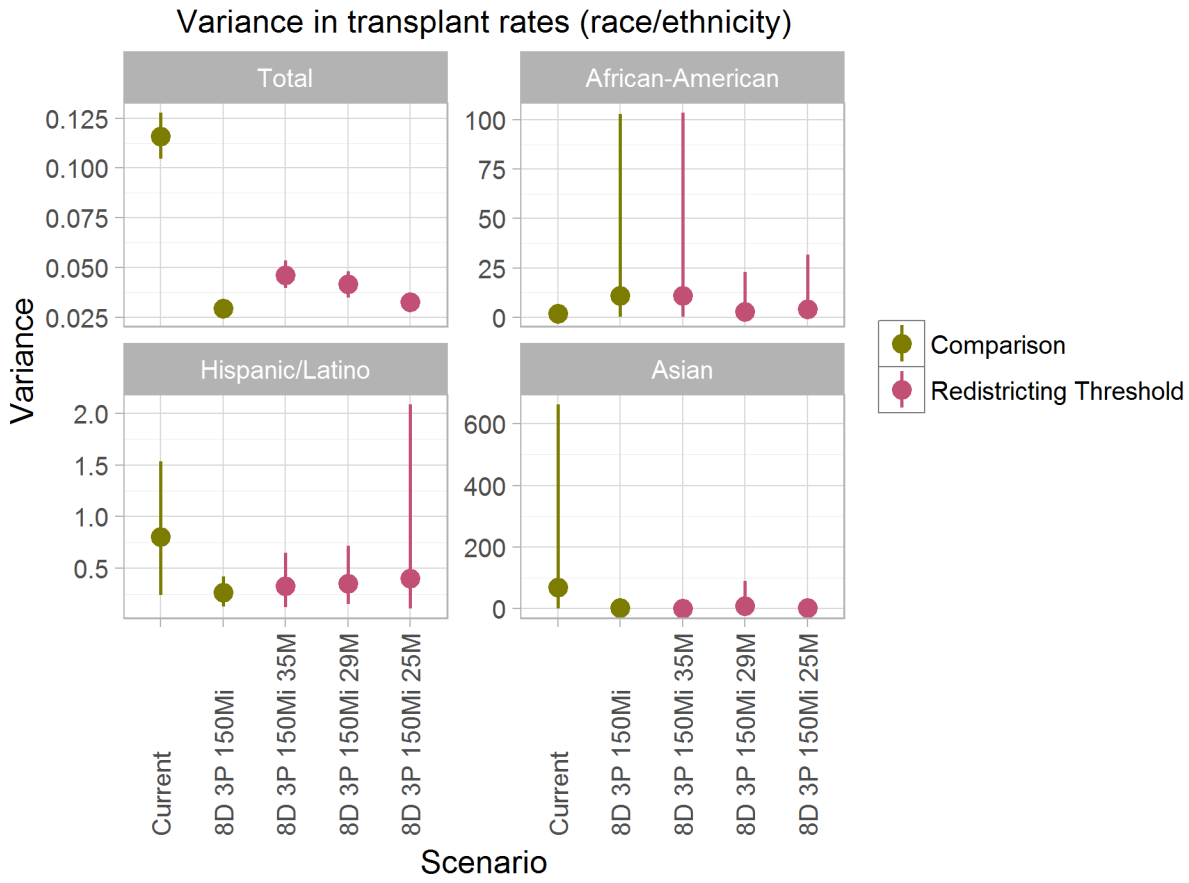

Figure 31 Variance in transplant rates by DSA (all transplants by race/ethnicity)

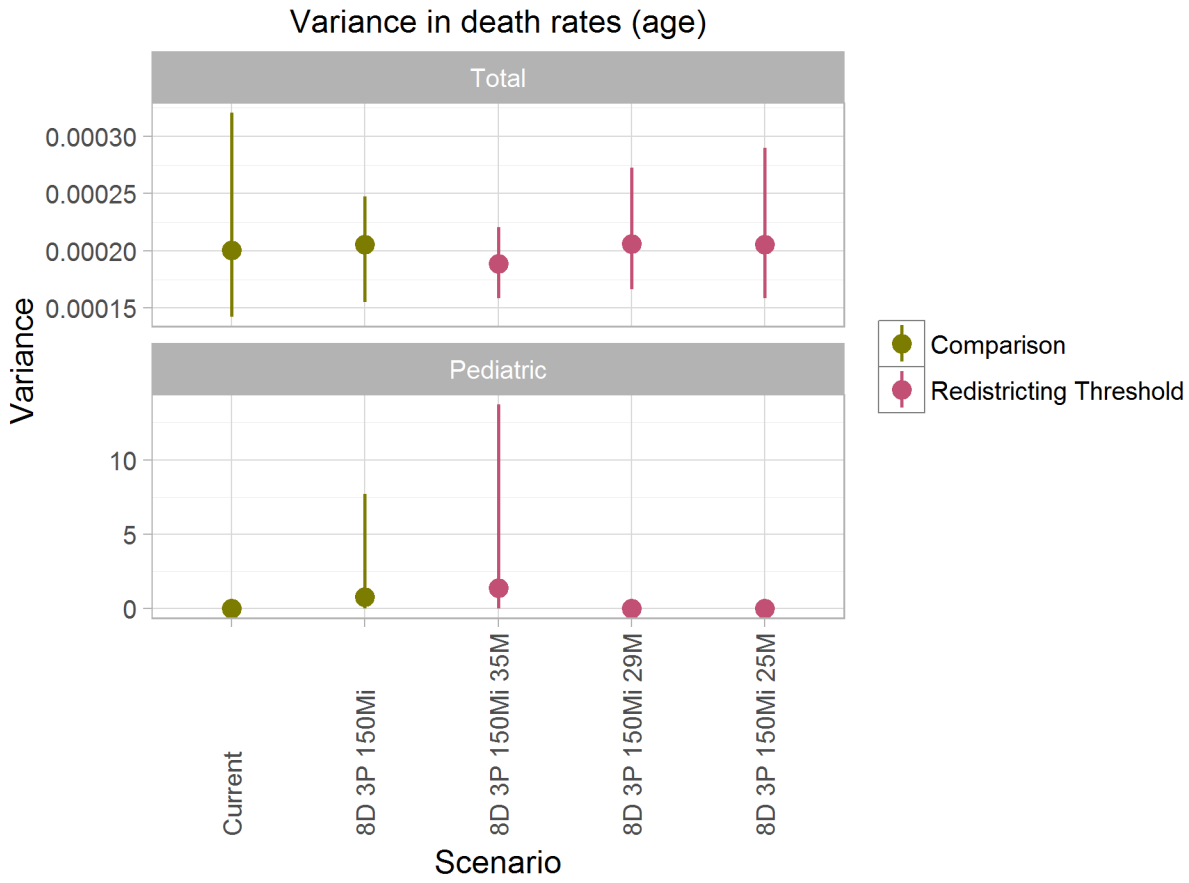

Figure 32 Variance in overall mortality rates (pre- and post-transplant) by DSA (all transplants by pediatric status)

Figure 33 Variance in overall mortality rates (pre- and post-transplant) by DSA (all transplants by gender)

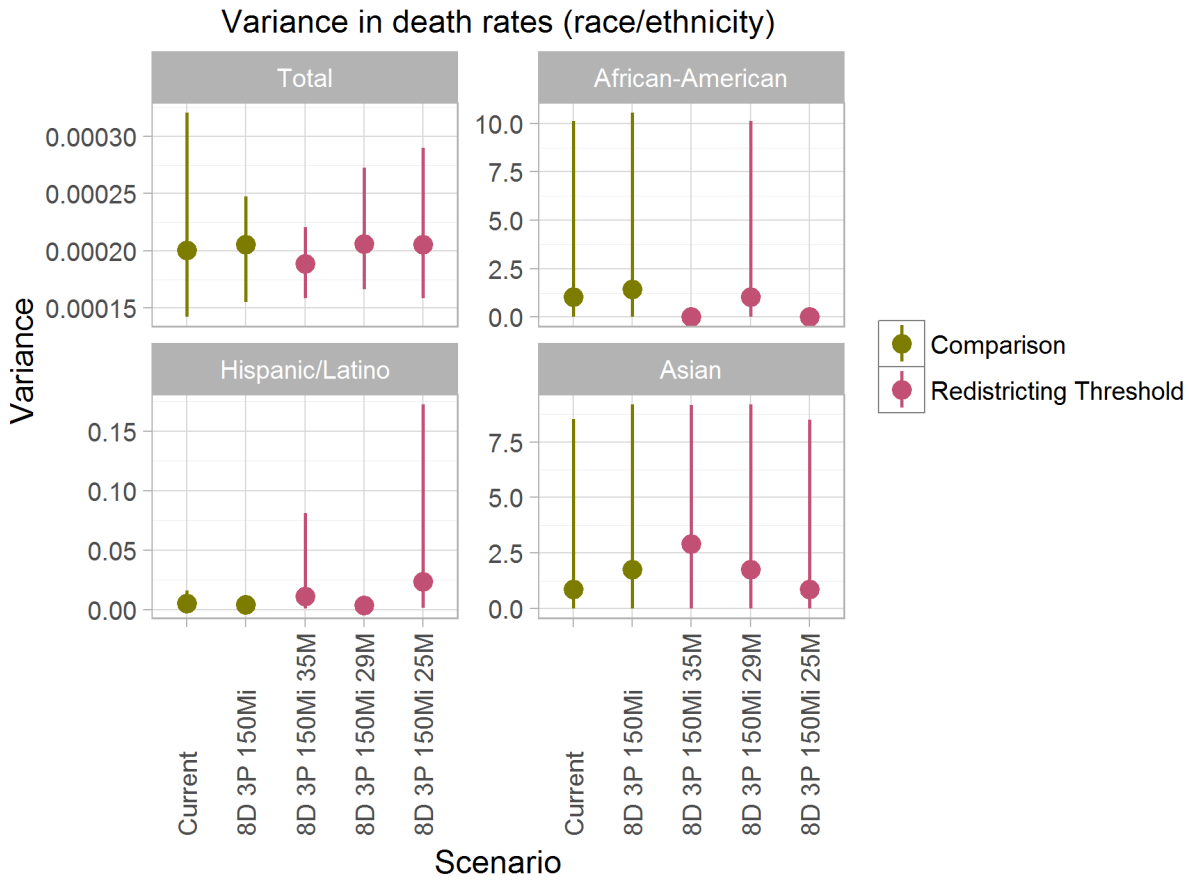

Figure 34 Variance in overall mortality rates (pre- and post-transplant) by DSA (all transplants by race/ethnicity)

Summative Metrics

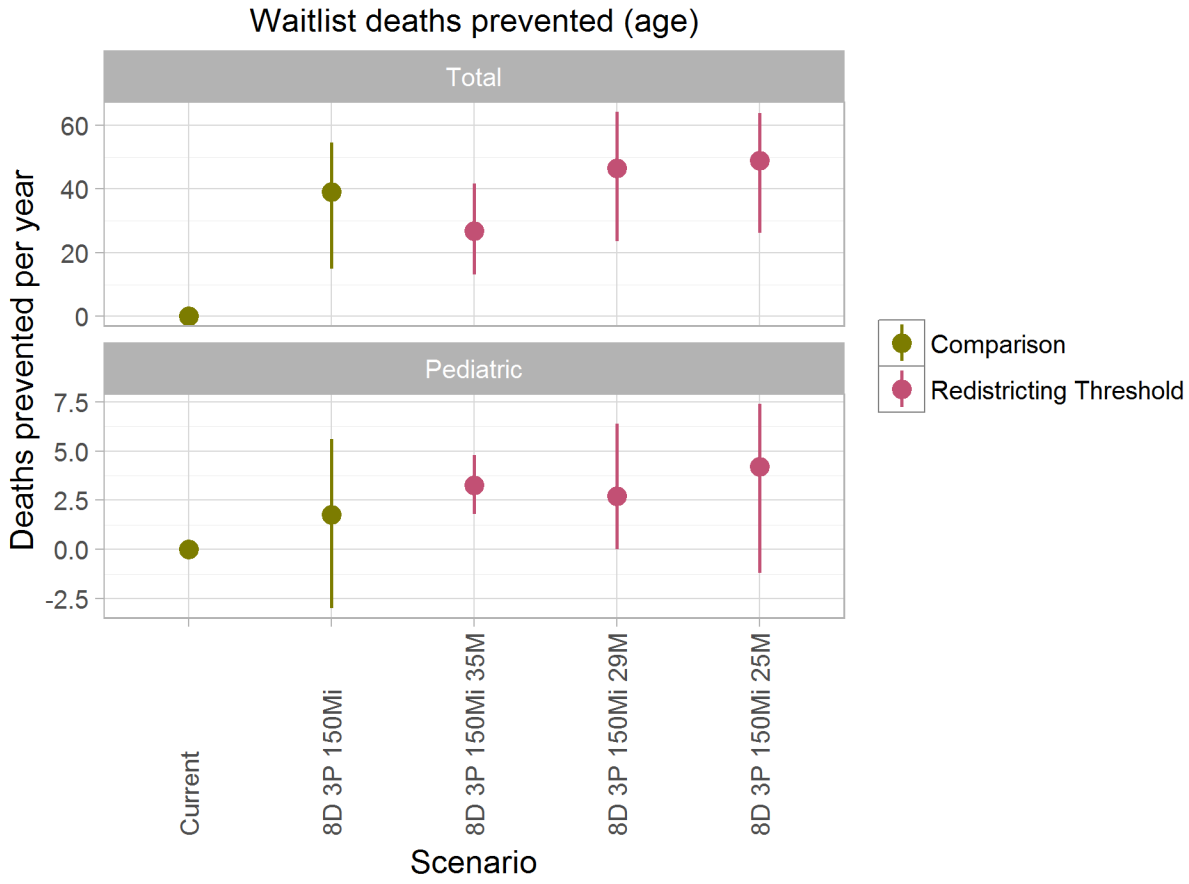

Figure 35 Waitlist deaths prevented (all transplants by pediatric status)

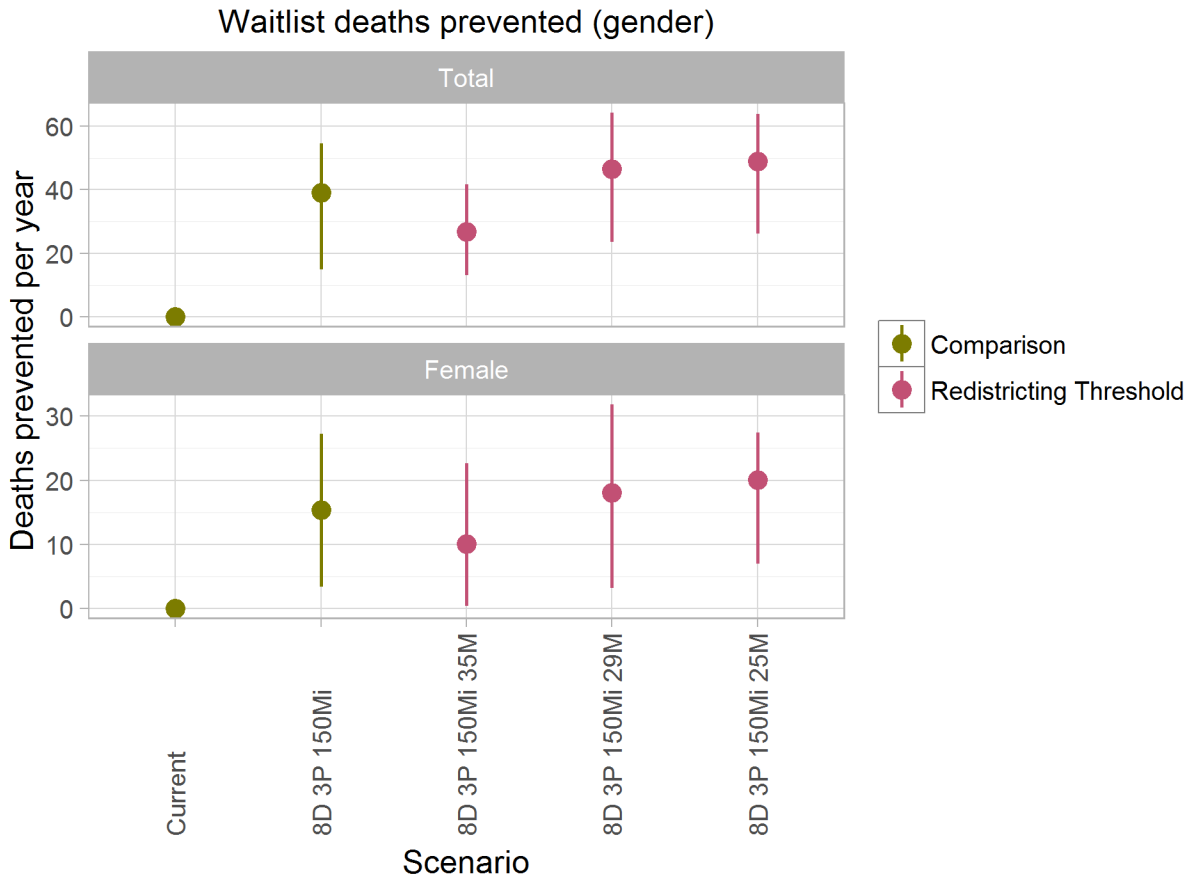

Figure 36 Waitlist deaths prevented (all transplants by gender)

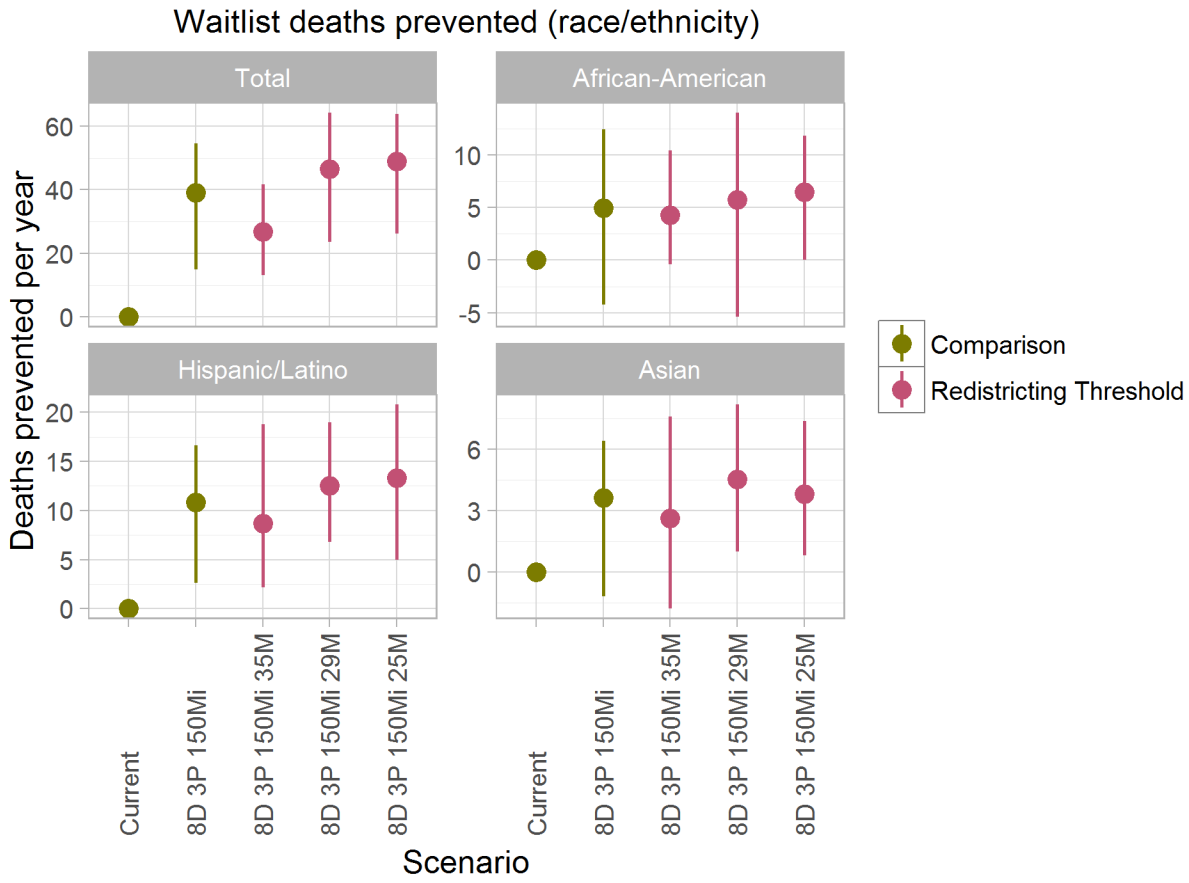

Figure 37 Waitlist deaths prevented (all transplants by race/ethnicity)

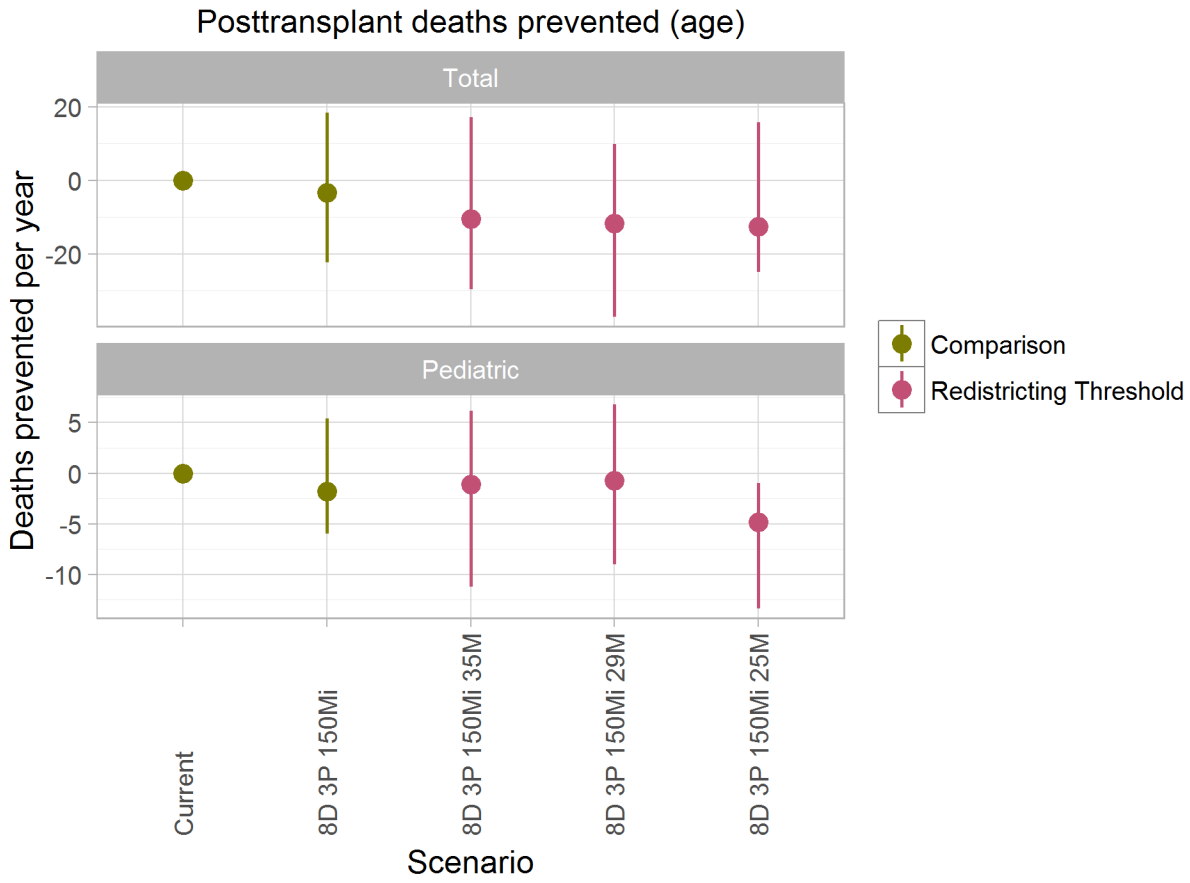

Figure 38 Posttransplant deaths prevented (all transplants by pediatric status)

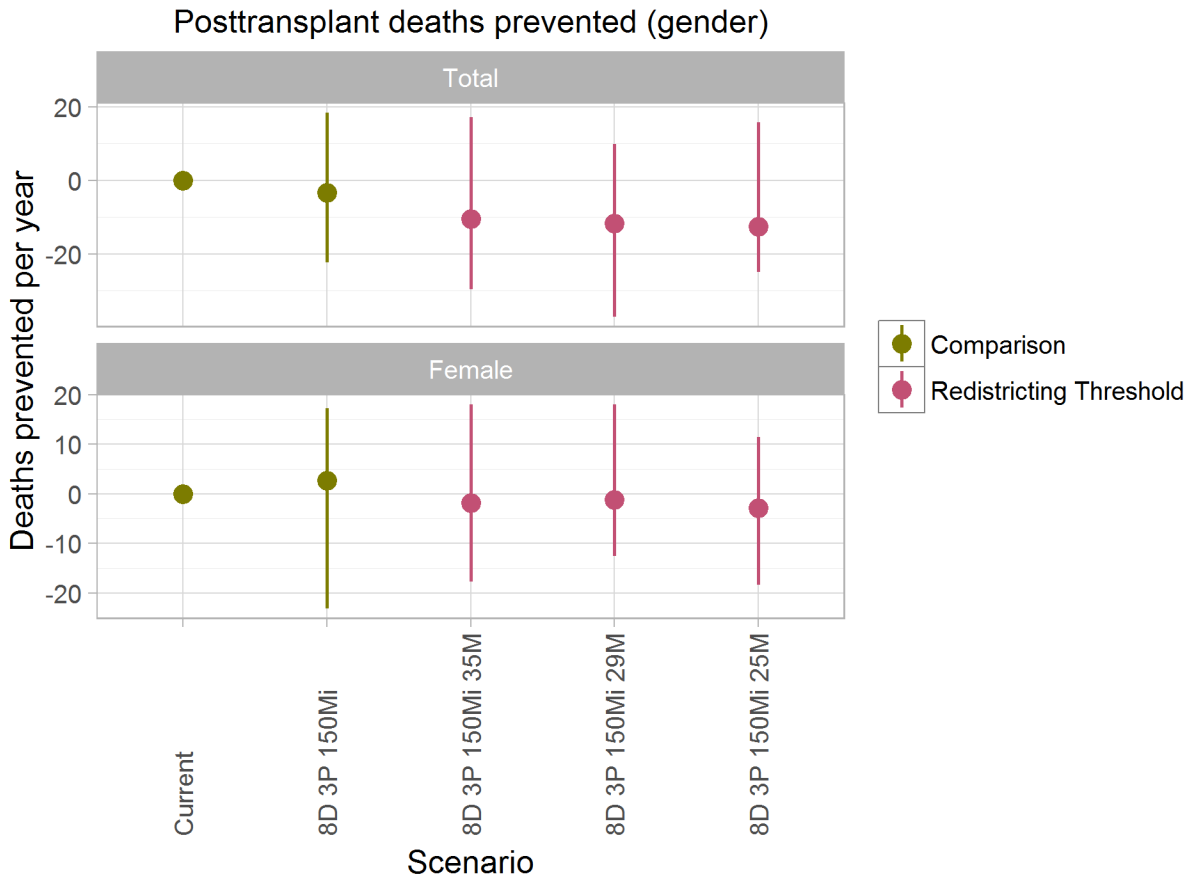

Figure 39 Posttransplant deaths prevented (all transplants by gender)

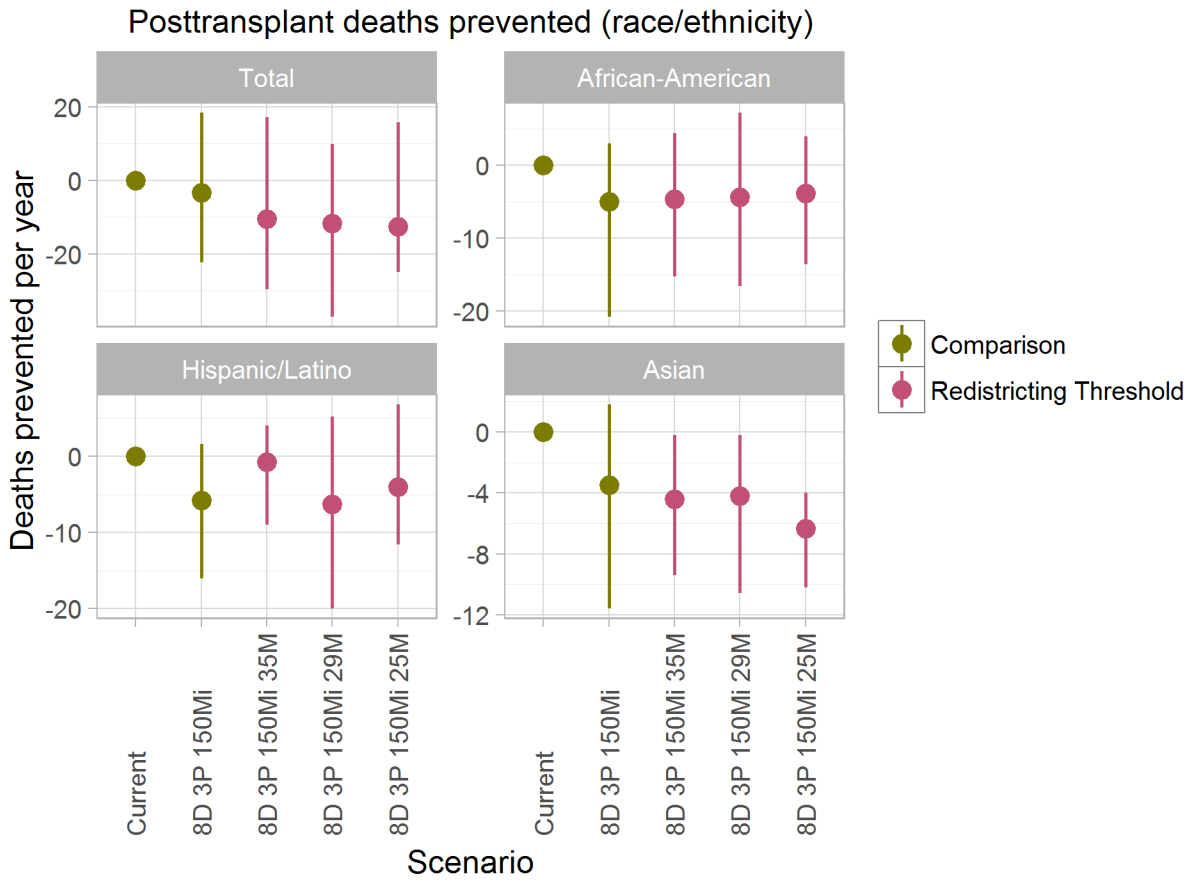

Figure 40 Posttransplant deaths prevented (all transplants by race/ethnicity)

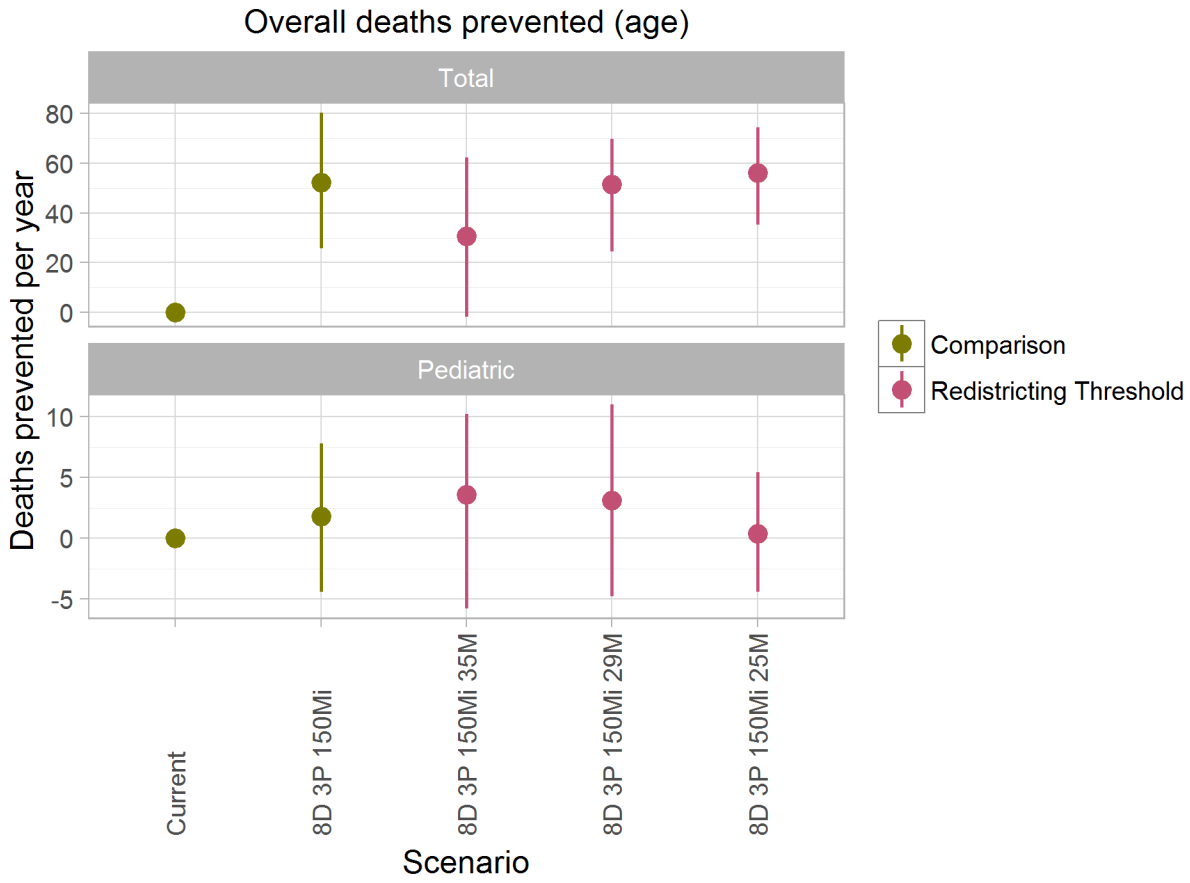

Figure 41 Overall deaths prevented (all transplants by pediatric status)

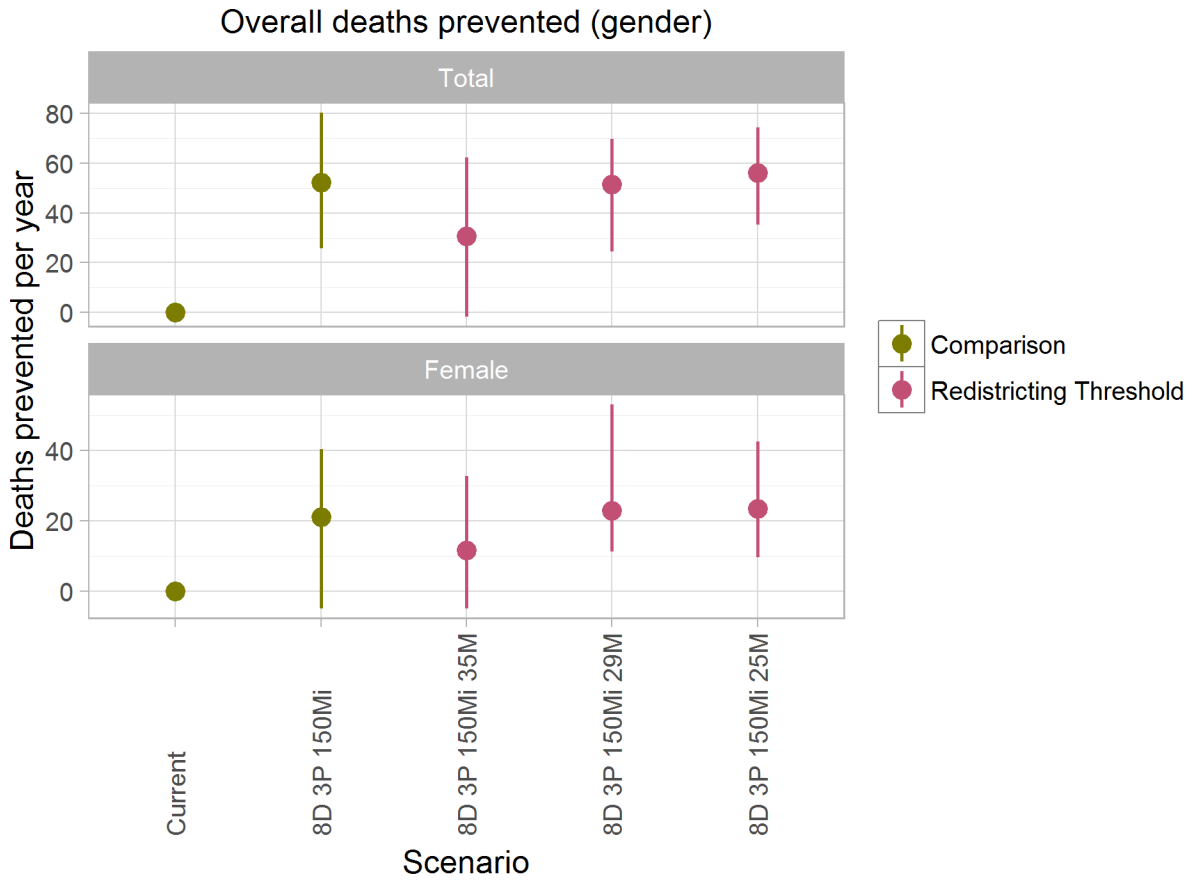

Figure 42 Overall deaths prevented (all transplants by gender)

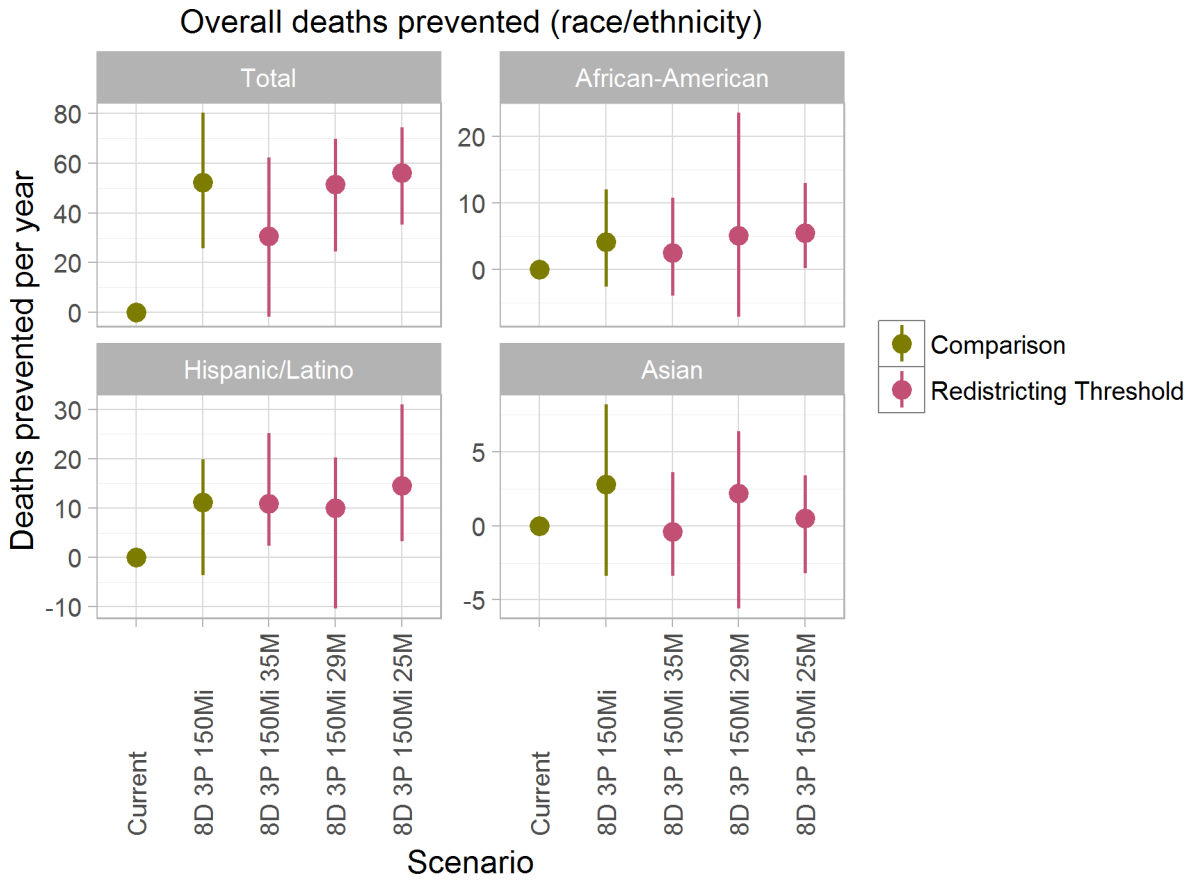

Figure 43 Overall deaths prevented (all transplants by race/ethnicity)

Figure 44 Waitlist mortality rates (all transplants by pediatric status)

Figure 45 Waitlist mortality rates (all transplants by gender)

Figure 46 Waitlist mortality rates (all transplants by race/ethnicity)

Figure 47 Posttransplant mortality rates (all transplants by pediatric status)

Figure 48 Posttransplant mortality rates (all transplants by gender)

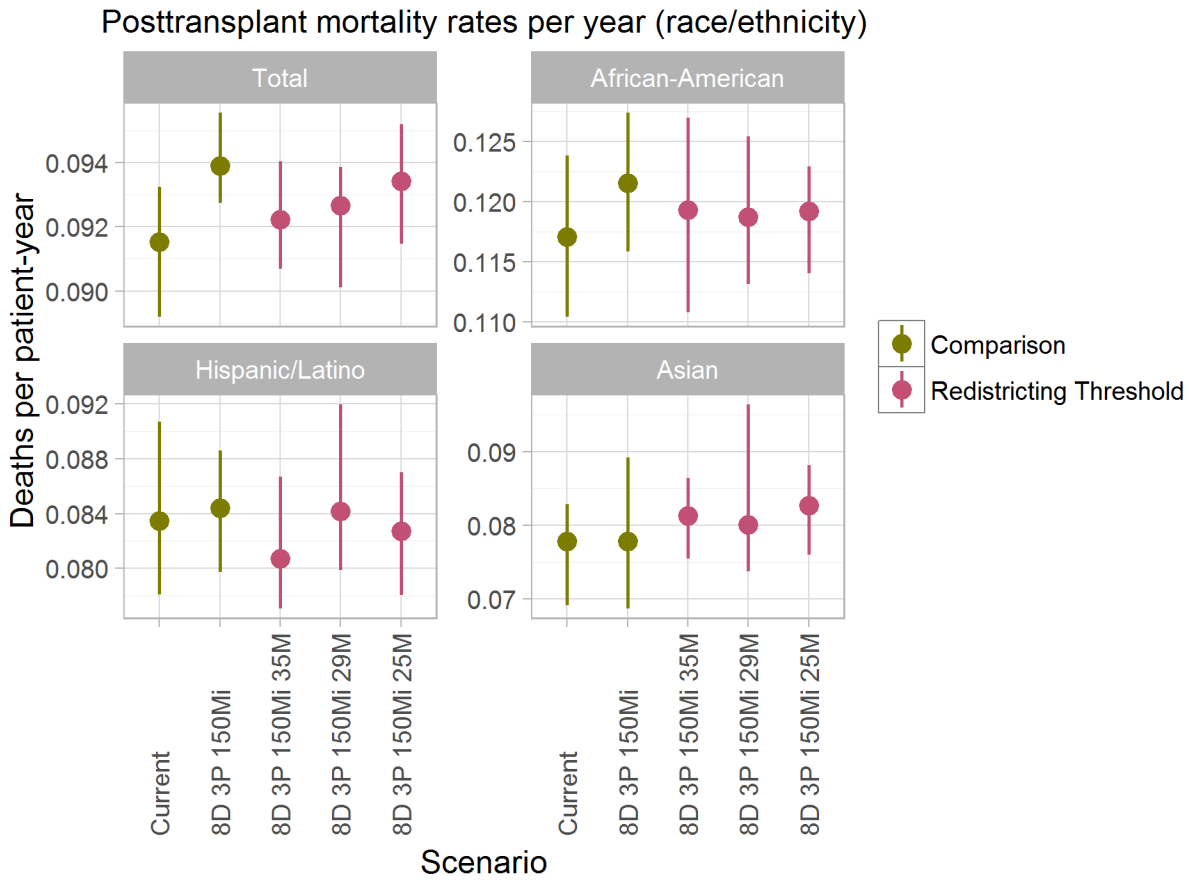

Figure 49 Posttransplant mortality rates (all transplants by race/ethnicity)

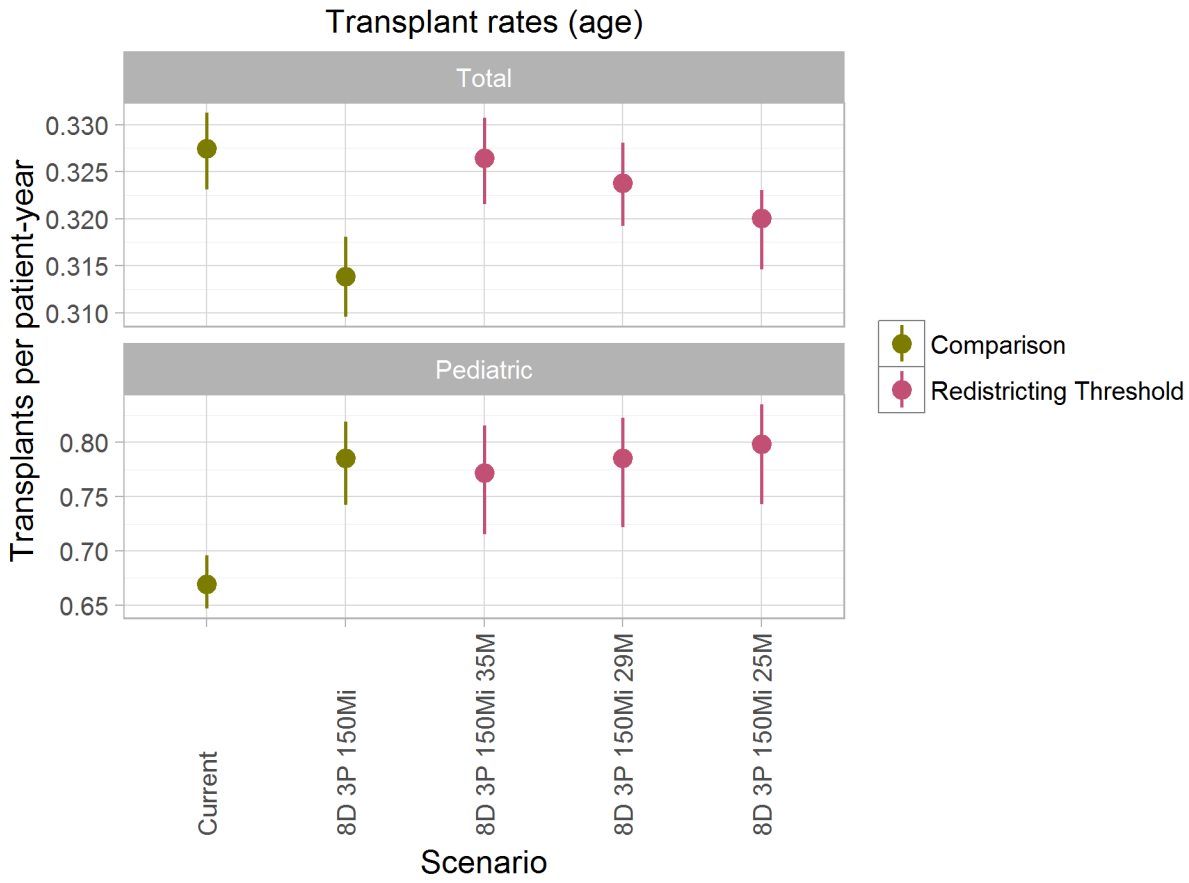

Figure 50 Transplant rates (all transplants by pediatric status)

Figure 51 Transplant rates (all transplants by gender)

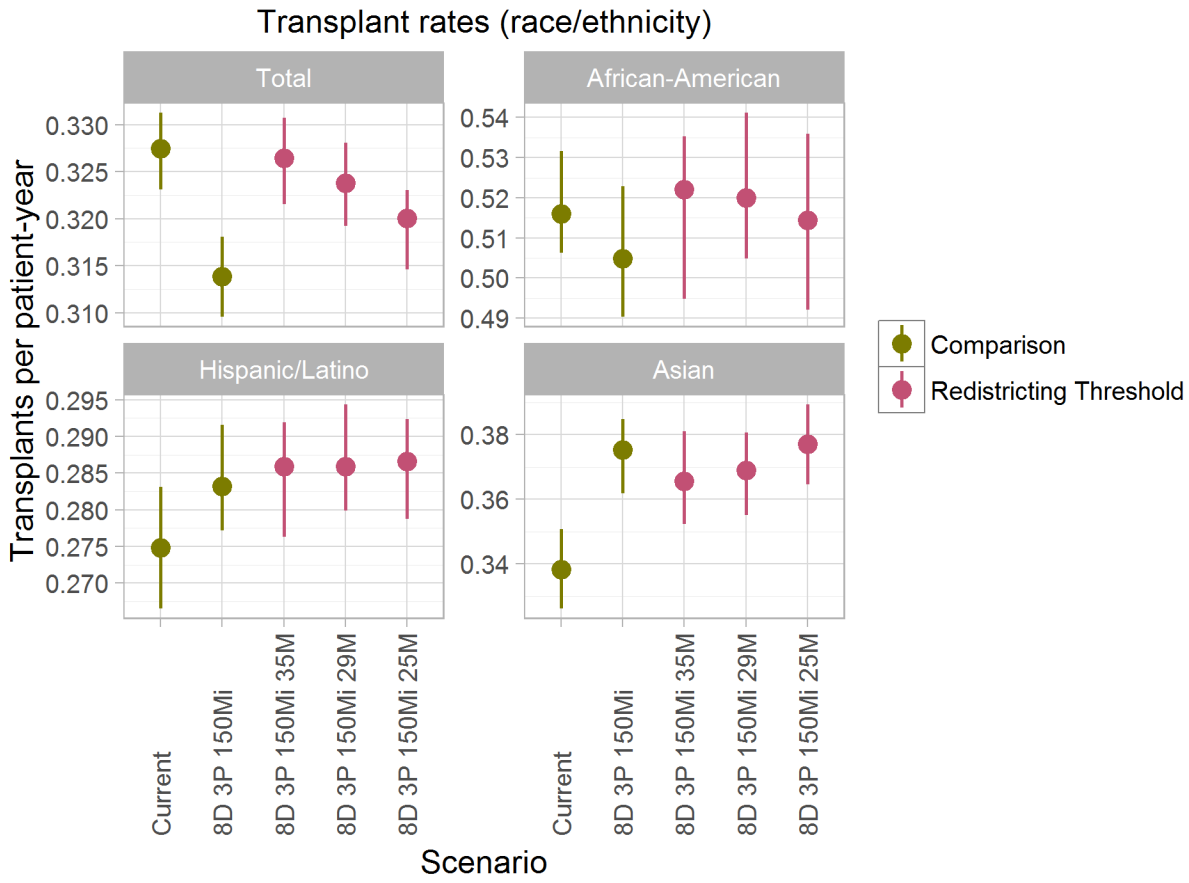

Figure 52 Transplant rates (all transplants by race/ethnicity)

Transport Metrics

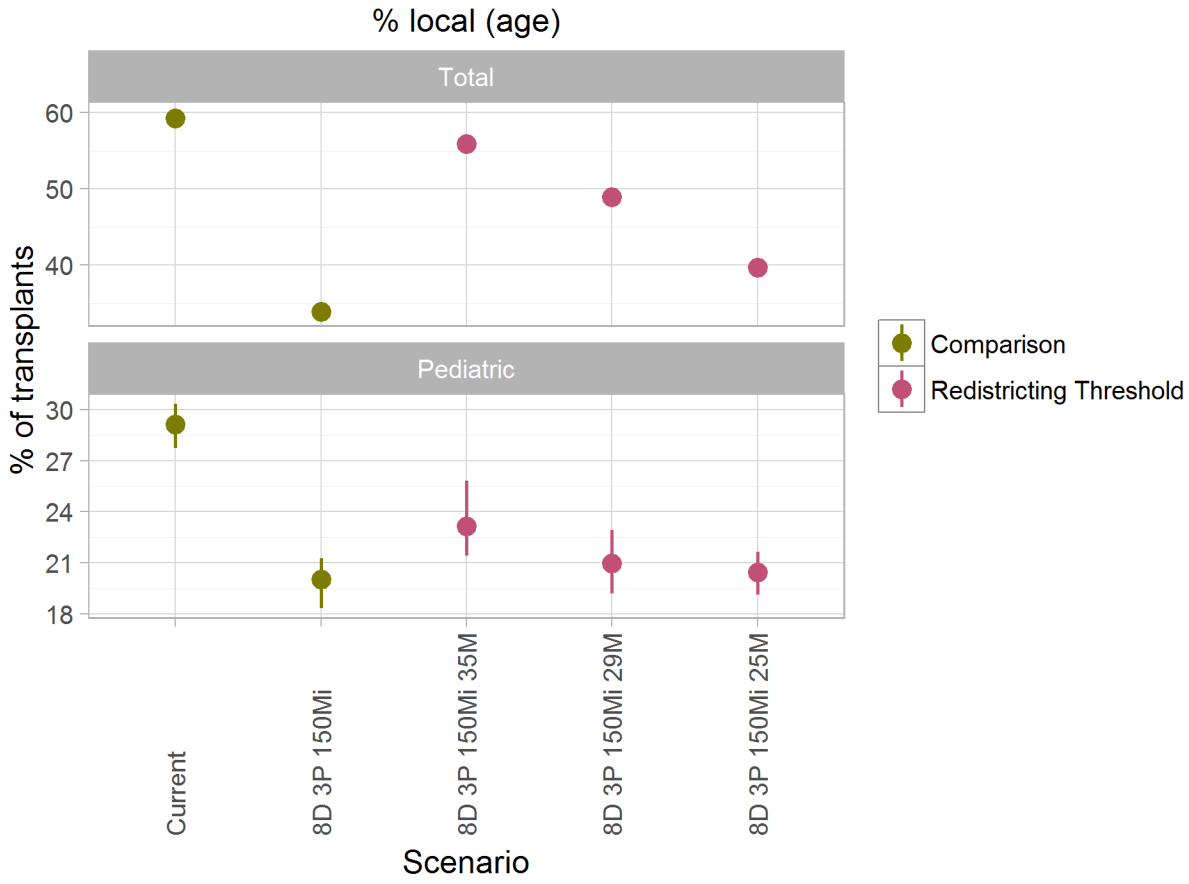

Figure 53 Percentage of transplants performed locally (within DSA) (all transplants by pediatric status)

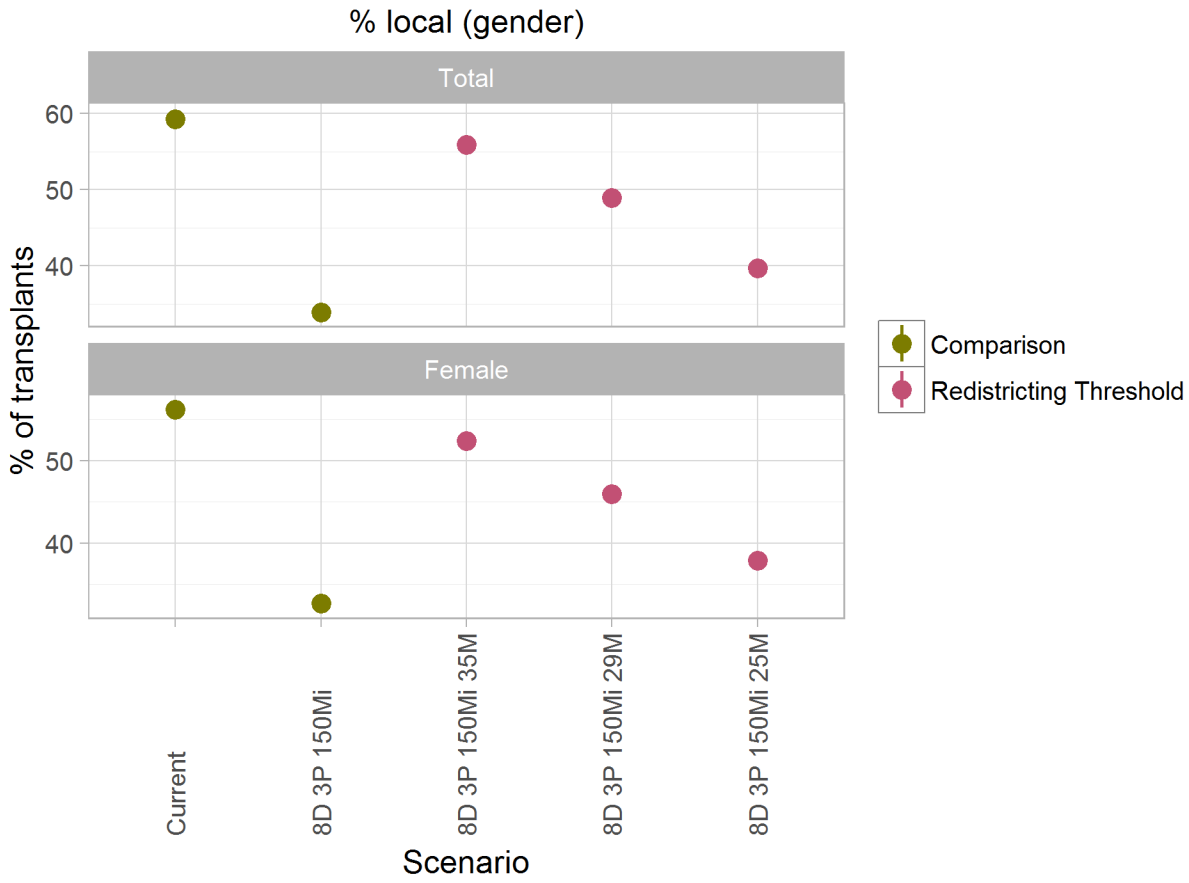

Figure 54 Percentage of transplants performed locally (within DSA) (all transplants by gender)

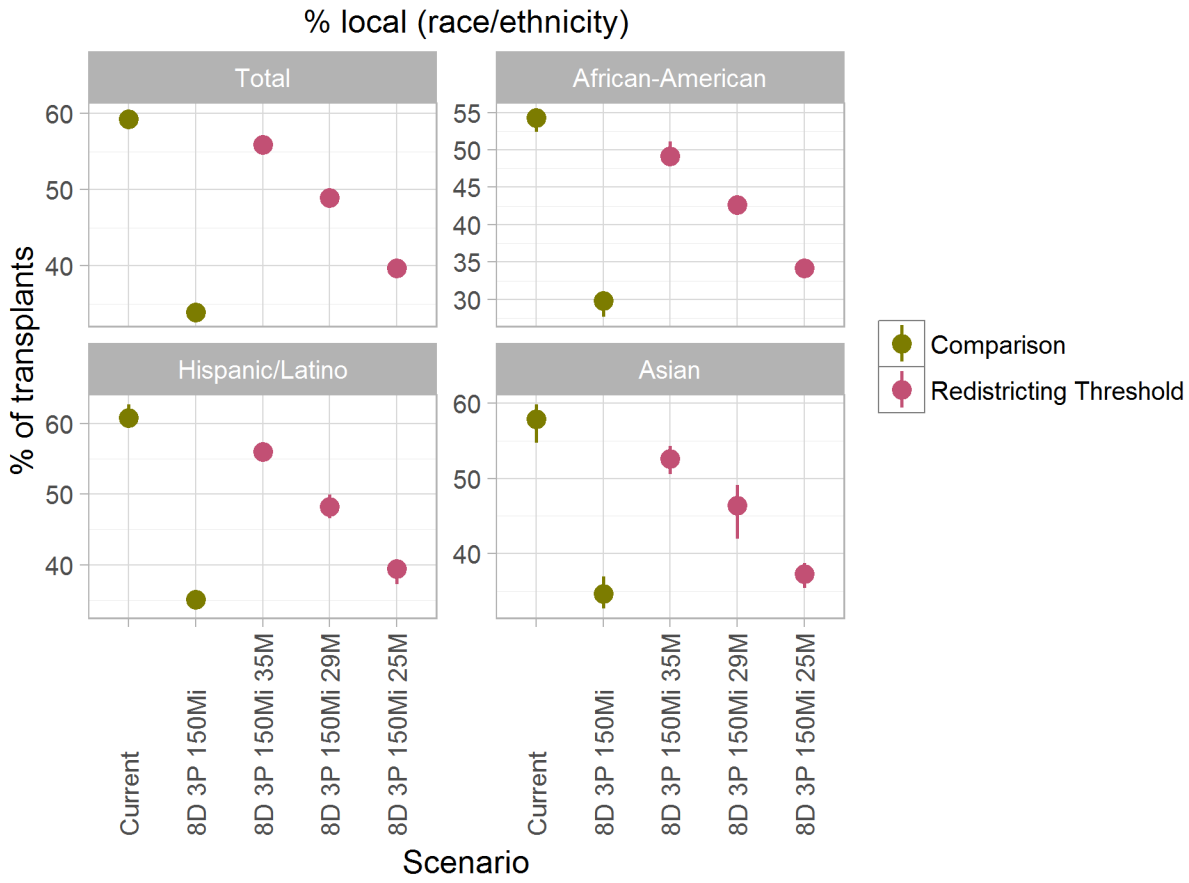

Figure 55 Percentage of transplants performed locally (within DSA) (all transplants by race/ethnicity)

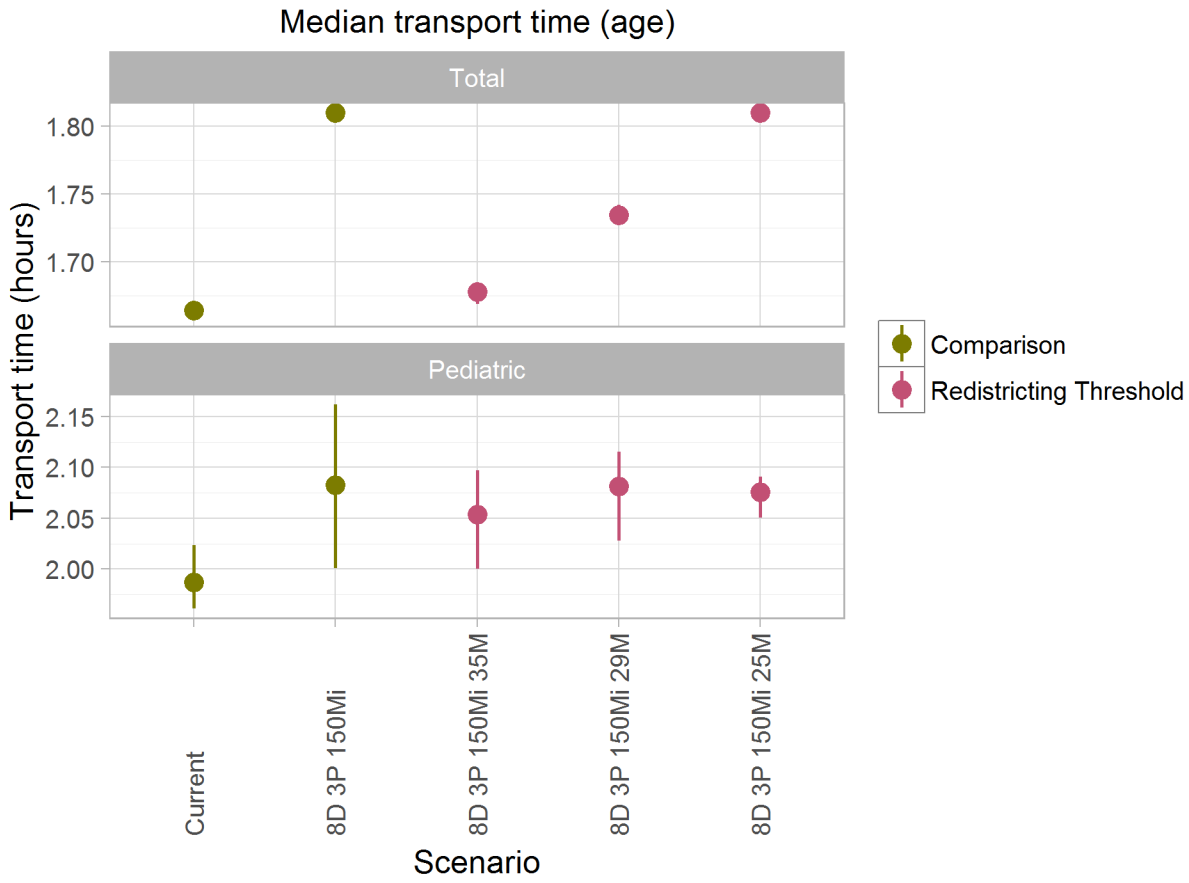

Figure 56 Median transport time (all transplants by pediatric status)

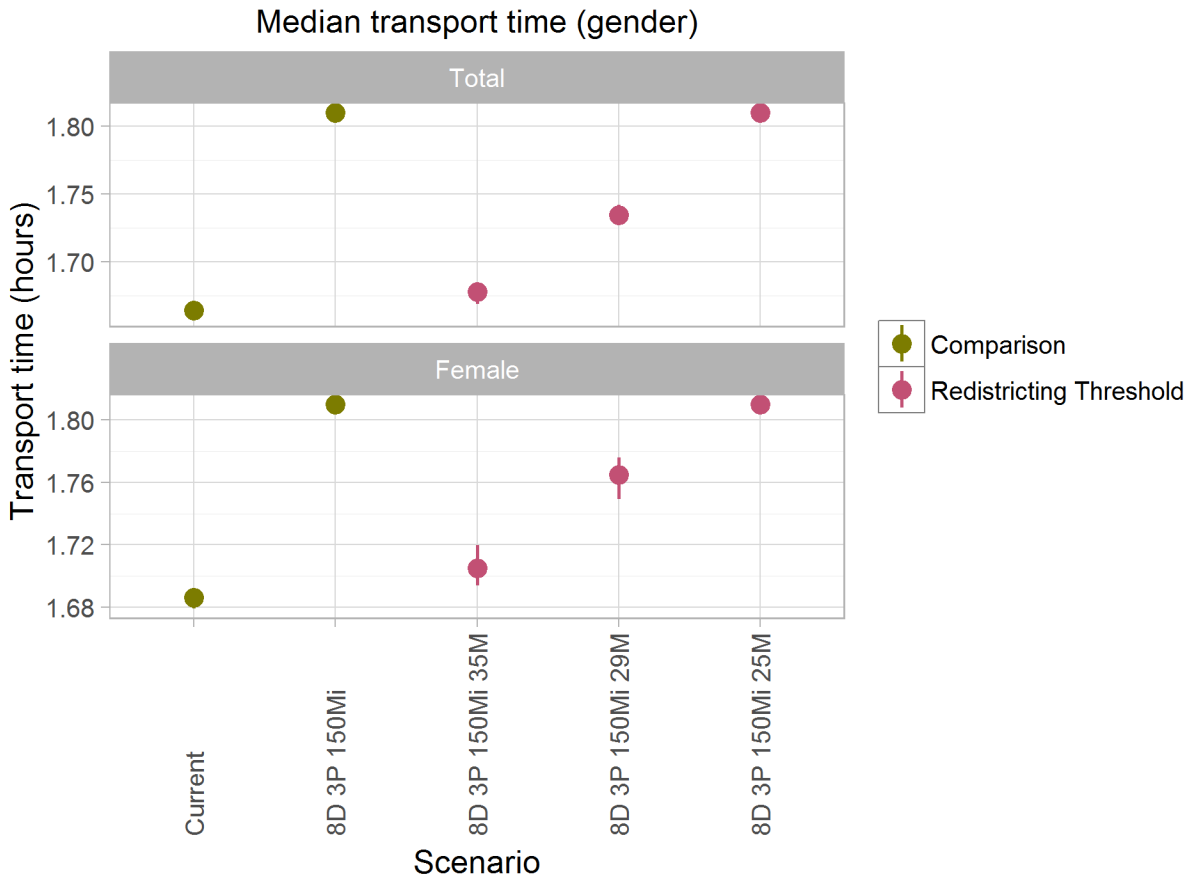

Figure 57 Median transport time (all transplants by gender)

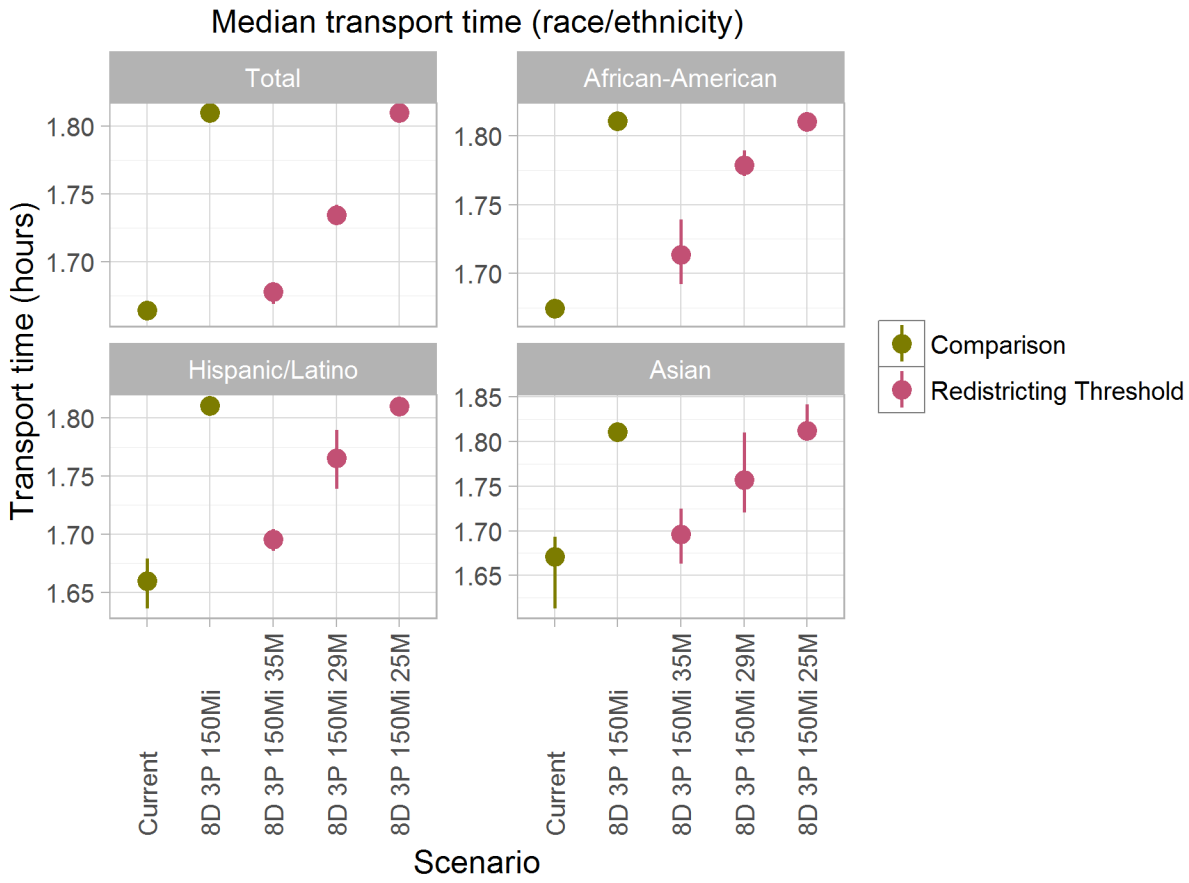

Figure 58 Median transport time (all transplants by race/ethnicity)

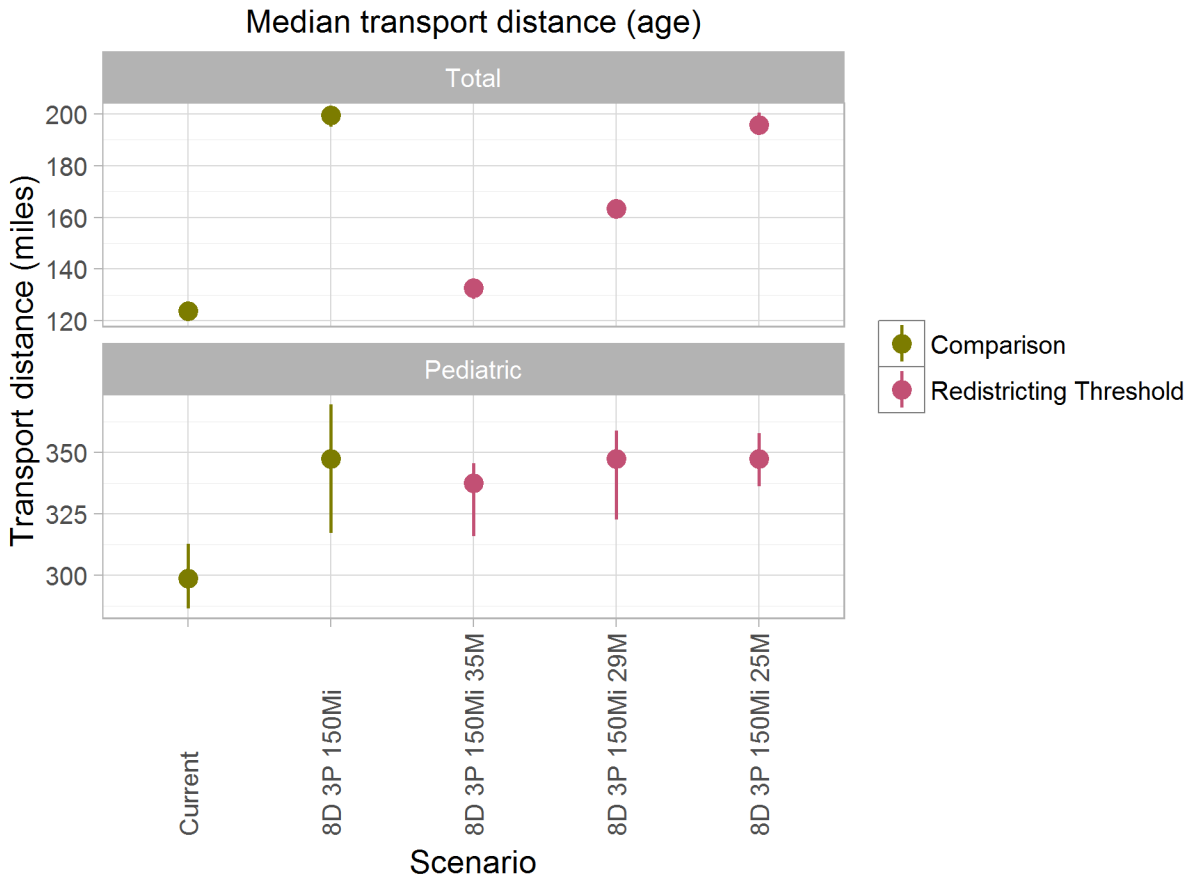

Figure 59 Median transport distance (all transplants by pediatric status)

Figure 60 Median transport distance (all transplants by gender)

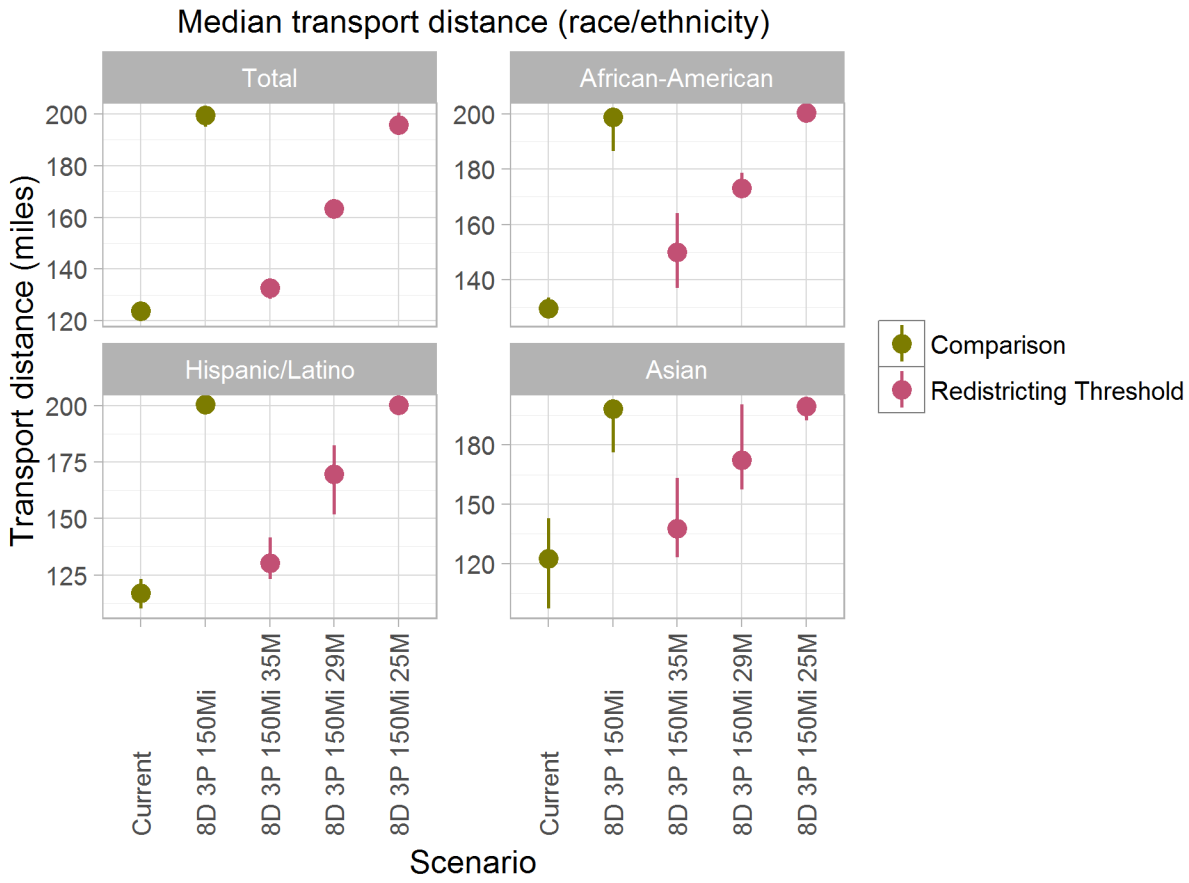

Figure 61 Median transport distance (all transplants by race/ethnicity)

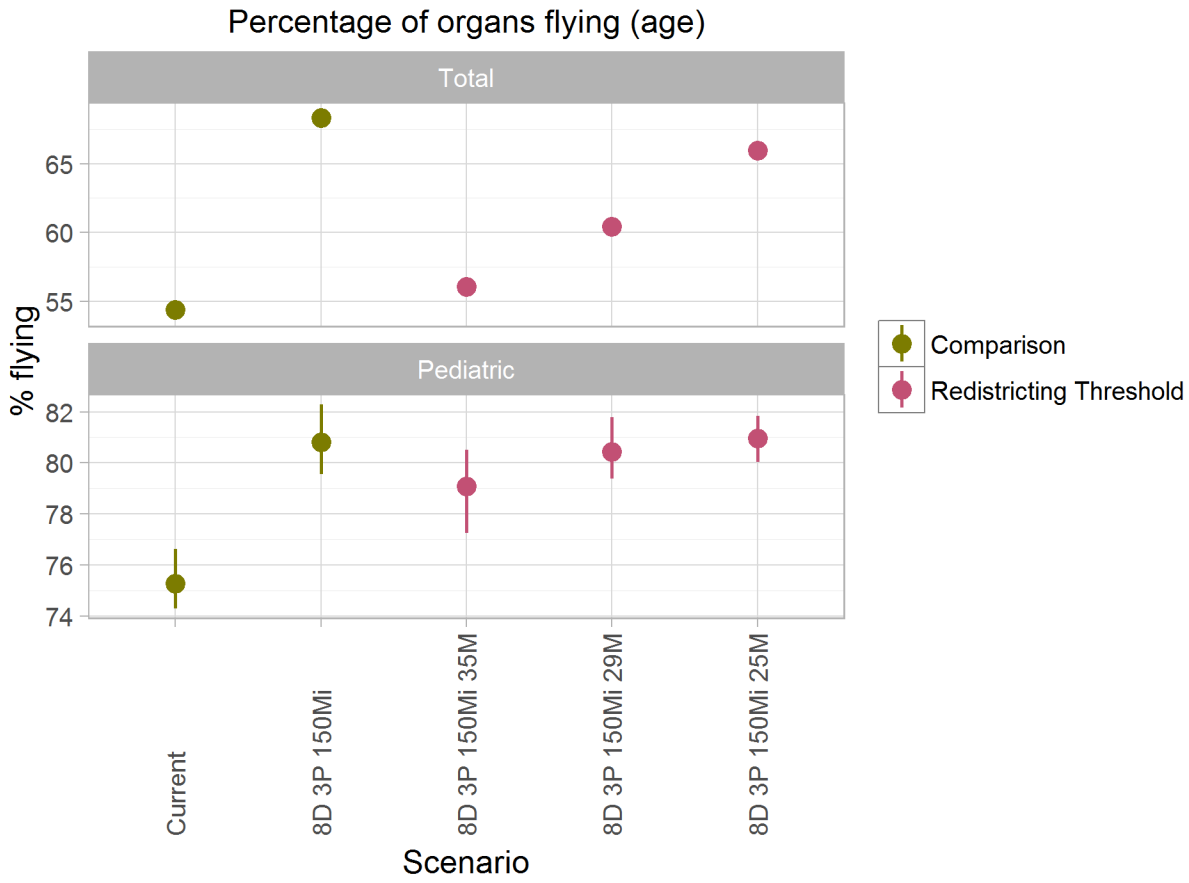

Figure 62 Percentage of organs flown (all transplants by pediatric status)

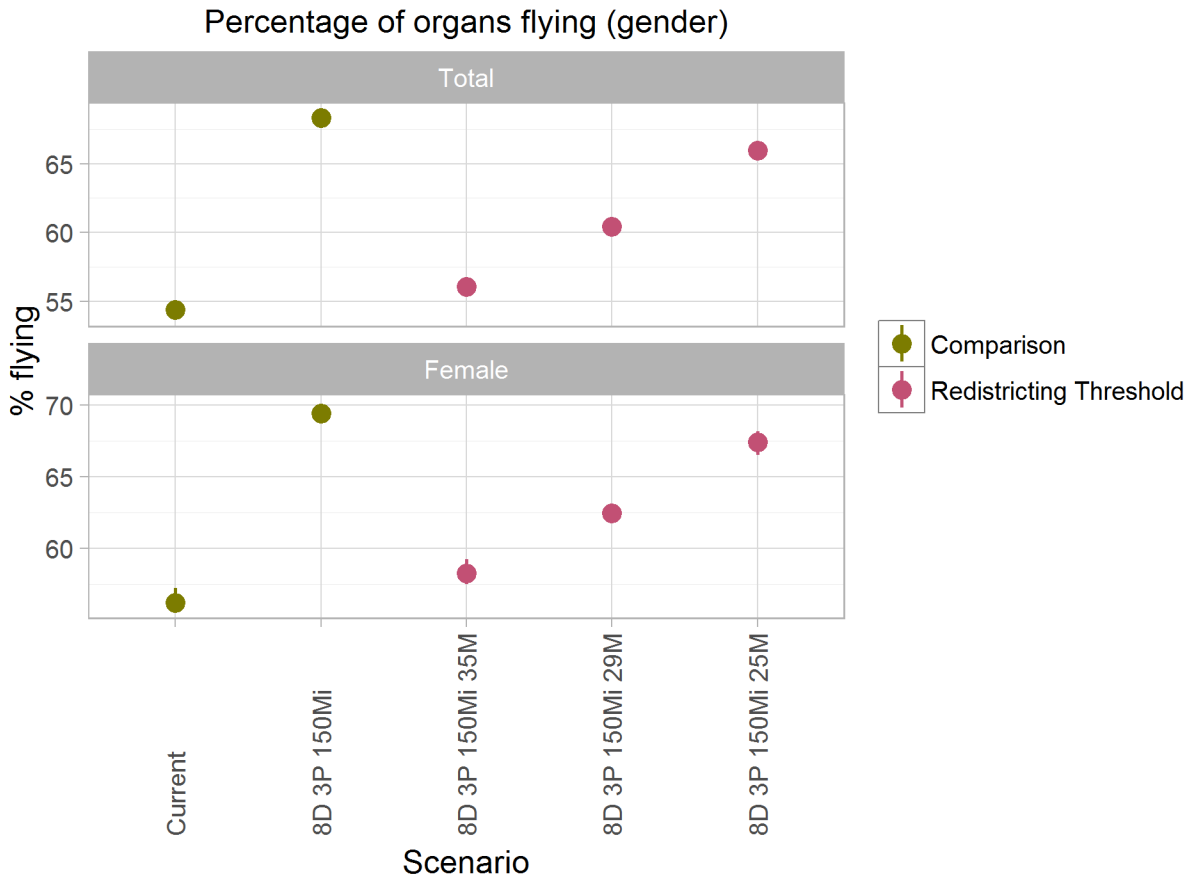

Figure 63 Percentage of organs flown (all transplants by gender)

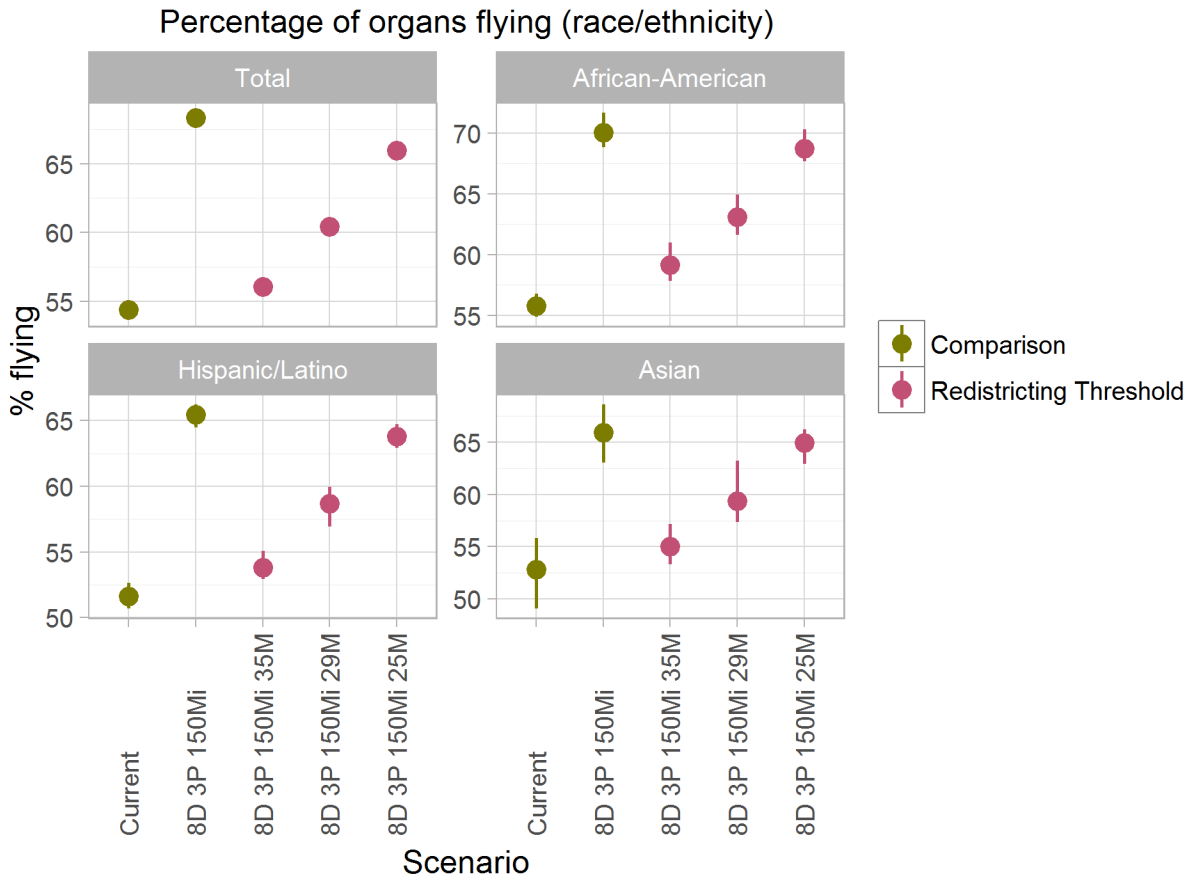

Figure 64 Percentage of organs flown (all transplants by race/ethnicity)

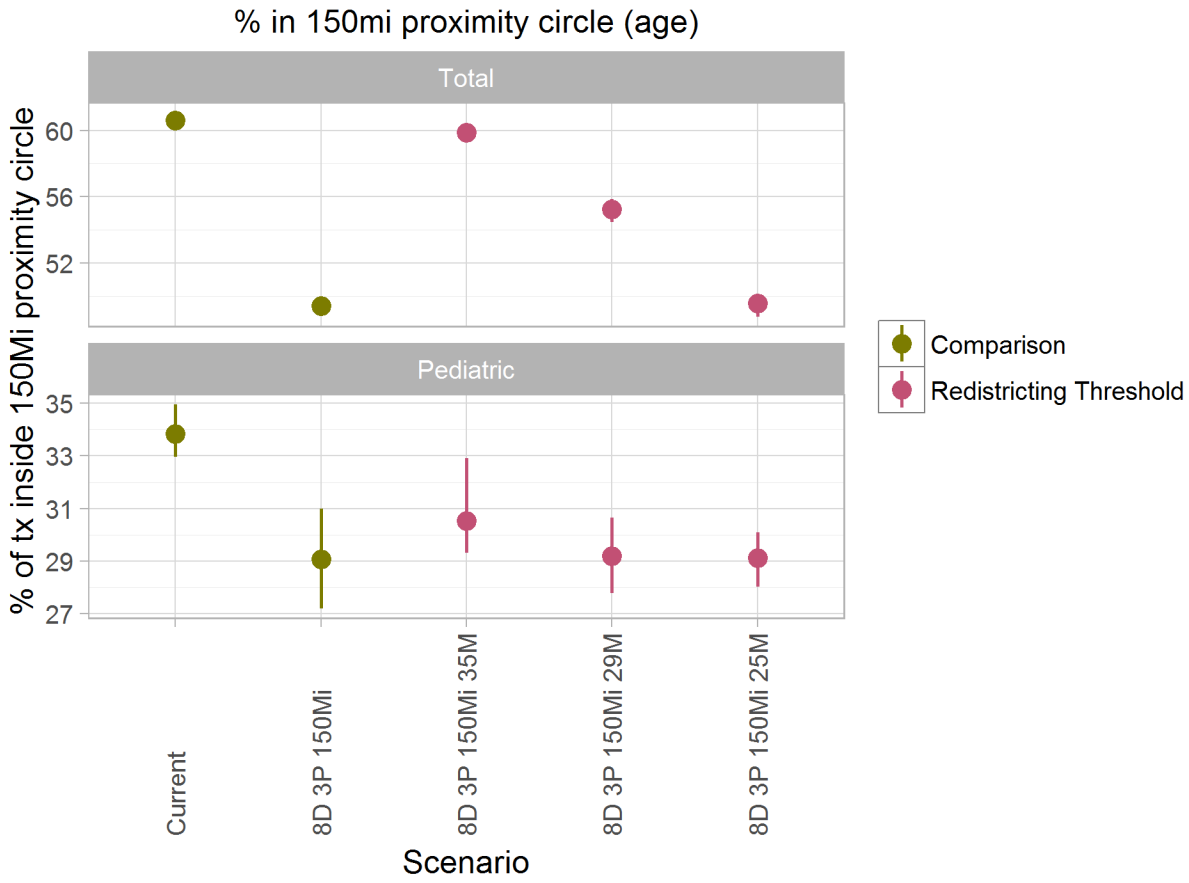

Figure 65 Percentage of transplants occurring inside the 150-mile proximity point circle (all transplants by pediatric status)

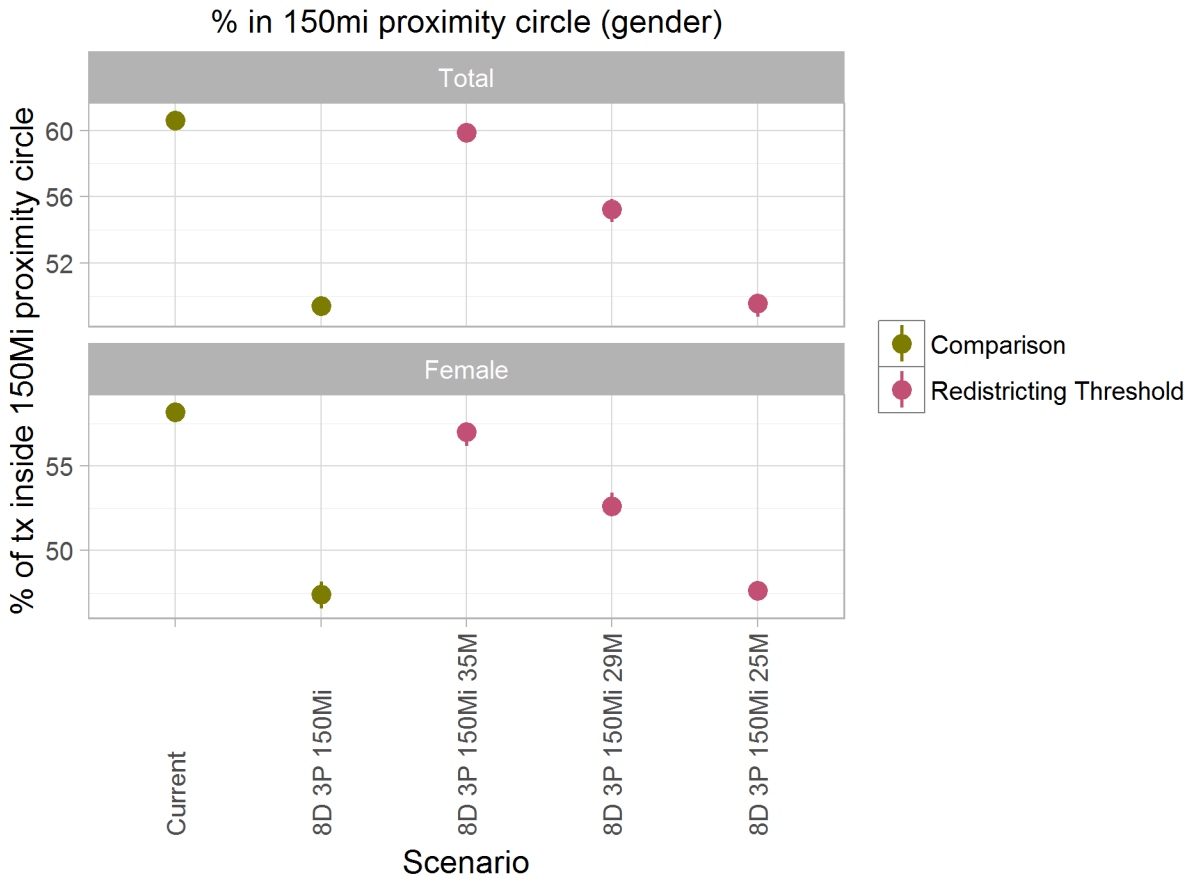

Figure 66 Percentage of transplants occurring inside the 150-mile proximity point circle (all transplants by gender)

914 SOUTH 8TH STREET SUITE S4.100 MINNEAPOLIS, MN 55404 1.877.970.SRTR WWW.SRTR.ORG

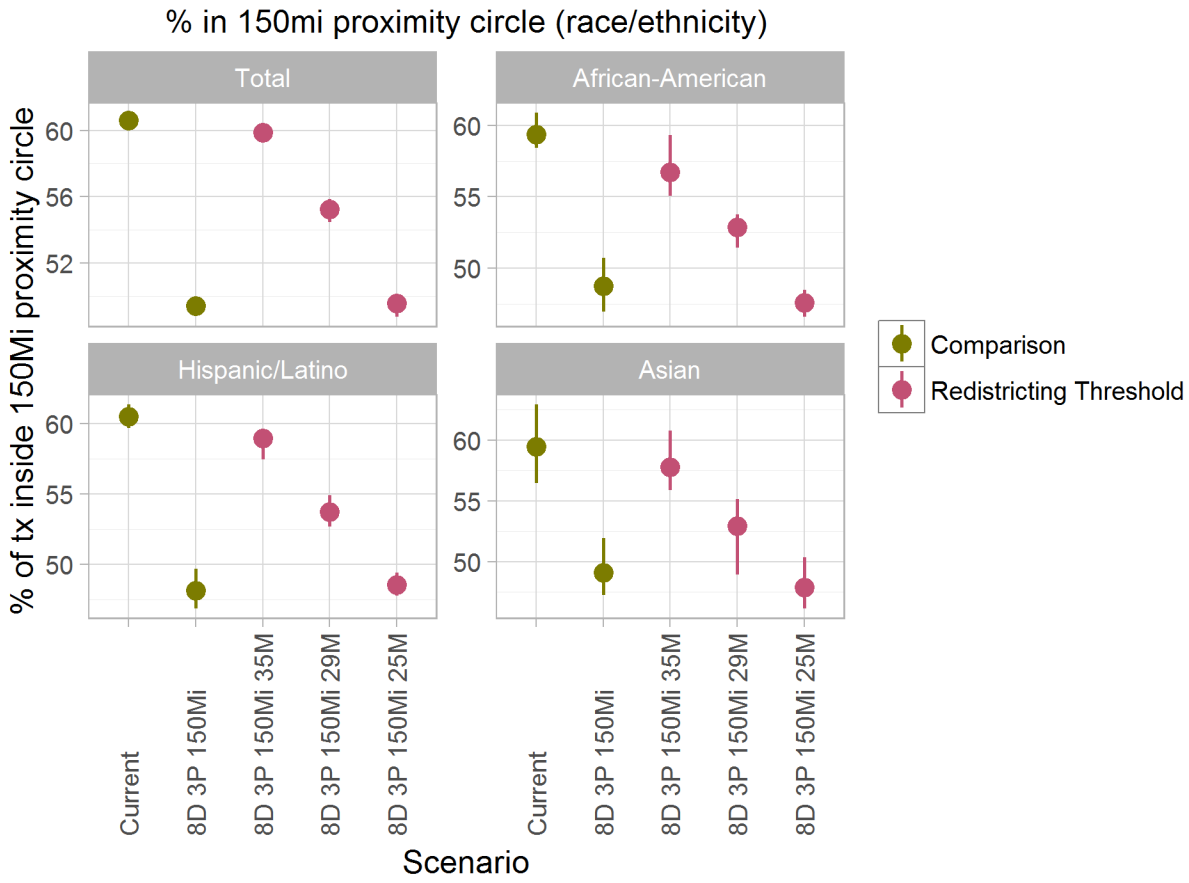

Figure 67 Percentage of transplants occurring inside the 150-mile proximity point circle (all transplants by race/ethnicity)

Appendix C. District Definitions

As specified in the OPTN attachment to the data request, the 8 districts modeled as part of this analysis are defined as follows:

District 1

LifeChoice Donor Services (CTOP), Washington Regional Transplant Community (DCTC), LifeLink of Georgia (GALL), New England Organ Bank (MAOB), The Living Legacy Foundation of Maryland (MDPC), LifeShare of the Carolinas (NCCM), Carolina Donor Services (NCNC), New Jersey Organ and Tissue Sharing Network (NJTO), Center for Donation and Transplant (NYAP), LiveOnNY (NYRT), Gift of Life Donor Program (PADV), LifeLink of Puerto Rico (PRLL), LifePoint (SCOP), LifeNet Heath (VATB)

District 2

LifeChoice Donor Services (CTOP), Washington Regional Transplant Community (DCTC), LifeLink of Georgia (GALL), New England Organ Bank (MAOB), The Living Legacy Foundation of Maryland (MDPC), LifeShare of the Carolinas (NCCM), Carolina Donor Services (NCNC), New Jersey Organ and Tissue Sharing Network (NJTO), Center for Donation and Transplant (NYAP), LiveOnNY (NYRT), Gift of Life Donor Program (PADV), LifeLink of Puerto Rico (PRLL), LifePoint (SCOP), LifeNet Heath (VATB)

District 3

Gift of Hope Organ & Tissue Donor Network (ILIP), Indiana Donor Network (INOP), Kentucky Organ Donor Affiliates (KYDA), LifeCenter Organ Donor Network (OHOV), Tennessee Donor Services (TNDS), Wisconsin Donor Network (WIDN), and UW Health Organ and Tissue Donation (WIUW)

District 4

Arkansas Regional Organ Recovery Agency (AROR), Mid-America Transplant Services (MOMA), and Mid-South Transplant Foundation (TNMS)

District 5

Iowa Donor Network (IAOP), LifeSource Upper Midwest Organ Procurement Organization (MNOP), Midwest Transplant Network (MWOB), Nebraska Organ Recovery System (NEOR), and LifeShare Transplant Donor Services of Oklahoma (OKOP)

District 6

Alabama Organ Center (ALOB), TransLife (FLFH), Life Alliance Organ Recovery Agency (FLMP), LifeQuest Organ Recovery Services (FLUF), LifeLink of Florida (FLWC), Louisiana Organ Procurement Agency (LAOP), Mississippi Organ Recovery Agency (MSOP), LifeGift Organ Donation Center (TXGC), Texas Organ Sharing Alliance (TXSA), and Southwest Transplant Alliance (TXSB)

District 7

Donor Network of Arizona (AZOB), Donor Alliance (CORS), New Mexico Donor Services (NMOP), and Intermountain Donor Services (UTOP)

District 8

Donor Network West (CADN), Sierra Donor Services (CAGS), OneLegacy (CAOP), Lifesharing - A Donate Life Organization (CASD), Legacy of Life Hawaii (HIOP), Nevada Donor Network (NVLV), Pacific Northwest Transplant Bank (ORUO), and LifeCenter Northwest (WALC)

Appendix D. Allocation ordering

Current Allocation

For adult donors:

- Regional Status 1A
- Regional Status 1B
- Local and Regional MELD/PELD >= 35 (by MELD)
- Local MELD/PELD 15-34
- Regional MELD/PELD 15-34
- National Status 1A
- National Status 1B
- National MELD/PELD >= 15
- Local MELD/PELD < 15
- Regional MELD/PELD < 15
- National MELD/PELD < 15

For adolescent donors (11-17 years):

- Local Pediatric Status 1A
- Regional Pediatric Status 1A
- Local Adult Status 1A
- Regional Adult Status 1A
- Local Pediatric Status 1B
- Regional Pediatric Status 1B
- Local and Regional Any PELD
- Local MELD >= 15, 12-17 years
- Local MELD >= 15, 18+ years
- Regional MELD >= 15, 12-17 years
- Regional MELD >= 15, 18+ years
- Local MELD < 15, 12-17 years
- Local MELD < 15, 18+ years
- Regional MELD < 15, 12-17 years
- Regional MELD < 15, 18+ years
- National Pediatric Status 1A
- National Adult Status 1A
- National Pediatric Status 1B
- National Any PELD
- National Any MELD, 12-17 years
- National Any MELD, 18+ years

For child donors (0-10 years):

- Regional Pediatric Status 1A
- National Pediatric Status 1A, 0-11 years

- Local Adult Status 1A
- Regional Adult Status 1A
- Regional Pediatric Status 1B
- Regional Any PELD
- Local MELD >= 15, 12-17 years
- Local MELD >= 15, 18+ years
- Regional MELD >= 15, 12-17 years
- Regional MELD >= 15, 18+ years
- Local MELD < 15, 12-17 years
- Local MELD < 15, 18+ years
- Regional MELD < 15, 12-17 years
- Regional MELD < 15, 18+ years
- National Status 1A, 12-17 years
- National Status 1A, 18+ years
- National Status 1B, 0-17 years
- National Any PELD
- National Any MELD, 12-17 years
- National Any MELD, 18+ years

8 district allocation with no threshold

For adult donors:

- District Status 1A
- District Status 1B
- District MELD/PELD >= 15
- National Status 1A
- National Status 1B
- National MELD/PELD >= 15
- District MELD/PELD < 15
- National MELD/PELD < 15

For adolescent donors (11-17 years):

- District Pediatric Status 1A
- District Adult Status 1A
- District Pediatric Status 1B
- District Any PELD
- District MELD >= 15, 12-17 years
- District MELD >= 15, 18+ years
- District MELD < 15, 12-17 years
- District MELD < 15, 18+ years
- National Pediatric Status 1A
- National Adult Status 1A
- National Pediatric Status 1B
- National Any PELD

- National Any MELD, 12-17 years
- National Any MELD, 18+ years

For child donors (0-10 years):

- District Pediatric Status 1A
- National Pediatric Status 1A, 0-11 years
- District Adult Status 1A
- District Pediatric Status 1B
- District Any PELD
- District MELD >= 15, 12-17 years
- District MELD >= 15, 18+ years
- District MELD < 15, 12-17 years
- District MELD < 15, 18+ years
- National Status 1A, 12-17 years
- National Status 1A, 18+ years
- National Status 1B, 0-17 years
- National PELD
- National MELD, 12-17 years
- National MELD, 18+ years

8 district allocation with threshold of MELD/PELD of 35 or greater

For adult donors:

- District Status 1A
- District Status 1B
- District MELD/PELD >=35
- Local MELD/PELD >=15
- District MELD/PELD >=15
- National Status 1A
- National Status 1B
- National MELD/PELD >=15
- Local MELD/PELD <15
- District MELD/PELD < 15
- National MELD/PELD < 15

For adolescent donors (11-17 years):

- Same order as '8 district allocation with no threshold' scenario

For child donors (0-10 years):

- Same order as '8 district allocation with no threshold' scenario

8 district allocation with threshold of MELD/PELD of 29 or greater

For adult donors:

- District Status 1A
- District Status 1B
- District MELD/PELD >=29
- Local MELD/PELD >=15
- District MELD/PELD >=15
- National Status 1A
- National Status 1B
- National MELD/PELD >=15
- Local MELD/PELD <15
- District MELD/PELD < 15
- National MELD/PELD < 15

For adolescent donors (11-17 years):

- Same order as '8 district allocation with no threshold' scenario

For child donors (0-10 years):

- Same order as '8 district allocation with no threshold' scenario

8 district allocation with threshold of MELD/PELD of 25 or greater

For adult donors:

- District Status 1A
- District Status 1B
- District MELD/PELD >=25
- Local MELD/PELD >=15
- District MELD/PELD >=15
- National Status 1A
- National Status 1B
- National MELD/PELD >=15
- Local MELD/PELD <15
- District MELD/PELD < 15
- National MELD/PELD < 15

For adolescent donors (11-17 years):

- Same order as '8 district allocation with no threshold' scenario

For child donors (0-10 years):

- Same order as '8 district allocation with no threshold' scenario