

# Continuous distribution simulations for lung transplant: Round 2

## **Data request: Continuous distribution simulations for lung transplant**

This report was provided to HRSA by SRTR in support of ongoing policy consideration by the OPTN Lung 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:**

Andrew Wey, PhD; Jon Miller, PhD; Melissa Skeans, MS; Tim Weaver, MS; Katie Audette, MS; Maryam Valapour, MD, MPP

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## Background:

The OPTN Lung Committee is currently working on adopting the continuous distribution framework for lung allocation. At the March 31-April 1, 2021 meetings of the OPTN Lung Committee, the Committee requested simulations for 6 different scenarios, plus current rules. Each model, a run of the Thoracic Simulated Allocation Model (TSAM) software, represents a different set of weights for each of the 6 attributes that will define continuous distribution.

## Strategic Goal or Committee Project Addressed:

Increase equity in access to transplants.

## Request:

The continuous distribution framework for lung transplant includes 6 components: waitlist survival, posttransplant survival, candidate biology, pediatric priority, prior living donor, and proximity efficiency. The OPTN Lung Committee has spent considerable time discussing and evaluating how each component should be prioritized. Their priorities are defined in terms of weights per component. They requested TSAM runs for the current allocation rules, as well as 6 different continuous allocation rules. Three sets of rules will use 2:1 WLAUC: PTAUC and vary proximity efficiency (PE), and three sets will use 1:1 WLAUC: PTAUC, and the same variation in PE.

Weights of each component (%) per continuous allocation scenario

Component	1:1 WLAUC:PTAUC			2:1 WLAUC:PTAUC		
	10% PE	15% PE	20% PE	10% PE	15% PE	20% PE
Waitlist Survival	25	22.5	20	33.33	30	26.67
Posttransplant Survival	25	22.5	20	16.67	15	13.33
Candidate Biology	15	15.0	15	15.00	15	15.00
Pediatric	20	20.0	20	20.00	20	20.00
Prior Living Donor	5	5.0	5	5.00	5	5.00
Proximity Efficiency	10	15.0	20	10.00	15	20.00

Each component has a rating scale. The committee chose the following rating scales:

1. Waitlist survival: A non-linear curve, where y=points and x=WLAUC based on recent LAS update.
2. Posttransplant survival: A linear relationship, where y=points and x=PTAUC based on 5-year PTAUC model from data request LU2020\_04. This scale has changed since the TSAM run for request LU2020\_05.
3. Candidate biology: A steep non-linear curve for each of blood type, CPRA, and candidate height. Each component gets 5% weight, for 15% total given to "candidate biology."
4. Pediatric: Binary, with increased points for candidates aged 0-<18 years at listing.
5. Prior living donor: Binary, with increased points for candidates who previously donated a lung lobe for transplant.
6. Proximity efficiency: There are two components (proximity and travel cost), each of which gets half the weight given to "proximity efficiency" in the table above. For example, when the

proximity efficiency is 10%, proximity and travel cost are each weighted 5%. The proximity efficiency curve is a combination of a sigmoidal curve and line segments, capturing the efficiencies of proximity other than cost. The rating based on cost is a piecewise linear curve, with 3 segments between 0 and 100 miles (not nautical miles) and one segment from 100-max miles. The discontinuity at 0 miles that was present in LU2020\_05 has been removed.

Each continuous distribution TSAM run will compute one global score per patient each time a donor organ arrives in the system, using an equation based on the weights given above.

## Study Population

The TSAM cohort includes transplant candidates listed on the lung, heart, and heart-lung waiting lists on January 1, 2018, and candidates added to those waiting lists from January 1, 2018, through December 31, 2019. The posttransplant survival model was estimated with recipients who underwent transplant from January 1, 2018, through December 31, 2019. Recipients were administratively censored on March 12, 2020. The offer acceptance models, used to determine the probability of accepting an offer, were estimated with offers recovered from donors between January 1, 2018, and December 31, 2019. Results for isolated lung transplant candidates are included in this report.

## Methods

To compare the effects of each continuous distribution scenario on different segments of the cohort population, we examined waitlist outcomes (waitlist mortality, transplant rates) and posttransplant outcomes per scenario by several stratification variables: age, sex, race, ethnicity, height, blood type, LAS, WLAUC, PTAUC, diagnosis group, OPTN region of transplant center, candidate urbanicity (based on ZIP code of candidate's permanent residence), and center volume. Among simulated transplants, we examined transplant counts, distribution, and posttransplant outcomes by distance between donor and recipient. Waitlist outcomes are not available by distance, because distance is not defined until a simulated offer acceptance generates a donor/recipient pair. Among transplants, we also examined median donor-to-recipient distance for each non-distance stratification variable. Outcomes based on likelihood of driving versus flying were requested. We defined a metric as "expected to fly" if the donor-to-recipient distance was greater than 75 nautical miles (NM). Distances were computed as straight-line distances based on latitude and longitude of donor and recipient centers.

Each simulation was repeated 10 times. The average, minimum, and maximum of each outcome were calculated overall and by subgroup and given in graphs and tables. Further details about the models used in the simulation are given in the appendix.

Data by LAS used LAS computed under approved but not yet implemented policy. To compute LAS, we used 1-year WLAUC and 1-year PTAUC that resulted from models fit on candidates and recipients, 2015-2018. These values were not substantially different from the LAS currently used. LAS for a given patient at a given time is the same in every scenario. Even though this LAS is used for allocation only under the current rules scenario, we show all outcomes by LAS because it's a well-understood quantity in the transplant community. Showing outcomes "by LAS" allows the reader to see how a person with a computed LAS of 45, for example, might fare under each allocation scenario.

Data by WLAUC use the 1-year WLAUC that resulted from models fit on candidates and recipients, 2015-2018. Data by PTAUC use the 5-year PTAUC that resulted from a 5-year survival model fit on recipients 2014-2018, presented in data request LU2020\_04.

## Scenario labels

We chose names for the scenarios to be brief but highlight the differences in each.

- Current rules was named the “Current” scenario.
- Ratio of WLAUC:PTAUC was represented by “LAS1.1” or “LAS2.1”, meaning 1:1 WLAUC:PTAUC and 2:1 WLAUC:PTAUC, respectively. LAS will to be an independent entity under continuous allocation, but we continue to use its constituent parts and retain the nomenclature for this report.
- Weight given to proximity efficiency was represented by “PE20,” “PE15,” and “PE10,” representing 20%, 15%, and 10% PE, respectively.
- Thus, the scenario with 10% PE and 1:1 WLAUC:PTAUC ratios was called “PE10LAS1.1.” The others follow a similar pattern.

## Summary

- The number of waitlist deaths declined considerably in all continuous allocation scenarios compared with current rules. Declines ranged from 36% to 47%, with larger decreases in deaths at lower PE weight and higher WLAUC weight.
- Transplant rates declined with continuous allocation, but the number of transplants was similar across scenarios. Lower overall transplant rates were likely due to longer waiting times for less urgent candidates.
- Median distances between donor and recipient hospitals increased for all continuous allocation scenarios. Distances were higher with lower PE weight, and the impact of WLAUC weight (2:1 LAS compared with 1:1 LAS) was minimal for a given PE weight.
- Though median distances increased, overall percent of organs expected to fly declined with continuous allocation compared with current rules, reflecting the balance between waitlist urgency and placement efficiency priority across the distance spectrum. Under current rules, all adult candidates within 250 NM have the same distance priority. Under continuous allocation, donor lungs are usually placed closer to the donor hospital, but when they are not, they are placed much further away, usually for a high priority candidate.
- Two-year predicted posttransplant deaths were similar across scenarios, a finding that held for most subgroups.

Notable group-specific findings:

1. By age group: Under continuous allocation, transplant rates increased considerably for pediatric candidates, especially those aged 12-17, increased more modestly for candidates aged 18-49, and declined for candidates 65 years or older. Waitlist death counts decreased in all age groups. Median donor-to-recipient distances were high for the pediatric population,

regardless of scenario. Among adults, median distances were higher within scenarios with less emphasis on allocation efficiency and lower when efficiency was prioritized more.

2. By LAS: Under all continuous allocation scenarios, transplant rates increased for candidates with LAS  $\geq 60$ , decreased for LAS 35- $<50$ , and varied by scenario for the other two groups. Most reductions in waitlist death occurred in the LAS  $\geq 60$  group, with the largest declines when PE weight was low and WLAUC weight was 2. Donor-to-recipient distances increased most for this high-LAS group.
3. By height: Under continuous allocation, transplant rates for candidates  $<158$  cm increased compared with current rules, even after removing children from the group. The number of waitlist deaths in this group declined by nearly half.
4. By race/ethnicity: Transplant rates increased for Latinos and decreased for white candidates under most continuous allocation scenarios compared with current rules. Declines in waitlist deaths were more pronounced for Latino candidates.
5. By blood type: Under continuous allocation, transplant rates for blood type O candidates increased considerably, and rates for all other blood types decreased, compared with current rules. Declines in waitlist deaths were more pronounced among type O candidates than other blood types.
6. By WLAUC: Patterns by WLAUC were similar to patterns by LAS, in which transplant rates increased for the most severely ill quartile of patients in all continuous allocation scenarios and more so when WLAUC weight was higher and PE weight was lower. In the current rules simulation, 75% of the waitlist deaths were in the lowest WLAUC quartile, and most of the declines in waitlist deaths occurred among candidates with low WLAUC. These low-WLAUC patients also had the largest increases in median donor-to-recipient distances under continuous allocation.
7. By PTAUC: Under continuous allocation, transplant rates for those with the best predicted posttransplant outcomes increased; rates among those with the lowest two quartiles of predicted posttransplant survival declined. Waitlist deaths declined in all PTAUC quartiles. Median distance increased in the two lowest PTAUC quartiles and decreased in the two highest quartiles when PE weight was 20%.
8. By diagnosis group: Transplant rates declined for diagnosis group B and D candidates under continuous allocation and increased for group C; rates for group A candidates varied by scenario but largely declined. Waitlist deaths declined modestly for group B, and considerably for groups C and D under continuous allocation, while waitlist deaths in group A were similar to current rules. Median distances increased for all continuous allocation scenarios in groups B, C, and D.
9. By distance: Compared with current rules, continuous allocation increased the proportion of transplants from donors within 50 NM, as well as the proportion within  $>250$  NM, and decreased the proportion from 50 to 250 NM. Proportions of transplants from distant donors were higher when PE weight was lowest, and the proportion with 50 NM was highest when PE weight was 20%.

10. By OPTN region: Variability in transplant rates across regions was reduced under continuous allocation compared with current rules and tended to decline in regions with the highest rates and increase in regions with the lowest rates under current rules. Waitlist deaths declined in nearly all regions and increased in no regions. There were regional differences in median donor-to-recipient distances.
11. By center volume: Transplant rates at the lowest-volume centers (those performing 1-15 transplants per year) increased with continuous allocation and decreased at all other center volume levels, compared with current rules. This is likely due to increased transplant rates among pediatric candidates. Waitlist deaths declined for all center volume groups; in centers performing 16-100 transplants per year, declines in waitlist death were larger in the 2:1 LAS scenarios than in the 1:1 LAS scenarios.

## Results

### Considerations for Interpreting Data

Graphs and tables in this report provide point estimates for the average of each metric and well as the minimum and maximum of the range of the simulation. They look like confidence intervals, but they are not. For example, in Table 1, the data for transplant rate under current rules was “1.77 (1.75, 1.79).” This means that among the 10 runs of the simulation, the average overall transplant rate for the current rules scenario was 1.77 transplants per patient-year; the minimum and maximum rates observed were 1.75 and 1.79, respectively. When the distance between the minimum and maximum was small, the graph appears to have just a dot for the point estimates (see Figure 1). The vertical bars ranging from the minimum to maximum of observed data exist but were obscured by the size of the dot. When group counts were small and ranges large, vertical bars representing the larger range of simulation output are visible (Figure 4).

We generally conclude that simulated results are similar when the ranges of the simulation overlap. Since each simulation run uses the same candidates and donors, we don't have independent samples that statistical tests require.

Though continuous distribution scenarios use a 5-year PTAUC, 2-year posttransplant outcomes are given. The model used to generate predictors for 5-year PTAUC was based on a larger cohort than the TSAM cohort. Thus, TSAM outcomes models are limited to 2-year posttransplant outcomes.

### Overall Outcomes

Overall, waitlist deaths declined considerably in all continuous allocation scenarios compared with current rules (Figure 2, Table 1). Generally, waitlist deaths were higher in the 1:1 LAS scenarios compared with the 2:1 LAS scenarios at similar proximity efficiency (PE). In both 1:1 and 2:1 LAS scenarios, waitlist deaths were quite similar at 10% and 15% PE but higher with 20% PE. Under the current rules scenario, 435 candidates died awaiting transplant, compared with 260, 269, and 280 in the 1:1 LAS at 10%, 15%, and 20% PE, respectively. In the 2:1 LAS scenarios, there were 231, 236, and 247 waitlist deaths, respectively, at 10%, 15%, and 20% PE. The lowest number of waitlist deaths occurred in the scenario with the highest weight for WLAUC and lowest PE weight; the highest number of deaths among continuous allocation scenarios occurred when distance was prioritized the most and WLAUC the least.

Median distances from donor to recipient and percent of donor organs expected to be flown were lowest at higher PE but varied little by ratio of WLAUC to PTAUC. At 20% PE, the 1:1 LAS scenario estimated median distance was 236 NM, and the 2:1 LAS scenario median distance was 245 NM.

Figure 3 shows the distributions of distances by scenario, and Table 14 shows number and percent of transplants by distance category. Though Figure 3 shows some transplants occurring beyond 4000 NM, the number of patients in this group was small. Under current rules, fewer than 200 cases (<4%) had donor-to-recipient distances of 1000 NM or more, compared with 7%-12% in all continuous allocation scenarios. The proportion of transplants where donors were <50 NM from recipients increased under all continuous allocation rules. Under the current rules scenario, donor-to-recipient distance was <50 NM for 14% of recipients but ranged from 17%-26% under continuous allocation, with greater proportions at higher PE.

Overall, two-year posttransplant deaths for all scenarios were similar, even though PTAUC was based on a 5-year outcomes model. Though the mean was slightly lower for current rules, the ranges observed across all scenarios overlapped considerably.

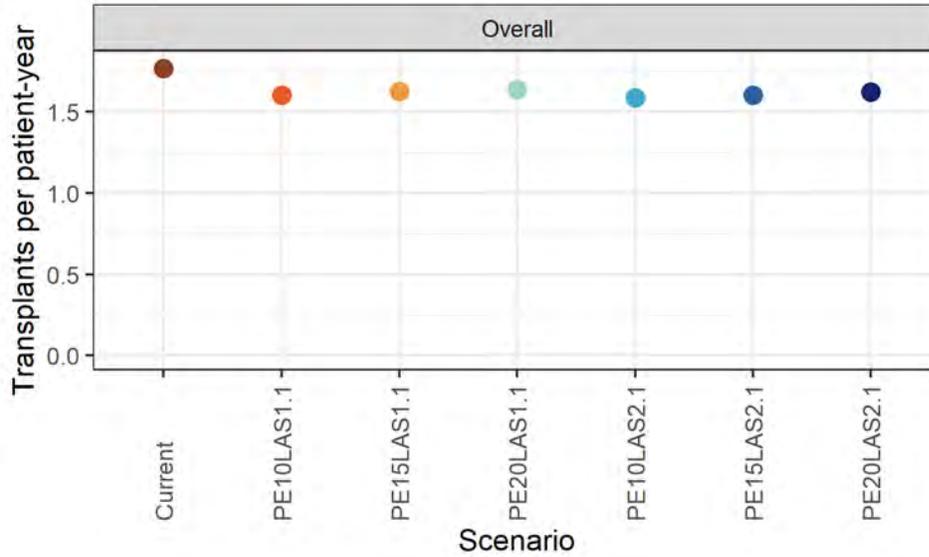


Figure 1: Transplant Rates - Overall

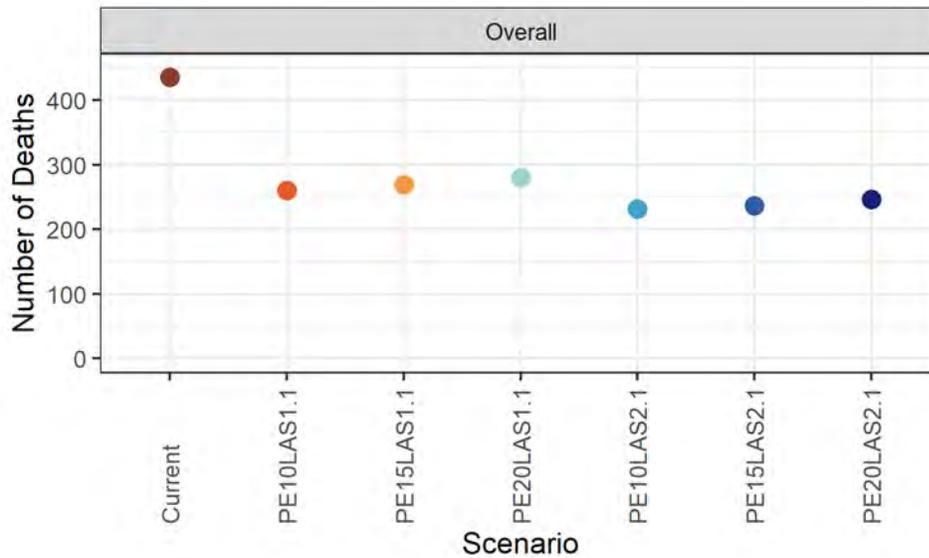


Figure 2: Waitlist Death Counts - Overall

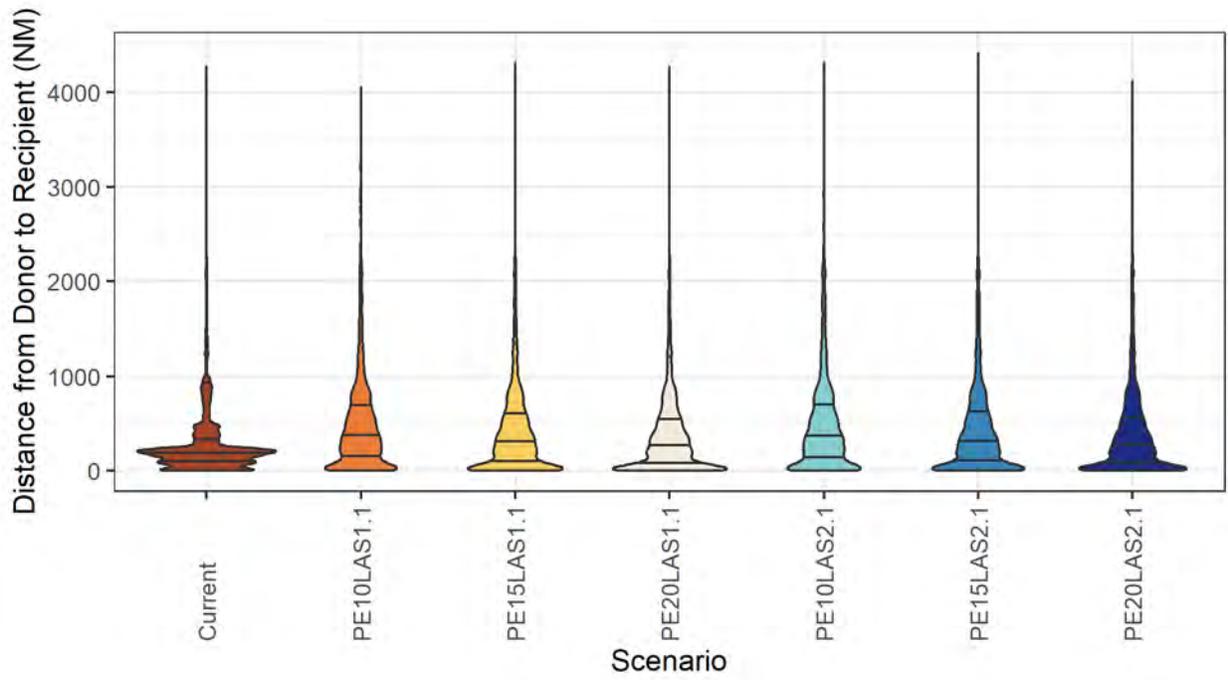


Figure 3: Distribution of Distance from Donor - By Scenario



Table 1: Outcome Counts and Rates by Scenario

Outcome	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
Transplant Rate per Patient-Year	1.77 (1.75,1.79)	1.6 (1.6,1.61)	1.63 (1.62,1.64)	1.64 (1.63,1.65)	1.59 (1.58,1.6)	1.61 (1.59,1.62)	1.62 (1.61,1.63)
Transplant Count (N)	5056 (5038,5068)	5064 (5056,5070)	5081 (5066,5093)	5084 (5073,5090)	5085 (5069,5097)	5096 (5088,5105)	5102 (5086,5112)
Waitlist Mortality Count (N)	435 (419,449)	260 (251,270)	269 (253,284)	280 (269,293)	231 (220,240)	236 (221,249)	247 (239,254)
Percent Died by 2 Years Posttransplant	23.38 (22.09,24.35)	23.44 (22.49,24.16)	23.64 (22.42,24.53)	24.08 (23.64,24.93)	23.71 (22.78,24.2)	24.07 (22.99,24.86)	23.86 (22.6,24.72)
Median Donor-to-Recipient Distance	195 (191,198)	353 (343,361)	283 (273,290)	236 (223,246)	345 (334,355)	288 (274,294)	245 (231,255)
Percent Expected to Fly (>75 NM)	81.32 (80.74,82.31)	79.02 (77.99,80.16)	73.12 (72.33,74)	69.42 (68.52,70.1)	78.17 (77.33,78.63)	73.53 (72.63,74.65)	70.63 (69.95,71.22)

## Outcomes by Age

Simulated outcomes varied from current rules by age group (Table 2). Transplants rates among children aged 0-11 increased from 0.71 transplants per patient-year under current rules to 1.10-1.19 under all continuous allocation scenarios (Figure 4). Transplant rates among children aged 12-17 increased from 1.73 transplants per patient-year to 6.83-7.83 under all continuous allocation scenarios, a 3.9-4.5-fold increase. The proportion of children among transplant recipients increased for all continuous allocation scenarios, though they remained at less than 2.5% of all recipients.

Adults aged 18-49 also had higher transplant rate point estimates under continuous allocation compared with current rules, though in some cases there was overlap in the rate ranges. Among adults aged 18-49, transplant rates declined slightly with increasing PE, and at a given PE level, rates were higher in the 1:1 LAS scenarios than the 2:1 LAS scenarios.

The opposite was true for older patients. Among those aged 50-64, transplant rates declined slightly under all continuous allocation scenarios compared with current rules, and those declines were greatest at the lowest PE threshold. The pattern persisted for candidates aged 65 years and older, but were more pronounced.

Changes in transplant rates shifted the distributions of transplant recipients by age group. All continuous allocation scenarios increased the proportions of recipients under age 50 (Table 2, Figure 5). The proportions of recipients aged 50-64 years were similar to current rules, and proportions aged 65 and older declined from 36% under current rules to 30%-33% under continuous allocation.

Waitlist deaths were similar for children aged 0-11, with 11 deaths under current rules and 8 for each continuous distribution scenario; ranges of waitlist deaths in this age group overlapped for all scenarios (Table 2, Figure 6). Waitlist deaths among children aged 12-17 declined from 12 under current rules to 2 or 3 under all continuous allocation rules. Among adults aged 18-49, declines were similar across all six continuous distribution scenarios. Among adults aged 50 and older, declines in waitlist deaths were largest for the 2:1 LAS scenarios compared with 1:1 LAS scenarios and varied little by PE weight.

Among adults, the percent of 2-year posttransplant deaths was similar in all scenarios. The number and percent of 2-year posttransplant deaths among children appears concerning, with considerable increases in death among the continuous distribution scenarios compared with current rules (Table 2, Figure 7). Due to the small number of patients aged 17 and younger, the posttransplant mortality model for this group included only one predictor: donor age older than 20 years. The increase in posttransplant death among children was likely the result of an increase in the donor age for transplants among children aged 12-17. Table 3 shows the donor age distribution among recipients aged 12-17. Under current rules, 73% of donors to adolescent recipients were also aged 12-17. Under all continuous allocation scenarios, over 80% of donors to adolescent recipients were adults, with 41%-46% aged 18-34 years and 35%-40% aged 35 years or older.

Among children aged 0-11 years, median distance from donor to recipient was high (>600 NM) and variable (479-842 NM for current rules), and range across scenarios overlapped widely (Table 2). Among children aged 12-17 years, median distances increased for all continuous allocation scenarios compared with current rules, reflecting the high priority given to all children under continuous allocation. Under current rules, children aged 12-17 had high priority for pediatric

donors out to 1000 NM but similar priority to adults for more numerous adult donors. In all continuous allocation scenarios, all children had increased priority for all donors through the pediatric weight scale, and many pediatric candidates got increased priority to all donors through the height component of the candidate biology scale.

Among adults, patterns of donor-to-recipient distance were similar to the overall data, in which distances were higher under continuous allocation than current rules. Among continuous allocation rules, distances were lowest when PE weight was highest. Organs to pediatric recipients had a high likelihood of being flown in all scenarios, which was expected. Among adults 50 years or older, fewer organs were expected to have been flown under continuous allocation, reflecting the linear distance scale across the entire distance spectrum.

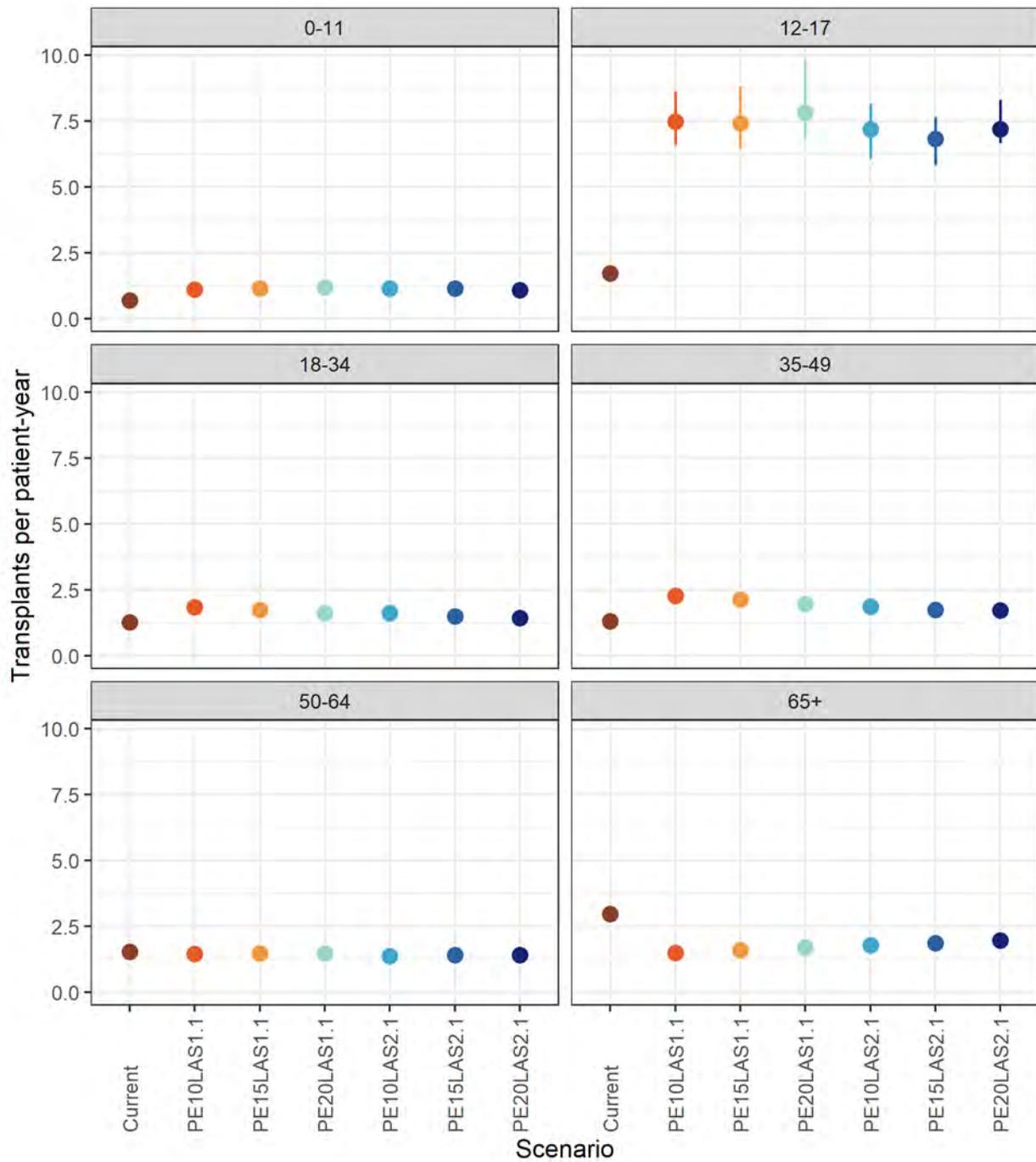


Figure 4: Transplant Rates - By Age

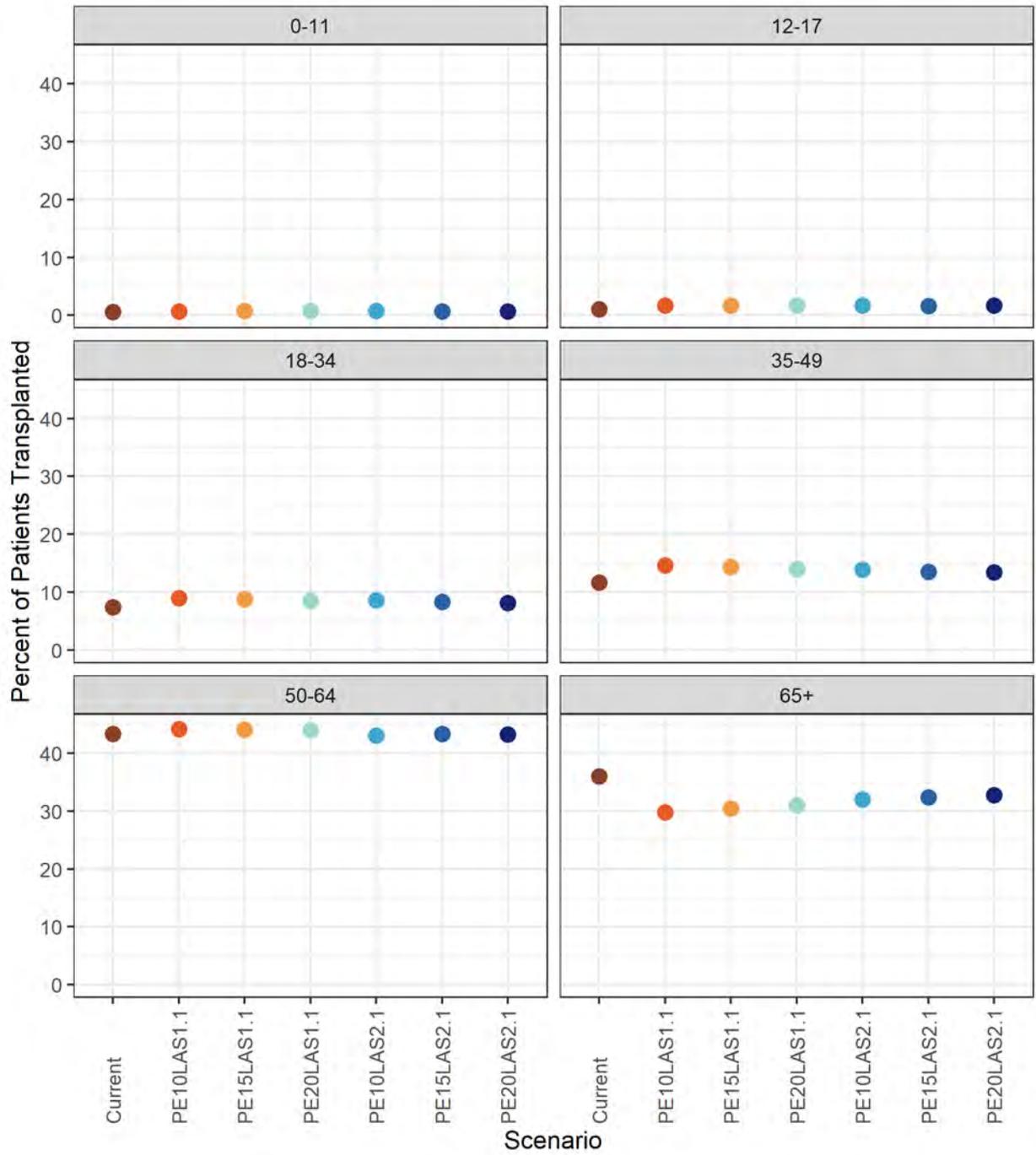


Figure 5: Transplant Distribution - Percent By Age

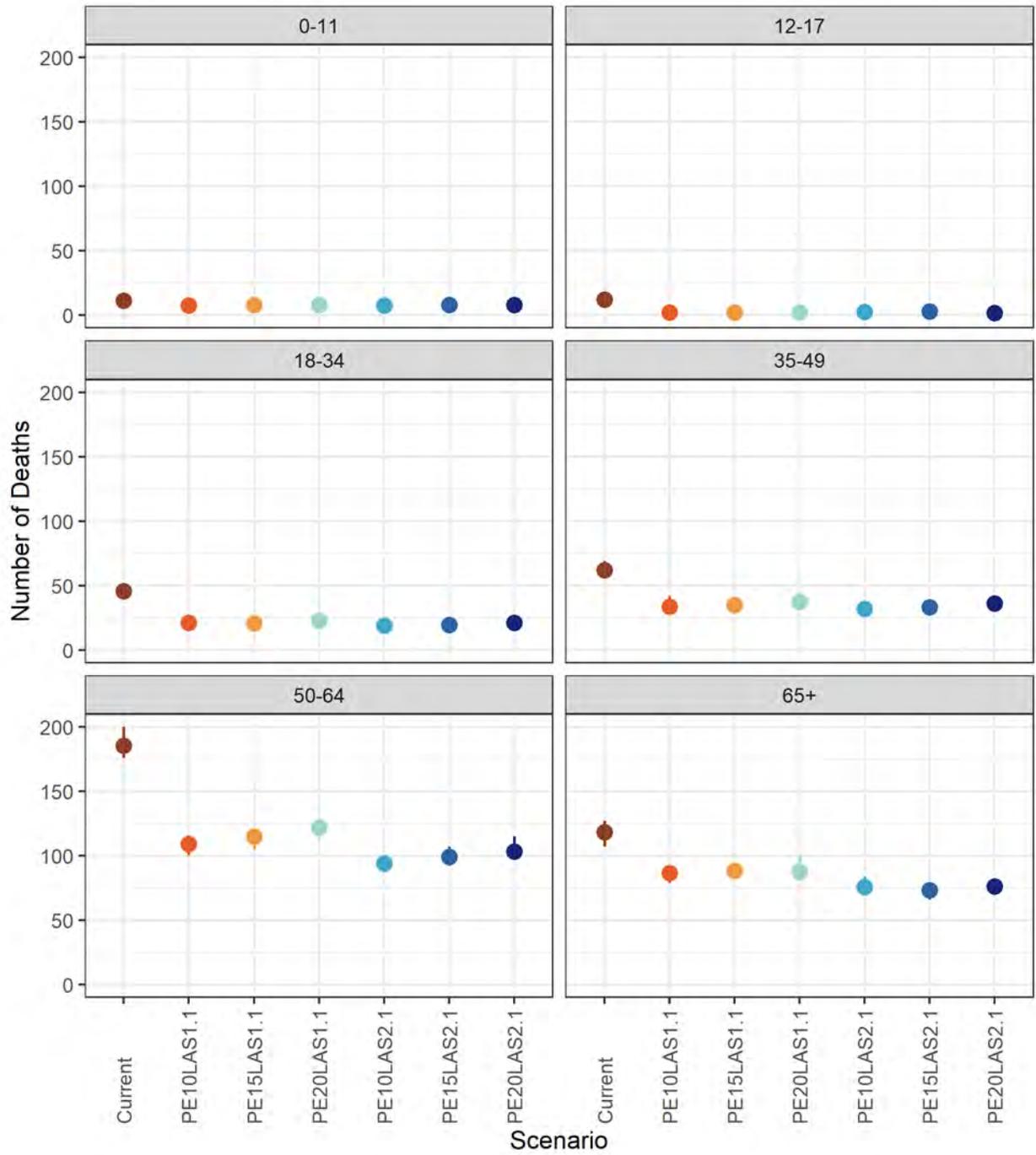


Figure 6: Waitlist Death Counts - By Age

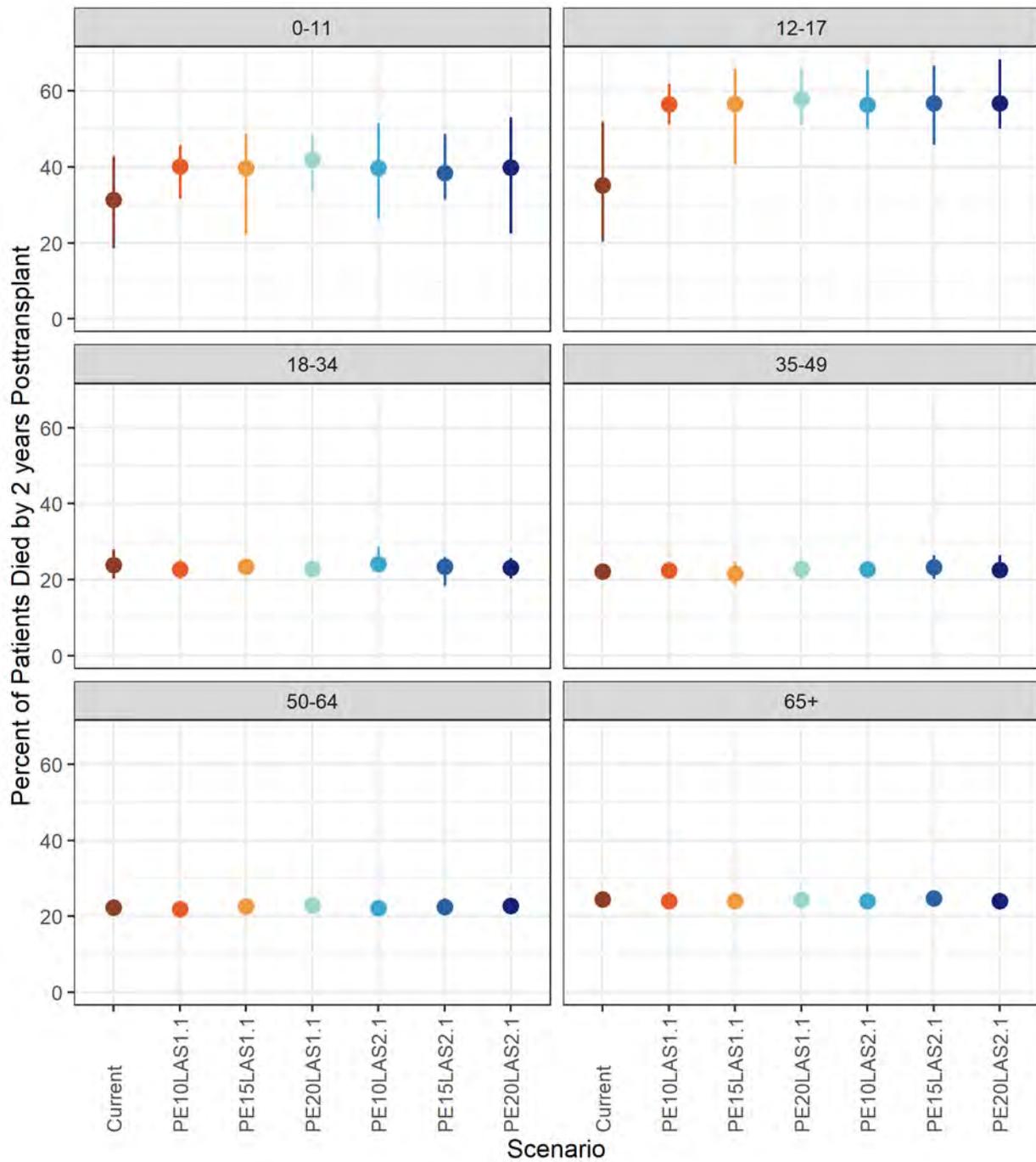


Figure 7: Percent Died by 2 Years Posttransplant - By Age

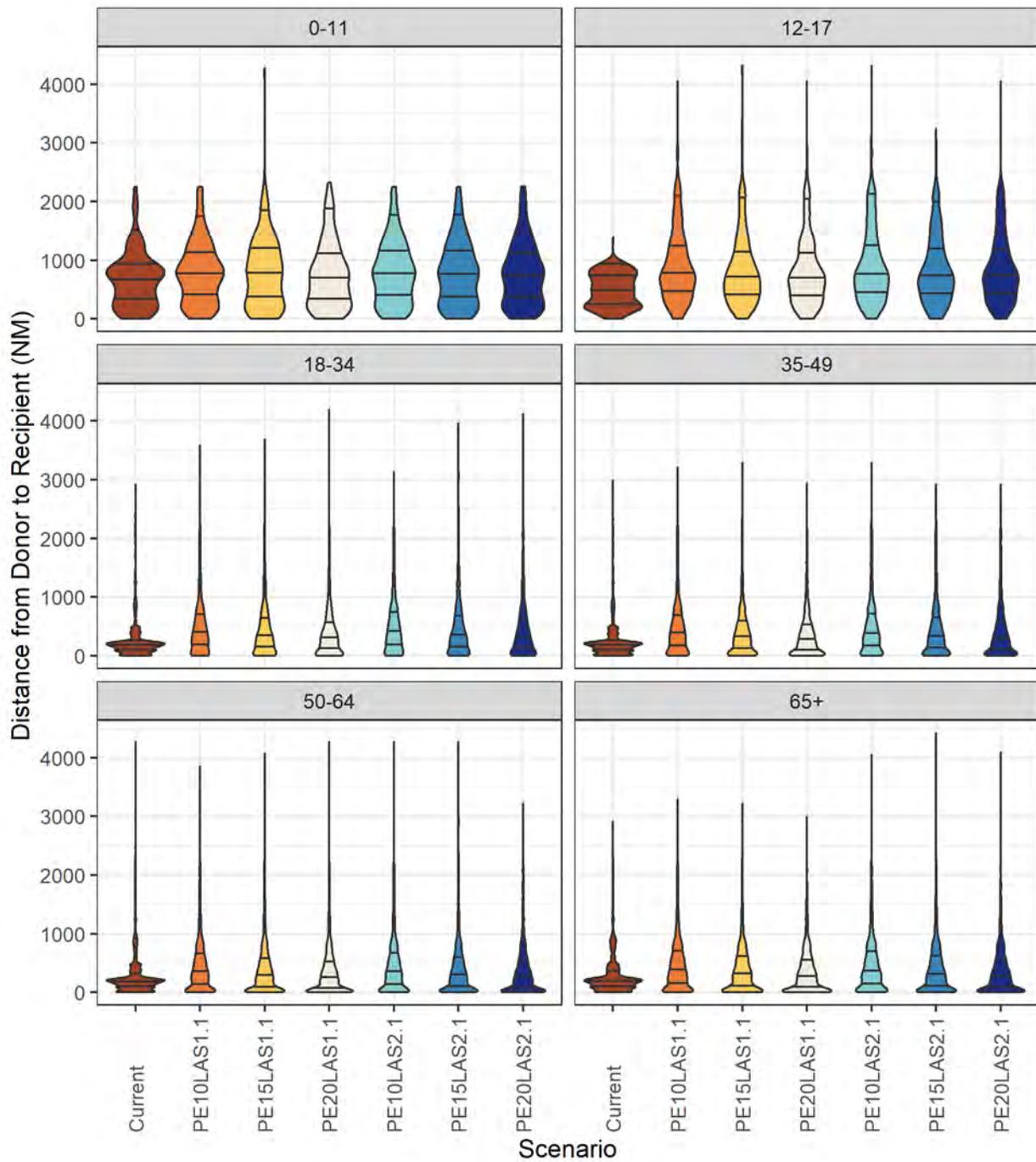


Figure 8: Distribution of Distance from Donor - By Age



Table 2: Outcome Counts and Rates by Scenario by Age

Outcome	Age (Years)	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
Transplant Count (N)								
	0-11	28 (22,32)	36 (34,39)	37 (33,40)	37 (35,40)	37 (35,40)	37 (32,41)	36 (32,40)
	12-17	53 (48,57)	84 (80,87)	84 (81,88)	86 (83,89)	84 (82,87)	84 (80,86)	85 (83,86)
	18-34	372 (359,384)	454 (446,463)	447 (438,455)	433 (425,444)	438 (431,446)	426 (416,433)	417 (398,430)
	35-49	591 (578,601)	742 (732,748)	728 (717,752)	712 (701,722)	706 (686,719)	690 (676,709)	685 (678,695)
	50-64	2192 (2177,2220)	2237 (2211,2255)	2238 (2207,2266)	2239 (2217,2254)	2192 (2180,2206)	2210 (2181,2237)	2207 (2190,2236)
	65+	1819 (1798,1837)	1511 (1491,1527)	1547 (1534,1560)	1578 (1566,1595)	1627 (1616,1644)	1650 (1636,1662)	1673 (1658,1683)
Transplant Rate per Patient-Year								
	0-11	0.71 (0.49,0.85)	1.12 (1.01,1.25)	1.16 (0.99,1.45)	1.19 (1.02,1.4)	1.16 (1.04,1.3)	1.15 (0.96,1.4)	1.1 (0.97,1.3)
	12-17	1.73 (1.52,2.04)	7.49 (6.58,8.6)	7.43 (6.46,8.82)	7.83 (6.81,9.83)	7.2 (6.07,8.15)	6.83 (5.83,7.65)	7.2 (6.67,8.31)
	18-34	1.26 (1.18,1.32)	1.83 (1.78,1.91)	1.73 (1.63,1.81)	1.61 (1.54,1.71)	1.61 (1.57,1.65)	1.5 (1.42,1.58)	1.43 (1.34,1.52)
	35-49	1.31 (1.25,1.36)	2.26 (2.18,2.32)	2.12 (2.02,2.3)	1.97 (1.89,2.05)	1.87 (1.77,1.97)	1.74 (1.66,1.83)	1.71 (1.65,1.78)
	50-64	1.54 (1.51,1.58)	1.46 (1.43,1.49)	1.48 (1.43,1.52)	1.49 (1.46,1.51)	1.37 (1.35,1.4)	1.41 (1.38,1.44)	1.42 (1.4,1.45)
	65+	2.97 (2.89,3.09)	1.5 (1.46,1.52)	1.61 (1.57,1.66)	1.71 (1.66,1.75)	1.79 (1.73,1.84)	1.87 (1.82,1.92)	1.97 (1.92,2.01)
Transplant Distribution (Percent)								
	0-11	0.56 (0.44,0.63)	0.71 (0.67,0.77)	0.72 (0.65,0.79)	0.73 (0.69,0.79)	0.73 (0.69,0.78)	0.72 (0.63,0.8)	0.7 (0.63,0.78)
	12-17	1.05 (0.95,1.13)	1.67 (1.58,1.72)	1.65 (1.6,1.73)	1.69 (1.63,1.75)	1.66 (1.61,1.71)	1.64 (1.57,1.69)	1.67 (1.63,1.69)
	18-34	7.37 (7.09,7.58)	8.96 (8.81,9.16)	8.8 (8.61,8.96)	8.52 (8.35,8.74)	8.62 (8.5,8.78)	8.35 (8.18,8.49)	8.17 (7.79,8.44)



Table 2: Outcome Counts and Rates by Scenario by Age

Outcome	Age (Years)	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
	35-49	11.69 (11.44,11.86)	14.65 (14.45,14.78)	14.32 (14.09,14.84)	13.99 (13.77,14.22)	13.89 (13.46,14.15)	13.55 (13.28,13.9)	13.43 (13.28,13.62)
	50-64	43.36 (43.07,43.83)	44.18 (43.68,44.55)	44.05 (43.56,44.53)	44.03 (43.7,44.28)	43.11 (42.86,43.32)	43.37 (42.76,43.93)	43.25 (42.91,43.74)
	65+	35.98 (35.5,36.35)	29.84 (29.45,30.17)	30.45 (30.14,30.73)	31.04 (30.78,31.37)	32 (31.79,32.25)	32.37 (32.15,32.59)	32.78 (32.48,33.04)
Waitlist Mortality Count (N)								
	0-11	11 (9,13)	8 (6,9)	8 (6,10)	8 (7,10)	8 (6,9)	8 (6,9)	8 (6,10)
	12-17	12 (11,13)	2 (1,3)	2 (1,3)	2 (1,4)	3 (2,3)	3 (2,4)	2 (1,4)
	18-34	46 (42,50)	21 (18,24)	21 (18,24)	23 (19,26)	19 (16,24)	20 (16,23)	21 (18,23)
	35-49	62 (57,69)	34 (29,42)	35 (32,40)	38 (34,45)	32 (26,36)	33 (28,38)	36 (32,40)
	50-64	186 (176,200)	109 (100,116)	115 (105,121)	122 (114,127)	94 (87,99)	99 (92,107)	103 (97,115)
	65+	118 (107,127)	87 (79,90)	88 (85,93)	88 (82,100)	76 (70,84)	73 (66,79)	76 (72,82)
Number Died by 2 Years Posttransplant								
	0-11	9 (5,12)	14 (12,16)	14 (9,18)	15 (13,18)	15 (10,18)	14 (10,19)	14 (9,18)
	12-17	19 (10,28)	48 (43,52)	48 (33,56)	50 (45,58)	47 (42,57)	47 (38,56)	48 (42,58)
	18-34	89 (73,104)	103 (92,114)	105 (95,114)	99 (89,110)	105 (95,123)	100 (78,112)	96 (87,104)
	35-49	130 (116,138)	166 (153,179)	157 (133,182)	162 (140,178)	161 (148,171)	161 (141,185)	154 (142,179)
	50-64	491 (471,511)	492 (451,516)	506 (481,532)	513 (495,535)	485 (444,522)	496 (465,547)	502 (465,525)
	65+	445 (415,479)	364 (336,397)	371 (344,399)	384 (360,403)	392 (371,415)	408 (384,427)	403 (375,419)
Percent Died by 2 Years Posttransplant								



Table 2: Outcome Counts and Rates by Scenario by Age

Outcome	Age (Years)	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
	0-11	31.32 (18.52,42.86)	40.18 (31.58,45.71)	39.72 (22.5,48.65)	41.78 (33.33,48.57)	39.69 (26.32,51.43)	38.38 (31.25,48.72)	39.89 (22.5,53.12)
	12-17	35.12 (20.37,51.85)	56.47 (51.19,61.9)	56.65 (40.74,65.88)	57.85 (51.14,65.91)	56.28 (50,65.52)	56.69 (45.78,66.67)	56.71 (50,68.24)
	18-34	23.8 (20.33,28.03)	22.66 (20.26,25.05)	23.44 (21.21,25.05)	22.89 (20.59,25.17)	24.06 (21.94,28.54)	23.41 (18.27,25.99)	23.07 (20.23,25.63)
	35-49	22.09 (19.8,23.71)	22.45 (20.65,23.93)	21.55 (18.5,24.76)	22.79 (19.97,25.07)	22.75 (20.67,24.39)	23.34 (20.11,26.43)	22.56 (20.43,26.4)
	50-64	22.38 (21.41,23.45)	21.97 (20.13,23.03)	22.61 (21.47,23.74)	22.93 (22.15,23.79)	22.14 (20.23,23.81)	22.47 (21,24.78)	22.73 (21.18,23.94)
	65+	24.47 (22.93,26.42)	24.07 (22.06,26.29)	24.01 (22.27,25.96)	24.36 (22.87,25.62)	24.12 (22.92,25.68)	24.73 (23.43,25.79)	24.09 (22.6,25.13)
Median Donor-to-Recipient Distance								
	0-11	671 (479,842)	755 (451,878)	748 (594,848)	662 (497,827)	767 (680,880)	741 (495,904)	729 (594,781)
	12-17	492 (428,581)	779 (636,877)	702 (633,786)	679 (544,780)	748 (626,858)	730 (648,884)	741 (625,853)
	18-34	182 (176,192)	377 (337,409)	313 (288,352)	277 (252,301)	377 (354,393)	320 (296,349)	279 (240,313)
	35-49	183 (168,194)	363 (334,398)	290 (263,323)	235 (213,253)	350 (316,377)	305 (282,348)	251 (227,294)
	50-64	193 (189,196)	329 (316,339)	259 (242,271)	218 (206,223)	324 (308,338)	264 (251,277)	225 (218,238)
	65+	199 (192,202)	355 (337,380)	283 (270,301)	231 (219,254)	333 (313,358)	281 (258,302)	236 (219,251)
Percent Expected to Fly (>75 NM)								
	0-11	95.06 (92.86,96.88)	96.31 (88.24,100)	92.98 (88.89,100)	94.06 (91.67,97.37)	95.66 (92.11,97.5)	95.21 (92.31,97.22)	95.57 (92.5,97.3)
	12-17	95.06 (88.46,100)	97.38 (93.98,100)	97.84 (95.12,100)	96.49 (91.67,98.86)	97.74 (95.24,100)	96.17 (91.57,100)	97.3 (95.29,98.82)
	18-34	81.57 (79.25,83.87)	83.25 (81.32,85.68)	78.62 (76.03,82.44)	74.35 (72.94,75.86)	81.89 (79.19,84.06)	79.33 (76.96,81.52)	75.4 (72.27,78.8)
	35-49	79.29 (77.63,80.58)	80.72 (78.52,82.88)	74.89 (72.74,77.93)	70.72 (68.03,73.32)	79.76 (77.09,81.42)	75.21 (73.63,77.53)	71.73 (69.84,74.78)



Table 2: Outcome Counts and Rates by Scenario by Age

Outcome	Age (Years)	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
	50-64	80.8 (80.06,81.69)	76.76 (75.77,78.2)	70.88 (69.56,72.78)	67.19 (66.08,68.47)	75.95 (74.46,77.04)	71.28 (70.07,72.77)	68.69 (67.43,69.65)
	65+	81.92 (80.94,83.67)	78.82 (77.28,80.55)	72.14 (70.86,74.19)	68.59 (67.79,70.01)	78.07 (77.19,79.12)	72.72 (71.48,74.59)	69.66 (68.55,70.77)

Table 3: Donor Age Distribution by Scenario among 12- to 17-Year-Old Recipients

Donor Age (Years)	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
0-11	8.99 (4.17,19.23)	4.75 (2.38,7.5)	4.04 (2.35,7.06)	3.51 (2.25,4.76)	4.17 (1.2,9.76)	4.77 (2.41,6.98)	3.53 (2.33,4.71)
12-17	72.63 (61.54,81.48)	14.08 (8.14,18.39)	14.14 (7.32,17.05)	13.36 (5.95,21.35)	11.62 (7.32,19.05)	12.79 (9.52,19.28)	13.16 (9.41,17.44)
18-34	9.57 (1.85,14.55)	46.37 (38.55,56.98)	44.13 (34.12,51.85)	43.58 (34.12,50.6)	44.67 (39.02,51.81)	41.26 (37.5,46.43)	43.06 (35.29,48.81)
35-49	5.44 (1.82,9.26)	21.43 (16.67,26.74)	24.21 (12.94,34.15)	25.58 (20.22,28.24)	24 (16.87,30.49)	28.01 (23.81,36.59)	25.3 (15.29,29.41)
50-64	3.33 (1.82,5.88)	12.78 (9.3,16.67)	12.99 (8.24,20.73)	13.05 (9.52,16.67)	14.6 (10.71,17.24)	12.34 (8.33,18.75)	14.01 (8.14,18.07)
65+	1.87 (1.82,1.92)	1.47 (1.15,2.38)	1.2 (1.18,1.23)	1.54 (1.12,2.3)	1.59 (1.16,2.44)	1.39 (1.16,2.33)	1.56 (1.16,3.49)

## Outcomes by Sex

Simulated outcomes by sex were different for male and female candidates. Among males, transplant rates declined for all continuous allocation scenarios compared with current rules (Table 4, Figure 9). Among females, transplant rates for continuous allocation scenarios were similar to current rules; point estimates were a little higher for 1:1 LAS scenarios and a little lower for the 2:1 LAS scenarios, but ranges of the simulations generally overlapped current rules.

Waitlist mortality declined for male and female candidates under continuous allocation, but the weight of PE seemed to matter more for female candidates (Table 4, Figure 11). For males, the number of waitlist deaths ranged from 125 to 129 for the 1:1 LAS scenarios, and 110 to 113 for the 2:1 LAS scenarios, varying little with changes in PE. For females the numbers of waitlist deaths ranged from 134 to 151 for the 1:1 LAS scenarios and 122 to 134 for the 2:1 LAS scenarios, increasing with increased PE weight.

For 2-year posttransplant death, distance organs were expected to have traveled, and proportion of organs expected to have been flown; males and females were similar to overall outcomes (Table 4, Figures 12-13).

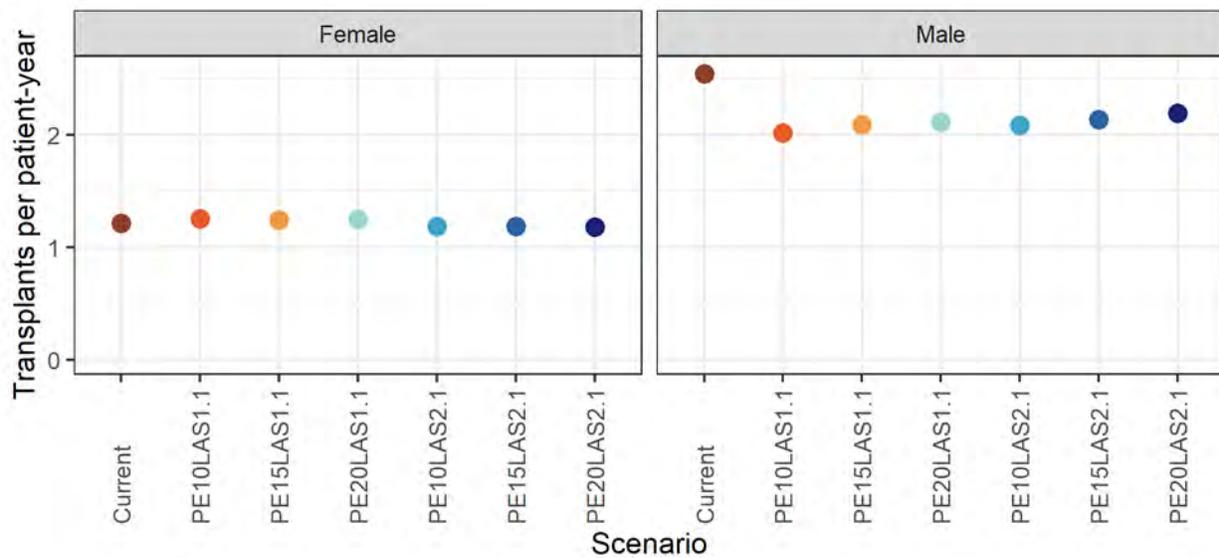


Figure 9: Transplant Rates - By Sex

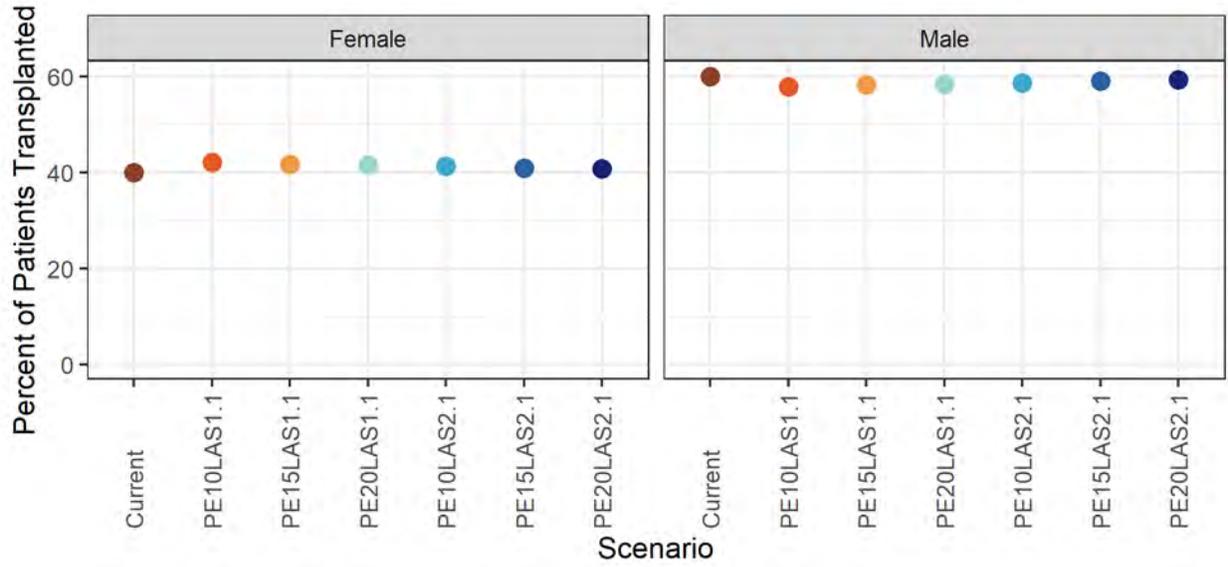


Figure 10: Transplant Distribution - Percent By Sex

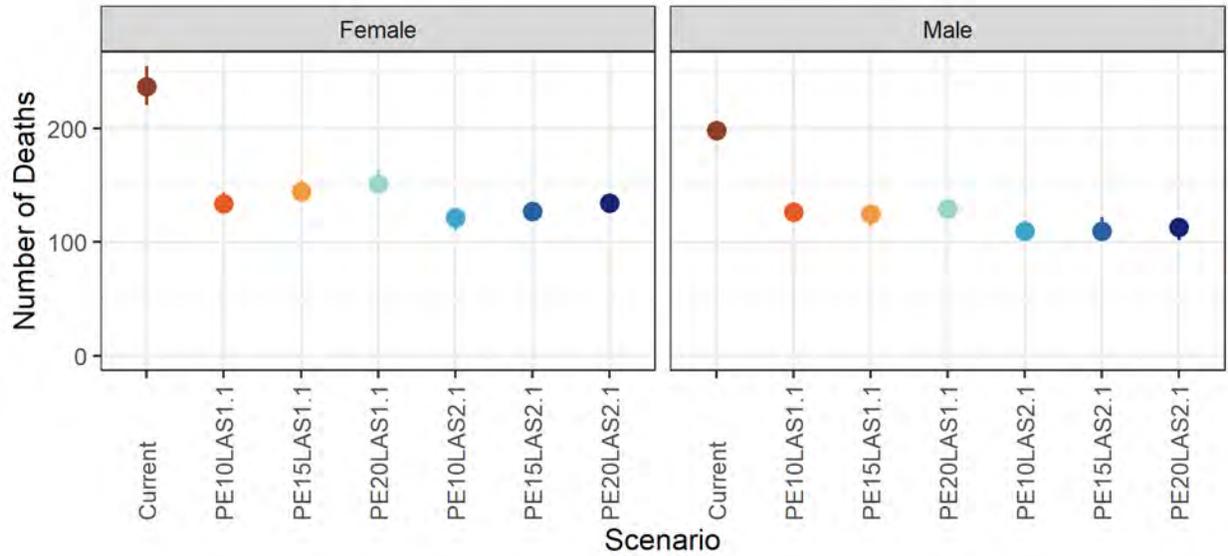


Figure 11: Waitlist Death Counts - By Sex

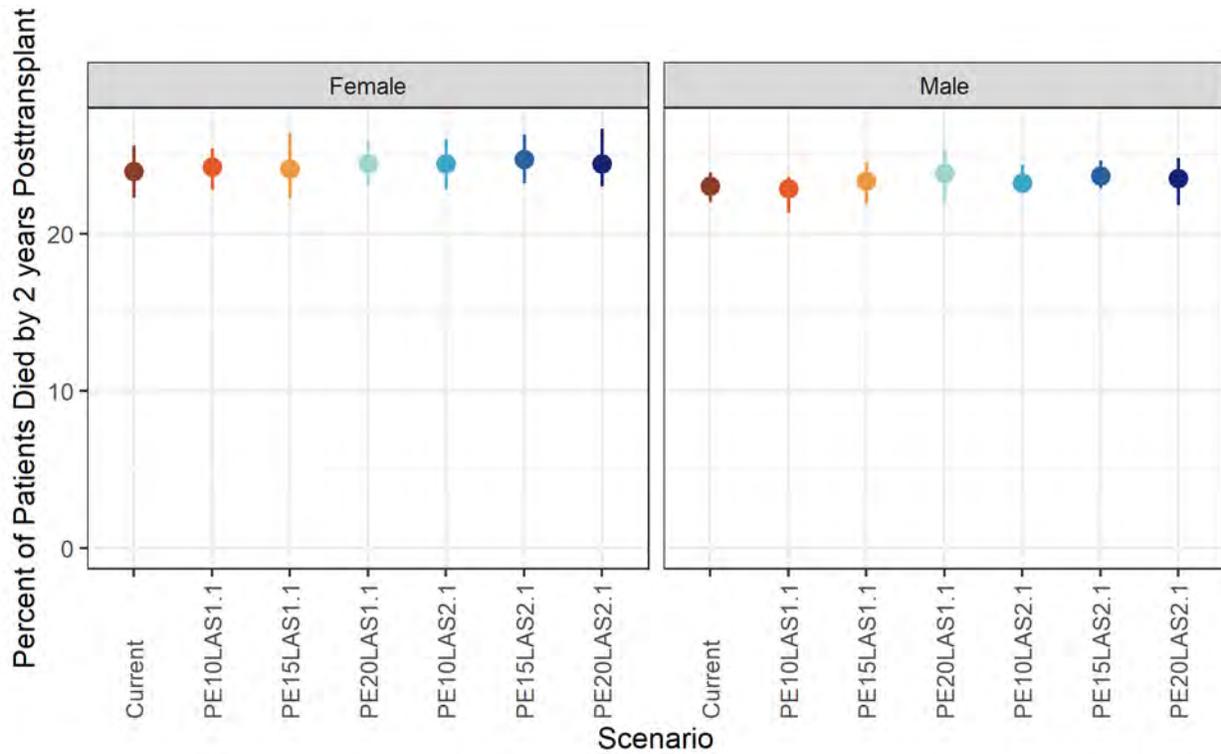


Figure 12: Percent Died by 2 Years Posttransplant - By Sex

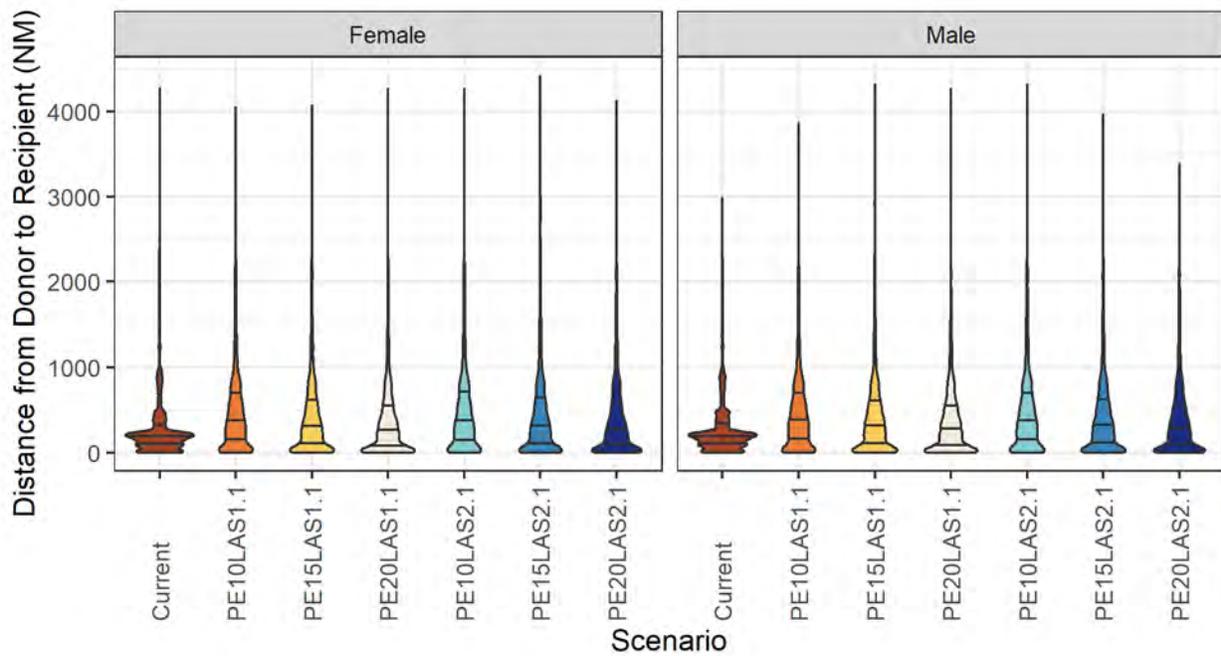


Figure 13: Distribution of Distance from Donor - By Sex



Table 4: Outcome Counts and Rates by Scenario by Sex

Outcome	Sex	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
Transplant Count (N)								
	Female	2022 (2001,2042)	2135 (2118,2164)	2119 (2100,2141)	2114 (2089,2143)	2098 (2086,2116)	2088 (2067,2111)	2077 (2047,2098)
	Male	3035 (3019,3045)	2929 (2897,2949)	2962 (2939,2985)	2970 (2930,2996)	2987 (2966,3005)	3009 (2983,3021)	3025 (3006,3048)
Transplant Rate per Patient-Year								
	Female	1.21 (1.19,1.24)	1.25 (1.24,1.27)	1.24 (1.22,1.27)	1.25 (1.22,1.29)	1.19 (1.18,1.2)	1.18 (1.17,1.2)	1.18 (1.15,1.2)
	Male	2.55 (2.49,2.57)	2.01 (1.98,2.04)	2.09 (2.04,2.13)	2.11 (2.05,2.14)	2.08 (2.05,2.12)	2.13 (2.09,2.16)	2.19 (2.14,2.25)
Transplant Distribution (Percent)								
	Female	39.98 (39.72,40.32)	42.16 (41.8,42.76)	41.71 (41.39,42.15)	41.58 (41.08,42.24)	41.26 (41.03,41.64)	40.96 (40.62,41.44)	40.71 (40.25,41.11)
	Male	60.02 (59.68,60.28)	57.84 (57.24,58.2)	58.29 (57.85,58.61)	58.42 (57.76,58.92)	58.74 (58.36,58.97)	59.04 (58.56,59.38)	59.29 (58.89,59.75)
Waitlist Mortality Count (N)								
	Female	237 (221,255)	134 (127,144)	144 (138,154)	151 (143,164)	122 (111,129)	127 (118,134)	134 (130,138)
	Male	198 (191,206)	126 (118,132)	125 (114,131)	129 (123,135)	110 (105,114)	110 (101,122)	113 (102,120)
Percent Died by 2 Years Posttransplant								
	Female	23.92 (22.23,25.59)	24.24 (22.82,25.39)	24.09 (22.22,26.39)	24.45 (23.05,25.92)	24.41 (22.81,25.96)	24.69 (23.17,26.27)	24.41 (22.98,26.64)
	Male	23.03 (21.99,23.85)	22.85 (21.3,23.57)	23.32 (21.9,24.56)	23.82 (22.01,25.4)	23.23 (22.59,24.33)	23.64 (22.84,24.62)	23.48 (21.82,24.78)
Median Donor-to-Recipient Distance								
	Female	193 (187,198)	342 (323,359)	274 (263,284)	227 (211,254)	339 (324,362)	282 (266,301)	234 (223,250)
	Male	196 (192,200)	358 (351,367)	291 (276,303)	245 (227,257)	346 (335,352)	293 (281,306)	251 (233,264)
Percent Expected to Fly (>75 NM)								



Table 4: Outcome Counts and Rates by Scenario by Sex

Outcome	Sex	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
	Female	80.4 (79.21,81.71)	78.1 (76.97,79.87)	72.28 (70.88,73.62)	67.93 (67.24,69.32)	77.39 (76.31,78.26)	72.71 (71.57,73.75)	69.75 (68.5,70.74)
	Male	81.93 (81.09,83.19)	79.69 (78.73,80.71)	73.73 (72.51,74.83)	70.48 (69.4,71.42)	78.72 (77.91,79.27)	74.1 (73.26,75.27)	71.23 (70.79,72.16)

## Outcomes by Race/Ethnicity

Simulated outcomes by race and ethnicity differed from overall outcomes for some groups. Compared with the current rules scenario, transplant rates among Latino candidates increased under all continuous allocation scenarios compared with current rules (Figure 14, Table 5). Point estimates for transplant rates among Asian candidates increased under the 10% PE 2:1 LAS scenarios, but the other continuous distribution scenarios were similar to current rules. Among Black and White candidates, transplant rates decline under all continuous allocation scenarios compared with current rules; among Black and White candidates, rates across the continuous allocation scenarios were similar.

For most race and ethnicity groups, waitlist deaths under all continuous distribution scenarios declined considerably compared with the number of deaths under current rules (Figure 16, Table 5). Among Latino candidates, those declines were the most extreme, from 61 under current rules and 19-29 under continuous allocation. Among Asian and Black candidates, declines in waitlist deaths from current rules were similar across continuous distribution scenarios and Latino and White candidates; declines were largest for 2:1 LAS compared with 1:1 LAS.

The percent of 2-year posttransplant deaths was similar by race and ethnicity groups (Figure 17, Table 5).

The patterns of median distance from donor to recipient by race and ethnicity group were similar to overall patterns, in which distances under current rules were shortest, and lower PE weight had longer distances.

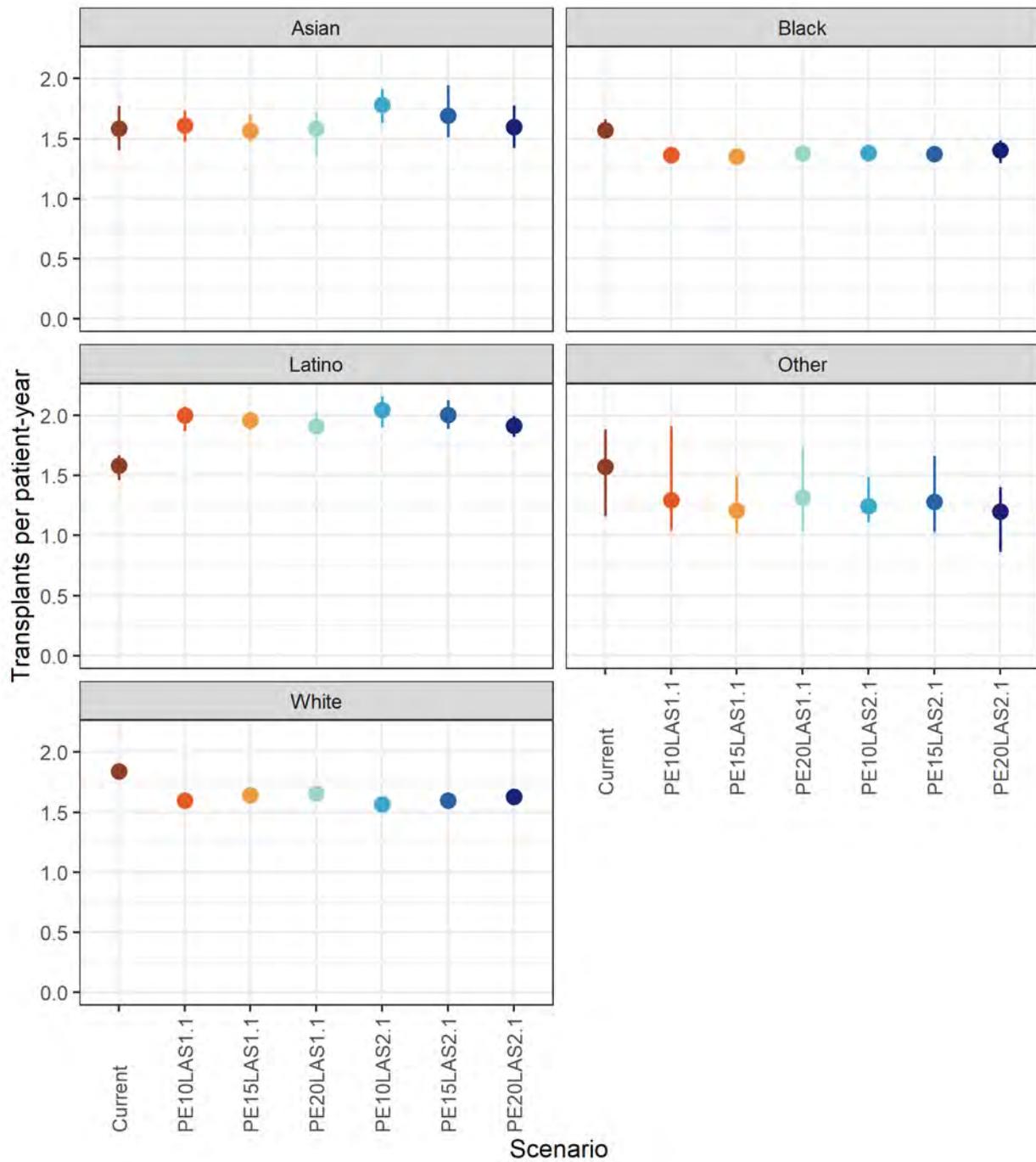


Figure 14: Transplant Rates - By Race/Ethnicity

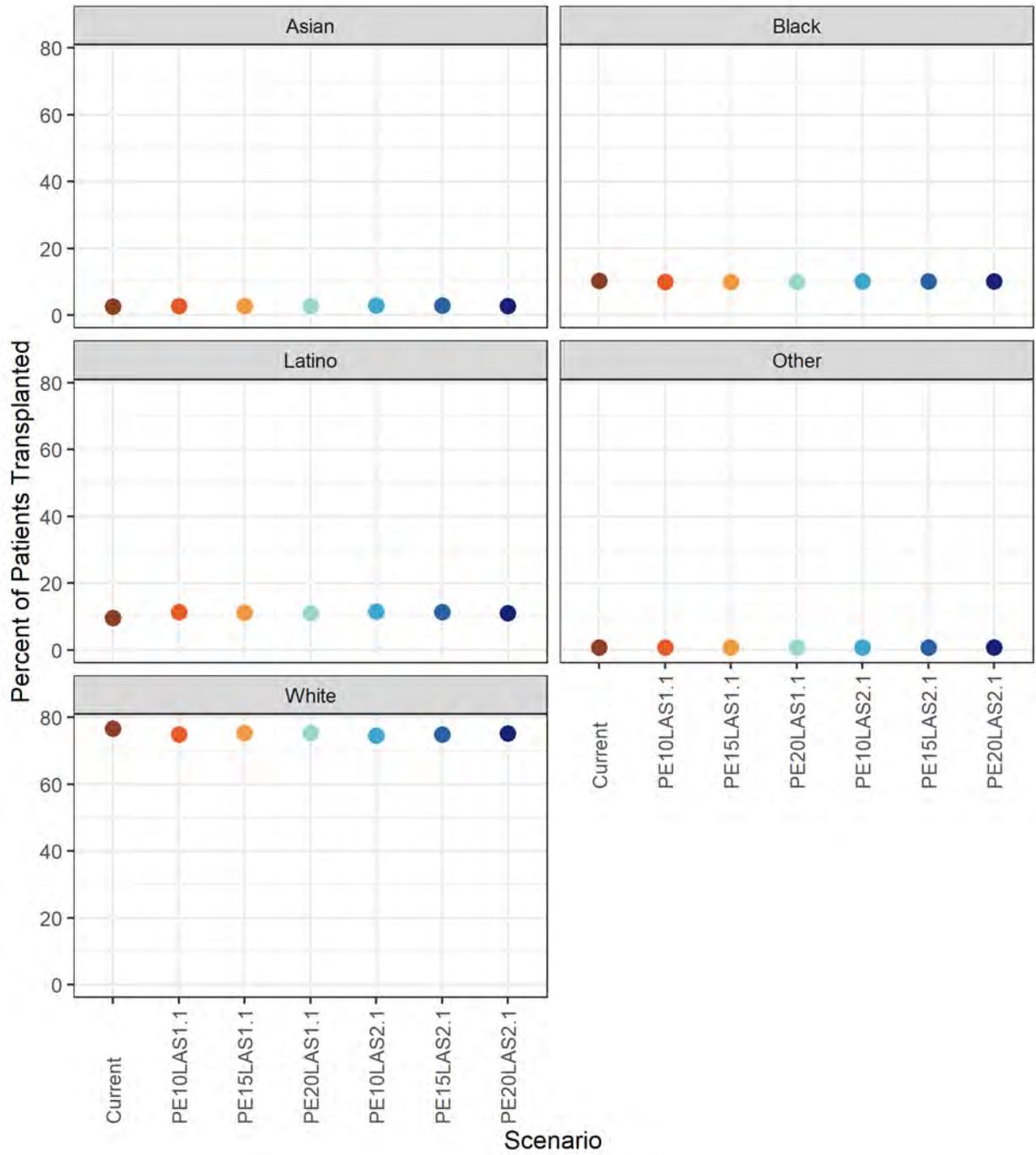


Figure 15: Transplant Distribution - Percent By Race/Ethnicity

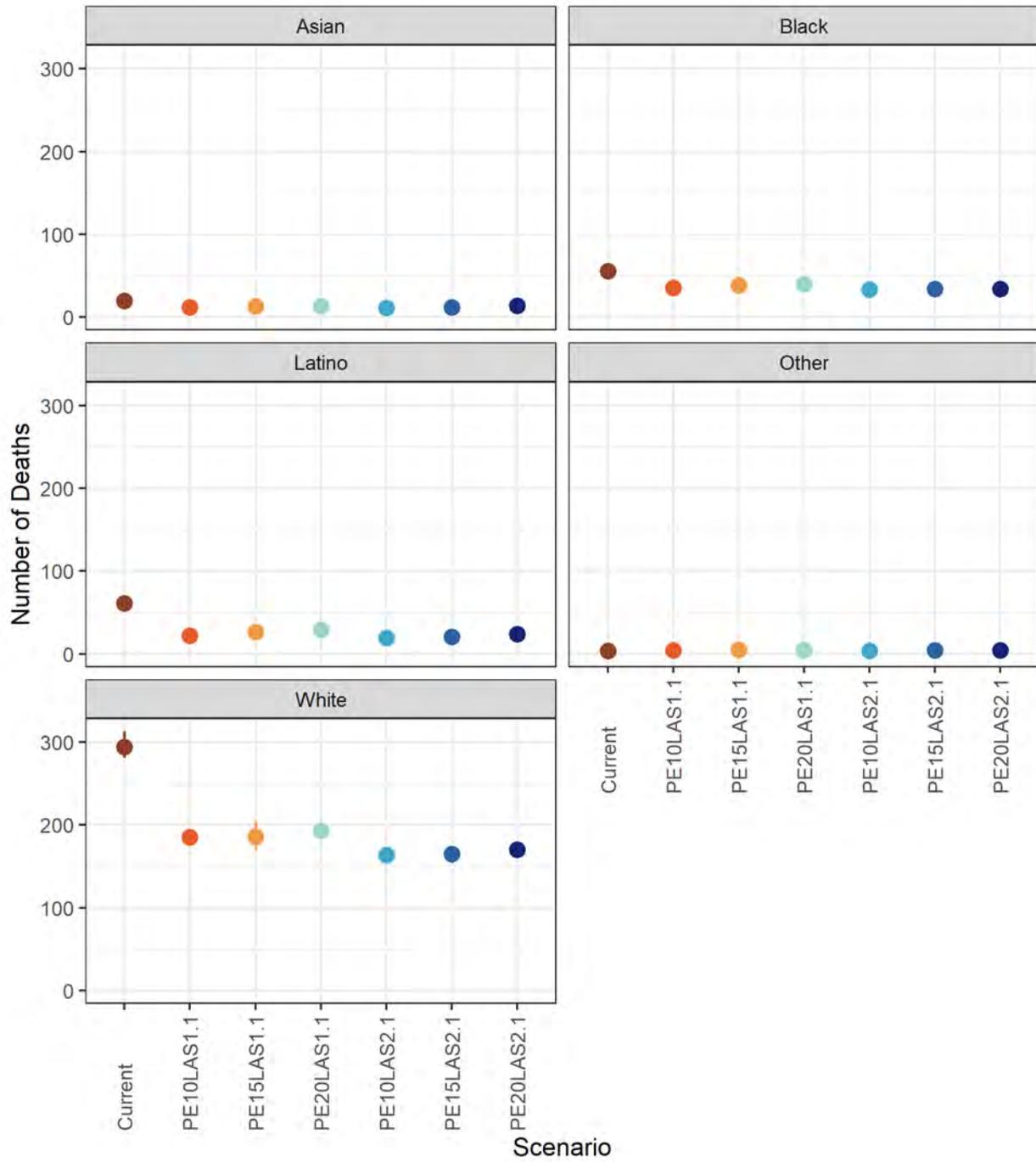


Figure 16: Waitlist Death Counts - By Race/Ethnicity

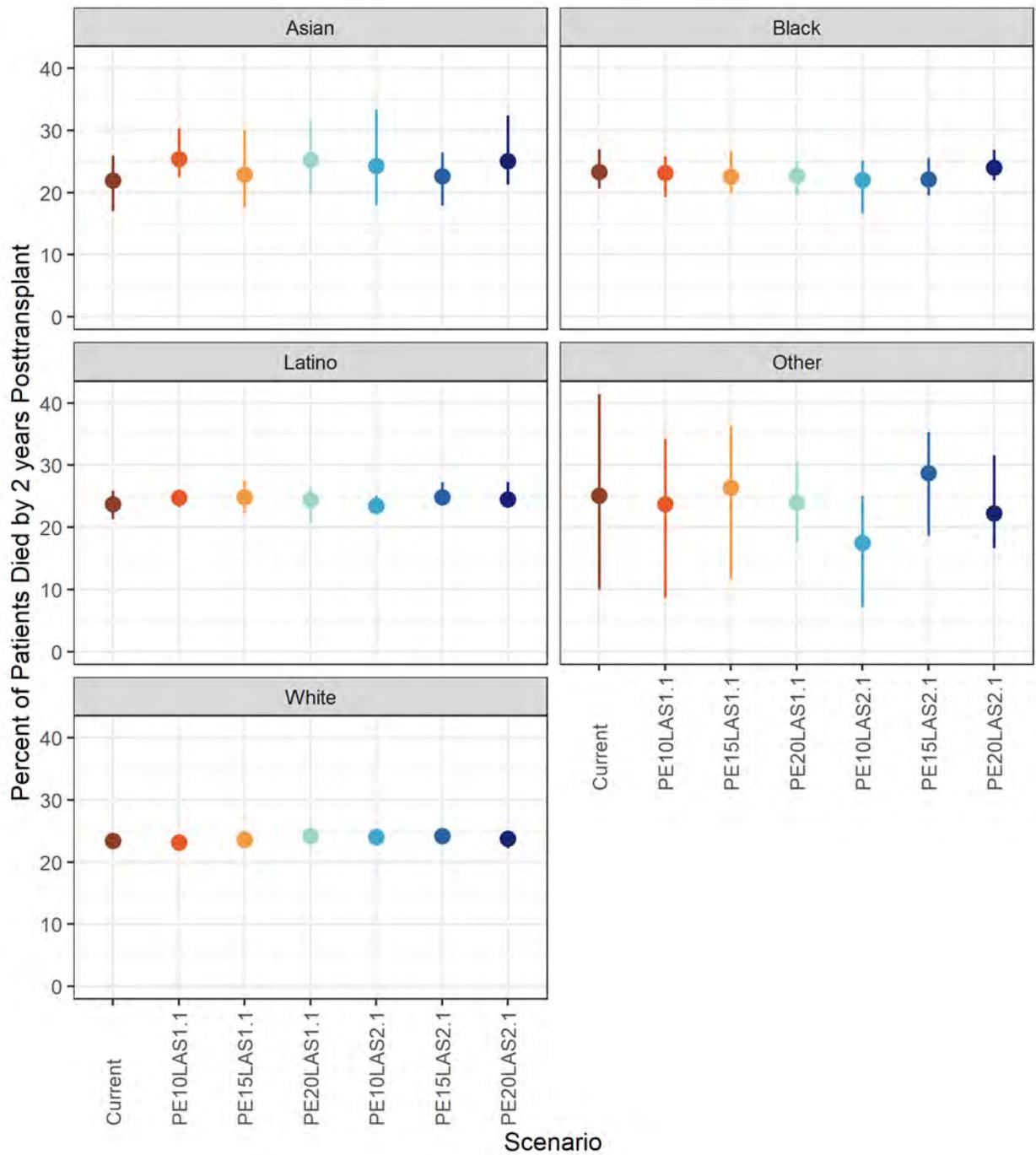


Figure 17: Percent Died by 2 Years Posttransplant - By Race/Ethnicity

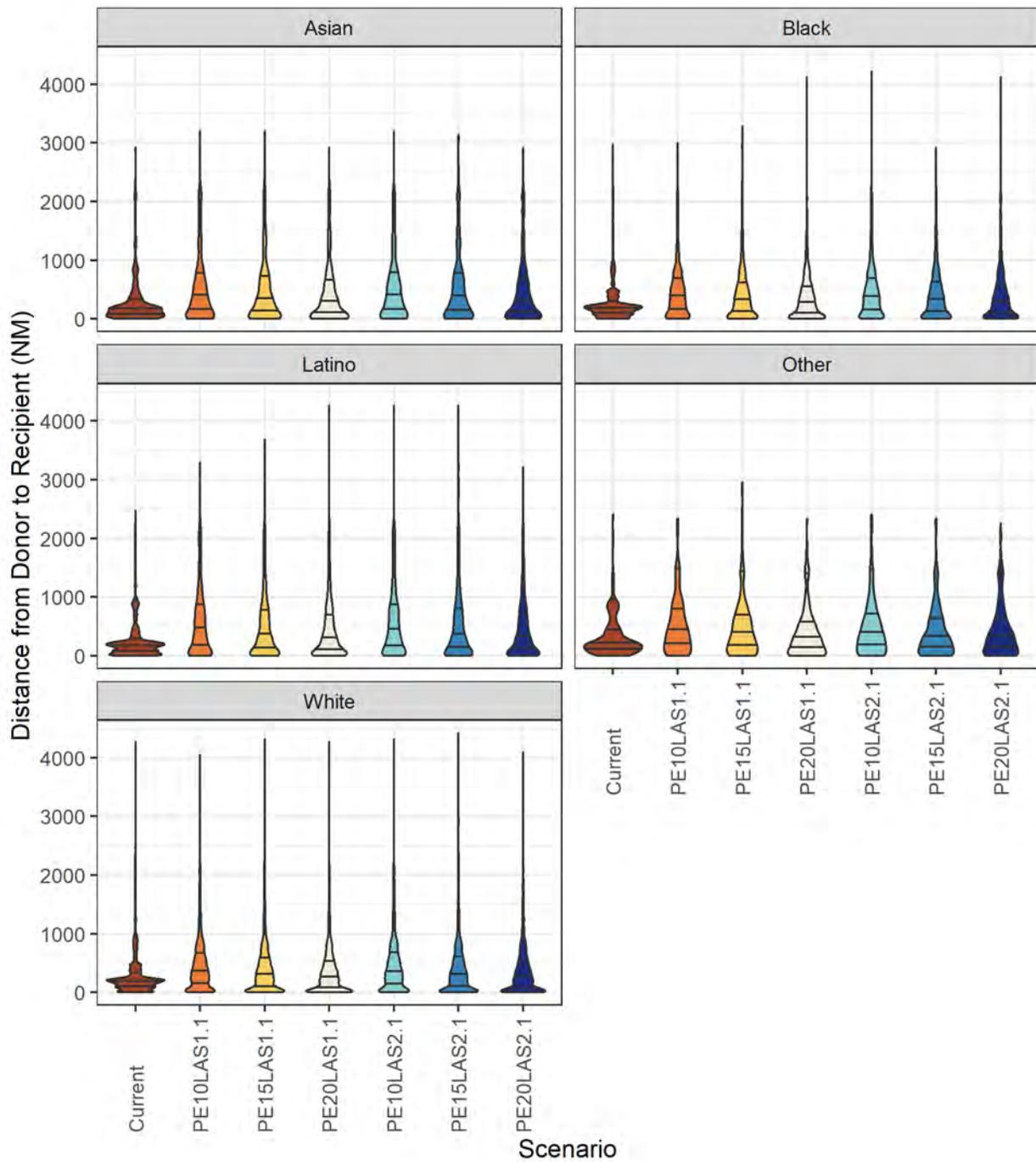


Figure 18: Distribution of Distance from Donor - By Race/Ethnicity

**Table 5: Outcome Counts and Rates by Scenario by Race/Ethnicity**

Outcome	Race/Ethnicity	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
Transplant Count (N)								
	Asian	130 (121,140)	144 (139,151)	142 (139,147)	143 (131,150)	150 (146,155)	147 (140,155)	142 (137,148)
	Black	520 (508,531)	509 (499,523)	507 (499,515)	510 (504,524)	518 (505,534)	515 (508,527)	518 (498,528)
	Latino	489 (470,498)	575 (562,582)	566 (555,578)	559 (547,571)	583 (561,592)	578 (564,587)	566 (548,576)
	Other	39 (35,45)	39 (35,45)	36 (33,41)	38 (33,44)	39 (36,42)	39 (34,44)	37 (30,40)
	White	3878 (3845,3909)	3797 (3767,3812)	3829 (3807,3842)	3835 (3817,3848)	3795 (3776,3841)	3816 (3791,3844)	3840 (3826,3865)
Transplant Rate per Patient-Year								
	Asian	1.58 (1.41,1.77)	1.61 (1.47,1.73)	1.56 (1.48,1.7)	1.58 (1.36,1.72)	1.78 (1.63,1.91)	1.69 (1.51,1.94)	1.6 (1.42,1.78)
	Black	1.57 (1.51,1.66)	1.36 (1.31,1.43)	1.35 (1.31,1.39)	1.38 (1.33,1.42)	1.38 (1.35,1.45)	1.37 (1.31,1.42)	1.4 (1.3,1.49)
	Latino	1.58 (1.46,1.67)	2 (1.87,2.07)	1.96 (1.88,2.03)	1.91 (1.84,2.03)	2.04 (1.9,2.16)	2 (1.89,2.13)	1.91 (1.82,2)
	Other	1.57 (1.16,1.88)	1.29 (1.04,1.91)	1.21 (1.02,1.49)	1.31 (1.03,1.74)	1.25 (1.11,1.48)	1.28 (1.03,1.66)	1.2 (0.86,1.4)
	White	1.84 (1.79,1.87)	1.6 (1.58,1.61)	1.64 (1.62,1.65)	1.65 (1.64,1.67)	1.57 (1.54,1.61)	1.6 (1.57,1.63)	1.63 (1.61,1.65)
Transplant Distribution (Percent)								
	Asian	2.57 (2.39,2.77)	2.85 (2.74,2.98)	2.8 (2.74,2.89)	2.81 (2.58,2.95)	2.95 (2.87,3.05)	2.89 (2.75,3.04)	2.78 (2.69,2.9)
	Black	10.29 (10.05,10.54)	10.05 (9.85,10.34)	9.98 (9.81,10.12)	10.03 (9.9,10.32)	10.18 (9.94,10.49)	10.11 (9.96,10.33)	10.16 (9.77,10.34)
	Latino	9.66 (9.31,9.84)	11.36 (11.1,11.49)	11.14 (10.91,11.41)	10.99 (10.76,11.22)	11.47 (11.01,11.65)	11.35 (11.05,11.53)	11.09 (10.75,11.27)
	Other	0.78 (0.69,0.89)	0.76 (0.69,0.89)	0.71 (0.65,0.81)	0.74 (0.65,0.86)	0.77 (0.71,0.83)	0.77 (0.67,0.86)	0.72 (0.59,0.78)
	White	76.69 (76.14,77.13)	74.98 (74.51,75.2)	75.37 (75.15,75.63)	75.43 (75.11,75.69)	74.63 (74.22,75.36)	74.88 (74.49,75.3)	75.25 (74.86,75.83)
Waitlist Mortality Count (N)								



Table 5: Outcome Counts and Rates by Scenario by Race/Ethnicity

Outcome	Race/Ethnicity	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
	Asian	20 (14,23)	12 (9,17)	13 (11,16)	13 (9,17)	11 (9,13)	12 (10,15)	14 (12,15)
	Black	56 (52,61)	36 (33,38)	39 (36,42)	40 (37,45)	34 (31,36)	34 (30,36)	34 (31,38)
	Latino	61 (55,69)	22 (20,25)	27 (22,33)	29 (23,36)	19 (17,23)	21 (16,26)	24 (21,27)
	Other	4 (3,5)	5 (3,5)	5 (4,6)	4 (3,5)	4 (3,5)	4 (3,5)	4 (4,5)
	White	294 (281,313)	185 (178,194)	186 (171,204)	193 (184,201)	164 (158,172)	165 (154,174)	170 (166,178)
Percent Died by 2 Years Posttransplant								
	Asian	22 (17.05,25.95)	25.44 (22.52,30.34)	22.93 (17.61,30)	25.26 (19.85,31.43)	24.33 (18,33.33)	22.64 (17.88,26.43)	25.03 (21.28,32.37)
	Black	23.32 (20.66,27.01)	23.15 (19.25,25.85)	22.61 (19.92,26.68)	22.7 (19.6,25.1)	22.08 (16.57,25.15)	22.14 (19.54,25.59)	24 (21.92,26.89)
	Latino	23.71 (21.28,25.87)	24.78 (23.18,25.65)	24.85 (22.34,27.51)	24.4 (20.67,26.33)	23.48 (22.07,25.09)	24.86 (23.76,27.26)	24.48 (23.4,27.26)
	Other	25.15 (10,41.46)	23.71 (8.57,34.21)	26.45 (11.76,36.36)	23.96 (17.65,30.56)	17.49 (7.14,25)	28.72 (18.6,35.29)	22.28 (16.67,31.58)
	White	23.38 (22.31,24.32)	23.19 (21.93,23.89)	23.6 (22.35,24.61)	24.17 (23.43,25.7)	24.01 (23.04,24.6)	24.23 (23.26,25.53)	23.73 (22.23,24.75)
Median Donor-to-Recipient Distance								
	Asian	165 (143,189)	329 (281,368)	281 (225,333)	236 (189,268)	337 (261,400)	308 (260,370)	249 (195,300)
	Black	191 (183,204)	364 (349,384)	293 (270,333)	240 (207,270)	353 (309,382)	297 (258,344)	251 (234,273)
	Latino	172 (164,180)	398 (374,432)	299 (260,319)	247 (226,264)	390 (348,427)	306 (277,341)	277 (241,302)
	Other	201 (162,249)	390 (249,533)	332 (216,465)	254 (176,330)	346 (230,463)	280 (178,363)	274 (190,353)
	White	198 (195,201)	347 (330,357)	279 (269,290)	234 (222,248)	338 (324,347)	284 (274,295)	239 (227,246)
Percent Expected to Fly (>75 NM)								



Table 5: Outcome Counts and Rates by Scenario by Race/Ethnicity

Outcome	Race/Ethnicity	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
	Asian	74.28 (66.41,83.09)	74.85 (70.42,80.95)	71.12 (65.73,77.7)	65.9 (62.84,68.53)	74.15 (71.33,76.16)	71.59 (65.71,76.6)	69 (64.96,73.61)
	Black	81.68 (78.67,85.63)	79.27 (78.16,80.98)	73.47 (70.57,75.74)	69.79 (67.86,74.51)	78.74 (75.29,82.15)	74.44 (71.4,78.35)	70.66 (69.08,72.82)
	Latino	74.74 (72.38,76.99)	77.04 (74.18,78.48)	71.75 (70.16,73.94)	69.08 (67.56,70.02)	78.27 (76.67,80.57)	73.47 (69.95,76.59)	71.15 (68.25,75.04)
	Other	81.78 (74.29,89.19)	79.92 (71.05,91.67)	75.93 (70.73,86.49)	70.29 (61.54,81.82)	79.55 (64.1,89.74)	73.39 (61.76,83.78)	73.06 (60.53,83.33)
	White	82.33 (81.73,83.25)	79.44 (78.5,80.48)	73.33 (72.63,74.23)	69.55 (68.8,70.21)	78.22 (77.16,78.95)	73.49 (72.35,74.47)	70.58 (69.59,71.38)

## Outcomes by Quintile of Height

Compared with the current rules scenario, transplant rates among the shortest (<158 cm) candidates increased under all continuous distribution scenarios and declined for candidates over 165 cm tall (Table 6, Figure 19). The height distributions of transplant recipients under continuous allocation scenarios showed a small increase in the proportion of recipients under 158 cm tall (Figure 20).

The number of waitlist deaths among the shortest candidates declined by almost half in the continuous distribution scenarios compared with current rules, and declines were largest among candidates <158 cm tall (Figure 21, Table 6). For most height groups, declines in waitlist deaths were larger in the 2:1 LAS scenarios compared with the 1:1 LAS scenarios, and lower PE weight was associated with lower numbers of waitlist deaths.

The percent of 2-year posttransplant deaths was similar across scenarios for each height group (Figure 22, Table 6).

The patterns of median distance from donor to recipient by height group were similar to overall patterns, in which distances under current rules were shortest, and lower PE weight had longer distances.

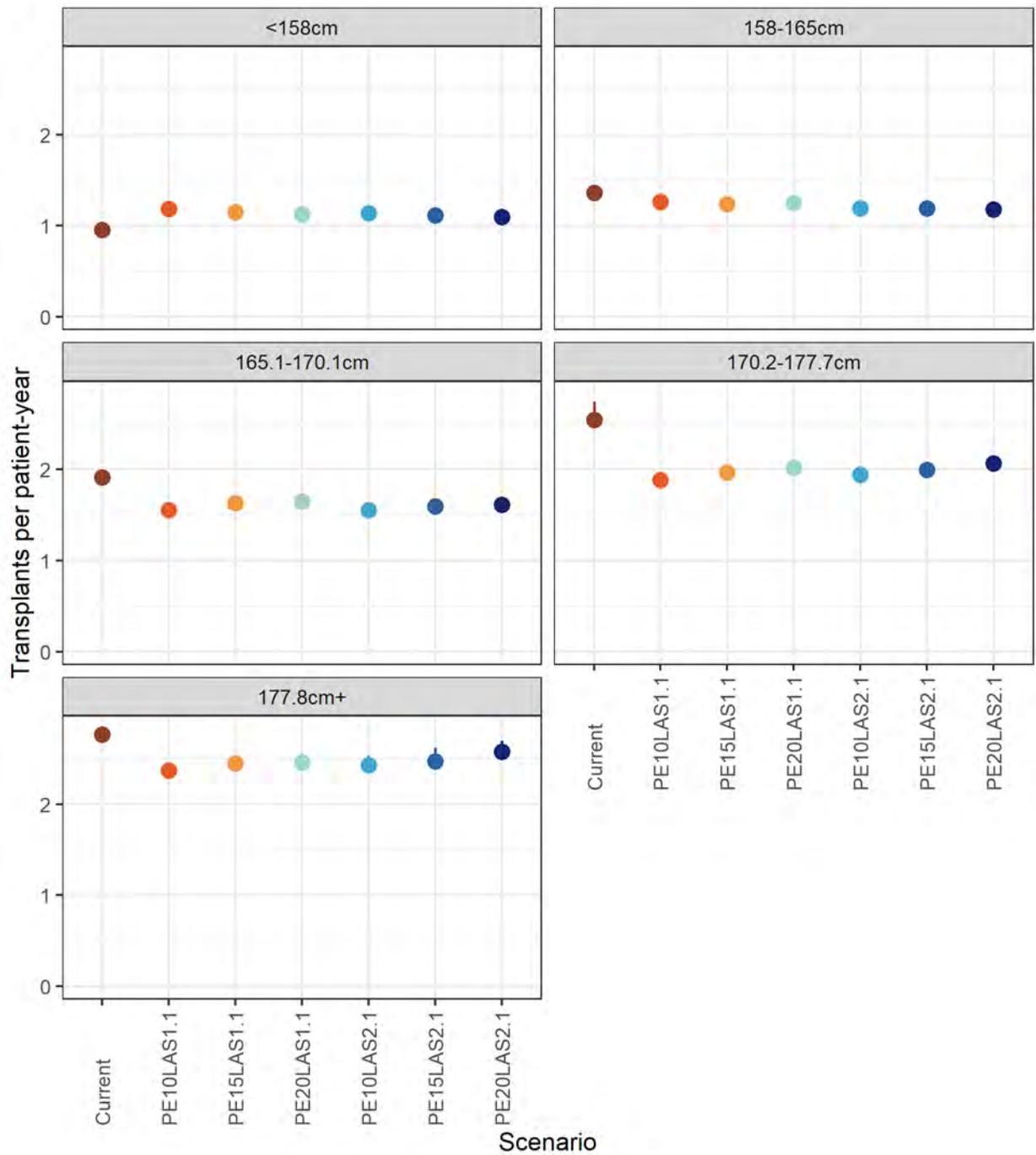


Figure 19: Transplant Rates - By Height

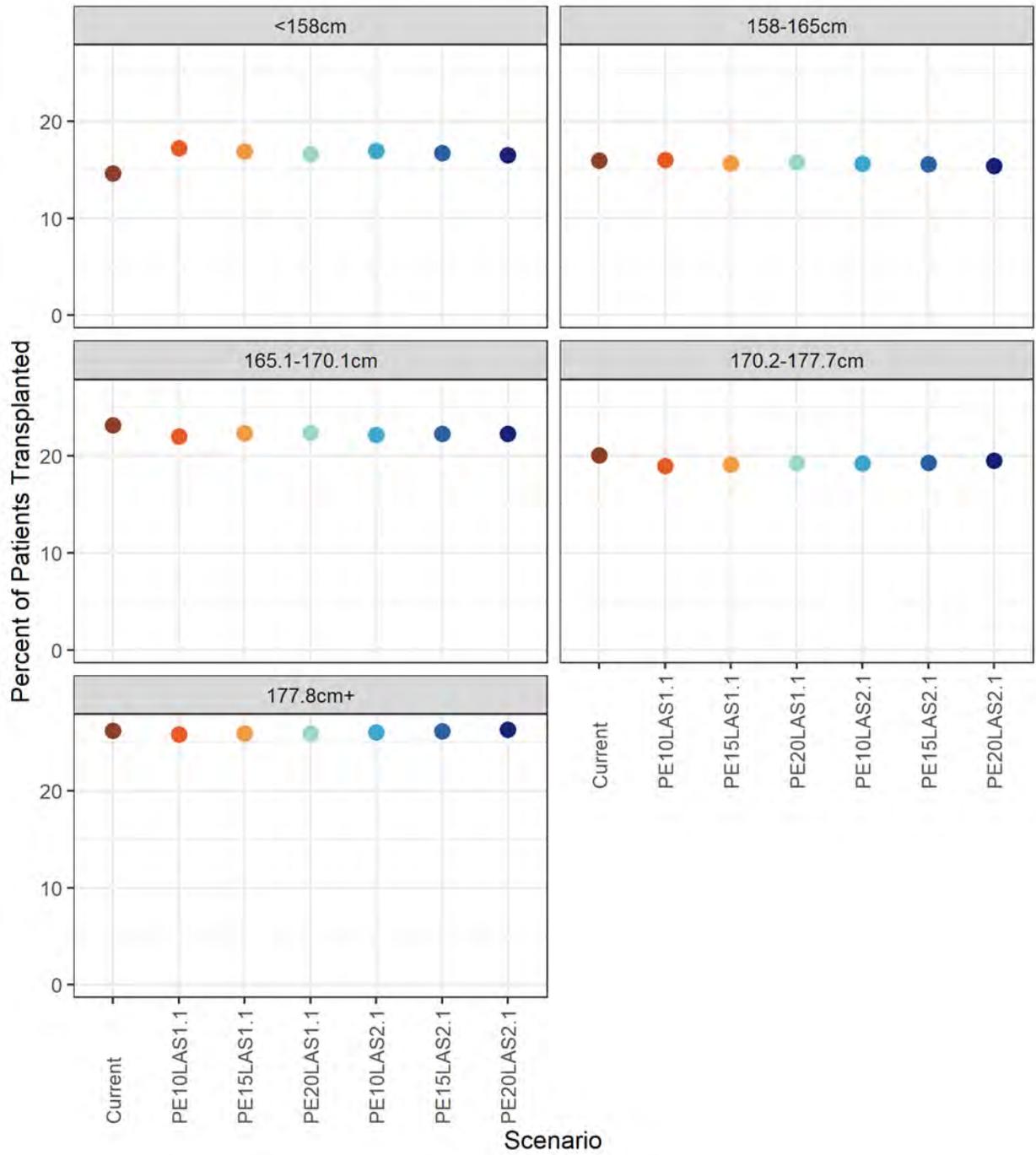


Figure 20: Transplant Distribution - Percent By Height

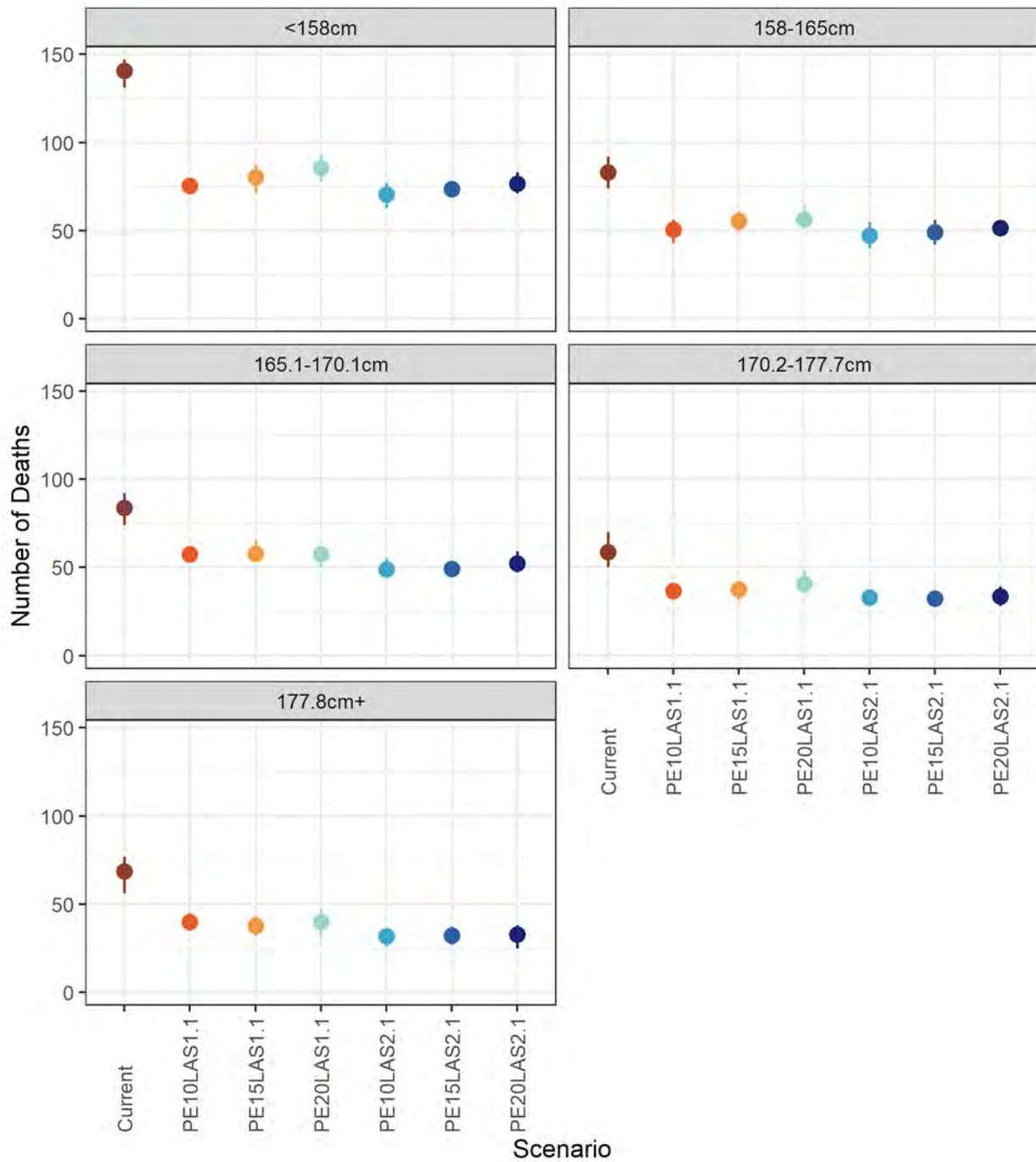


Figure 21: Waitlist Death Counts - By Height

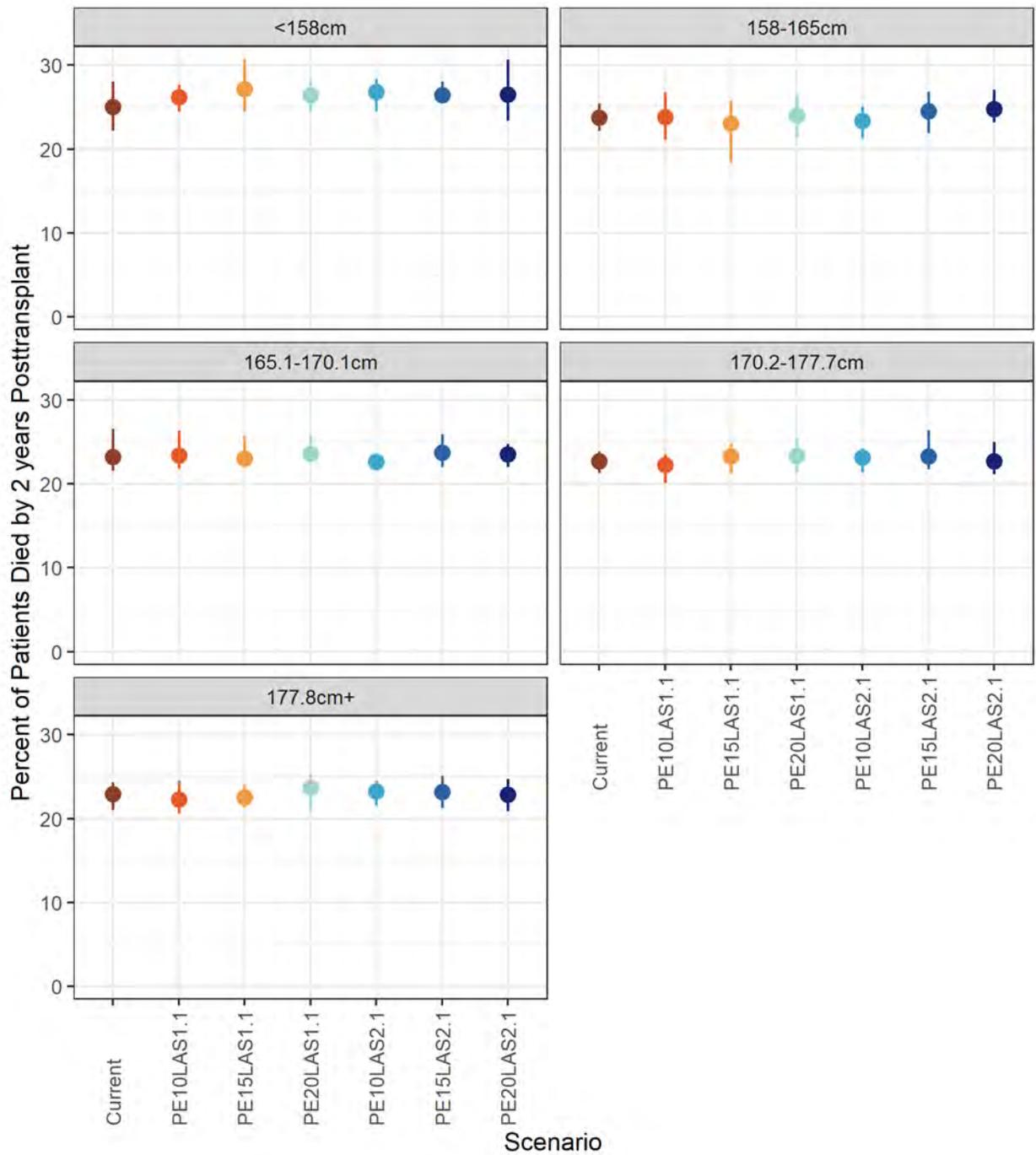


Figure 22: Percent Died by 2 Years Posttransplant - By Height

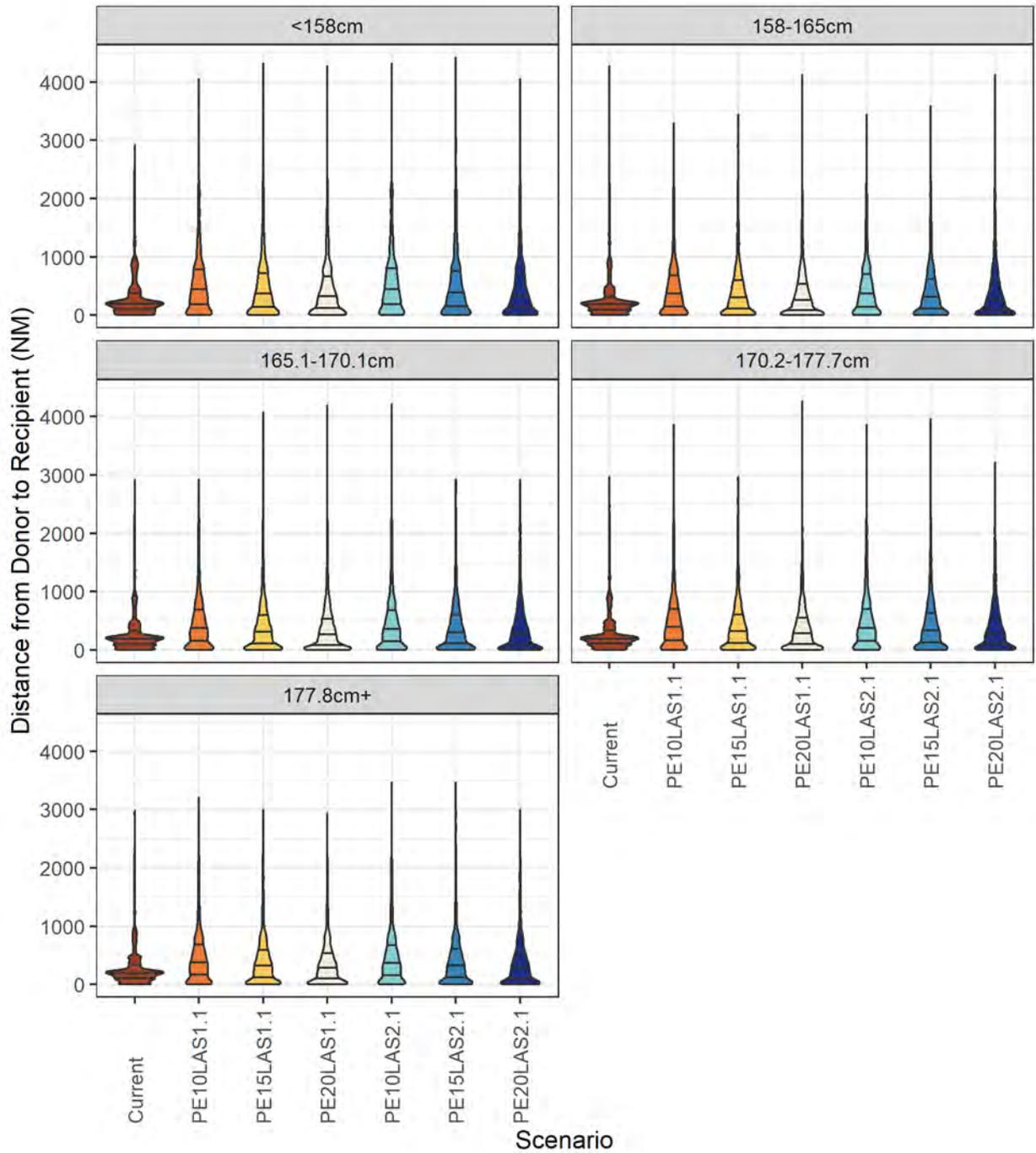


Figure 23: Distribution of Distance from Donor - By Height



Table 6: Outcome Counts and Rates by Scenario by Height Category

Outcome	Height Category	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
Transplant Count (N)								
	<158cm	741 (729,750)	871 (857,890)	859 (847,882)	846 (836,862)	862 (851,877)	852 (833,867)	842 (826,858)
	158-165cm	806 (791,820)	810 (784,834)	798 (783,811)	802 (785,826)	795 (773,809)	792 (777,809)	785 (769,795)
	165.1-170.1cm	1171 (1151,1181)	1116 (1101,1125)	1135 (1125,1147)	1139 (1125,1148)	1128 (1101,1143)	1136 (1121,1148)	1138 (1117,1158)
	170.2-177.7cm	1016 (1002,1050)	960 (946,973)	972 (963,983)	980 (966,992)	978 (963,992)	985 (973,999)	995 (982,1009)
	177.8cm+	1323 (1315,1338)	1307 (1293,1318)	1317 (1295,1333)	1318 (1298,1333)	1323 (1306,1343)	1332 (1319,1355)	1342 (1332,1348)
Transplant Rate per Patient-Year								
	<158cm	0.96 (0.93,0.97)	1.18 (1.14,1.23)	1.15 (1.12,1.18)	1.13 (1.1,1.16)	1.14 (1.12,1.17)	1.11 (1.08,1.14)	1.1 (1.06,1.13)
	158-165cm	1.36 (1.31,1.41)	1.26 (1.18,1.32)	1.24 (1.19,1.27)	1.25 (1.19,1.33)	1.19 (1.15,1.22)	1.19 (1.17,1.22)	1.18 (1.14,1.21)
	165.1-170.1cm	1.91 (1.84,1.99)	1.55 (1.52,1.6)	1.63 (1.6,1.66)	1.65 (1.63,1.67)	1.55 (1.49,1.58)	1.59 (1.55,1.64)	1.61 (1.56,1.67)
	170.2-177.7cm	2.54 (2.46,2.74)	1.88 (1.8,1.93)	1.96 (1.89,2.01)	2.02 (1.95,2.09)	1.94 (1.84,2.01)	2 (1.9,2.05)	2.07 (2.01,2.15)
	177.8cm+	2.76 (2.69,2.83)	2.37 (2.3,2.42)	2.44 (2.35,2.5)	2.46 (2.35,2.56)	2.43 (2.33,2.53)	2.47 (2.41,2.62)	2.57 (2.51,2.69)
Transplant Distribution (Percent)								
	<158cm	14.65 (14.47,14.85)	17.21 (16.93,17.58)	16.91 (16.69,17.33)	16.64 (16.45,16.94)	16.95 (16.78,17.25)	16.72 (16.37,17)	16.5 (16.19,16.81)
	158-165cm	15.93 (15.65,16.18)	16 (15.49,16.45)	15.7 (15.46,16)	15.77 (15.45,16.23)	15.63 (15.21,15.92)	15.55 (15.24,15.88)	15.39 (15.07,15.58)
	165.1-170.1cm	23.17 (22.78,23.32)	22.03 (21.75,22.2)	22.34 (22.16,22.54)	22.4 (22.15,22.59)	22.17 (21.72,22.46)	22.28 (21.99,22.55)	22.31 (21.93,22.7)
	170.2-177.7cm	20.09 (19.77,20.78)	18.95 (18.67,19.19)	19.14 (18.92,19.38)	19.27 (19.04,19.52)	19.24 (18.95,19.57)	19.32 (19.1,19.6)	19.51 (19.24,19.81)
	177.8cm+	26.16 (25.97,26.42)	25.81 (25.51,26.04)	25.91 (25.49,26.17)	25.92 (25.51,26.25)	26.01 (25.71,26.37)	26.14 (25.89,26.57)	26.3 (26.06,26.46)

Table 6: Outcome Counts and Rates by Scenario by Height Category

Outcome	Height Category	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
Waitlist Mortality Count (N)								
	<158cm	141 (131,147)	75 (73,77)	80 (71,87)	86 (78,93)	70 (63,77)	74 (69,78)	76 (71,83)
	158-165cm	83 (74,92)	51 (43,56)	56 (50,61)	56 (52,64)	47 (40,55)	49 (42,56)	52 (48,56)
	165.1-170.1cm	84 (74,92)	58 (54,62)	58 (53,65)	58 (50,60)	49 (45,55)	49 (46,52)	52 (47,59)
	170.2-177.7cm	59 (50,70)	37 (33,40)	38 (31,42)	41 (35,48)	33 (30,36)	32 (29,36)	34 (28,39)
	177.8cm+	69 (56,77)	40 (35,45)	38 (32,43)	40 (32,47)	32 (26,34)	32 (27,37)	33 (25,38)
Percent Died by 2 Years Posttransplant								
	<158cm	25.03 (22.12,28.03)	26.15 (24.45,27.65)	27.11 (24.44,30.71)	26.42 (24.43,28.23)	26.85 (24.44,28.34)	26.44 (25.53,28.05)	26.47 (23.33,30.65)
	158-165cm	23.74 (22.17,25.44)	23.78 (21.08,26.73)	23.05 (18.43,25.7)	23.98 (21.4,26.61)	23.39 (21.27,25.09)	24.51 (21.87,26.82)	24.75 (23.16,27.04)
	165.1-170.1cm	23.22 (21.55,26.53)	23.41 (21.82,26.34)	23.01 (22.31,25.68)	23.57 (22.54,25.76)	22.63 (21.55,23.49)	23.72 (21.96,25.91)	23.53 (21.99,24.76)
	170.2-177.7cm	22.71 (21.31,23.85)	22.26 (20.08,23.53)	23.3 (21.22,24.72)	23.33 (21.37,25.44)	23.15 (21.37,24.2)	23.29 (21.72,26.39)	22.68 (21.17,24.97)
	177.8cm+	22.91 (21,24.3)	22.29 (20.58,24.48)	22.53 (21.31,24.02)	23.65 (20.93,25.21)	23.21 (21.52,24.51)	23.18 (21.24,25.09)	22.86 (20.9,24.7)
Median Donor-to-Recipient Distance								
	<158cm	199 (196,204)	399 (376,418)	323 (297,351)	283 (255,304)	401 (360,451)	338 (311,380)	289 (275,312)
	158-165cm	190 (183,198)	325 (297,346)	265 (235,280)	212 (191,229)	320 (306,343)	268 (253,291)	226 (214,248)
	165.1-170.1cm	190 (175,198)	335 (309,380)	269 (239,291)	212 (197,229)	320 (296,342)	254 (237,272)	224 (220,232)
	170.2-177.7cm	192 (183,199)	354 (313,379)	283 (264,301)	239 (223,263)	341 (323,360)	290 (274,304)	242 (223,256)
	177.8cm+	200 (193,204)	356 (332,374)	285 (267,306)	249 (234,260)	344 (330,357)	296 (281,316)	250 (230,268)



Table 6: Outcome Counts and Rates by Scenario by Height Category

Outcome	Height Category	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
Percent Expected to Fly (>75 NM)								
	<158cm	80.32 (79.08,82.33)	80.61 (78.3,82.31)	75.23 (70.81,77.56)	72.58 (70.42,74.29)	80.75 (78.42,82.34)	77.27 (75.32,78.63)	73.89 (72.4,75.83)
	158-165cm	80.46 (78.57,81.65)	77.57 (75.37,79.12)	72.31 (70.36,74.94)	67.01 (64.99,69.38)	76.75 (75.28,78.01)	71.68 (69.11,73.24)	68.95 (67.36,71.05)
	165.1-170.1cm	79.76 (77.86,81.31)	76.78 (74.35,78.29)	70.63 (68.7,72.7)	65.99 (64.67,67.66)	75.58 (73.86,77.38)	70.19 (68.15,72)	68.08 (66.67,70.29)
	170.2-177.7cm	82.27 (80.86,83.27)	79.73 (78.64,81.81)	73.58 (72.25,75.84)	69.6 (67.96,70.91)	78.54 (76.94,79.84)	73.72 (72.91,74.41)	70.52 (69.08,71.82)
	177.8cm+	83.04 (80.62,85.06)	80.26 (79.14,81.55)	74.04 (73.14,76.74)	71.7 (70.44,73.31)	79.29 (77.36,80.69)	74.95 (73.28,76.87)	71.79 (69.76,73.85)

## Outcomes by Height - Adults

We also produced outcomes by height and separated the pediatric candidates into one group, leaving only the adults classified by height. Children can be expected to be shorter than most adults, and we show whether the continuous allocation scenarios improved access to transplant for shorter adults or if most of that improved transplant rate was due to pediatric priority in children.

Table 7 and Figure 24 show that while pediatric candidates had considerably higher transplant rates under continuous distribution compared with current rules, some increased access to transplant remained for shorter adults as well due to the candidate biology component of all continuous distribution scenarios. Compared with the current rules scenario, transplants rates among the shortest (<158 cm) adult candidates increased under all continuous distribution scenarios and declined for adult candidates over 158 cm tall. The height distributions of transplant recipients under continuous allocation scenarios showed a small increase in the proportion of adult recipients under 158 cm tall (Figure 25).

The number of waitlist deaths among the shortest adult candidates declined by nearly half in the continuous distribution scenarios compared with current rules (Figure 26, Table 7).

The percent of 2-year posttransplant deaths was similar across scenarios for each adult height group, though the proportion of deaths among pediatric candidates increased, as described in Outcomes by Age (Figure 26, Table 7).

The patterns of median distance from donor to recipient by height group were similar to overall patterns, in which distances under current rules were shortest, and lower PE weight had longer distances. Distances among pediatric recipients were expectedly high in all continuous distribution scenarios.

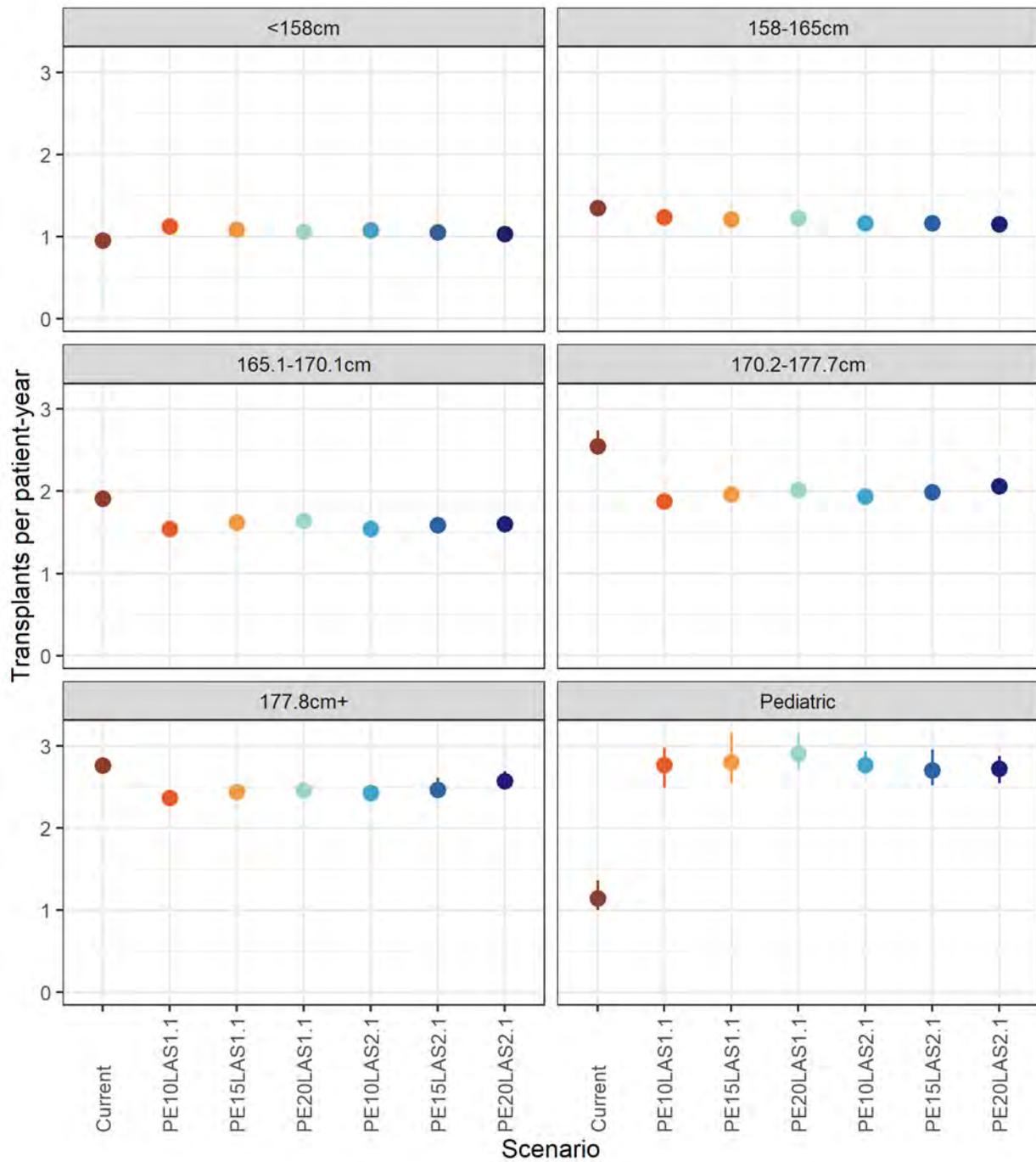


Figure 24: Transplant Rates - By Height Adults Only

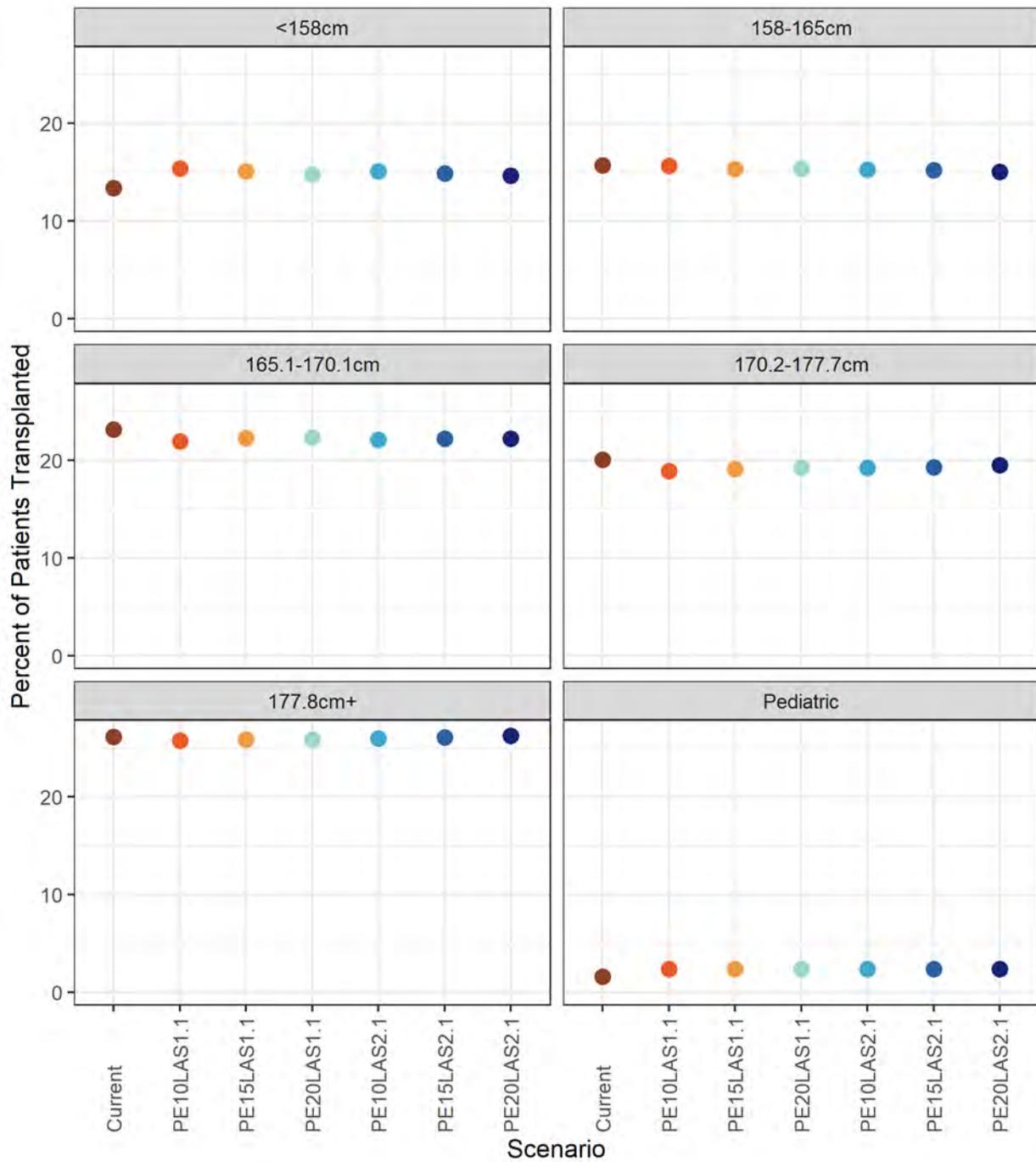


Figure 25: Transplant Distribution - Percent By Height Adults Only

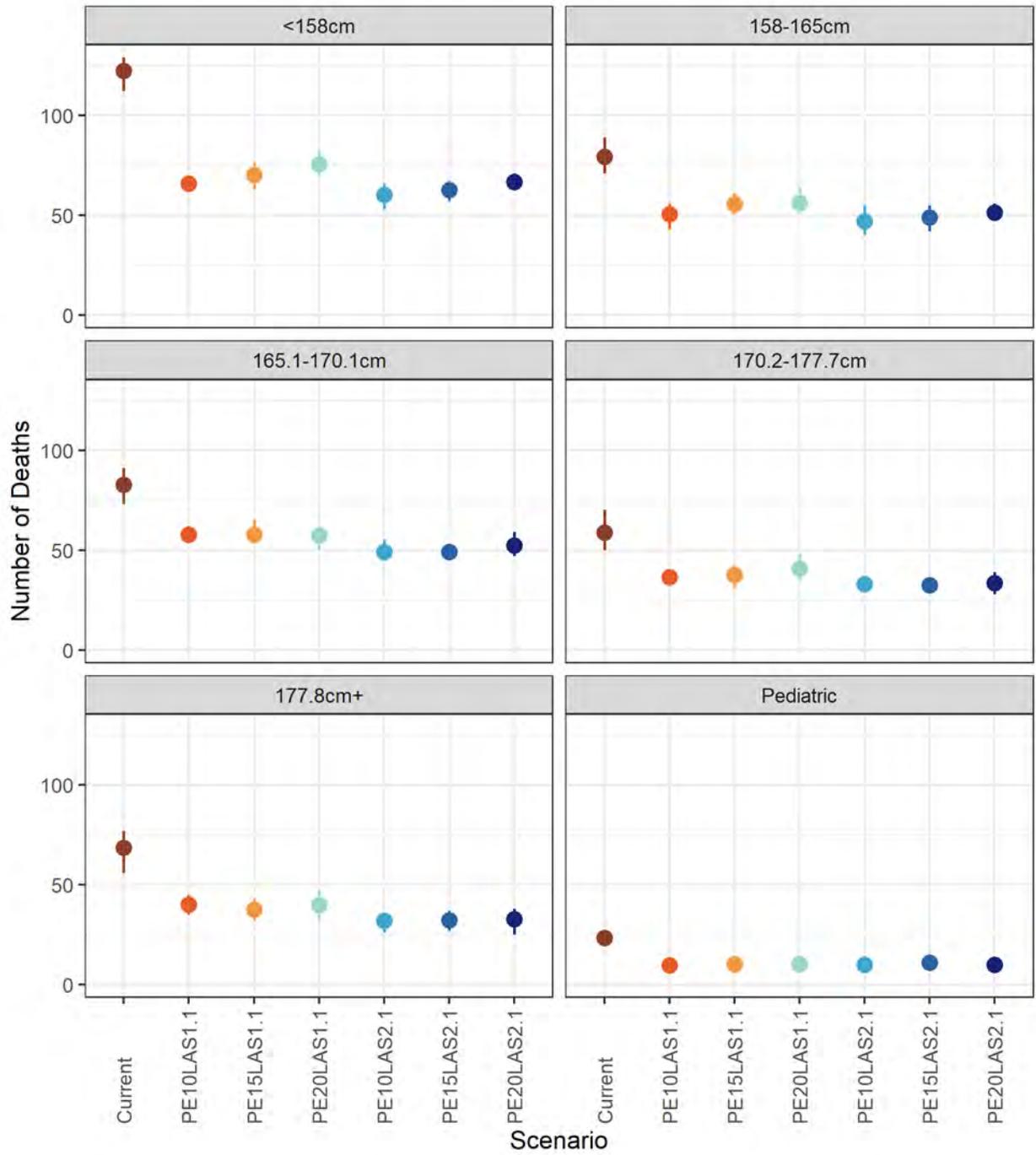


Figure 26: Waitlist Death Counts - By Height Adults Only

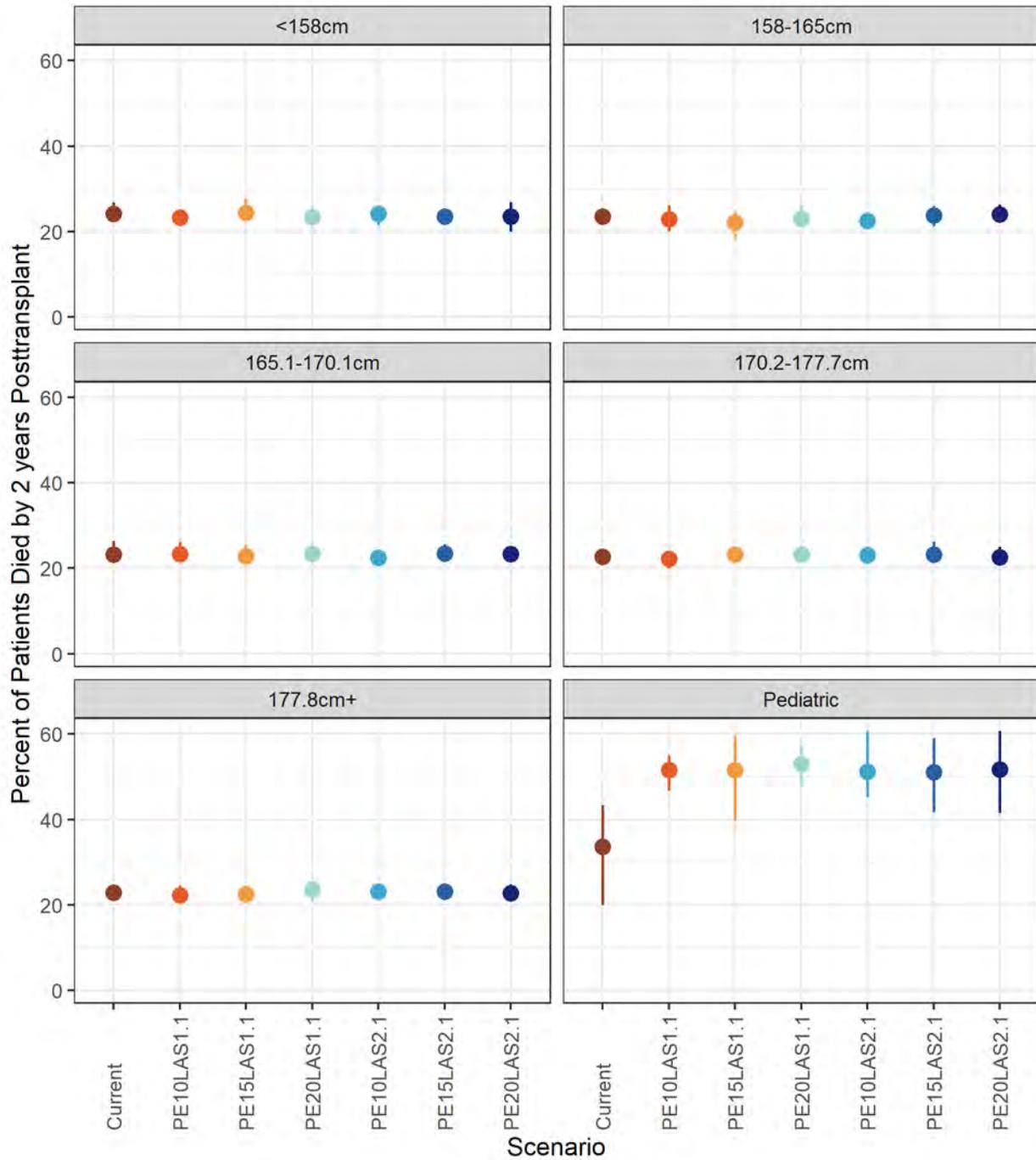


Figure 27: Percent Died by 2 Years Posttransplant - By Height Adults Only

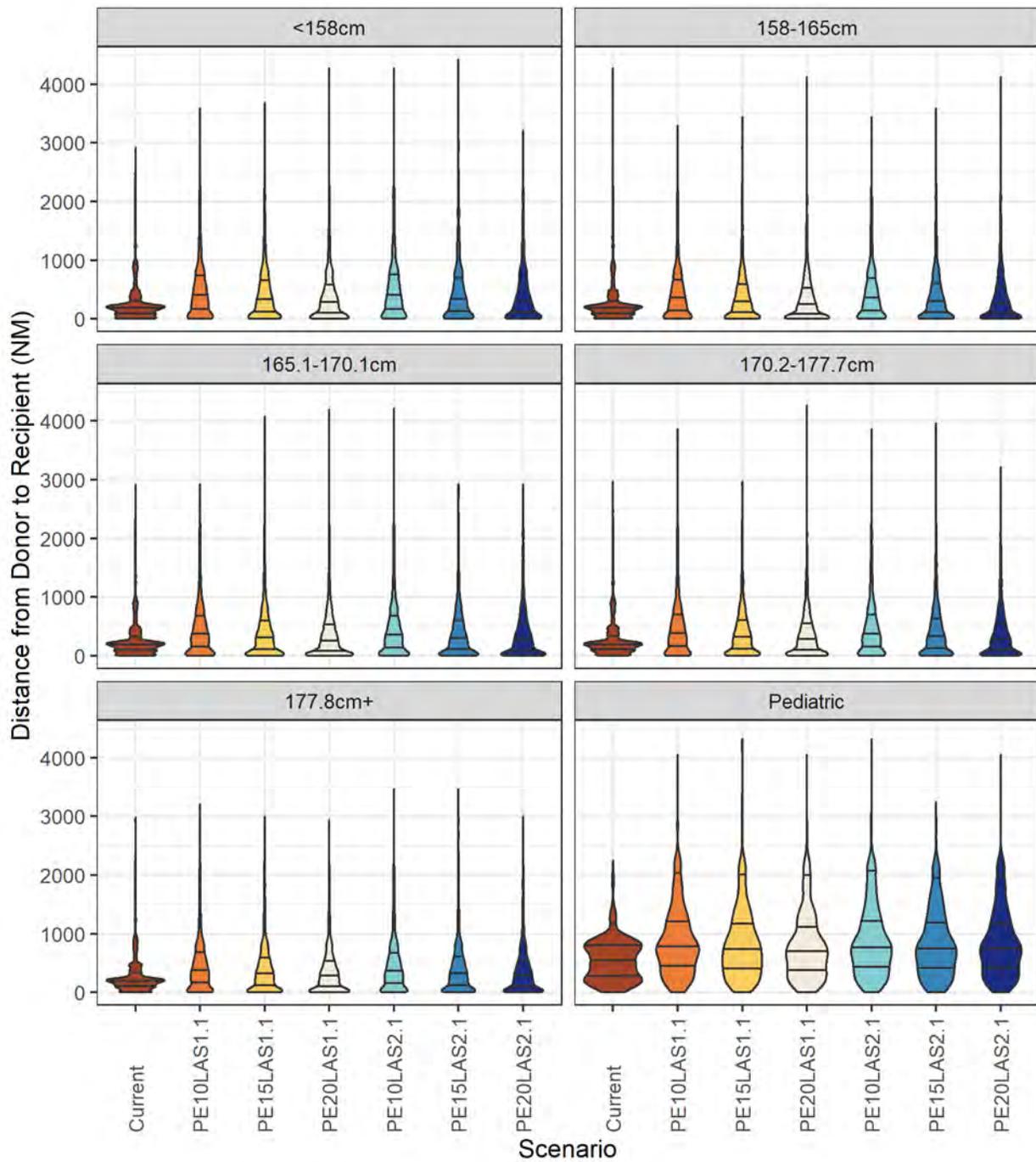


Figure 28: Distribution of Distance from Donor - By Height Adults Only

**Table 7: Outcome Counts and Rates by Scenario by Adult Height Categories**

Outcome	Height Category	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
Transplant Count (N)								
	<158cm	676 (664,692)	778 (762,799)	766 (753,787)	751 (740,767)	768 (757,781)	759 (741,777)	748 (732,764)
	158-165cm	794 (781,806)	792 (766,815)	779 (764,792)	783 (767,808)	776 (754,790)	774 (759,791)	767 (750,776)
	165.1-170.1cm	1169 (1149,1178)	1111 (1096,1120)	1130 (1120,1142)	1134 (1120,1143)	1122 (1096,1138)	1130 (1116,1143)	1133 (1112,1153)
	170.2-177.7cm	1014 (1001,1048)	958 (944,971)	970 (961,981)	978 (964,990)	976 (961,990)	983 (971,997)	993 (980,1007)
	177.8cm+	1322 (1314,1337)	1305 (1291,1317)	1315 (1293,1331)	1316 (1296,1331)	1321 (1305,1341)	1330 (1317,1353)	1340 (1330,1346)
	Pediatric	82 (75,89)	120 (114,124)	121 (116,123)	123 (120,127)	121 (117,126)	120 (115,124)	121 (117,123)
Transplant Rate per Patient-Year								
	<158cm	0.96 (0.92,0.98)	1.12 (1.07,1.18)	1.09 (1.07,1.12)	1.06 (1.04,1.09)	1.08 (1.06,1.1)	1.05 (1.02,1.09)	1.03 (0.99,1.07)
	158-165cm	1.35 (1.3,1.39)	1.23 (1.15,1.29)	1.21 (1.16,1.24)	1.22 (1.16,1.3)	1.16 (1.12,1.2)	1.17 (1.14,1.19)	1.16 (1.11,1.18)
	165.1-170.1cm	1.91 (1.84,1.99)	1.54 (1.51,1.59)	1.62 (1.59,1.65)	1.64 (1.62,1.66)	1.55 (1.48,1.58)	1.59 (1.54,1.64)	1.6 (1.55,1.66)
	170.2-177.7cm	2.55 (2.46,2.74)	1.88 (1.79,1.92)	1.96 (1.89,2.01)	2.02 (1.95,2.08)	1.94 (1.84,2)	1.99 (1.9,2.05)	2.06 (2,2.15)
	177.8cm+	2.76 (2.69,2.83)	2.37 (2.3,2.42)	2.44 (2.35,2.49)	2.46 (2.35,2.56)	2.42 (2.33,2.53)	2.47 (2.4,2.61)	2.57 (2.51,2.69)
	Pediatric	1.15 (1,1.36)	2.77 (2.49,2.98)	2.8 (2.55,3.16)	2.9 (2.71,3.15)	2.77 (2.65,2.93)	2.71 (2.52,2.95)	2.72 (2.54,2.87)
Transplant Distribution (Percent)								
	<158cm	13.37 (13.14,13.7)	15.37 (15.05,15.78)	15.08 (14.82,15.47)	14.77 (14.55,15.07)	15.11 (14.85,15.36)	14.88 (14.56,15.24)	14.67 (14.36,14.97)
	158-165cm	15.7 (15.45,15.9)	15.64 (15.13,16.08)	15.33 (15.08,15.63)	15.4 (15.09,15.87)	15.26 (14.83,15.55)	15.19 (14.89,15.53)	15.03 (14.69,15.2)
	165.1-170.1cm	23.12 (22.74,23.27)	21.93 (21.66,22.1)	22.25 (22.06,22.44)	22.3 (22.05,22.49)	22.07 (21.62,22.36)	22.18 (21.9,22.45)	22.21 (21.83,22.6)



Table 7: Outcome Counts and Rates by Scenario by Adult Height Categories

Outcome	Height Category	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
	170.2-177.7cm	20.05 (19.75,20.74)	18.91 (18.63,19.15)	19.1 (18.88,19.34)	19.23 (19,19.48)	19.2 (18.91,19.53)	19.28 (19.06,19.56)	19.47 (19.2,19.77)
	177.8cm+	26.15 (25.95,26.4)	25.77 (25.47,26.02)	25.88 (25.45,26.13)	25.88 (25.47,26.21)	25.97 (25.68,26.33)	26.1 (25.85,26.53)	26.26 (26.02,26.43)
	Pediatric	1.61 (1.48,1.76)	2.38 (2.25,2.45)	2.37 (2.29,2.42)	2.41 (2.36,2.5)	2.38 (2.3,2.47)	2.36 (2.25,2.44)	2.37 (2.29,2.41)
Waitlist Mortality Count (N)								
	<158cm	122 (112,129)	66 (63,68)	70 (63,76)	76 (70,82)	60 (53,66)	63 (57,67)	67 (63,71)
	158-165cm	79 (71,89)	51 (43,56)	56 (50,61)	56 (51,64)	47 (40,55)	49 (42,55)	52 (48,56)
	165.1-170.1cm	83 (73,91)	58 (54,62)	58 (53,65)	58 (50,60)	49 (45,55)	49 (46,52)	52 (47,59)
	170.2-177.7cm	59 (50,70)	37 (33,40)	38 (31,42)	41 (35,48)	33 (30,36)	32 (29,36)	34 (28,39)
	177.8cm+	68 (56,77)	40 (35,45)	38 (32,43)	40 (32,47)	32 (26,34)	32 (27,37)	33 (25,38)
	Pediatric	23 (20,25)	10 (8,12)	10 (8,12)	10 (7,12)	10 (9,12)	11 (9,13)	10 (8,13)
Percent Died by 2 Years Posttransplant								
	<158cm	24.21 (22.24,26.83)	23.29 (21.54,24.94)	24.37 (22.66,27.74)	23.38 (21.62,25.94)	24.11 (21.4,25.61)	23.56 (22.27,25.3)	23.52 (20,26.83)
	158-165cm	23.57 (21.52,25.31)	22.96 (19.95,26.2)	22.17 (18.24,24.74)	23.06 (20.77,26.06)	22.51 (20.58,24.18)	23.83 (21.24,25.92)	23.98 (22.37,26.29)
	165.1-170.1cm	23.19 (21.58,26.43)	23.31 (21.65,26.19)	22.89 (22.18,25.44)	23.41 (22.38,25.53)	22.45 (21.29,23.29)	23.53 (21.88,25.67)	23.4 (21.82,24.42)
	170.2-177.7cm	22.69 (21.25,23.78)	22.16 (19.92,23.47)	23.22 (21.16,24.67)	23.25 (21.31,25.39)	23.15 (21.31,24.25)	23.21 (21.56,26.23)	22.61 (21.01,24.92)
	177.8cm+	22.91 (21.02,24.32)	22.25 (20.53,24.52)	22.49 (21.34,23.9)	23.6 (20.89,25.17)	23.16 (21.48,24.47)	23.15 (21.2,25.06)	22.81 (20.93,24.74)
	Pediatric	33.63 (20,43.37)	51.59 (46.61,55)	51.52 (39.67,59.5)	52.99 (47.54,57.26)	51.22 (45.16,60.66)	51.12 (41.74,58.97)	51.64 (41.46,60.66)
Median Donor-to-Recipient Distance								



Table 7: Outcome Counts and Rates by Scenario by Adult Height Categories

Outcome	Height Category	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
	<158cm	190 (184,197)	366 (323,389)	289 (257,312)	247 (221,273)	364 (337,396)	303 (273,345)	245 (231,282)
	158-165cm	189 (182,197)	315 (287,338)	257 (224,273)	207 (189,223)	313 (289,341)	259 (240,288)	218 (205,229)
	165.1-170.1cm	190 (175,198)	334 (308,377)	267 (236,290)	211 (196,227)	318 (296,341)	252 (234,271)	223 (218,231)
	170.2-177.7cm	192 (183,200)	354 (313,375)	282 (263,299)	238 (223,263)	341 (323,360)	289 (274,303)	242 (223,256)
	177.8cm+	200 (192,204)	356 (333,374)	285 (266,306)	249 (234,259)	343 (330,355)	296 (281,316)	250 (229,267)
	Pediatric	538 (468,682)	772 (667,832)	714 (632,792)	679 (562,758)	753 (675,853)	738 (654,868)	739 (682,819)
Percent Expected to Fly (>75 NM)								
	<158cm	78.96 (77.54,80.88)	78.64 (75.72,80.43)	72.75 (67.89,75.42)	69.66 (67.01,71.75)	78.77 (76.54,80.32)	75.04 (72.45,76.38)	71.03 (69.07,73.09)
	158-165cm	80.18 (78.38,81.42)	77.07 (74.81,78.65)	71.67 (69.64,74.35)	66.34 (64.29,68.62)	76.24 (74.71,77.51)	71.08 (68.38,72.74)	68.26 (66.67,70.47)
	165.1-170.1cm	79.72 (77.81,81.28)	76.69 (74.24,78.19)	70.5 (68.56,72.58)	65.85 (64.52,67.52)	75.48 (73.74,77.28)	70.06 (68.01,71.87)	67.96 (66.52,70.16)
	170.2-177.7cm	82.24 (80.82,83.23)	79.68 (78.59,81.77)	73.53 (72.19,75.79)	69.53 (67.89,70.85)	78.5 (76.99,79.79)	73.66 (72.86,74.36)	70.48 (69.02,71.76)
	177.8cm+	83.05 (80.61,85.05)	80.26 (79.2,81.52)	74.01 (73.1,76.7)	71.67 (70.39,73.27)	79.27 (77.32,80.66)	74.92 (73.24,76.84)	71.76 (69.72,73.81)
	Pediatric	95.08 (91.14,97.59)	97.08 (95.99,18)	96.33 (94.83,98.37)	95.77 (91.8,97.54)	97.11 (95.16,99.15)	95.83 (93.04,98.37)	96.77 (95.08,98.32)

## Outcomes by Blood Type

Compared with the current rules scenario, transplant rates among blood type O candidates increased considerably in all continuous allocation scenarios, and rates among blood types A, B, and AB declined (Table 8, Figure 29). Rates among type O candidates increased from 1.54 transplants per patient-year under current rules to 1.84-1.93 under continuous allocation. Rates among type AB candidates declined from 2.52 to 1.57-1.62; type A, from 2.05 to 1.36-1.40; and type B, from 1.84 to 1.39-1.44. As a share of all patients who received a simulated transplant, type O increased from 45.6% of recipients under current rules to 51.1%-51.4% under all continuous allocation scenarios (Table 8, Figure 30).

For all blood types, waitlist deaths declined under all continuous allocation scenarios compared with current rules, and the decline was largest for type O candidates (Table 8, Figure 31).

The percent of 2-year posttransplant deaths was similar across scenarios for each blood type (Table 8, Figure 32).

The patterns of median distance from donor to recipient by blood type were similar to overall patterns, in which distances under current rules were shortest, and lower PE weight had longer distances.

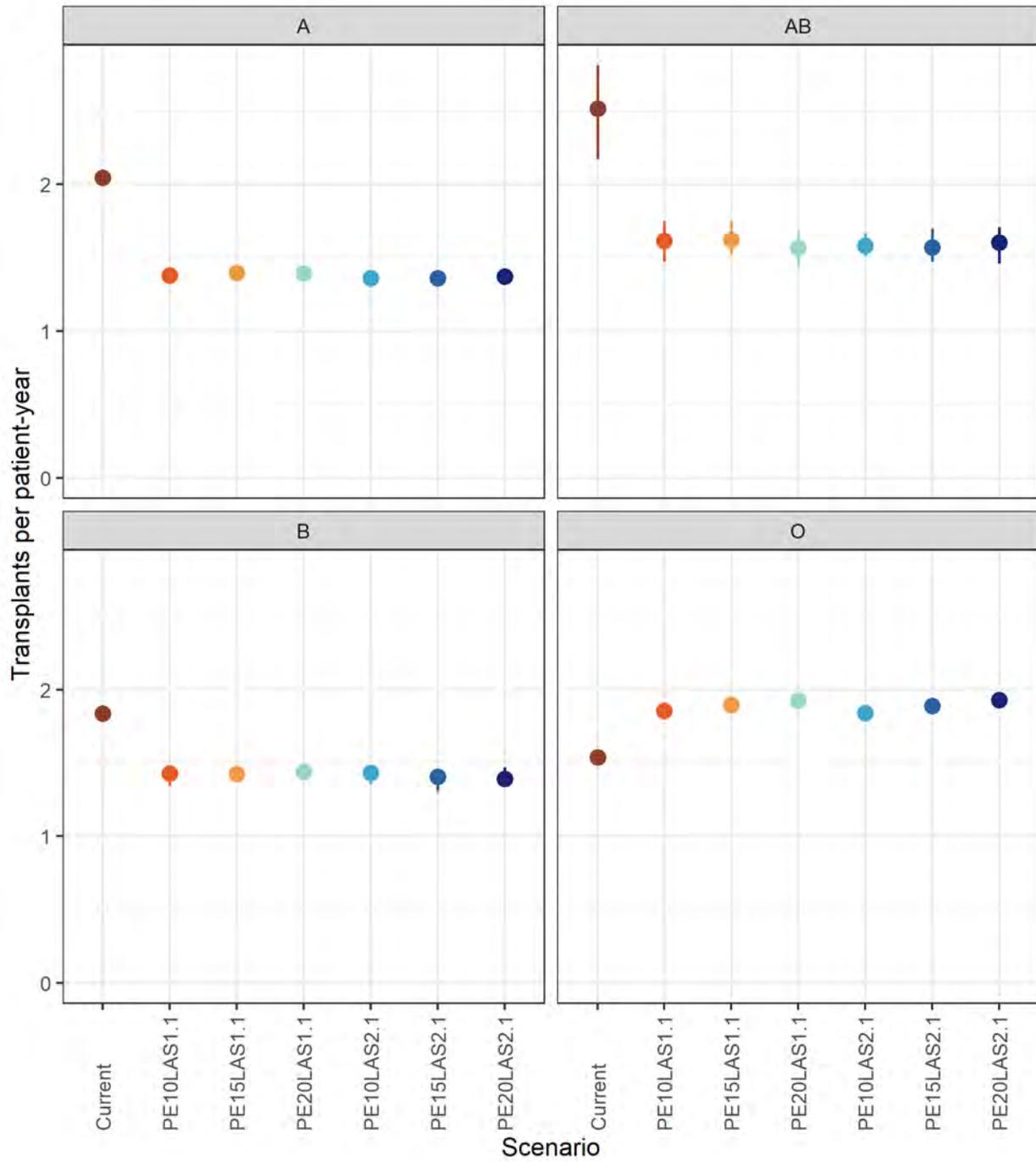


Figure 29: Transplant Rates - By Blood Type

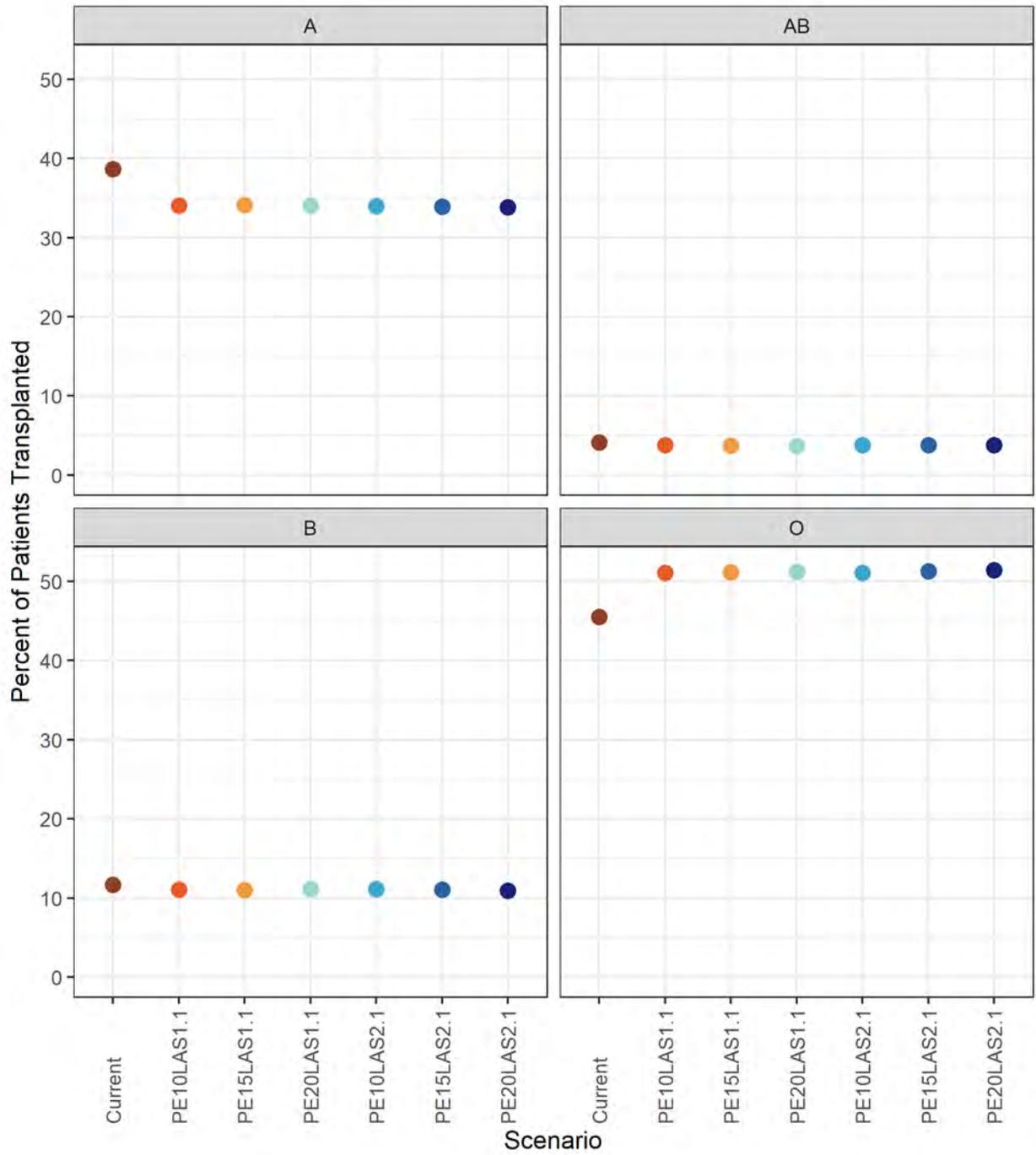


Figure 30: Transplant Distribution - Percent By Blood Type

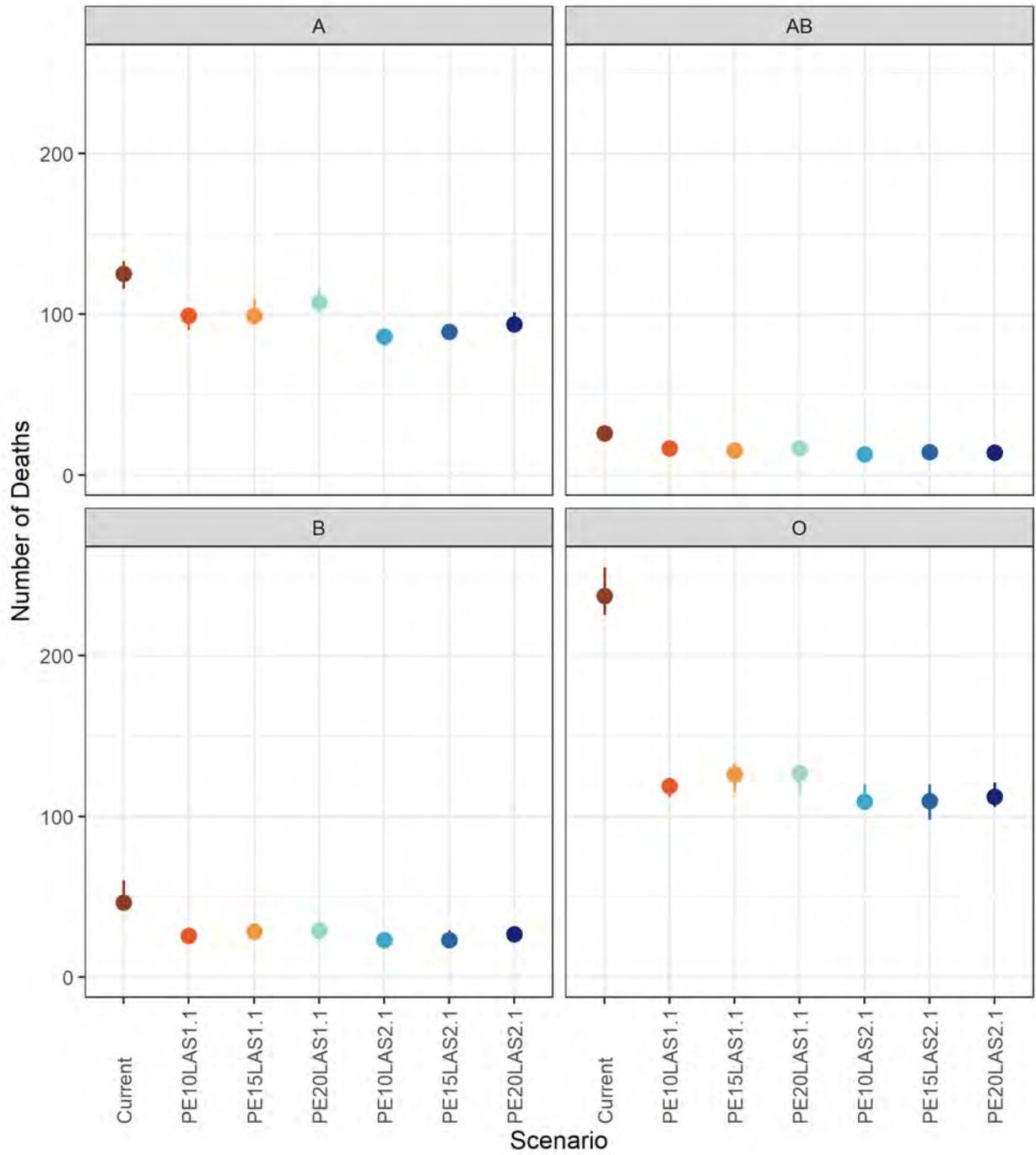


Figure 31: Waitlist Death Counts - By Blood Type

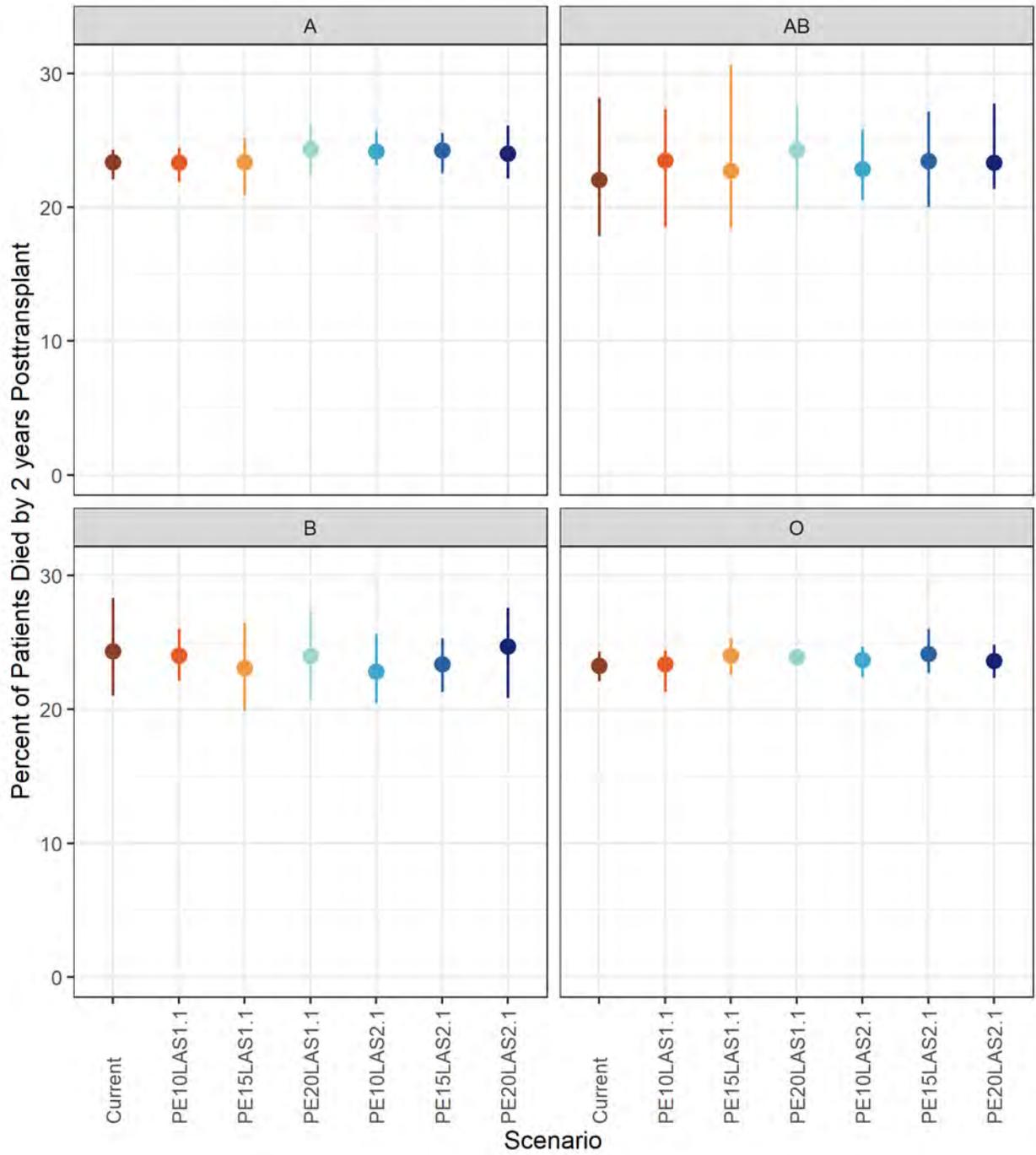


Figure 32: Percent Died by 2 Years Posttransplant - By Blood Type

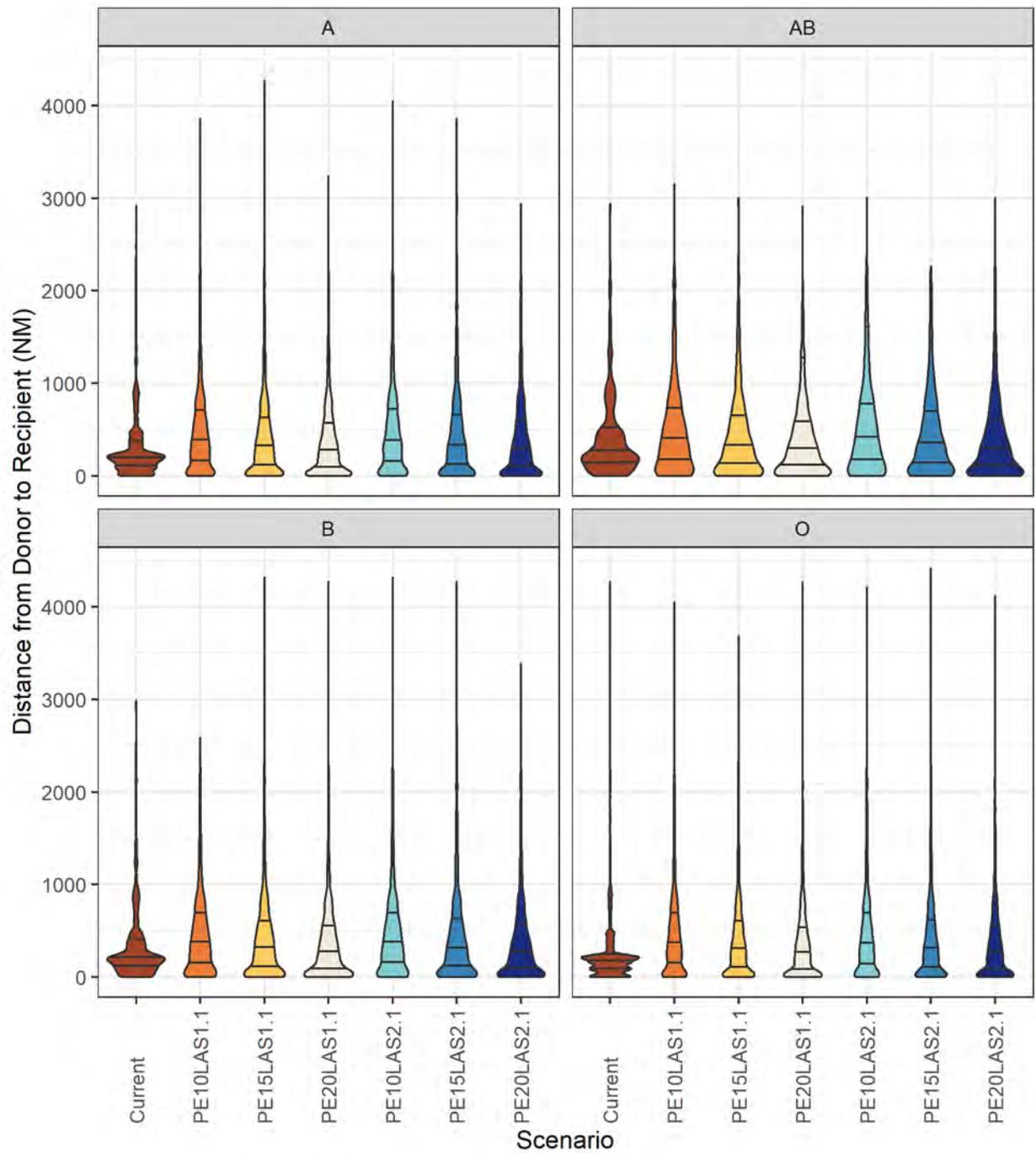


Figure 33: Distribution of Distance from Donor - By Blood Type

**Table 8: Outcome Counts and Rates by Scenario by Blood Type**

Outcome	Blood Type	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
Transplant Count (N)								
	A	1954 (1930,1966)	1724 (1710,1739)	1733 (1709,1752)	1730 (1705,1761)	1727 (1704,1743)	1727 (1704,1753)	1728 (1705,1750)
	AB	209 (199,219)	193 (183,205)	190 (185,196)	187 (181,197)	194 (190,197)	192 (187,201)	192 (185,198)
	B	590 (586,598)	561 (547,573)	560 (550,570)	564 (553,571)	566 (549,579)	562 (540,569)	558 (544,576)
	O	2304 (2283,2327)	2586 (2569,2596)	2598 (2575,2630)	2603 (2587,2628)	2599 (2580,2612)	2614 (2597,2638)	2624 (2594,2645)
Transplant Rate per Patient-Year								
	A	2.05 (2.01,2.09)	1.38 (1.37,1.4)	1.4 (1.36,1.43)	1.4 (1.36,1.43)	1.36 (1.32,1.38)	1.36 (1.32,1.4)	1.37 (1.35,1.39)
	AB	2.52 (2.17,2.81)	1.62 (1.47,1.75)	1.62 (1.52,1.75)	1.57 (1.43,1.69)	1.58 (1.51,1.67)	1.57 (1.47,1.7)	1.6 (1.46,1.71)
	B	1.84 (1.79,1.87)	1.43 (1.34,1.49)	1.42 (1.37,1.46)	1.44 (1.38,1.47)	1.43 (1.35,1.49)	1.41 (1.3,1.45)	1.39 (1.34,1.47)
	O	1.54 (1.49,1.57)	1.85 (1.81,1.89)	1.89 (1.84,1.95)	1.93 (1.9,1.96)	1.84 (1.82,1.87)	1.89 (1.86,1.93)	1.93 (1.9,1.96)
Transplant Distribution (Percent)								
	A	38.63 (38.2,38.92)	34.05 (33.78,34.32)	34.1 (33.64,34.43)	34.02 (33.52,34.62)	33.95 (33.53,34.24)	33.89 (33.45,34.45)	33.87 (33.41,34.33)
	AB	4.13 (3.93,4.32)	3.81 (3.62,4.05)	3.75 (3.64,3.86)	3.68 (3.56,3.87)	3.81 (3.74,3.87)	3.78 (3.66,3.94)	3.77 (3.62,3.88)
	B	11.68 (11.57,11.83)	11.08 (10.8,11.31)	11.02 (10.83,11.23)	11.1 (10.87,11.24)	11.12 (10.81,11.39)	11.03 (10.61,11.17)	10.93 (10.7,11.31)
	O	45.56 (45.2,45.93)	51.06 (50.76,51.29)	51.13 (50.83,51.64)	51.2 (50.89,51.64)	51.12 (50.69,51.34)	51.3 (50.95,51.79)	51.43 (50.92,51.8)
Waitlist Mortality Count (N)								
	A	125 (116,133)	99 (90,104)	99 (93,110)	108 (101,116)	86 (80,91)	89 (84,92)	94 (89,101)
	AB	26 (23,30)	17 (14,18)	15 (12,18)	17 (14,21)	13 (10,16)	14 (12,17)	14 (12,17)



Table 8: Outcome Counts and Rates by Scenario by Blood Type

Outcome	Blood Type	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
	B	47 (41,60)	26 (23,28)	28 (24,33)	29 (23,35)	23 (20,26)	23 (19,29)	27 (23,31)
	O	237 (225,255)	119 (112,123)	126 (115,133)	127 (114,132)	109 (104,120)	110 (98,120)	112 (106,121)
Percent Died by 2 Years Posttransplant								
	A	23.38 (22.07,24.31)	23.34 (21.87,24.44)	23.37 (20.87,25.11)	24.34 (22.27,26.16)	24.16 (23.12,25.72)	24.25 (22.53,25.55)	24 (22.11,26.08)
	AB	22.05 (17.82,28.17)	23.5 (18.54,27.32)	22.72 (18.42,30.61)	24.24 (19.79,27.72)	22.85 (20.51,25.79)	23.44 (20,27.13)	23.33 (21.35,27.75)
	B	24.33 (21.01,28.31)	24.03 (22.14,26)	23.1 (19.86,26.47)	24 (20.64,27.31)	22.81 (20.46,25.63)	23.38 (21.28,25.31)	24.69 (20.83,27.59)
	O	23.26 (22.08,24.3)	23.37 (21.3,24.42)	24 (22.57,25.35)	23.92 (23.57,24.24)	23.68 (22.39,24.67)	24.16 (22.71,26.03)	23.63 (22.35,24.81)
Median Donor-to-Recipient Distance								
	A	202 (198,207)	363 (346,380)	292 (281,297)	241 (218,266)	353 (339,362)	299 (290,308)	257 (230,272)
	AB	254 (222,313)	360 (304,415)	280 (255,313)	248 (197,280)	362 (294,424)	300 (228,332)	248 (205,280)
	B	210 (202,219)	339 (300,363)	278 (263,298)	223 (208,251)	343 (321,381)	279 (255,301)	227 (213,253)
	O	180 (175,185)	348 (340,355)	280 (262,293)	236 (227,251)	337 (323,353)	282 (263,290)	240 (226,249)
Percent Expected to Fly (>75 NM)								
	A	82.31 (81.09,83.57)	80.04 (78.89,82.09)	73.63 (72.25,75.19)	69.82 (67.28,72.08)	78.55 (77.4,79.64)	74.32 (73.59,75.12)	71.52 (70.36,72.63)
	AB	85.48 (83.41,89.05)	80.27 (77.6,82.72)	73.59 (70.41,76.34)	70 (62.5,75.52)	77.65 (70.41,83.51)	74.56 (70.53,77.95)	70.74 (64.62,73.6)
	B	83.56 (82.43,85.18)	77.5 (73.7,79.54)	71.49 (69,74.39)	67.53 (65.32,70.82)	78.14 (75.66,80.39)	71.94 (69.66,73.8)	69.34 (65.96,73.01)
	O	79.52 (78.6,80.74)	78.57 (77.51,79.21)	73.1 (72.04,73.95)	69.53 (69.22,70.24)	77.96 (76.62,78.84)	73.27 (71.89,74.4)	70.31 (69.64,70.89)



Table 9: LAS Distribution (Percent) by Blood Type

Blood Type	LAS: <35	LAS: 35-<40	LAS: 40-<50	LAS: 50-<60	LAS: 60+
A	25.9	23.8	23.9	9.1	17.3
AB	24.1	23.1	23.4	8.9	20.5
B	24.5	25.4	24.2	8.5	17.5
O	24.9	23.5	23.5	8.1	20.0

## Outcomes by LAS

Outcomes by LAS use LAS as defined by the most recent LAS update in 2020. All continuous distribution scenarios use WLAUC from the 2020 LAS update and a PTAUC component based on 5-year posttransplant outcomes. The weights of those components are different per scenario. Here we provided outcomes by LAS values with which clinicians are familiar. LAS values per patient are the same across all scenarios.

For current rules and all continuous allocation scenarios, transplant rates followed LAS in a dose-response relationship. That is, the lowest transplant rates occurred in the lowest LAS groups, with increasingly higher rates as LAS rose (Table 10, Figure 34). The shape of that dose-response varied by scenario. Under current rules, transplant rates increased from 0.79 transplants per patient-year for LAS <35 to 8.11 for LAS ≥60. With continuous allocation, transplant rates for candidates with LAS ≥60 increased considerably compared with current rules, and those increases were higher in the 2:1 allocation scenarios than the 1:1 allocation scenarios and were generally higher when PE weights were lowest. For candidates with LAS 50-<60, transplant rates increased for the 2:1 LAS scenarios with 10% and 15% PE weight but remained the same for 20% PE weight; rates decreased for all 1:1 LAS scenarios. For candidates with LAS 35-<50, transplant rates decreased under all continuous allocation scenarios compared with current rules. For candidates with LAS <35, transplant rates decreased for all the 2:1 LAS scenarios and stayed the same or increased slightly for the 1:1 LAS scenarios, compared with current rules.

Dramatic changes in transplant rates among the most medically urgent candidates changed the distribution of simulated transplants by LAS, compared with current rules (Table 10, Figure 35). Recipients with LAS ≥60 increased from 17% under current rules to 30%-32% under continuous allocation. Recipients with LAS 50-<60 increased under the 2:1 LAS scenarios and had similar or slightly lower representation under the 1:1 LAS scenarios. Recipients with LAS 35-<50 decreased under all continuous allocation scenarios, while recipients with LAS <35 were similarly represented under the 1:1 LAS scenarios and declined under the LAS 2:1 scenarios.

Under current rules, 62% of waitlist deaths occurred in candidates with LAS ≥60. Under continuous allocation, almost all of the reduction in waitlist deaths occurred in this group (Table 10, Figure 36); waitlist deaths dropped from 268 under current rules to 51-88 under continuous allocation, with the largest decline in the 2:1 LAS scenario with 10% PE weight. For candidates with LAS <40, the number of deaths was similar to current rules for most continuous allocation scenarios and slightly higher for the 2:1 LAS scenarios. For candidates with LAS 40-<50, there was an increase in waitlist deaths under the 1:1 LAS scenarios, but the 2:1 LAS scenarios were similar to current rules. For candidates with LAS 50-<60, waitlist deaths for all continuous allocation scenarios were similar to current rules.

The percent of 2-year posttransplant deaths was similar across scenarios for each LAS group (Table 10, Figure 37).

In general, under continuous distribution, median distances and percent of organs expected to fly increased with LAS, while under current rules, the opposite was true. For recipients with LAS ≥50, median distances increased under continuous allocation compared with current rules and increased the most when PE weight was the lowest (Table 10). For recipients with LAS 40-<50, median distances increased slightly for 10% PE but decreased for 15% and 20% PE. For recipients with LAS <40, distances decreased for 15% and 20% PE, and at 10% PE, were similar to current rules (2:1 LAS scenario) or slightly increased (1:1 LAS scenario). Proportion of organs expected to fly followed a

similar pattern: increased under all continuous allocation rules for those with LAS  $\geq 60$ , decreased for recipients with LAS  $< 50$ , and a mix for LAS  $50 < 60$ . Continuous distribution scenarios shipped organs more often and farther for high-risk candidates and shipped less for low-risk candidates, while current rules shipped farthest and most often for low-risk candidates.

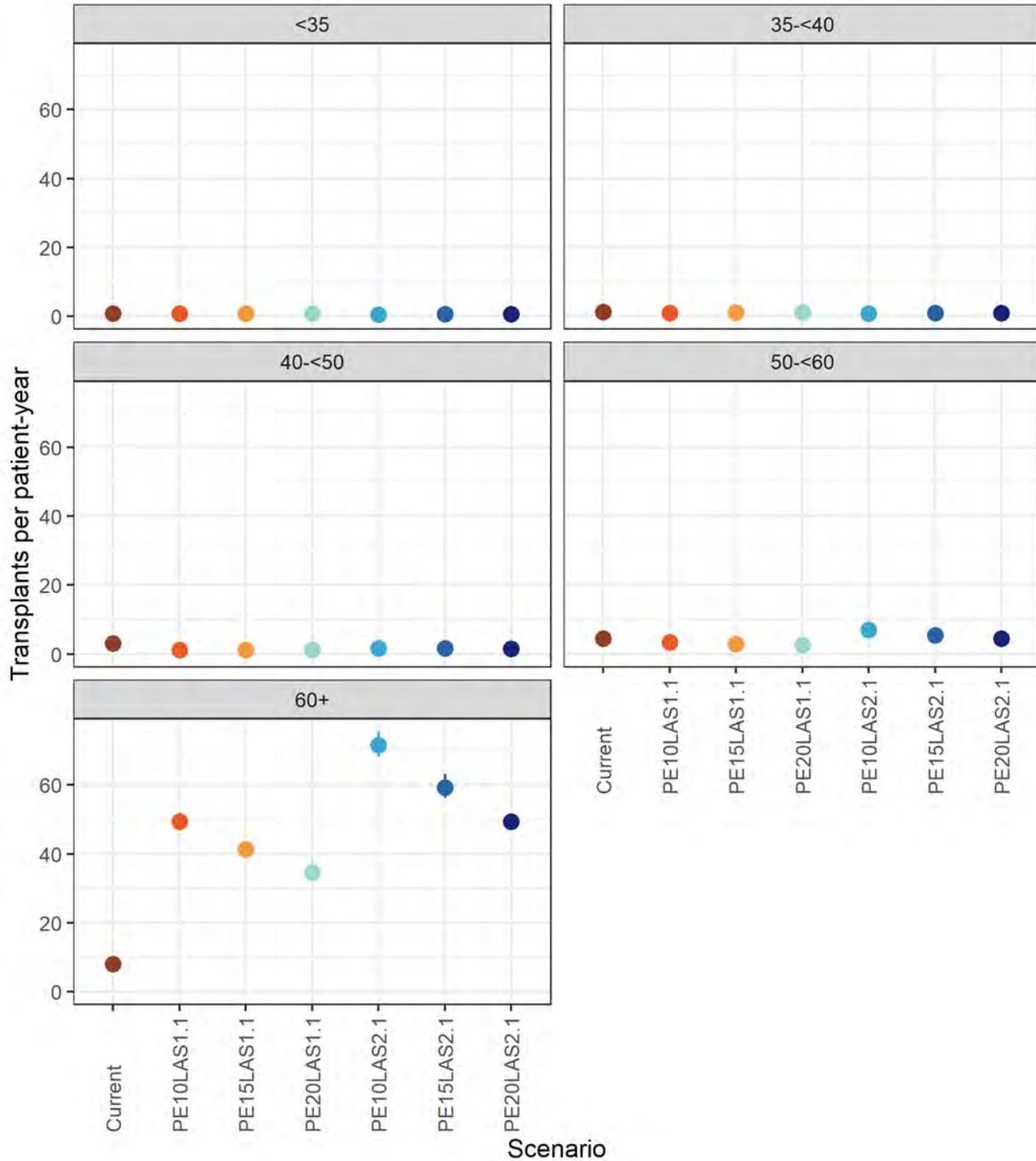


Figure 34: Transplant Rates - By LAS Group

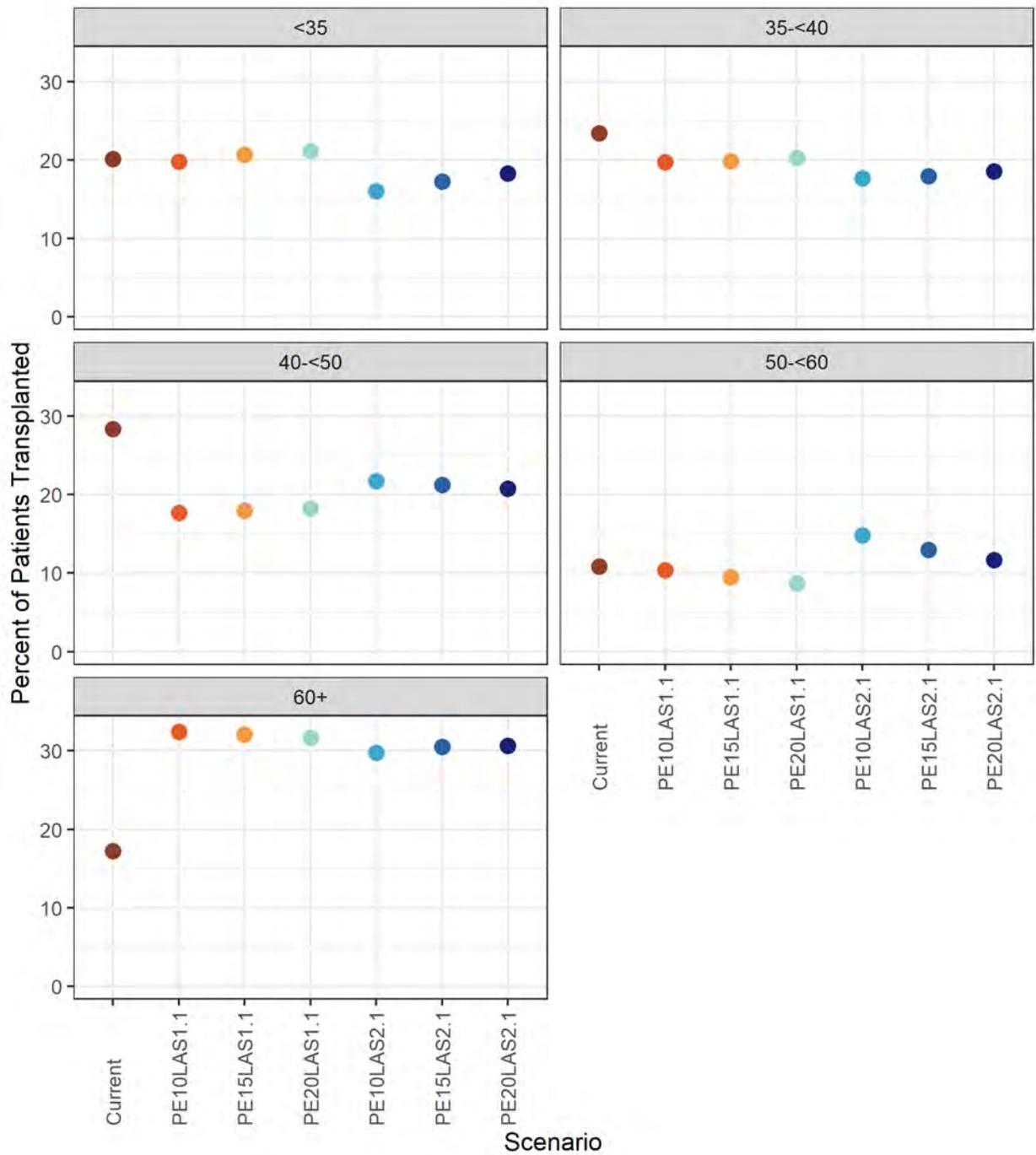


Figure 35: Transplant Distribution - Percent By LAS at Transplant

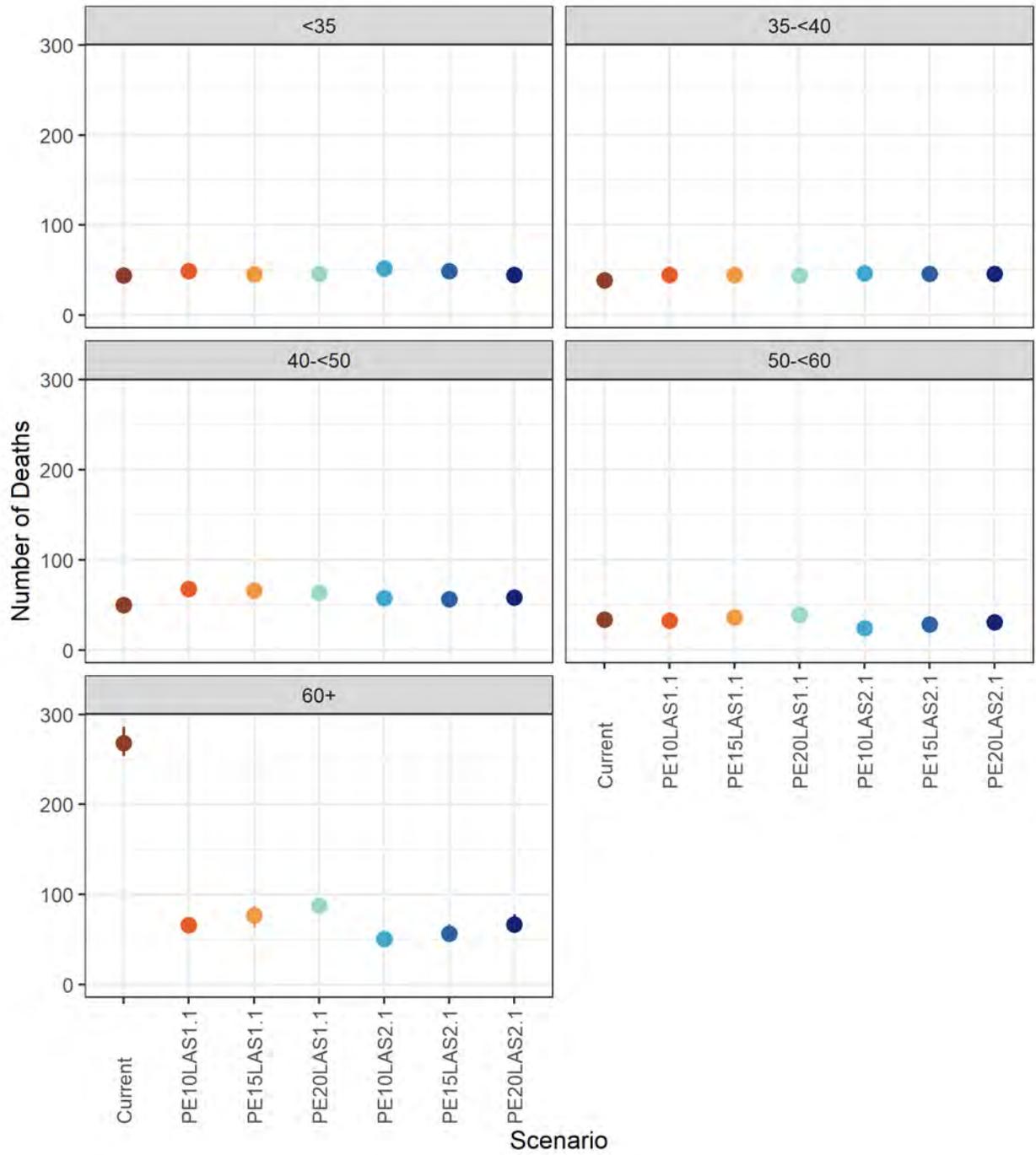


Figure 36: Waitlist Death Counts - By LAS Group

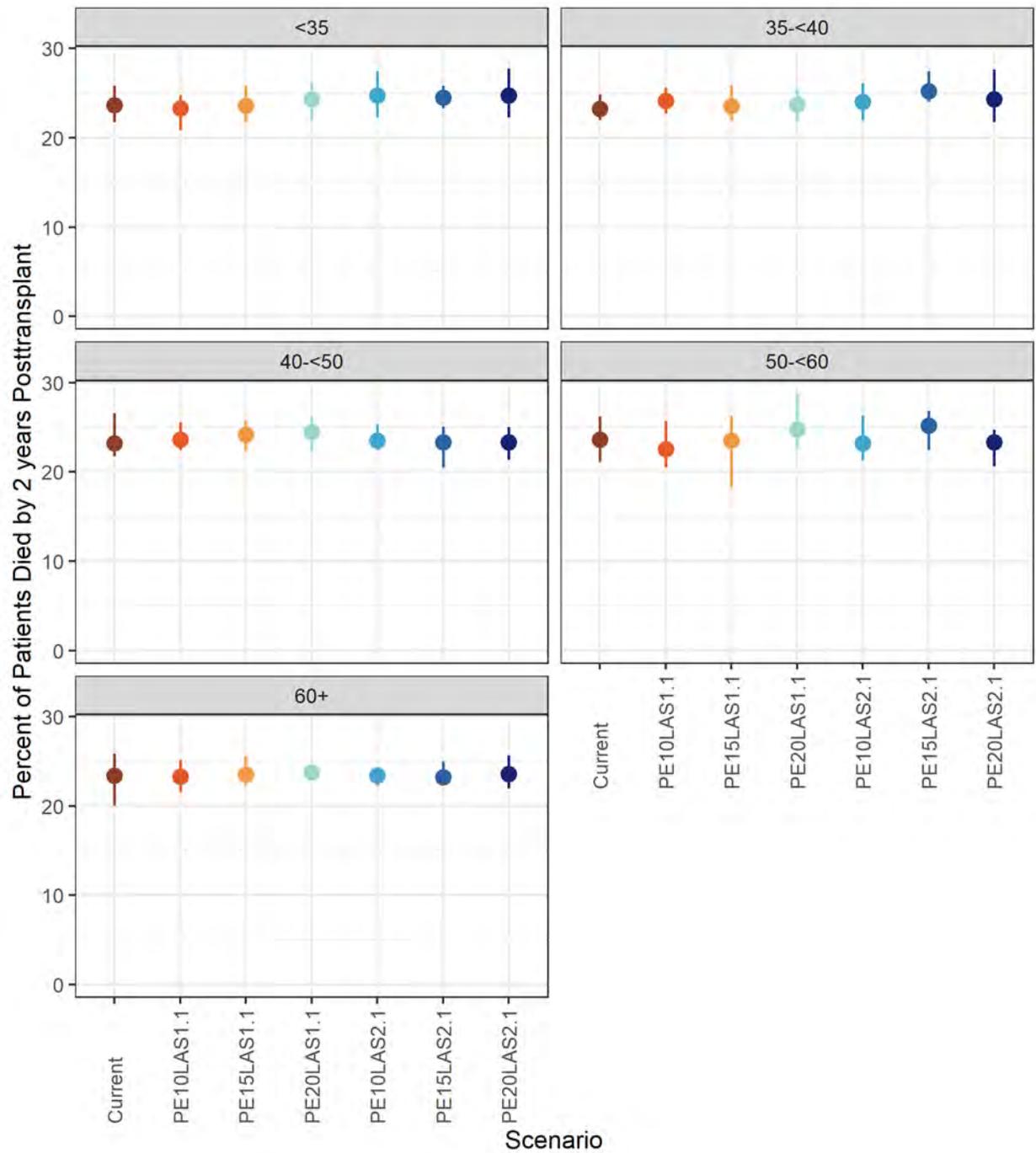


Figure 37: Percent Died by 2 Years Posttransplant - By LAS Group

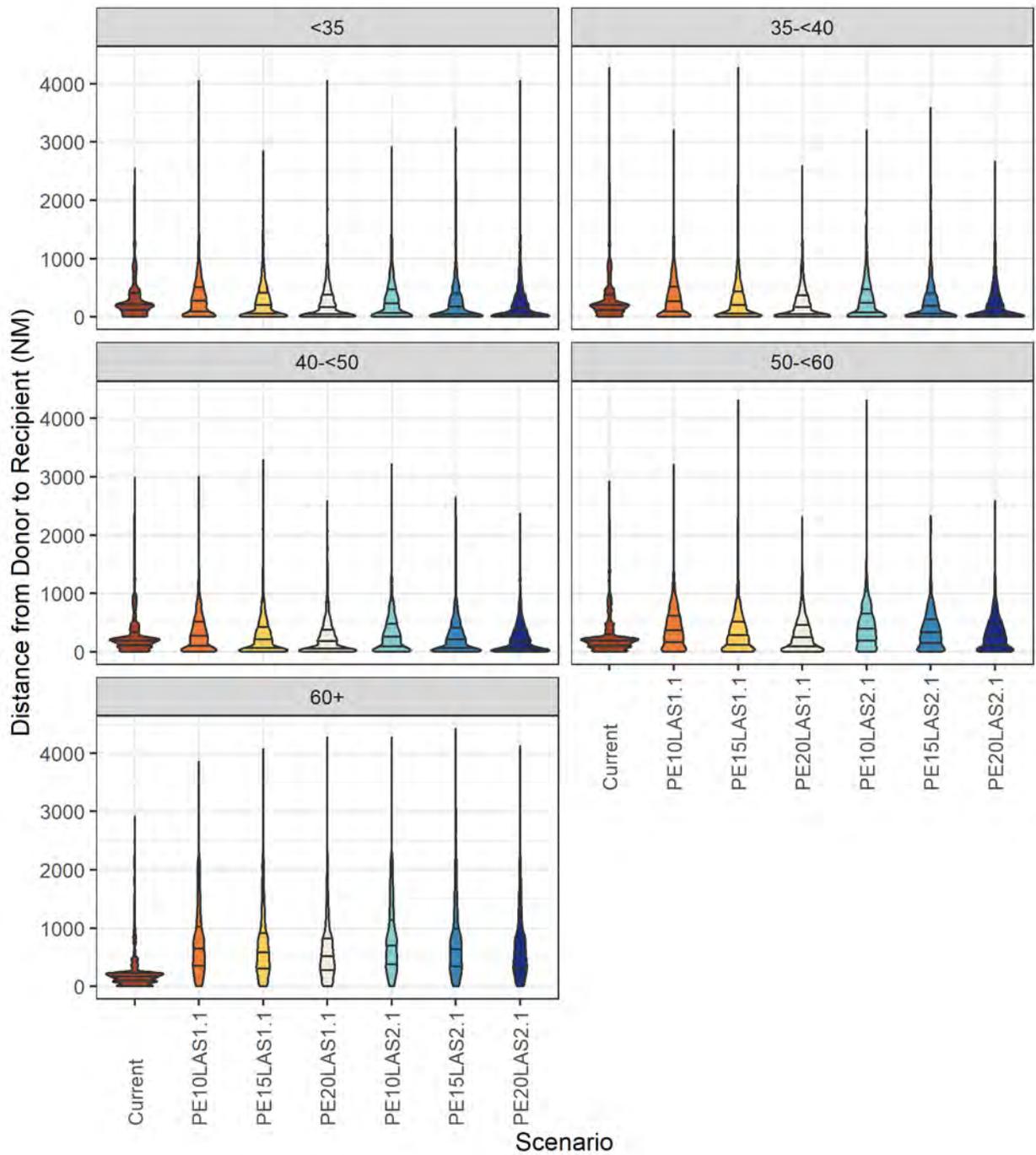


Figure 38: Distribution of Distance from Donor - By LAS at Transplant



Table 10: Outcome Counts and Rates by Scenario by LAS Category

Outcome	LAS Group	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
Transplant Count (N)								
	<35	1019 (1000,1039)	1002 (961,1017)	1049 (1028,1072)	1075 (1051,1097)	813 (791,833)	881 (862,901)	934 (913,948)
	35-<40	1185 (1153,1221)	998 (972,1024)	1009 (978,1030)	1030 (1002,1059)	899 (866,938)	915 (895,951)	945 (908,966)
	40-<50	1433 (1397,1467)	897 (870,928)	913 (880,953)	926 (875,958)	1105 (1076,1123)	1084 (1067,1125)	1060 (1019,1091)
	50-<60	548 (517,568)	526 (506,542)	481 (456,509)	445 (419,467)	755 (729,780)	662 (648,679)	597 (583,632)
	60+	872 (845,907)	1641 (1597,1659)	1628 (1604,1665)	1609 (1588,1625)	1513 (1494,1535)	1555 (1514,1586)	1565 (1530,1594)
Transplant Rate per Patient-Year								
	<35	0.79 (0.76,0.82)	0.79 (0.74,0.81)	0.84 (0.81,0.87)	0.88 (0.86,0.91)	0.57 (0.54,0.59)	0.64 (0.62,0.66)	0.7 (0.68,0.72)
	35-<40	1.36 (1.29,1.42)	1.05 (1,1.09)	1.07 (1.04,1.1)	1.09 (1.06,1.13)	0.9 (0.87,0.95)	0.92 (0.89,0.96)	0.96 (0.91,0.99)
	40-<50	3.05 (2.91,3.18)	1.21 (1.17,1.27)	1.24 (1.2,1.29)	1.27 (1.19,1.31)	1.71 (1.68,1.74)	1.66 (1.6,1.75)	1.6 (1.51,1.69)
	50-<60	4.48 (4.17,4.72)	3.41 (3.24,3.55)	2.99 (2.8,3.28)	2.65 (2.49,2.74)	7.02 (6.47,7.36)	5.4 (5.18,5.54)	4.51 (4.29,4.76)
	60+	8.11 (7.84,8.51)	49.39 (47.54,51.98)	41.28 (39.8,43.27)	34.62 (32.46,37.46)	71.43 (68.21,75.42)	59.26 (56.2,63.12)	49.35 (47.02,50.93)
Transplant Distribution (Percent)								
	<35	20.16 (19.74,20.51)	19.79 (18.98,20.07)	20.64 (20.28,21.1)	21.14 (20.67,21.58)	15.99 (15.6,16.37)	17.28 (16.9,17.71)	18.31 (17.92,18.58)
	35-<40	23.43 (22.81,24.11)	19.71 (19.18,20.23)	19.86 (19.31,20.26)	20.26 (19.71,20.83)	17.68 (17.05,18.41)	17.96 (17.54,18.69)	18.52 (17.85,18.93)
	40-<50	28.34 (27.6,29.04)	17.71 (17.19,18.33)	17.97 (17.35,18.73)	18.21 (17.25,18.83)	21.72 (21.11,22.11)	21.27 (20.97,22.06)	20.79 (19.99,21.34)
	50-<60	10.84 (10.23,11.24)	10.39 (9.98,10.71)	9.47 (8.96,10.05)	8.75 (8.24,9.21)	14.84 (14.32,15.39)	12.98 (12.71,13.32)	11.7 (11.4,12.38)
	60+	17.24 (16.73,17.96)	32.4 (31.55,32.74)	32.05 (31.62,32.83)	31.65 (31.27,31.96)	29.76 (29.31,30.2)	30.51 (29.69,31.13)	30.68 (29.98,31.27)

Table 10: Outcome Counts and Rates by Scenario by LAS Category

Outcome	LAS Group	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
Waitlist Mortality Count (N)								
	<35	44 (40,49)	49 (44,51)	46 (41,49)	46 (42,51)	52 (49,56)	49 (45,54)	45 (41,50)
	35-<40	39 (36,41)	45 (40,50)	45 (43,47)	44 (41,50)	47 (44,50)	46 (42,49)	46 (44,50)
	40-<50	50 (46,56)	68 (62,73)	66 (62,72)	63 (58,68)	58 (52,62)	57 (53,62)	58 (52,62)
	50-<60	34 (29,41)	33 (30,36)	36 (32,38)	39 (35,46)	24 (21,29)	28 (26,32)	31 (25,35)
	60+	268 (254,286)	66 (59,70)	77 (64,87)	88 (78,94)	51 (42,54)	56 (48,67)	67 (60,78)
Percent Died by 2 Years Posttransplant								
	<35	23.66 (21.71,25.8)	23.29 (20.83,24.77)	23.58 (21.71,25.84)	24.29 (21.9,26.28)	24.74 (22.25,27.42)	24.52 (23.29,25.84)	24.75 (22.26,27.72)
	35-<40	23.25 (21.96,24.85)	24.16 (22.7,25.58)	23.55 (21.94,25.88)	23.71 (21.79,25.51)	23.99 (21.9,26.11)	25.22 (24.02,27.44)	24.33 (21.71,27.63)
	40-<50	23.19 (21.74,26.54)	23.63 (22.41,25.51)	24.16 (22.35,25.74)	24.47 (22.27,26.17)	23.49 (22.42,25.28)	23.33 (20.44,25.07)	23.33 (21.35,25.02)
	50-<60	23.64 (21.11,26.17)	22.55 (20.48,25.65)	23.5 (18.29,26.28)	24.75 (22.54,28.8)	23.22 (21.27,26.32)	25.19 (22.41,26.81)	23.33 (20.61,24.68)
	60+	23.41 (20.04,25.84)	23.28 (21.57,25.15)	23.51 (22.24,25.56)	23.79 (23,24.75)	23.42 (22.25,24.27)	23.2 (22.46,24.97)	23.61 (21.96,25.65)
Median Donor-to-Recipient Distance								
	<35	207 (200,216)	237 (206,252)	167 (156,183)	126 (112,146)	187 (168,223)	123 (99,152)	114 (94,132)
	35-<40	202 (199,205)	231 (220,247)	163 (142,186)	128 (116,140)	198 (168,213)	146 (117,172)	115 (99,129)
	40-<50	194 (190,199)	237 (211,261)	174 (162,188)	140 (119,167)	225 (201,242)	175 (166,195)	144 (132,169)
	50-<60	186 (177,196)	335 (296,358)	255 (232,288)	207 (191,232)	382 (356,407)	305 (286,322)	242 (218,267)
	60+	170 (159,180)	638 (626,654)	573 (555,581)	506 (481,521)	697 (677,712)	632 (602,647)	564 (539,584)



Table 10: Outcome Counts and Rates by Scenario by LAS Category

Outcome	LAS Group	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
Percent Expected to Fly (>75 NM)								
	<35	82.27 (80.31,83.69)	69.38 (66.93,70.87)	61.43 (59.44,63.53)	56.85 (55.43,59.83)	62.89 (59.46,65.46)	57.2 (55.03,59.91)	56.02 (54.02,57.78)
	35-<40	81.8 (80.63,83.32)	69.52 (67.8,73.5)	61.29 (58.34,64.44)	57.44 (54.44,59.69)	65.64 (62.47,67.71)	59.38 (56.72,61.79)	56.38 (54.57,58.89)
	40-<50	81.37 (80.39,83.21)	70.37 (67.68,71.93)	62.72 (61.37,63.86)	58.85 (57.17,61.4)	70.11 (67.65,72.24)	63.86 (61.09,65.64)	60.12 (58.97,62.92)
	50-<60	81.25 (78.92,84.07)	80.91 (78.26,82.61)	74.69 (73.45,78.59)	68.21 (65.28,70.47)	85.79 (84.5,86.97)	80.32 (77.61,82.14)	73.6 (71.89,76.52)
	60+	79.47 (77.8,81.29)	94.81 (94.3,95.39)	93.33 (92.35,94.35)	91.89 (90.38,93.58)	95.92 (95.33,96.82)	94.96 (94.26,95.58)	93.94 (93.37,94.48)

## Outcomes by WLAUC Quartile

Recall that WLAUC is interpreted as the number of days a candidate is expected to live in a year on the waiting list without transplant. Thus, the first quartile of WLAUC includes candidates at high risk of death, and the fourth quartile includes candidates at low risk of death.

As with LAS, transplant rates by quartile of WLAUC followed a dose-response relationship, with the highest transplant rates at the lowest WLAUC levels across all scenarios (Table 11, Figure 39). In the 2:1 LAS scenarios, transplant rates increased compared with current rules for the lowest WLAUC group, those expected to live the fewest days while waiting, and increased for the other three WLAUC quartiles.

For the 1:1 LAS scenarios, transplant rates in the highest-urgency quartile increased and were the same or decreased at PE weights of 10%, 15%, and 20%, respectively. Transplant rates declined among the second-most urgent quartile of candidates, were similar for the third quartile, and increased for least urgent quartile.

Changes in rates changed the distribution of recipients by WLAUC quartile (Table 11, Figure 40). The proportion of highest-risk recipients (WLAUC <294 days) increased from 41% under current rules to 48%-53% under continuous allocation, and the proportion of recipients in the second-most urgent quartile decreased from 27% to 17%-19% of recipients.

As with the high-LAS group, the low-WLAUC group had the largest number of waitlist deaths under current rules (328 deaths, 75% of the total) and the largest declines in waitlist deaths under continuous allocation (Table 11, Figure 41). Declines in waitlist deaths in this group were largest in the 2:1 LAS scenarios, where waitlist urgency had twice the weight of posttransplant outcomes; there were 103-127 deaths in these scenarios and 135-159 deaths in the 1:1 LAS scenarios. In the three less-urgent quartiles of WLAUC, the numbers of waitlist deaths under continuous allocation were similar to or slightly higher than under current rules.

The percent of 2-year posttransplant deaths was similar across scenarios for each WLAUC quartile (Table 11, Figure 42).

The patterns of median distance from donor to recipient by WLAUC quartile were similar to the pattern by LAS, with the most severely ill patients seeing the biggest increases in median distance and larger distance increases with low PE weight (Table 11, Figure 43). For the three less-urgent quartiles of WLAUC, distances increased modestly or were similar at 10% PE and declined at 15% and 20% PE compared with current rules. The percent of organs expected to fly increased for the most urgent WLAUC group, from 81% under current rules to 82%-89% under continuous allocation, and decreased considerably for the three less-urgent WLAUC groups.

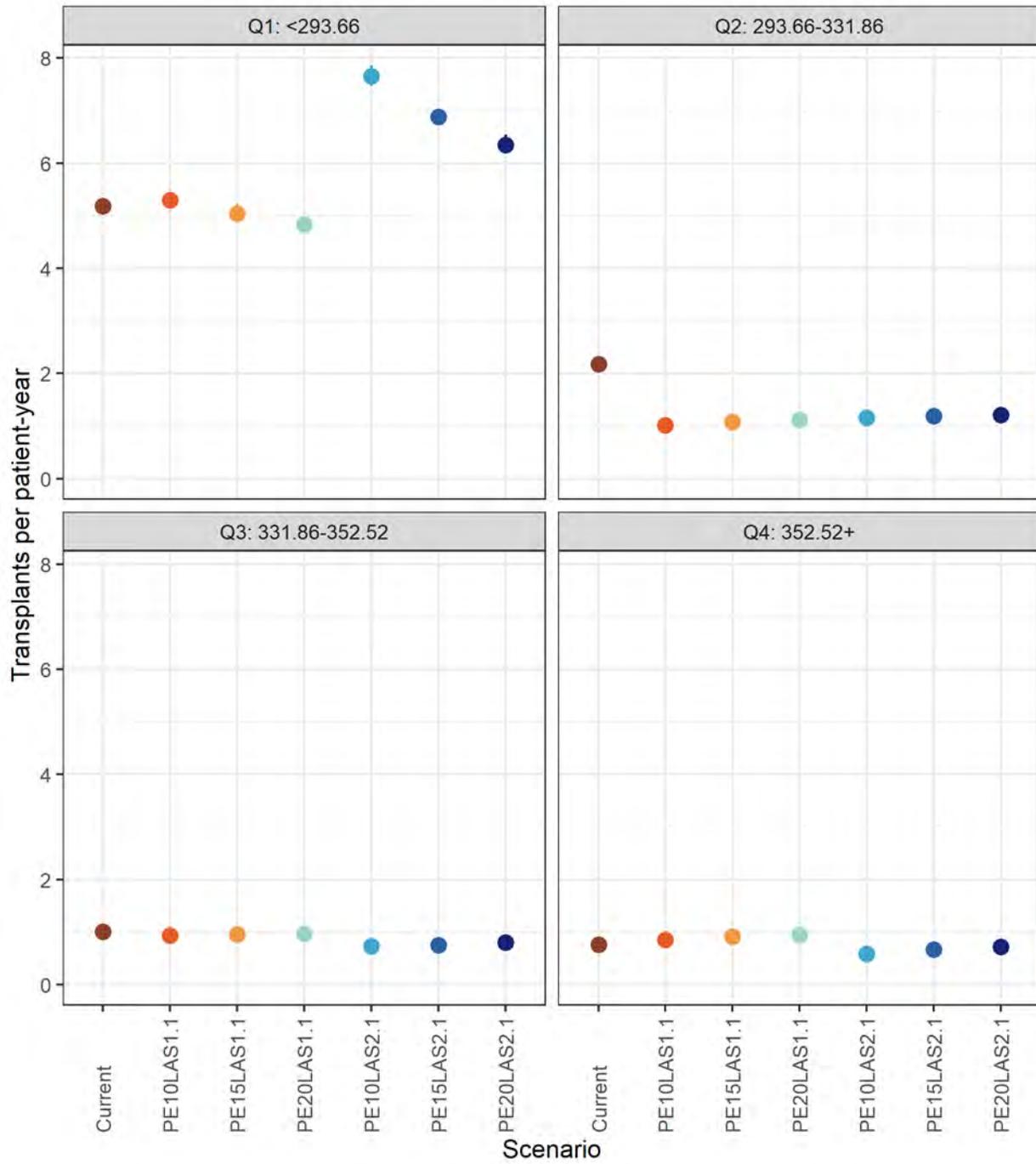


Figure 39: Transplant Rates - By WLAUC Quartile

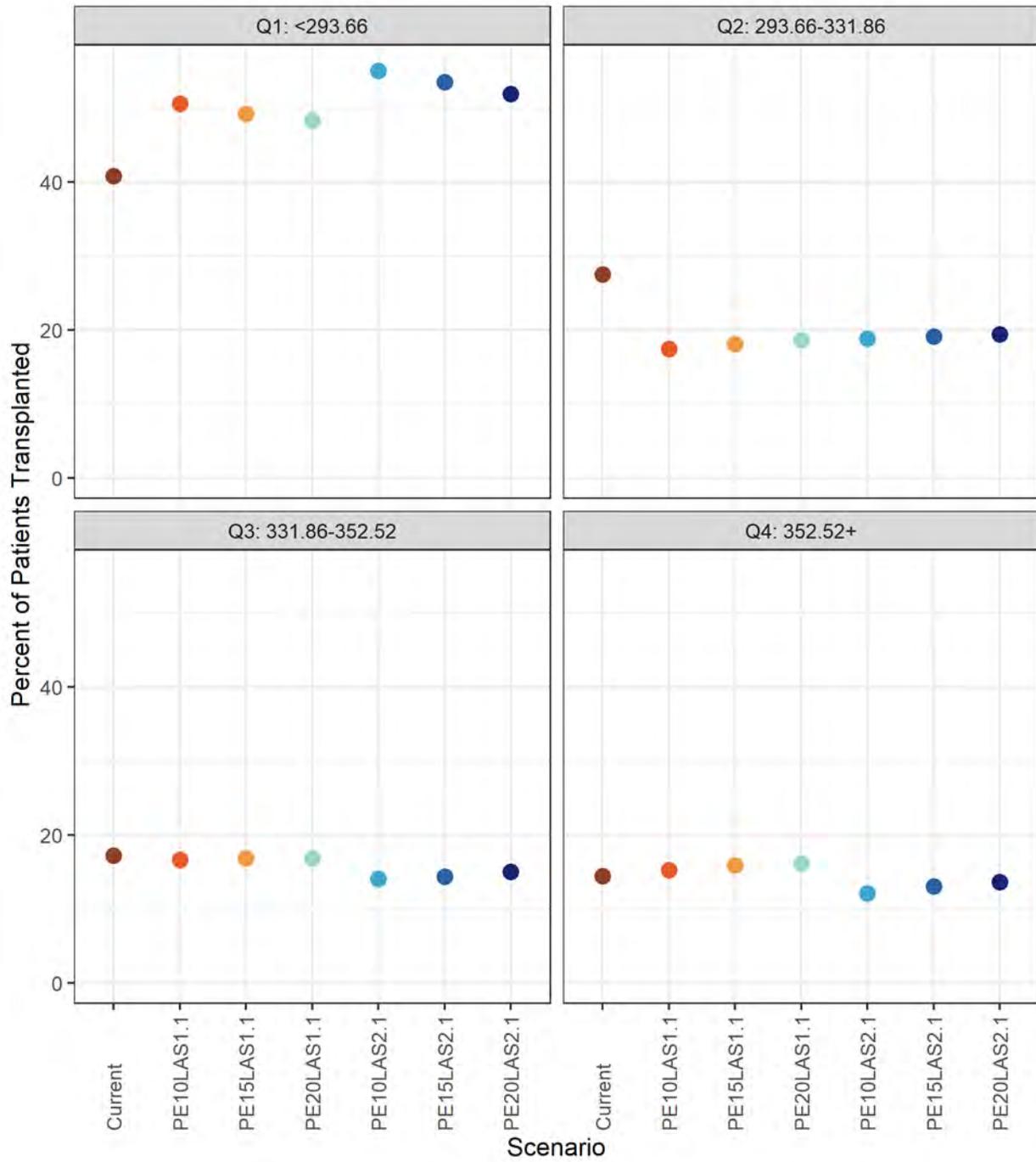


Figure 40: Transplant Distribution - Percent By WLAUC at Transplant

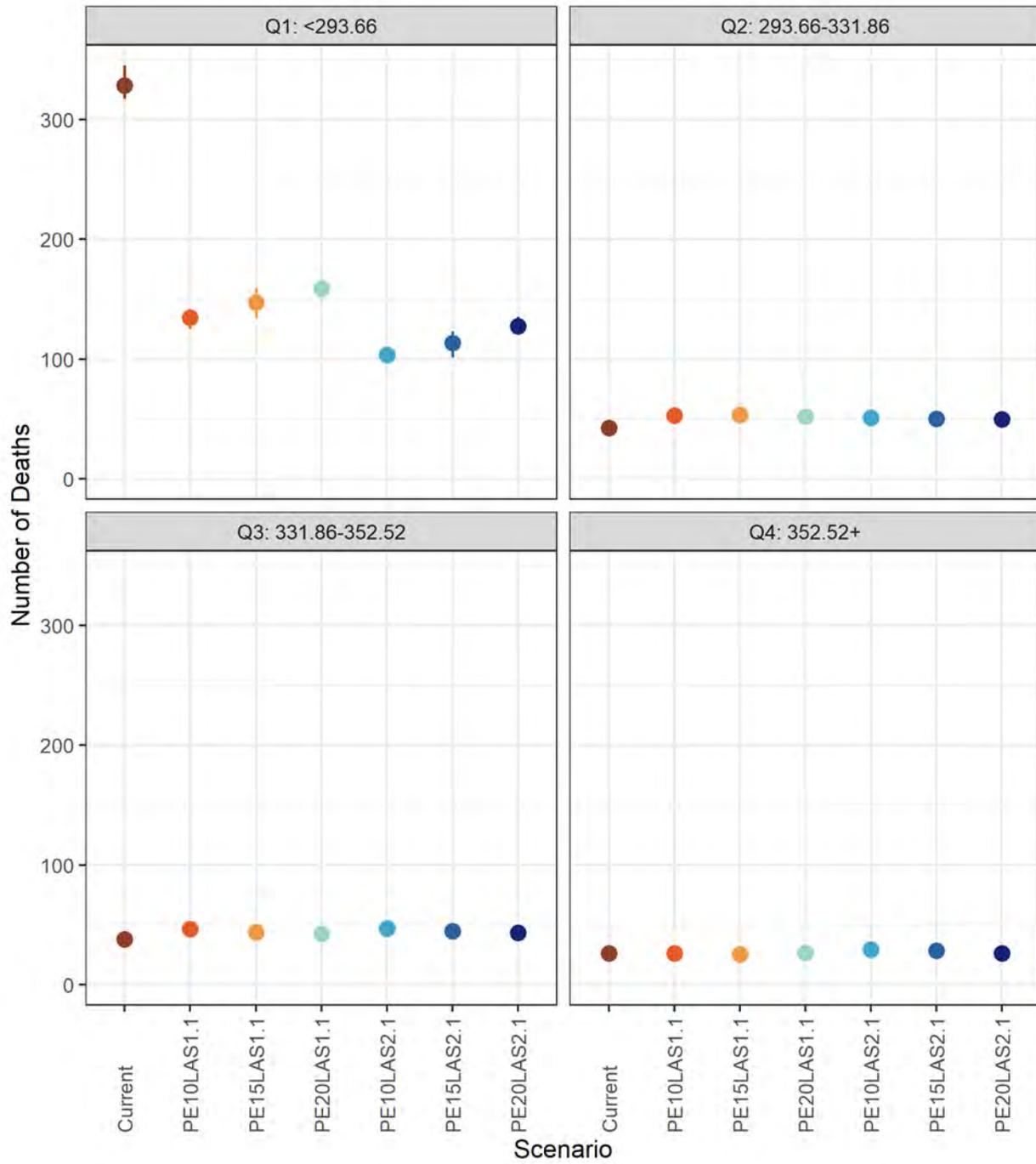


Figure 41: Waitlist Death Counts - By WLAUC Quartile

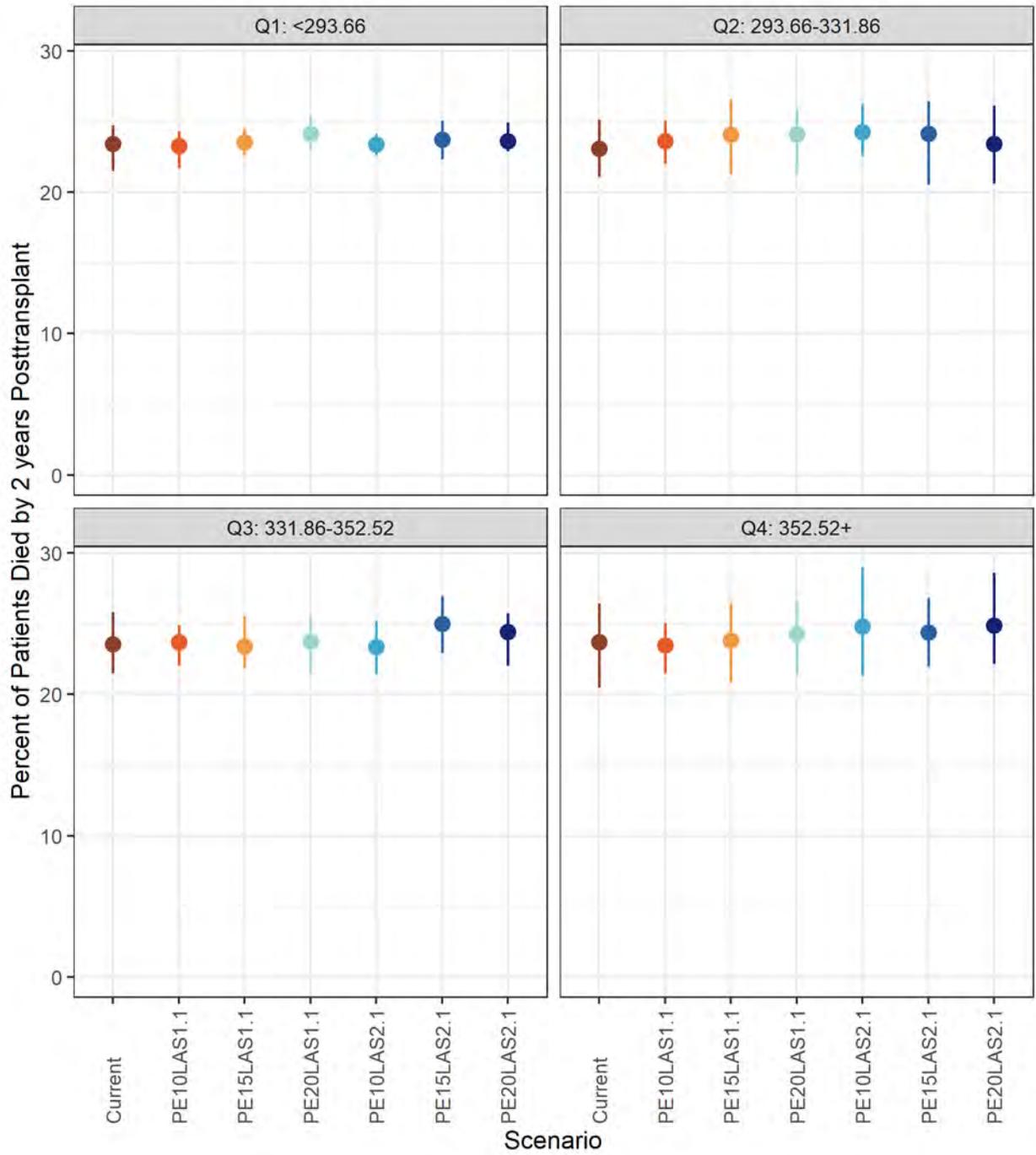


Figure 42: Percent Died by 2 Years Posttransplant - By WLAUC Quartile

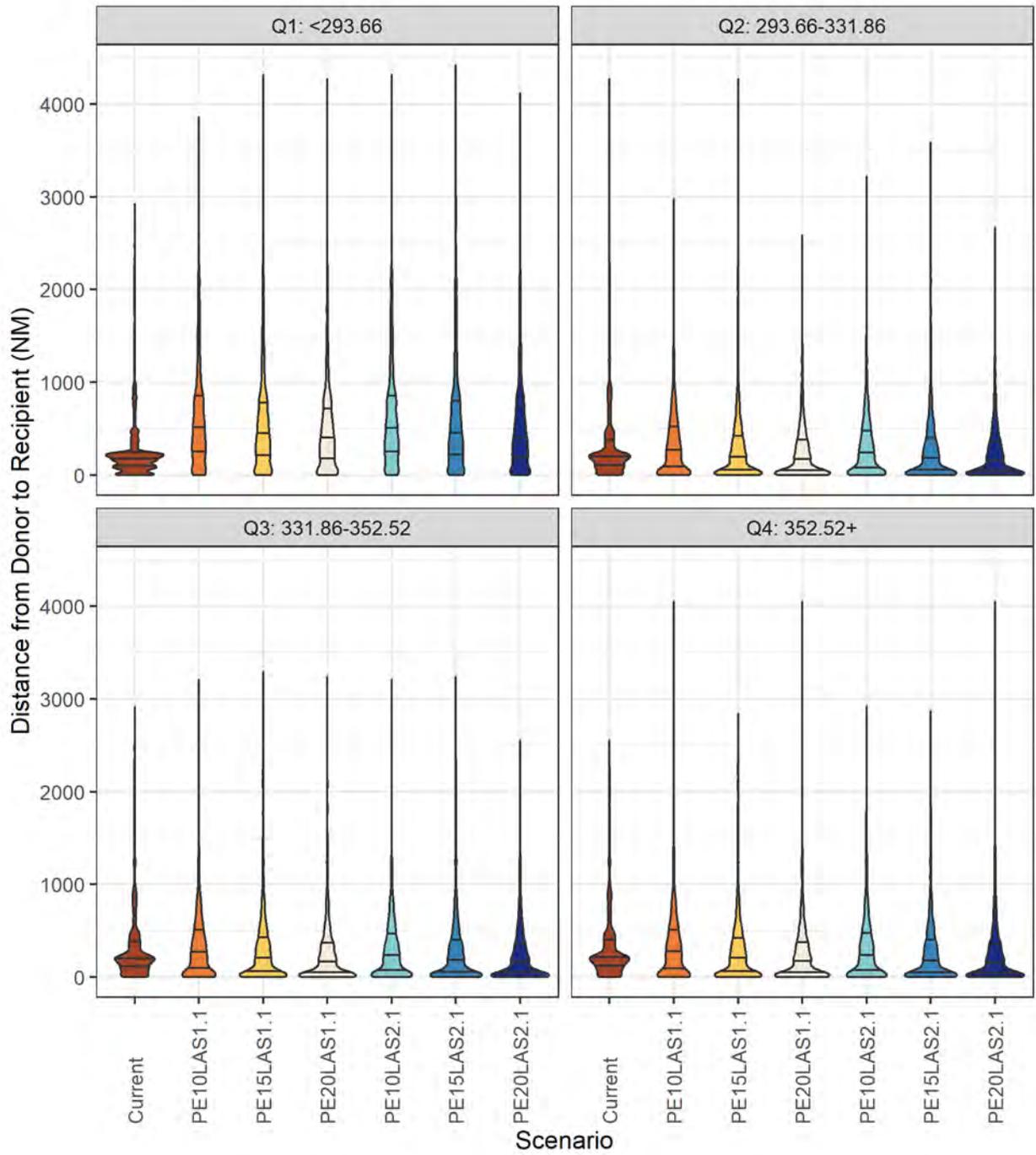


Figure 43: Distribution of Distance from Donor - By WLAUC at Transplant



Table 11: Outcome Counts and Rates by Scenario by WLAUC Quartile

Outcome	WLAUC Quartile	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
Transplant Count (N)								
	Q1: <293.66	2062 (2033,2093)	2564 (2532,2578)	2499 (2483,2513)	2458 (2418,2474)	2798 (2756,2826)	2726 (2699,2767)	2648 (2629,2666)
	Q2: 293.66-331.86	1390 (1357,1433)	883 (848,906)	919 (901,951)	948 (903,984)	956 (926,991)	973 (945,1012)	990 (966,1024)
	Q3: 331.86-352.52	871 (842,899)	844 (821,860)	856 (819,877)	858 (830,886)	716 (700,733)	732 (714,745)	766 (744,777)
	Q4: 352.52+	733 (716,756)	774 (735,797)	807 (792,823)	820 (800,849)	615 (595,639)	666 (640,682)	698 (692,709)
Transplant Rate per Patient-Year								
	Q1: <293.66	5.19 (5.03,5.34)	5.3 (5.23,5.43)	5.04 (4.93,5.23)	4.84 (4.74,4.96)	7.65 (7.47,7.86)	6.88 (6.77,7.04)	6.34 (6.2,6.55)
	Q2: 293.66-331.86	2.18 (2.09,2.3)	1.02 (0.97,1.06)	1.08 (1.05,1.11)	1.12 (1.05,1.18)	1.16 (1.12,1.21)	1.19 (1.13,1.26)	1.21 (1.16,1.25)
	Q3: 331.86-352.52	1.01 (0.96,1.06)	0.93 (0.89,0.96)	0.96 (0.92,0.99)	0.97 (0.93,1.02)	0.74 (0.72,0.75)	0.76 (0.74,0.77)	0.81 (0.78,0.83)
	Q4: 352.52+	0.76 (0.73,0.81)	0.85 (0.79,0.9)	0.92 (0.88,0.95)	0.95 (0.92,0.98)	0.59 (0.57,0.62)	0.67 (0.64,0.7)	0.73 (0.71,0.74)
Transplant Distribution (Percent)								
	Q1: <293.66	40.79 (40.14,41.44)	50.63 (50.02,50.93)	49.18 (48.95,49.49)	48.35 (47.61,48.77)	55.03 (54.15,55.75)	53.48 (53,54.32)	51.9 (51.53,52.34)
	Q2: 293.66-331.86	27.48 (26.85,28.29)	17.44 (16.75,17.9)	18.08 (17.74,18.69)	18.64 (17.74,19.37)	18.8 (18.23,19.45)	19.1 (18.55,19.84)	19.4 (18.95,20.05)
	Q3: 331.86-352.52	17.23 (16.66,17.74)	16.66 (16.2,16.99)	16.85 (16.1,17.31)	16.88 (16.31,17.41)	14.09 (13.77,14.42)	14.36 (14.02,14.62)	15.02 (14.61,15.24)
	Q4: 352.52+	14.49 (14.21,14.93)	15.28 (14.52,15.73)	15.89 (15.57,16.2)	16.12 (15.73,16.68)	12.09 (11.71,12.55)	13.06 (12.56,13.4)	13.69 (13.55,13.9)
Waitlist Mortality Count (N)								
	Q1: <293.66	328 (317,345)	135 (125,142)	147 (134,160)	159 (150,165)	103 (97,109)	113 (101,123)	127 (122,135)
	Q2: 293.66-331.86	42 (38,45)	53 (51,55)	53 (50,56)	52 (49,54)	51 (46,54)	50 (48,54)	50 (45,52)
	Q3: 331.86-352.52	38 (34,43)	46 (42,49)	44 (39,49)	42 (37,48)	47 (45,52)	45 (42,48)	43 (39,48)

Table 11: Outcome Counts and Rates by Scenario by WLAUC Quartile

Outcome	WLAUC Quartile	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
	Q4: 352.52+	26 (23,28)	26 (23,28)	25 (22,28)	27 (21,30)	30 (27,32)	28 (25,30)	26 (24,30)
Percent Died by 2 Years Posttransplant								
	Q1: <293.66	23.4 (21.49,24.71)	23.28 (21.68,24.29)	23.52 (22.58,24.51)	24.15 (23.04,25.47)	23.4 (22.6,24.11)	23.74 (22.31,25.06)	23.6 (22.9,24.95)
	Q2: 293.66-331.86	23.09 (21.06,25.14)	23.62 (21.96,25.06)	24.08 (21.25,26.57)	24.11 (21.27,25.94)	24.24 (22.56,26.22)	24.12 (20.55,26.4)	23.44 (20.59,26.13)
	Q3: 331.86-352.52	23.53 (21.49,25.83)	23.68 (22.01,24.88)	23.37 (21.84,25.52)	23.72 (21.41,25.57)	23.34 (21.4,25.18)	25 (22.91,26.94)	24.4 (22.01,25.69)
	Q4: 352.52+	23.71 (20.47,26.43)	23.47 (21.46,25.03)	23.82 (20.82,26.41)	24.25 (21.31,26.62)	24.8 (21.28,28.99)	24.39 (21.94,26.8)	24.88 (22.13,28.59)
Median Donor-to-Recipient Distance								
	Q1: <293.66	181 (176,185)	500 (486,519)	427 (414,440)	380 (354,396)	493 (481,514)	436 (425,448)	388 (375,405)
	Q2: 293.66-331.86	200 (198,204)	228 (213,247)	161 (143,185)	124 (104,149)	203 (181,227)	150 (130,167)	121 (105,135)
	Q3: 331.86-352.52	202 (196,205)	235 (215,259)	170 (142,194)	128 (105,149)	196 (178,219)	142 (115,169)	115 (98,134)
	Q4: 352.52+	208 (202,215)	237 (203,253)	169 (157,183)	135 (117,158)	190 (167,225)	128 (98,149)	116 (96,146)
Percent Expected to Fly (>75 NM)								
	Q1: <293.66	80.73 (79.65,82.51)	88.37 (87.3,89.53)	85.2 (84.67,85.98)	82.26 (81.41,82.98)	88.81 (87.99,89.42)	86.18 (84.95,87.22)	83.5 (82.89,84.6)
	Q2: 293.66-331.86	81.31 (79.96,82.18)	68.43 (66.86,70.18)	60.53 (57.94,62.58)	57.14 (55.46,60.96)	66.62 (65.13,70.03)	59.83 (57.8,61.66)	57.05 (55.49,58.98)
	Q3: 331.86-352.52	81.23 (79.38,83.22)	70.34 (67.73,73.49)	62.23 (59.06,65.58)	57.56 (54.66,60.38)	64.95 (62.87,68.03)	59.11 (55.98,62.82)	56.82 (54.96,59.72)
	Q4: 352.52+	83.07 (81.22,85.3)	69.58 (67.74,71.84)	61.63 (58.51,63.43)	57.55 (55.52,60.7)	63.11 (59.33,66.94)	57.62 (55.59,59.7)	56.19 (53.8,58.93)

## Outcomes by PTAUC Quartile

The first continuous distribution TSAM run (request LU2020\_05) used 1-year PTAUC to define each continuous distribution scenario. This request used an updated 5-year PTAUC model, which resulted in more differences between current rules and continuous allocation rules than were observed in the prior report. Recall that PTAUC is interpreted as the number of days a candidate is expected to live in the first 5 years posttransplant. The first quartile of PTAUC includes recipients at high risk for poor posttransplant outcomes, and the fourth quartile includes recipients with better predicted outcomes. Note that the range of PTAUC in the prior report had a maximum of 365 days, while the 5-year PTAUC range has a maximum of 1825 days.

Under current rules, organs were allocated by LAS that used 1-year PTAUC based on a cohort of recipients who underwent transplant from 2015-2018, and WLAUC was given twice the weight of PTAUC. Transplant rates by 5-year PTAUC quartile were highest, 3.09 transplants per patient-year, for candidates with the worst predicted 5-year posttransplant outcomes when allocated according to current rules; candidates with the best predicted posttransplant survival had the lowest transplant rates (Table 12, Figure 44). Under continuous allocation, transplant rates for those with the best predicted posttransplant outcomes increased over 2-fold for the 1:1 LAS scenarios and 1.5-fold for the 2:1 LAS scenarios. Transplant rates among those with the lowest two quartiles of predicted posttransplant survival declined, with larger declines in the 1:1 LAS scenarios than the 2:1 LAS scenarios. Consequently, the proportion of recipients in the lowest two quartiles of posttransplant survival declined, and proportions among those with the best predicted survival increased (Table 12, Figure 45).

Waitlist death declined in all quartiles of PTAUC under continuous allocation compared with current rules (Table 12, Figure 46). Most waitlist deaths occurred in patients with the lowest quartile of predicted posttransplant survival.

The percent of 2-year posttransplant deaths was similar across scenarios for each PTAUC quartile (Table 12, Figure 47).

Among recipients in the lowest two PTAUC quartiles (worse predicted outcomes), median distance from donor to recipient increased considerably for all continuous distribution scenarios; increases were larger for 1:1 LAS scenarios compared with 2:1 LAS, and for scenarios with 10% PE weight. Among recipients in the highest two PTAUC quartiles, median distances were lower under 20% PE weight scenarios compared with current rules.

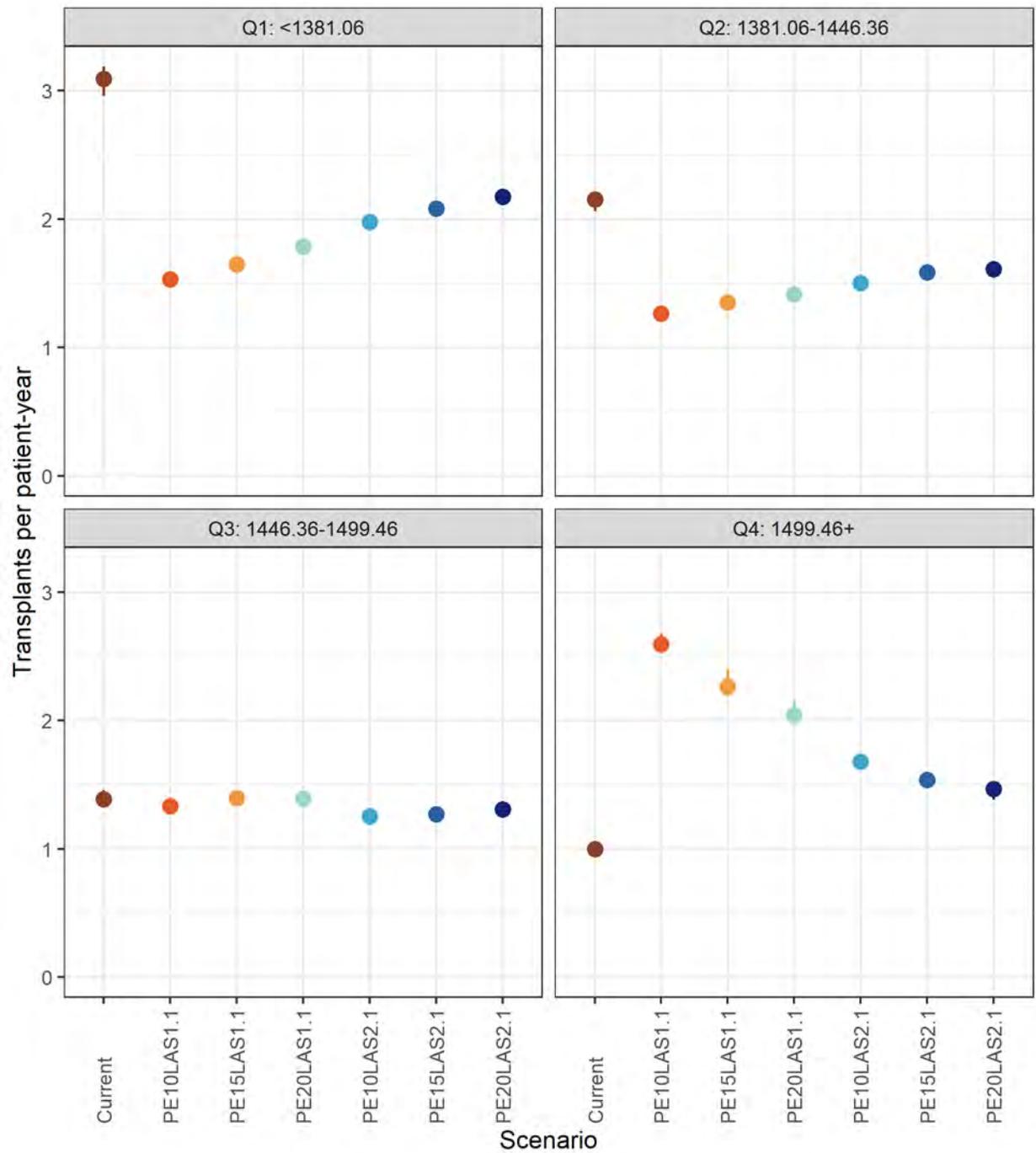


Figure 44: Transplant Rates - By PTAUC Quartile

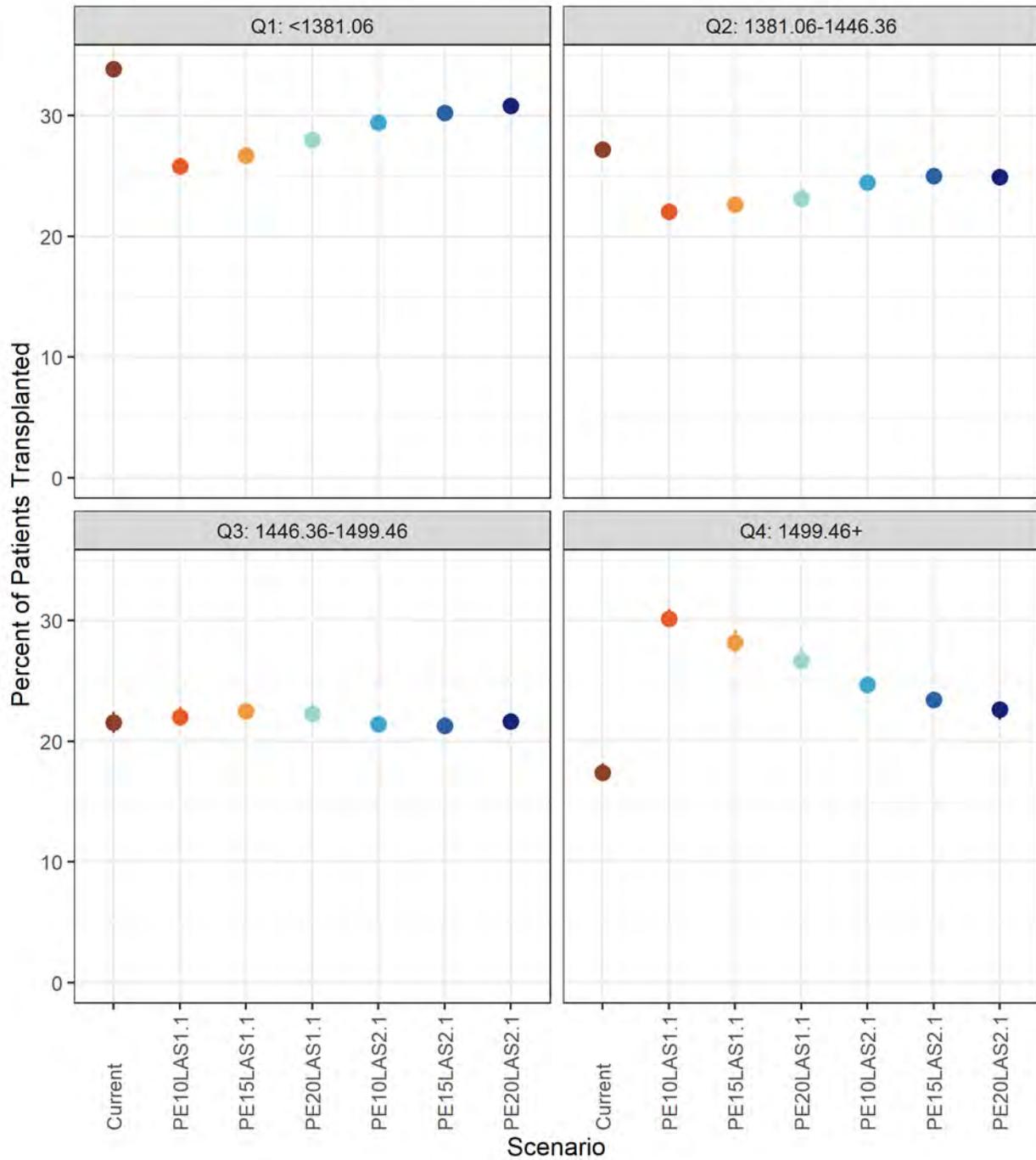


Figure 45: Transplant Distribution - Percent By PTAUC at Transplant

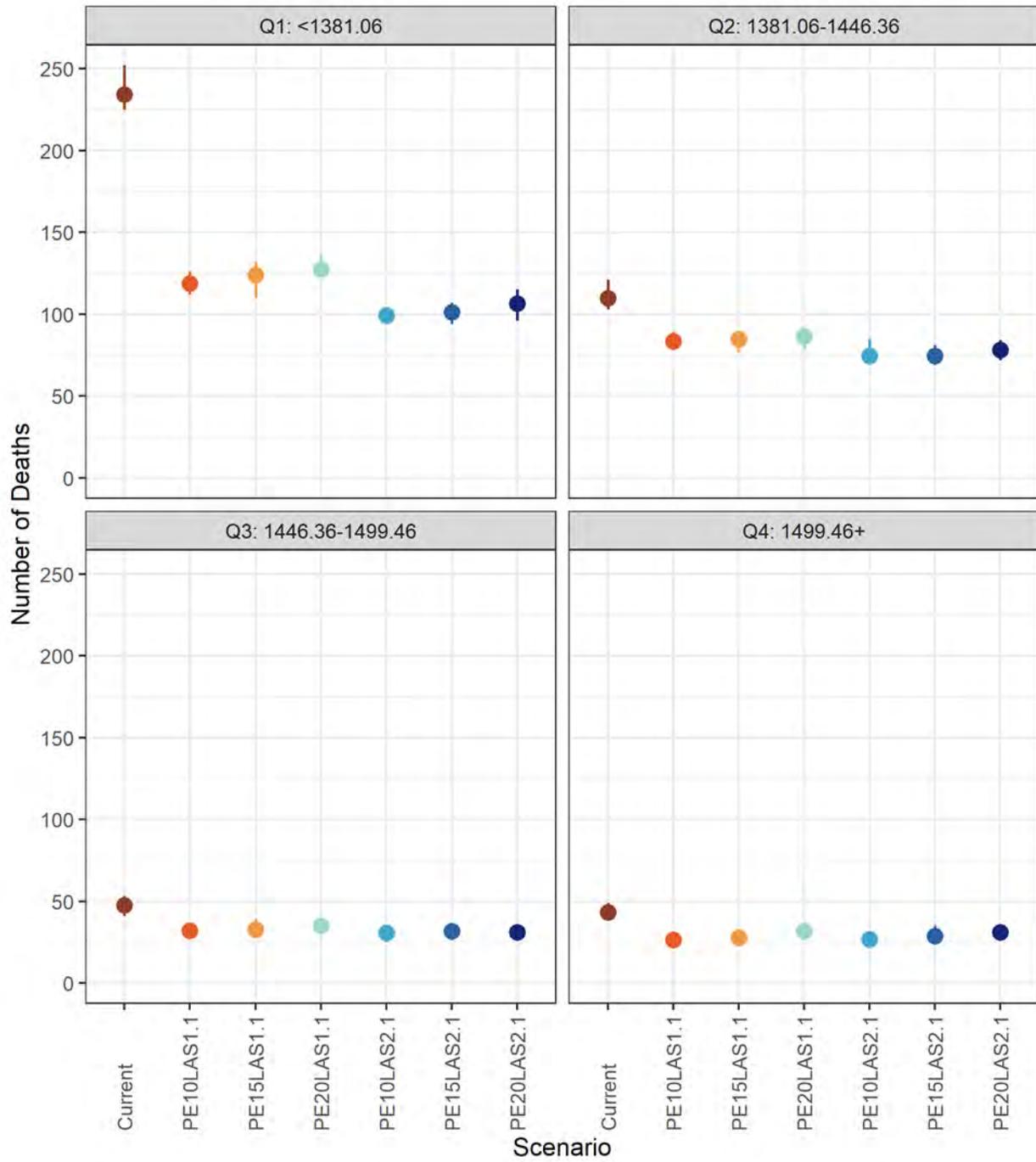


Figure 46: Waitlist Death Counts - By PTAUC Quartile

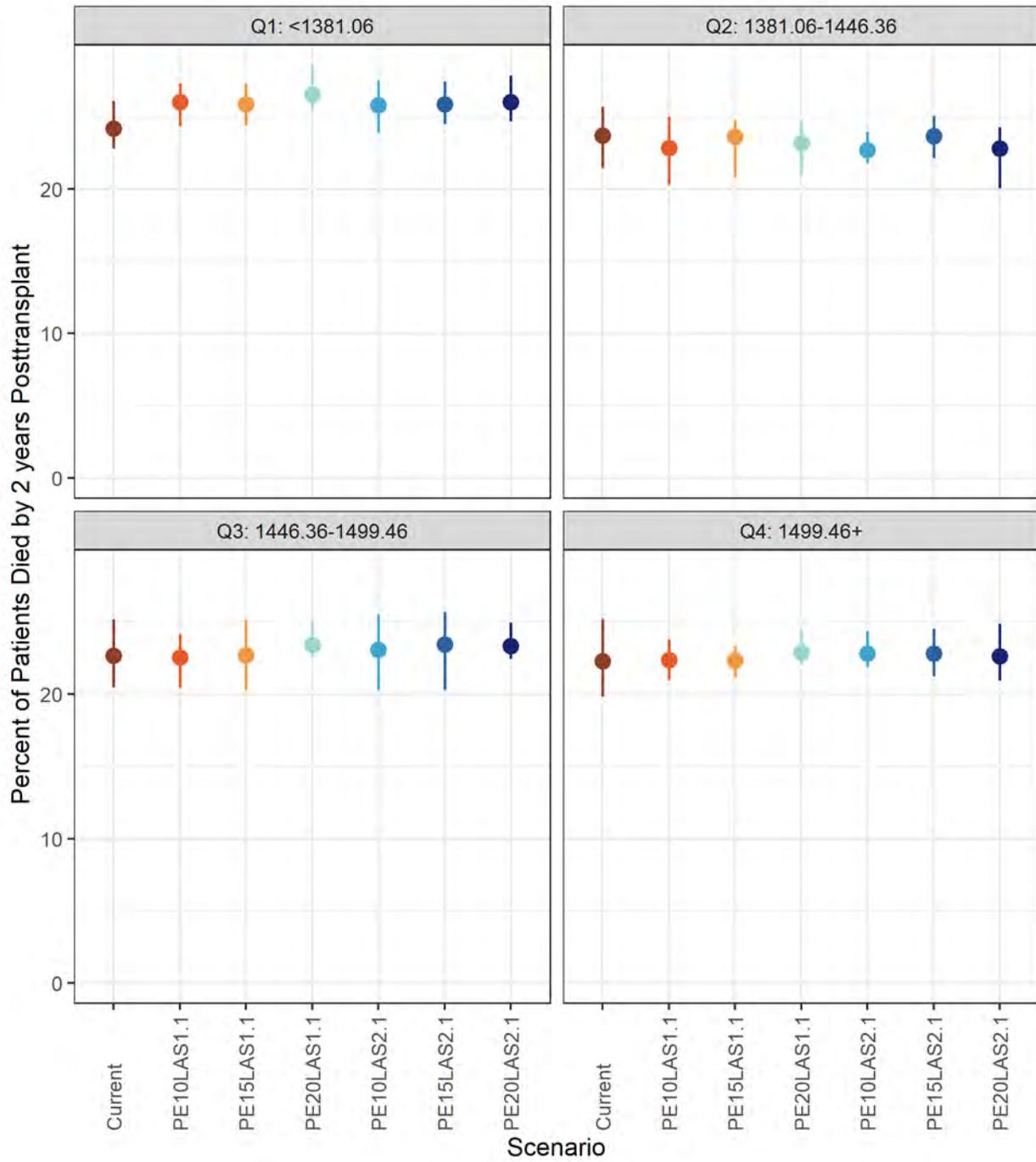


Figure 47: Percent Died by 2 Years Posttransplant - By PTAUC Quartile

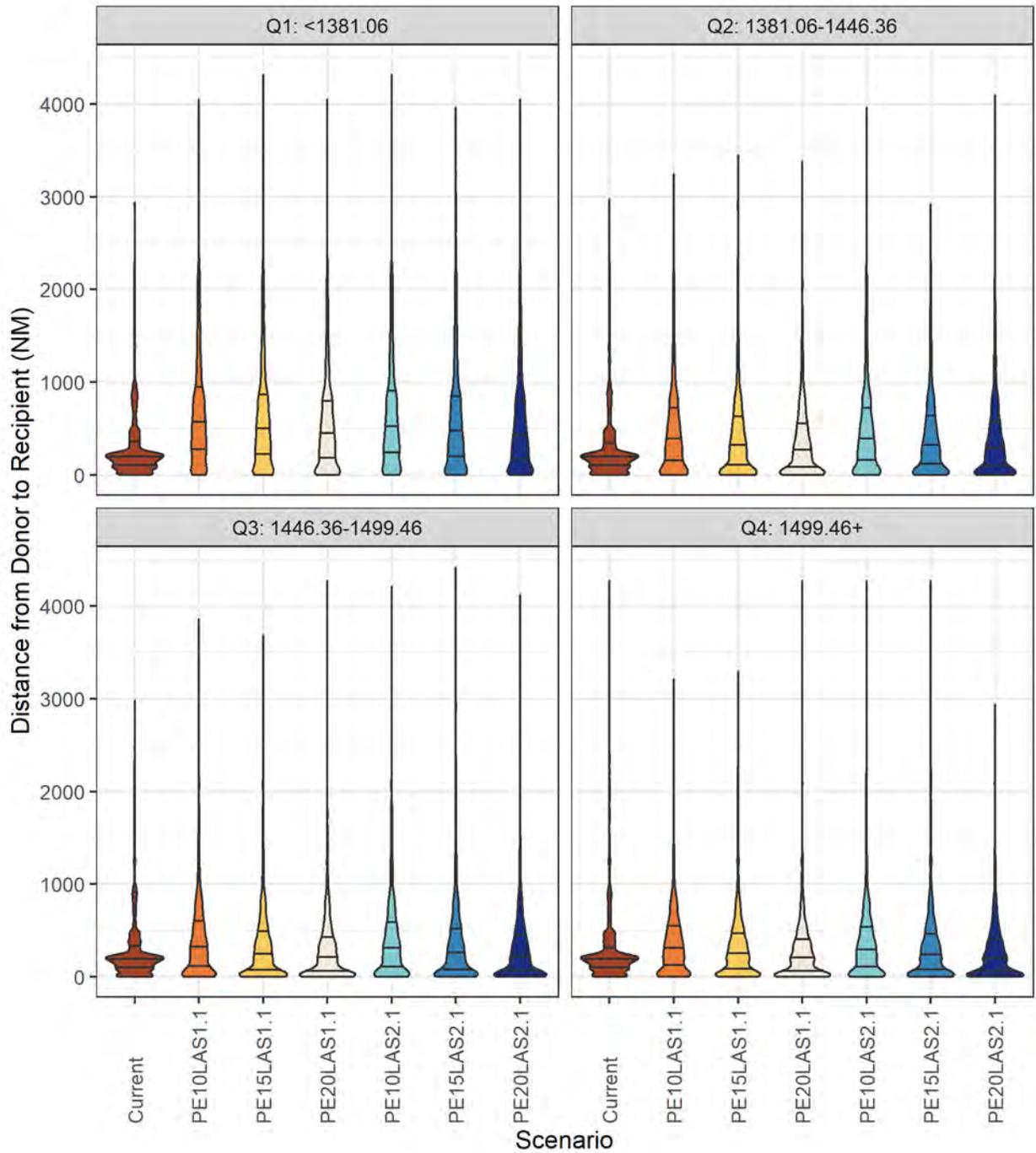


Figure 48: Distribution of Distance from Donor - By PTAUC at Transplant



Table 12: Outcome Counts and Rates by Scenario by PTAUC Quartile

Outcome	PTAUC Quartile	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
Transplant Count (N)								
	Q1: <1381.06	1712 (1686,1727)	1306 (1285,1334)	1356 (1319,1378)	1422 (1403,1442)	1497 (1482,1511)	1541 (1514,1557)	1572 (1563,1590)
	Q2: 1381.06-1446.36	1375 (1341,1399)	1116 (1086,1131)	1150 (1134,1179)	1176 (1145,1219)	1243 (1221,1261)	1274 (1246,1298)	1270 (1242,1297)
	Q3: 1446.36-1499.46	1090 (1050,1133)	1114 (1085,1153)	1143 (1126,1171)	1132 (1096,1173)	1089 (1072,1105)	1086 (1070,1124)	1105 (1075,1133)
	Q4: 1499.46+	879 (857,920)	1527 (1507,1567)	1432 (1387,1479)	1355 (1327,1409)	1256 (1241,1270)	1195 (1173,1221)	1154 (1113,1184)
Transplant Rate per Patient-Year								
	Q1: <1381.06	3.09 (2.96,3.19)	1.53 (1.51,1.57)	1.65 (1.58,1.7)	1.78 (1.76,1.83)	1.98 (1.95,2)	2.08 (2.02,2.13)	2.18 (2.14,2.21)
	Q2: 1381.06-1446.36	2.15 (2.06,2.22)	1.27 (1.22,1.29)	1.35 (1.33,1.38)	1.41 (1.38,1.48)	1.5 (1.46,1.54)	1.58 (1.53,1.63)	1.61 (1.56,1.66)
	Q3: 1446.36-1499.46	1.39 (1.34,1.46)	1.33 (1.28,1.38)	1.4 (1.35,1.44)	1.39 (1.34,1.46)	1.25 (1.23,1.27)	1.27 (1.24,1.33)	1.31 (1.27,1.36)
	Q4: 1499.46+	1 (0.97,1.05)	2.59 (2.54,2.68)	2.26 (2.19,2.4)	2.04 (2.2,16)	1.68 (1.66,1.7)	1.54 (1.49,1.59)	1.46 (1.38,1.52)
Transplant Distribution (Percent)								
	Q1: <1381.06	33.86 (33.37,34.15)	25.79 (25.39,26.32)	26.69 (26.04,27.06)	27.98 (27.6,28.36)	29.44 (29.16,29.73)	30.23 (29.73,30.57)	30.82 (30.61,31.15)
	Q2: 1381.06-1446.36	27.2 (26.46,27.7)	22.04 (21.42,22.34)	22.63 (22.28,23.26)	23.12 (22.52,23.95)	24.44 (24.09,24.74)	25.01 (24.42,25.46)	24.89 (24.33,25.37)
	Q3: 1446.36-1499.46	21.55 (20.73,22.42)	22 (21.43,22.8)	22.5 (22.11,23.01)	22.26 (21.54,23.07)	21.42 (21.09,21.73)	21.3 (21.01,22.03)	21.66 (21.07,22.19)
	Q4: 1499.46+	17.39 (16.96,18.16)	30.16 (29.81,30.96)	28.18 (27.37,29.19)	26.64 (26.1,27.69)	24.7 (24.35,25)	23.46 (23.01,23.96)	22.63 (21.77,23.23)
Waitlist Mortality Count (N)								
	Q1: <1381.06	234 (225,252)	119 (112,126)	124 (110,132)	127 (122,136)	99 (94,102)	101 (94,107)	107 (96,115)
	Q2: 1381.06-1446.36	110 (103,121)	83 (80,89)	85 (77,89)	86 (78,92)	74 (71,85)	75 (69,81)	78 (72,84)
	Q3: 1446.36-1499.46	48 (41,53)	32 (27,37)	33 (28,39)	35 (30,39)	31 (25,34)	32 (26,36)	31 (28,36)
	Q4: 1499.46+	43 (41,49)	26 (23,31)	28 (25,31)	32 (27,37)	27 (22,30)	29 (26,35)	31 (27,34)
Percent Died by 2 Years Posttransplant								
	Q1: <1381.06	24.18 (22.8,26.09)	25.99 (24.32,27.29)	25.86 (24.4,27.29)	26.53 (25.53,28.54)	25.79 (23.89,27.52)	25.86 (24.48,27.42)	26.02 (24.68,27.83)
	Q2: 1381.06-1446.36	23.68 (21.47,25.68)	22.82 (20.3,25)	23.62 (20.78,24.76)	23.17 (20.92,24.73)	22.68 (21.77,23.97)	23.65 (22.14,25.04)	22.78 (20.03,24.27)



Table 12: Outcome Counts and Rates by Scenario by PTAUC Quartile

Outcome	PTAUC Quartile	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
	Q3: 1446.36-1499.46	22.66 (20.45,25.15)	22.54 (20.42,24.16)	22.68 (20.25,25.11)	23.39 (22.54,24.98)	23.08 (20.26,25.48)	23.44 (20.28,25.7)	23.34 (22.42,24.93)
	Q4: 1499.46+	22.28 (19.8,25.2)	22.34 (20.99,23.76)	22.33 (21.11,23.33)	22.88 (22.08,24.39)	22.81 (21.88,24.32)	22.79 (21.23,24.52)	22.62 (20.93,24.87)
Median Donor-to-Recipient Distance								
	Q1: <1381.06	194 (188,200)	546 (520,565)	467 (443,499)	406 (381,433)	495 (466,547)	432 (411,445)	384 (366,404)
	Q2: 1381.06-1446.36	195 (187,200)	344 (313,371)	282 (263,298)	225 (219,236)	352 (328,373)	282 (268,308)	246 (229,267)
	Q3: 1446.36-1499.46	195 (186,199)	286 (275,306)	206 (196,212)	178 (164,192)	276 (256,289)	217 (204,245)	186 (172,198)
	Q4: 1499.46+	194 (186,201)	290 (269,311)	224 (209,236)	185 (171,198)	267 (252,282)	212 (194,227)	177 (165,197)
Percent Expected to Fly (>75 NM)								
	Q1: <1381.06	81.84 (80.66,82.83)	87.82 (85.71,89.09)	83.39 (82.62,84.47)	79.41 (78.19,80.58)	86.1 (85.12,87.43)	82.25 (81.05,83.83)	79.85 (78.2,81.08)
	Q2: 1381.06-1446.36	80.61 (79.56,82.55)	77.09 (75.54,78.73)	71.02 (68.82,72.82)	68.18 (67.12,69.53)	78.06 (76.79,79.21)	72.58 (69.88,73.69)	70.35 (68.69,72.06)
	Q3: 1446.36-1499.46	81.34 (79.43,83.05)	73.48 (71.49,75.99)	66.05 (64.73,67.5)	63.17 (60.47,64.86)	72.39 (71.11,73.42)	67.94 (66.55,70.39)	64.54 (63.09,66.73)
	Q4: 1499.46+	81.36 (79.93,82.72)	76.95 (75.84,78.8)	70.74 (69.5,73.33)	65.23 (63.36,66.59)	73.85 (72.12,75.16)	68.4 (66.3,70.68)	64.2 (62.86,65.54)

## Outcomes by Diagnosis Group

Outcomes by diagnosis group varied by scenario.

Among group A candidates, compared with current rules, transplant rates declined for all 2:1 LAS scenarios, as well as for the 1:1 LAS scenarios with 10% and 15% PE (Table 13, Figure 49). For group A patients, scenarios with higher PE weight had higher transplant rates. Among group B candidates, compared with current rules, transplant rates declined similarly for all continuous distribution scenarios, and PE weight had little impact. Among group C candidates, transplant rates increased for all continuous distribution scenarios; the increases were larger for 1:1 LAS than 2:1 LAS and larger for lower PE weight. Among group D candidates, transplant rates declined with continuous distributions compared with current rules; declines were larger for 1:1 LAS than 2:1 LAS scenarios, but PE weight had little impact.

These changes in transplant rates altered the distributions of recipients by diagnosis group, with decreases in the proportion of group A recipients, from 21.2% under current rules to 16.4%-20.5% under continuous allocation (Table 13, Figure 50). Proportions of group B recipients remained similar across simulations, while group C recipients increased from 8.6% under current rules to 10.1%-11.2% under continuous allocation.

The number of waitlist deaths among group A candidates was similar across all scenarios, from 65 to 76 (Table 13, Figure 51). For diagnosis group B, waitlist deaths dropped modestly for all continuous distribution scenarios compared with current rules. For group C candidates, waitlist deaths dropped considerably, from 46 under current rules to 11-12 under continuous allocation. For group D candidates, the largest group, waitlist deaths dropped from 278 under current rules to 40% or lower under the 1:1 LAS scenarios and 49% or lower under the 2:1 LAS scenarios.

The percent of 2-year posttransplant deaths was similar across scenarios for each diagnosis group (Table 13, Figure 52).

Median donor-to-recipient distances were lower for group A under most continuous allocation scenarios than current rules and were higher for groups B, C, and D (Table 13, Figure 53). Under continuous allocation, distances were highest for each diagnosis group when PE weight was lowest, though differences between 1:1 LAS and 2:1 LAS were minimal at a given PE weight.

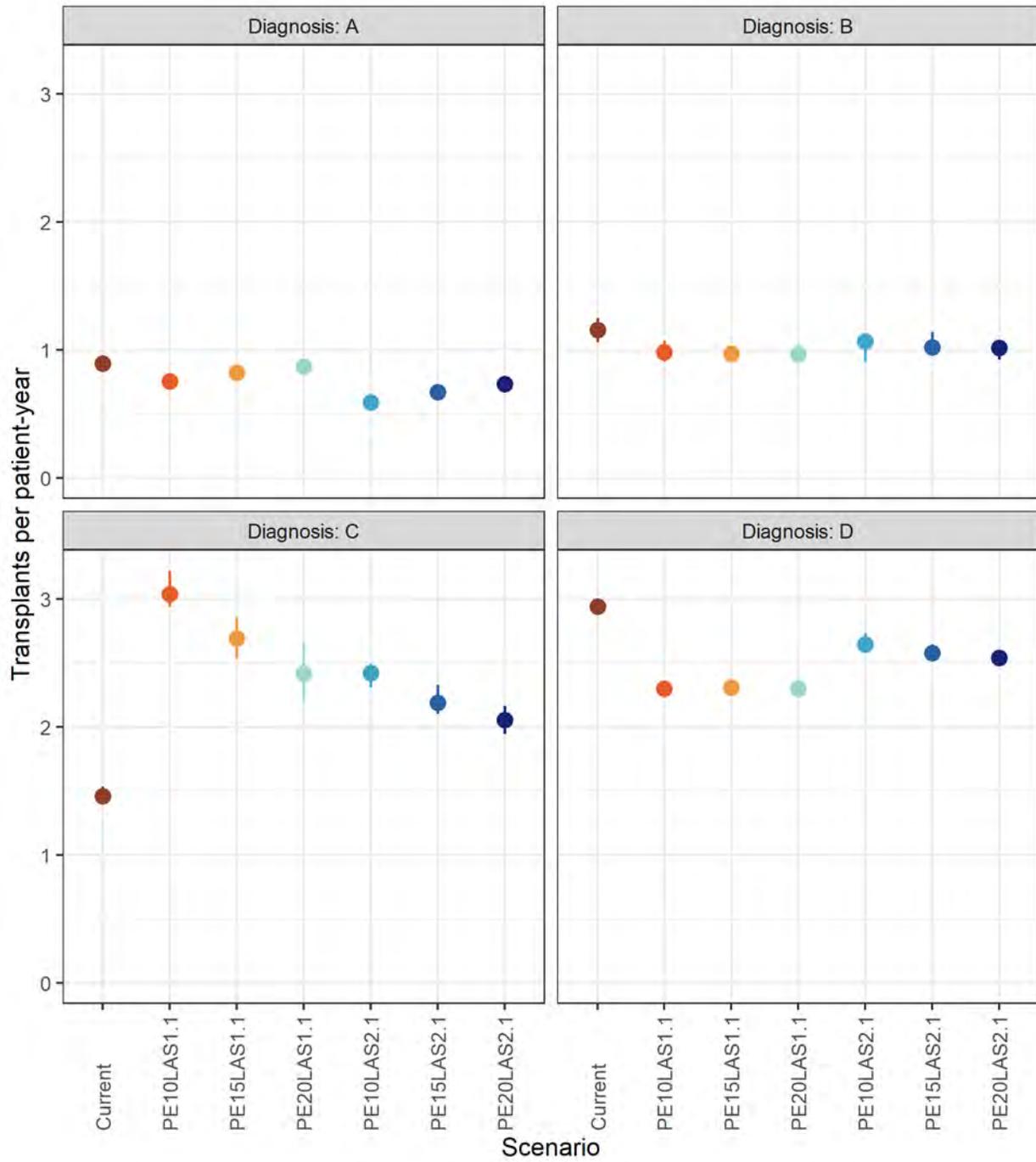


Figure 49: Transplant Rates - By Diagnosis Group

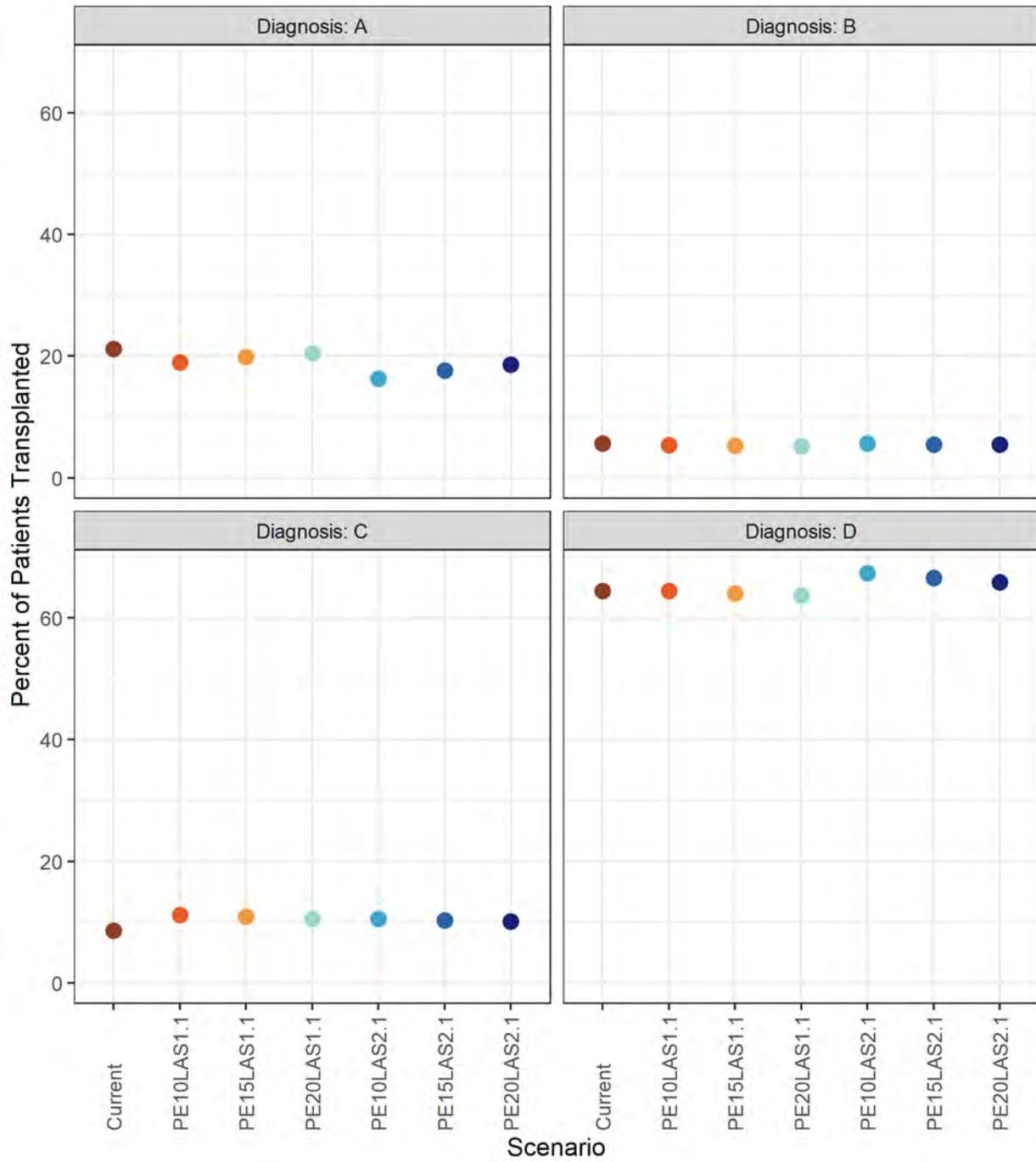


Figure 50: Transplant Distribution - Percent By Diagnosis Group

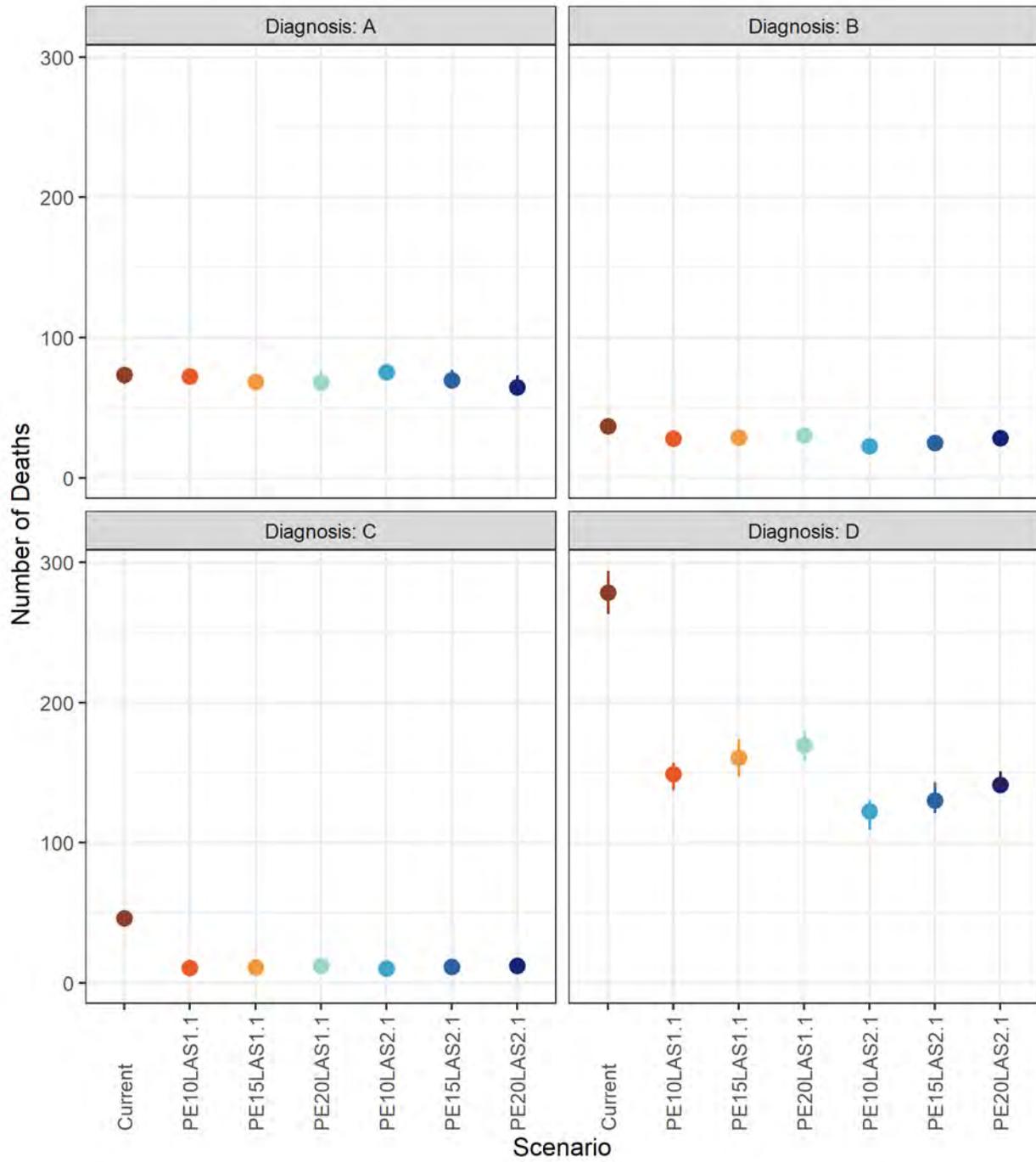


Figure 51: Waitlist Death Counts - By Diagnosis Group

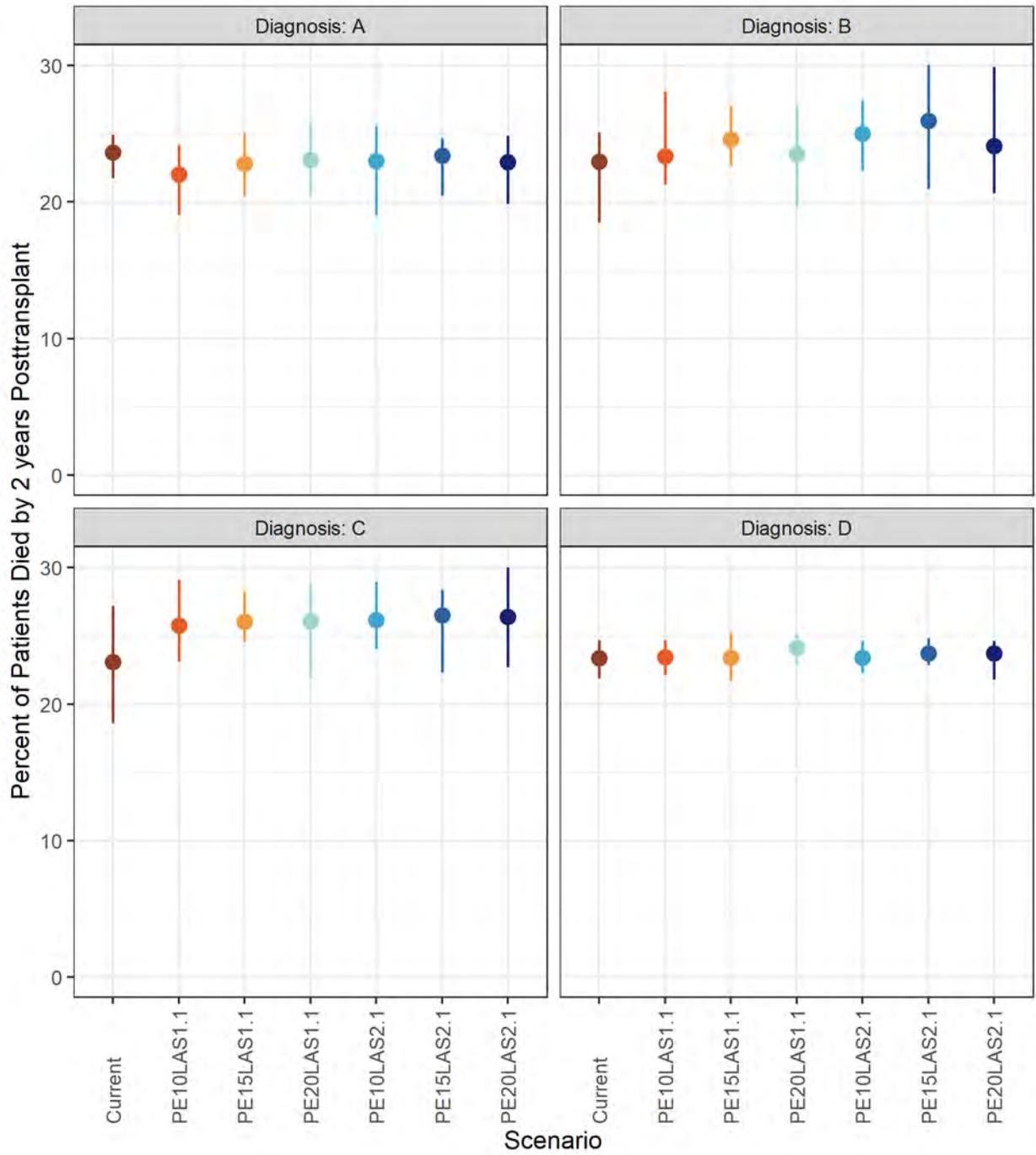


Figure 52: Percent Died by 2 Years Posttransplant - By Diagnosis Group

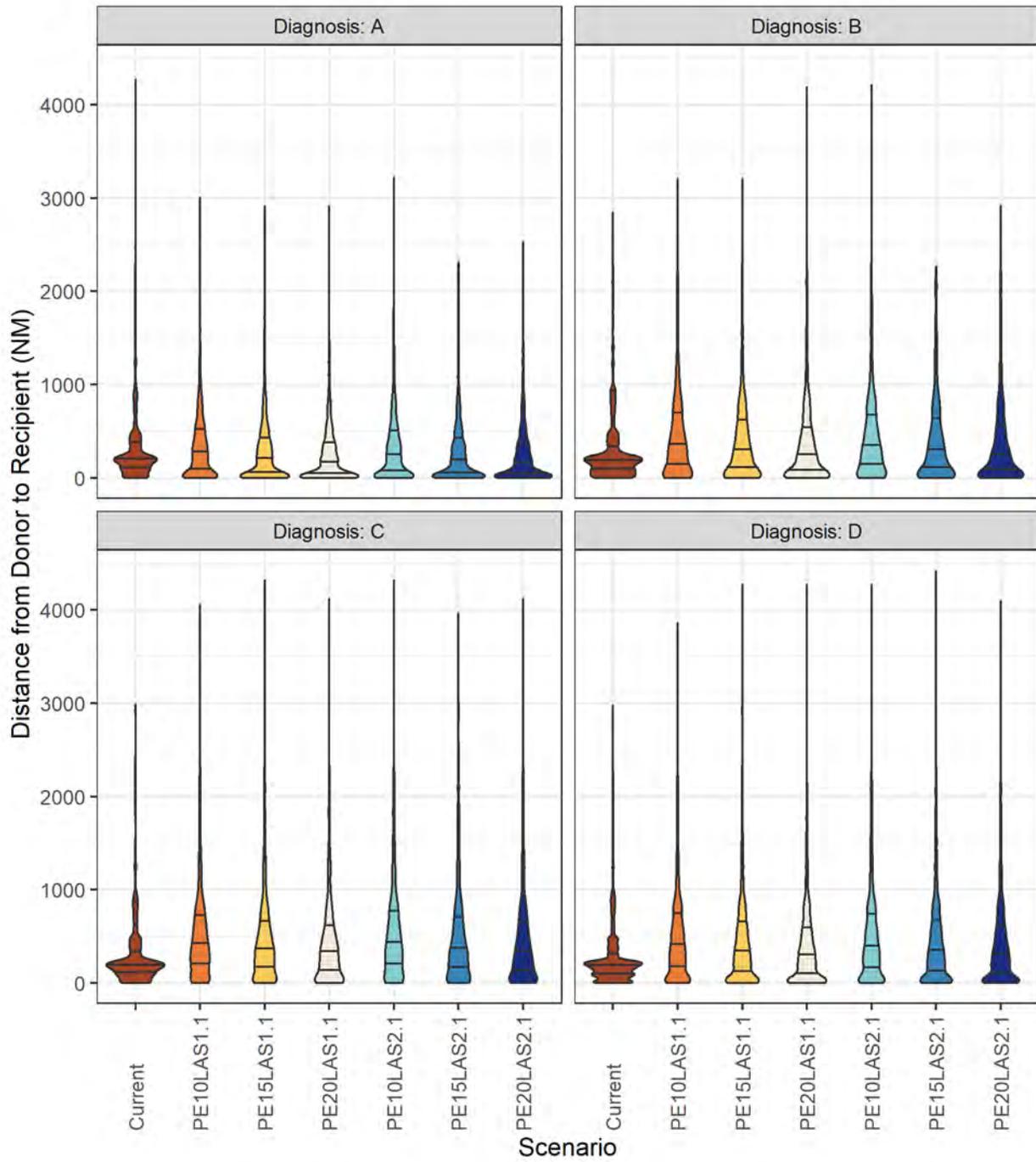


Figure 53: Distribution of Distance from Donor - By Diagnosis Group

**Table 13: Outcome Counts and Rates by Scenario by Diagnosis**

Outcome	Diagnosis	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
Transplant Count (N)								
	Diagnosis: A	1074 (1058,1093)	962 (928,986)	1009 (993,1026)	1041 (1028,1058)	832 (820,862)	899 (876,923)	948 (930,966)
	Diagnosis: B	288 (271,303)	273 (260,283)	269 (262,278)	264 (249,281)	290 (269,302)	280 (271,296)	278 (261,288)
	Diagnosis: C	435 (429,443)	567 (556,577)	553 (548,563)	538 (526,552)	536 (528,545)	524 (517,532)	515 (505,530)
	Diagnosis: D	3260 (3237,3284)	3262 (3247,3281)	3250 (3235,3262)	3241 (3216,3276)	3427 (3414,3453)	3393 (3374,3411)	3360 (3339,3385)
Transplant Rate per Patient-Year								
	Diagnosis: A	0.9 (0.87,0.93)	0.76 (0.71,0.8)	0.82 (0.8,0.86)	0.87 (0.84,0.89)	0.59 (0.57,0.62)	0.67 (0.64,0.7)	0.73 (0.72,0.75)
	Diagnosis: B	1.15 (1.06,1.25)	0.98 (0.91,1.07)	0.97 (0.93,1.02)	0.97 (0.91,1.04)	1.07 (0.91,1.11)	1.02 (0.96,1.14)	1.01 (0.92,1.05)
	Diagnosis: C	1.46 (1.4,1.54)	3.04 (2.94,3.22)	2.69 (2.53,2.86)	2.42 (2.2,2.65)	2.42 (2.31,2.49)	2.19 (2.1,2.33)	2.05 (1.95,2.16)
	Diagnosis: D	2.94 (2.9,2.98)	2.3 (2.26,2.35)	2.31 (2.29,2.33)	2.3 (2.25,2.37)	2.65 (2.6,2.74)	2.58 (2.53,2.64)	2.54 (2.48,2.6)
Transplant Distribution (Percent)								
	Diagnosis: A	21.23 (20.89,21.63)	19 (18.33,19.48)	19.85 (19.59,20.17)	20.47 (20.24,20.79)	16.36 (16.13,16.91)	17.64 (17.2,18.11)	18.58 (18.26,18.93)
	Diagnosis: B	5.69 (5.38,6)	5.38 (5.14,5.59)	5.3 (5.16,5.49)	5.2 (4.89,5.53)	5.71 (5.28,5.94)	5.5 (5.32,5.81)	5.46 (5.13,5.64)
	Diagnosis: C	8.61 (8.49,8.77)	11.2 (10.99,11.41)	10.88 (10.77,11.05)	10.58 (10.34,10.85)	10.55 (10.36,10.72)	10.28 (10.13,10.43)	10.1 (9.88,10.4)
	Diagnosis: D	64.47 (64.05,64.99)	64.42 (64.08,64.82)	63.97 (63.72,64.36)	63.75 (63.39,64.42)	67.39 (67.07,67.76)	66.58 (66.2,66.88)	65.86 (65.51,66.22)
Waitlist Mortality Count (N)								
	Diagnosis: A	74 (67,79)	72 (67,74)	69 (63,72)	68 (62,76)	76 (72,78)	70 (65,77)	65 (61,73)
	Diagnosis: B	37 (33,41)	28 (26,31)	29 (26,32)	30 (27,34)	23 (20,26)	25 (21,27)	28 (25,31)
	Diagnosis: C	46 (43,52)	11 (9,14)	11 (8,14)	12 (9,18)	11 (8,13)	12 (10,14)	12 (10,15)



Table 13: Outcome Counts and Rates by Scenario by Diagnosis

Outcome	Diagnosis	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
	Diagnosis: D	278 (263,294)	149 (137,157)	161 (147,174)	169 (158,180)	123 (109,130)	130 (121,143)	142 (135,151)
Percent Died by 2 Years Posttransplant								
	Diagnosis: A	23.62 (21.76,24.95)	22.04 (19.04,24.18)	22.79 (20.44,25.03)	23.08 (20.51,25.85)	22.99 (18.98,25.58)	23.39 (20.44,24.66)	22.92 (19.85,24.87)
	Diagnosis: B	22.97 (18.48,25.08)	23.38 (21.28,28.09)	24.59 (22.64,27.04)	23.5 (19.57,27.1)	25 (22.3,27.46)	25.94 (20.98,30.04)	24.11 (20.64,29.89)
	Diagnosis: C	23.1 (18.6,27.19)	25.75 (23.1,29.1)	26.05 (24.55,28.26)	26.09 (21.87,28.76)	26.15 (24.05,28.97)	26.5 (22.31,28.38)	26.4 (22.7,30)
	Diagnosis: D	23.38 (21.89,24.66)	23.45 (22.12,24.67)	23.42 (21.74,25.21)	24.12 (22.92,25.07)	23.4 (22.25,24.63)	23.73 (22.87,24.82)	23.72 (21.8,24.64)
Median Donor-to-Recipient Distance								
	Diagnosis: A	204 (198,209)	240 (202,260)	169 (157,181)	131 (112,147)	207 (191,228)	143 (118,168)	125 (108,140)
	Diagnosis: B	187 (161,204)	305 (279,337)	242 (200,273)	198 (158,230)	306 (270,369)	238 (173,282)	197 (174,229)
	Diagnosis: C	196 (186,204)	400 (363,421)	349 (316,371)	309 (282,353)	409 (379,450)	347 (311,388)	304 (274,357)
	Diagnosis: D	191 (188,194)	384 (367,399)	312 (300,325)	274 (258,285)	371 (361,385)	318 (307,334)	282 (266,302)
Percent Expected to Fly (>75 NM)								
	Diagnosis: A	82.66 (80.77,84.04)	69.3 (66.87,71.01)	61.3 (59.01,62.64)	57.25 (55.86,60.02)	65.13 (61.8,67.64)	58.75 (56.77,60.91)	57.3 (56.04,58.98)
	Diagnosis: B	77.94 (75.42,82.61)	74.76 (71.91,78.28)	68.65 (64.68,72.14)	64.33 (61.21,68.67)	76.13 (71.82,81.41)	69.31 (65.14,71.99)	64.67 (61.87,66.28)
	Diagnosis: C	82.79 (80.51,85.94)	85.43 (83.19,87.76)	81.43 (79.35,83.79)	76.93 (74.39,78.52)	84.05 (81.18,86.09)	80.71 (77.82,82.69)	76.85 (74.28,78.74)
	Diagnosis: D	80.98 (80.17,82.03)	81.13 (79.88,82.81)	75.75 (75.15,76.33)	72.5 (71.42,72.98)	80.6 (80.19,81.2)	76.69 (76.11,77.51)	73.93 (72.96,75.07)

## Outcomes by Distance from Donor

Distribution of simulated transplant by distance category varied considerably by scenario (Table 14), and 2-year posttransplant outcomes were similar across scenarios (Figure 54).

Under current rules, there is a hard boundary at 250 NM, but otherwise organs are generally allocated by LAS. Consequently, most (70%) of the simulated transplants under current rules used donors within 250 NM, and few organs (690, 14%) came from donors more than 500 NM away. All continuous allocation scenarios used an efficiency score that increased priority for nearby transplants, and the weight of that efficiency score varied by scenario.

When PE weight was 20%, 26% of transplants under the 1:1 LAS scenario and 24% of transplants under the 2:1 LAS scenario used donors within 50 NM (within driving distance), compared with 14% under current rules. When PE weight was 10%, 17% of transplants under the 1:1 LAS scenario and 18% of transplants under the 2:1 LAS scenario used donors within 50 NM. Under current rules, 3.7% of transplants used donors 1000 NM or more away, compared with 7.1%-11.6% under continuous allocation.

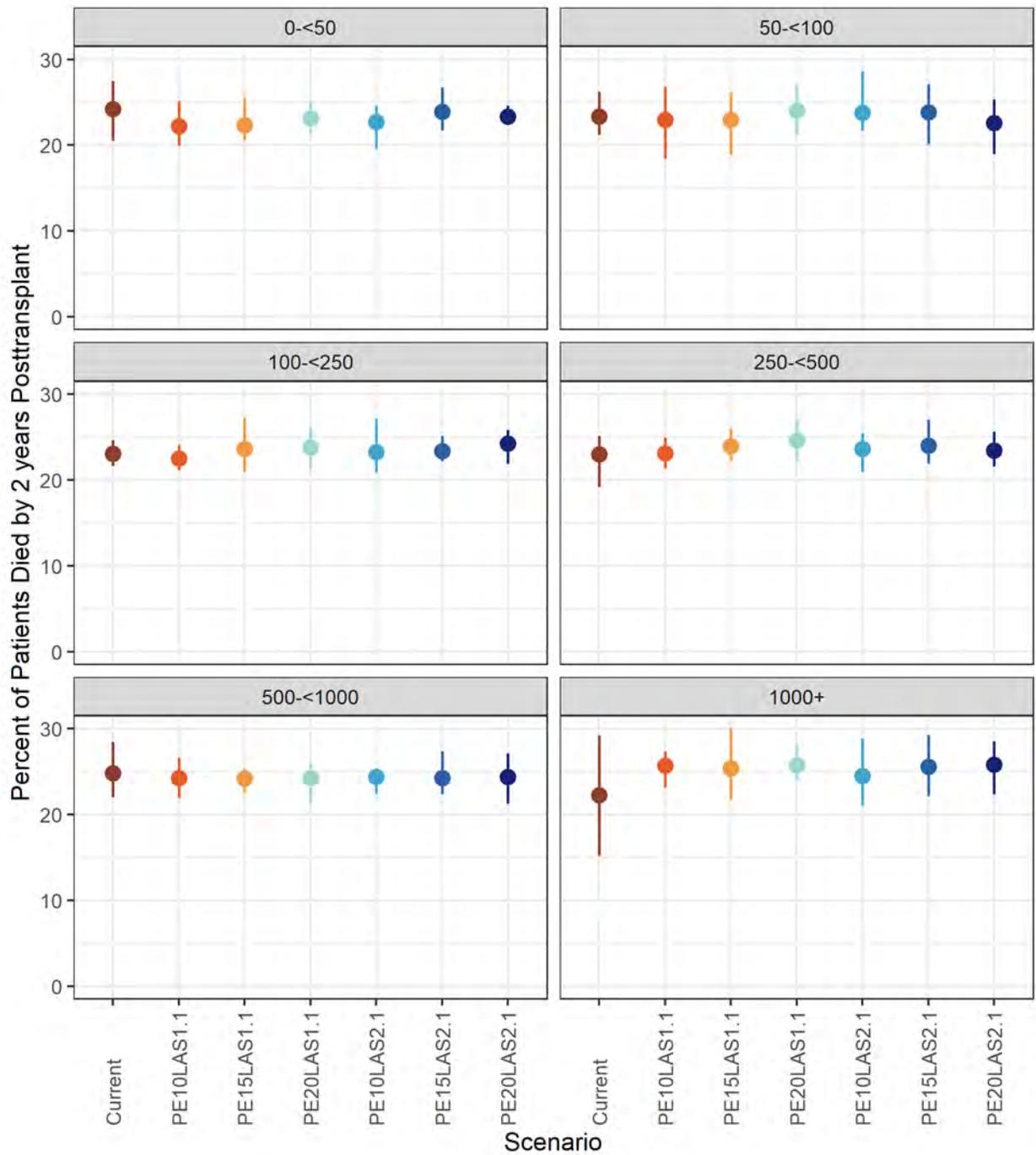


Figure 54: Percent Died by 2 Years Posttransplant - By Distance from Donor



Table 14: Outcome Counts and Rates by Scenario by Distance between Donor and Recipient

Outcome	Distance (NM)	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
Transplant Count (N)								
	0-<50	713 (675,746)	882 (821,930)	1144 (1099,1195)	1305 (1253,1354)	919 (884,958)	1125 (1073,1178)	1245 (1194,1276)
	50-<100	598 (569,612)	345 (310,363)	402 (367,429)	443 (411,466)	355 (336,386)	402 (380,431)	446 (419,462)
	100-<250	2229 (2186,2265)	757 (715,784)	813 (780,848)	854 (806,882)	768 (729,800)	820 (768,850)	884 (835,907)
	250-<500	826 (799,874)	1202 (1167,1258)	1166 (1100,1223)	1140 (1099,1186)	1182 (1158,1222)	1141 (1113,1173)	1123 (1078,1189)
	500-<1000	503 (477,543)	1318 (1254,1369)	1107 (1074,1158)	984 (951,1025)	1270 (1215,1309)	1118 (1069,1162)	992 (953,1014)
	1000+	187 (171,217)	559 (531,585)	449 (433,475)	359 (342,375)	591 (561,632)	491 (475,521)	412 (374,449)
Transplant Distribution (Percent)								
	0-<50	14.1 (13.4,14.77)	17.42 (16.19,18.37)	22.53 (21.63,23.49)	25.67 (24.62,26.61)	18.07 (17.39,18.85)	22.08 (21.05,23.1)	24.4 (23.48,25.05)
	50-<100	11.83 (11.23,12.11)	6.81 (6.13,7.18)	7.9 (7.24,8.45)	8.71 (8.08,9.16)	6.98 (6.61,7.57)	7.88 (7.45,8.46)	8.73 (8.21,9.08)
	100-<250	44.09 (43.25,44.96)	14.96 (14.12,15.46)	16.01 (15.32,16.74)	16.8 (15.86,17.35)	15.11 (14.34,15.73)	16.08 (15.08,16.68)	17.32 (16.33,17.76)
	250-<500	16.34 (15.81,17.26)	23.74 (23.05,24.85)	22.94 (21.71,24.01)	22.42 (21.6,23.3)	23.24 (22.77,24.05)	22.39 (21.86,23)	22.02 (21.16,23.29)
	500-<1000	9.94 (9.42,10.74)	26.03 (24.77,27.02)	21.78 (21.15,22.77)	19.34 (18.73,20.16)	24.98 (23.91,25.75)	21.95 (20.97,22.82)	19.45 (18.67,19.87)
	1000+	3.7 (3.38,4.29)	11.05 (10.5,11.56)	8.84 (8.54,9.33)	7.07 (6.72,7.39)	11.62 (11.03,12.43)	9.63 (9.34,10.22)	8.08 (7.33,8.8)
Percent Died by 2 Years Posttransplant								
	0-<50	24.23 (20.54,27.5)	22.2 (19.89,25.11)	22.37 (20.61,25.51)	23.18 (21.42,25.06)	22.71 (19.54,24.57)	23.88 (21.73,26.69)	23.33 (22.49,24.58)
	50-<100	23.37 (21.24,26.19)	22.97 (18.39,26.77)	22.99 (18.87,26.14)	24 (21.24,26.95)	23.76 (21.73,28.57)	23.84 (20.1,27.09)	22.61 (18.97,25.34)
	100-<250	23.03 (21.64,24.59)	22.51 (21.11,24.07)	23.6 (20.86,27.26)	23.83 (21.46,26.21)	23.23 (20.81,27.13)	23.37 (22.17,25.12)	24.22 (21.84,25.8)



Table 14: Outcome Counts and Rates by Scenario by Distance between Donor and Recipient

Outcome	Distance (NM)	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
	250-<500	22.99 (19.15,25.12)	23.11 (21.34,24.94)	23.94 (22.24,25.91)	24.6 (22.21,27.04)	23.65 (20.96,25.43)	23.99 (21.86,27.02)	23.41 (21.59,25.65)
	500-<1000	24.87 (22.02,28.46)	24.29 (21.95,26.63)	24.19 (22.5,25.32)	24.27 (21.35,25.96)	24.41 (22.49,25.37)	24.29 (22.38,27.41)	24.42 (21.3,27.15)
	1000+	22.3 (15.21,29.24)	25.69 (23.14,27.37)	25.4 (21.71,30.02)	25.79 (23.98,28.07)	24.5 (21.02,28.82)	25.61 (22.18,29.25)	25.83 (22.36,28.51)

## Outcomes by OPTN Region

Under current rules, transplant rates by region varied from 0.77 transplants per patient-year in region 1 to 3.06 in region 11, a nearly 4-fold difference (Table 15, Figure 55). Under continuous allocation, rates by region became less variable, ranging from about 1 or 2 transplants per patient year, a 2-fold difference. Rates tended to decline in regions with the highest rates under current rules and increase in regions with the lowest rates, though the pattern was not uniform across regions. In spite of the changes in transplant rates under continuous allocation, the proportion of patients given transplants in each region changed little (Table 15, Figure 56).

In most regions, numbers of waitlist deaths declined under continuous allocation compared with current rules (Table 15, Figure 57). In no region did waitlist deaths increase with continuous allocation, though in regions with lowest waitlist death counts under current rules (regions 6, 11, 8), declines with continuous allocation were more modest, and sometimes the ranges of the simulations overlapped with the current rules counts.

The percent of 2-year posttransplant deaths was similar across scenarios for each region (Table 15, Figure 58).

Under current rules, there were regional differences in median distance from donor to recipient and percent of organs expected to have been flown (Table 15), which likely result from regional characteristics. These differences remained under continuous allocation rules. For example, regions with higher median distances under current rules tended to have higher median distances under continuous allocation, and regions with a large proportion of organs flown under current rules had a larger proportion flown under continuous allocation. All regions changed in similar ways as well. In scenarios in which PE weight was lowest, distances increased the most. When PE weight was kept constant, distances under 1:1 LAS scenarios and 2:1 LAS scenarios were similar.

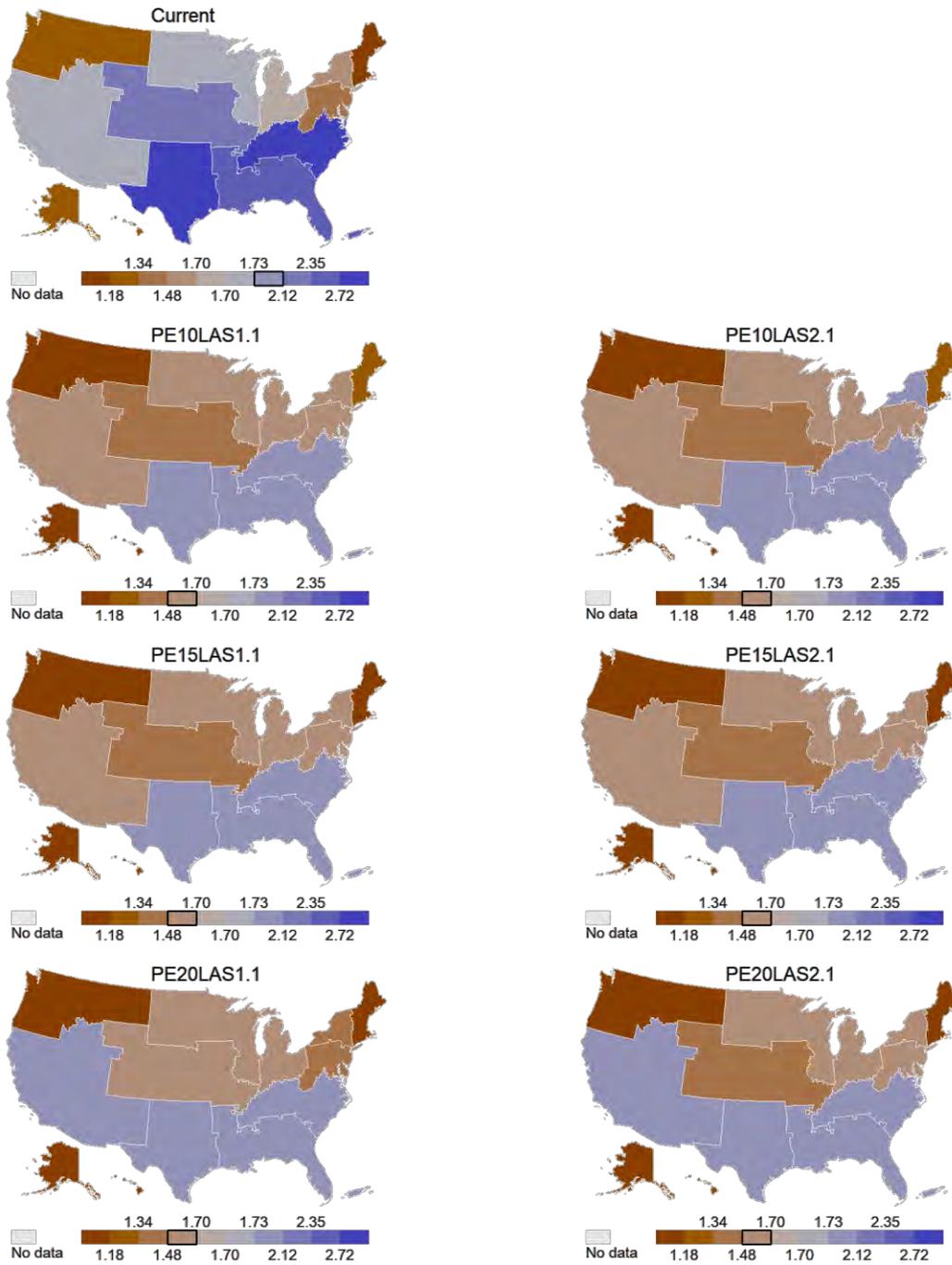


Figure 55: Transplant Rates - By OPTN Region

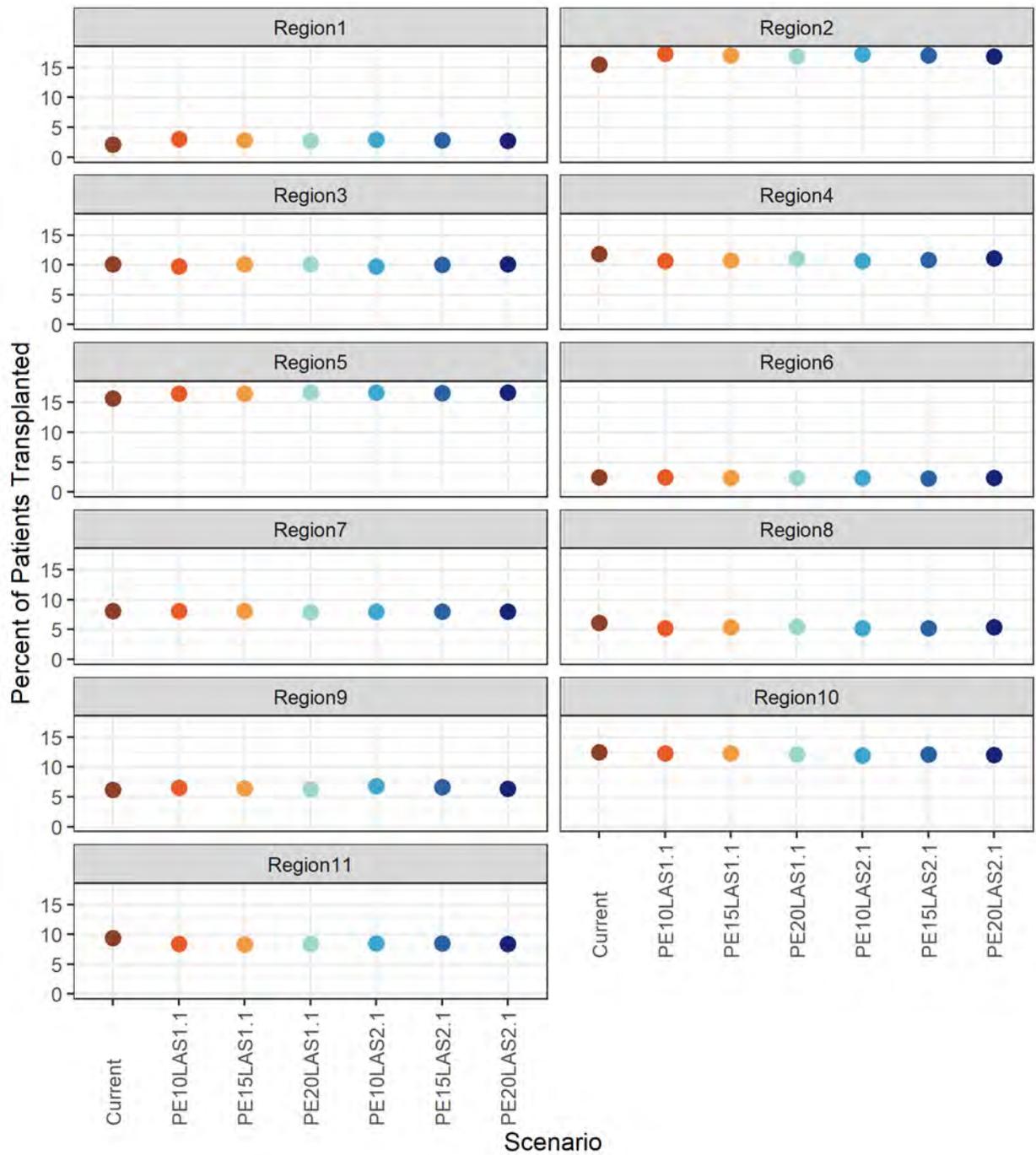


Figure 56: Transplant Distribution - Percent By OPTN Region

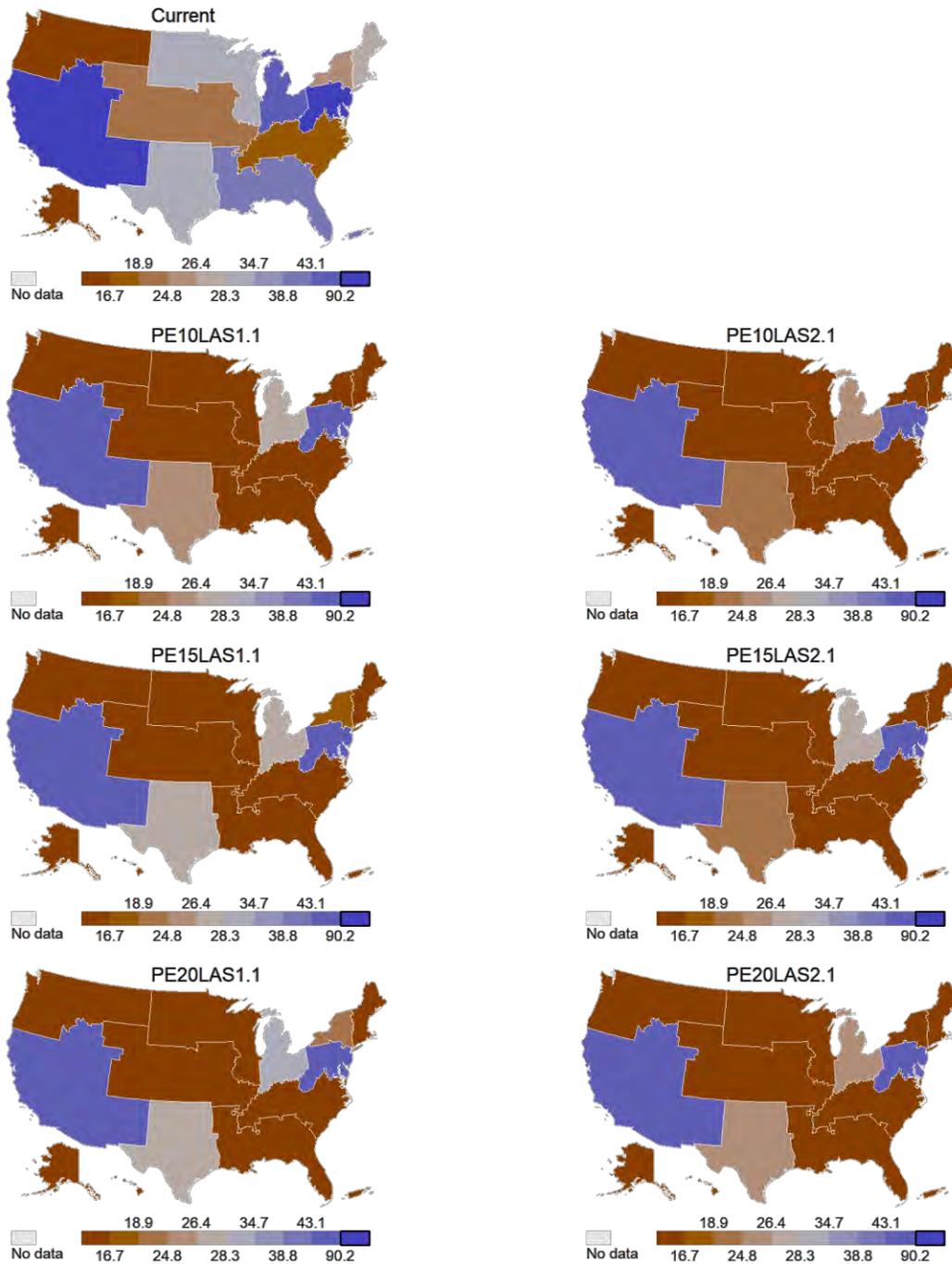


Figure 57: Waitlist Death Counts - By OPTN Region

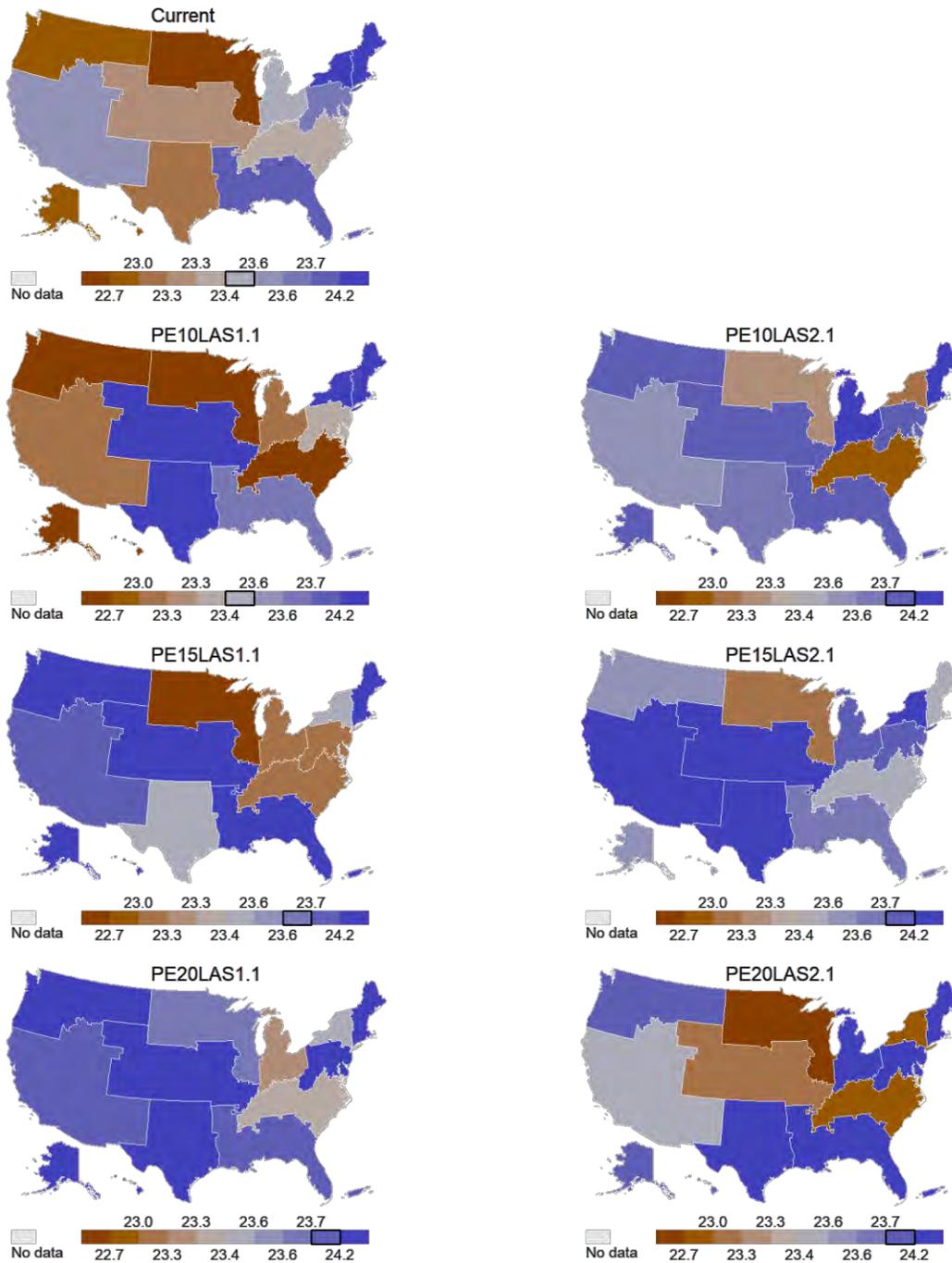


Figure 58: Percent Died by 2 Years Posttransplant - By OPTN Region

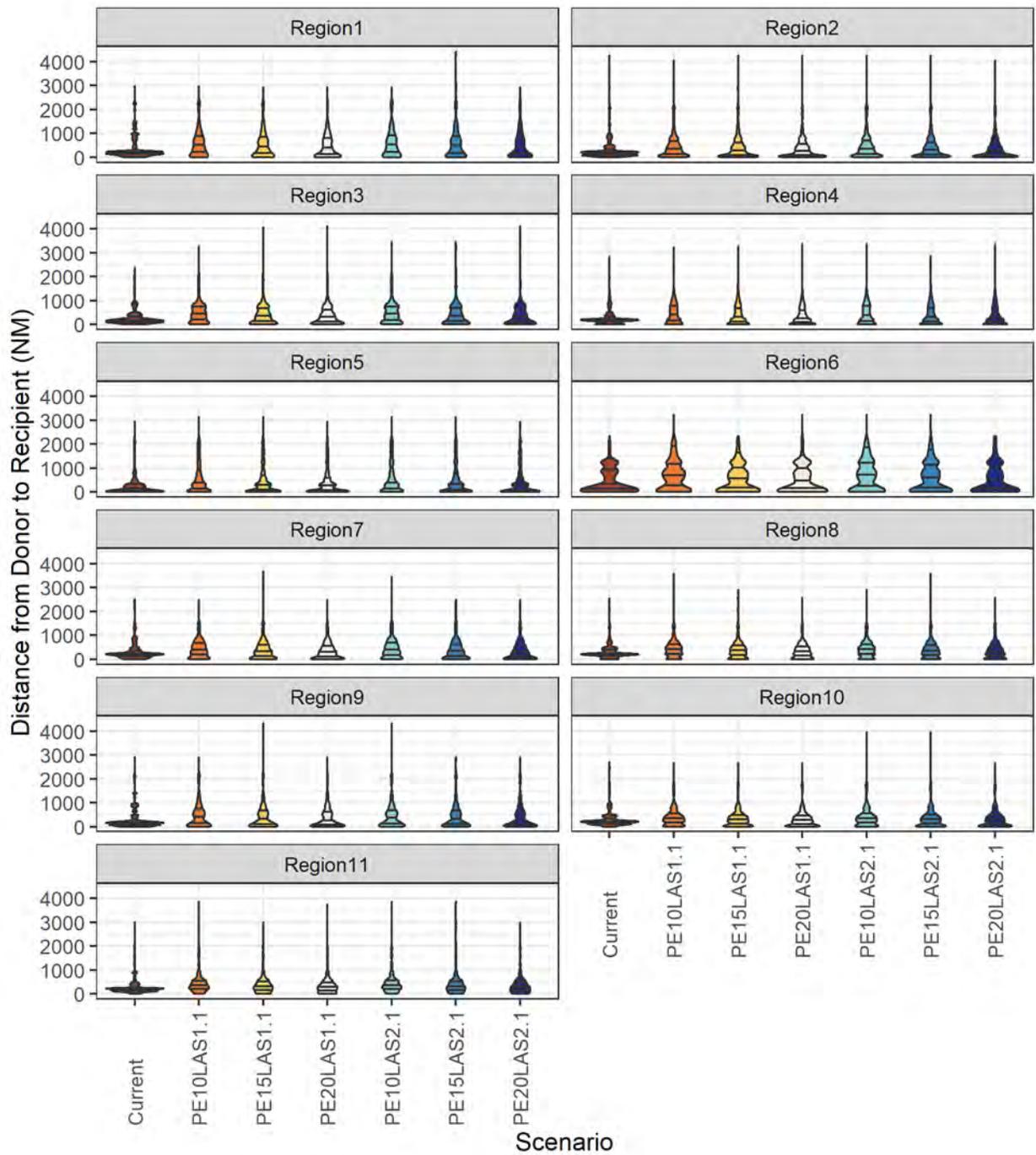


Figure 59: Distribution of Distance from Donor - By OPTN Region



Table 15: Outcome Counts and Rates by Scenario by OPTN Region

Outcome	OPTN Region	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
Transplant Count (N)								
	1	109 (103,114)	153 (146,159)	146 (140,151)	143 (136,149)	149 (142,153)	145 (140,155)	141 (134,149)
	2	785 (769,806)	875 (863,896)	864 (846,876)	856 (840,865)	877 (871,885)	871 (863,876)	860 (839,879)
	3	510 (493,519)	492 (483,504)	514 (509,518)	516 (505,538)	494 (481,510)	509 (502,518)	514 (503,525)
	4	599 (590,609)	537 (519,555)	547 (534,564)	560 (549,572)	543 (535,555)	552 (544,563)	566 (543,582)
	5	790 (773,804)	832 (815,843)	836 (821,848)	846 (836,858)	845 (827,864)	845 (829,862)	849 (832,866)
	6	126 (118,133)	122 (116,129)	121 (116,128)	122 (117,128)	120 (114,129)	117 (110,125)	122 (115,129)
	7	410 (395,418)	409 (400,420)	409 (397,422)	403 (400,409)	407 (398,414)	406 (394,416)	408 (399,420)
	8	309 (295,322)	265 (253,272)	272 (263,279)	279 (274,286)	264 (256,275)	267 (258,275)	275 (263,287)
	9	311 (302,319)	332 (322,341)	326 (313,340)	316 (307,323)	347 (339,356)	337 (326,346)	325 (316,332)
	10	632 (625,642)	620 (611,629)	622 (610,643)	617 (611,630)	608 (598,615)	615 (592,631)	614 (602,621)
	11	476 (462,487)	425 (418,434)	423 (418,431)	426 (416,441)	430 (420,438)	431 (427,443)	429 (426,434)
Transplant Rate per Patient-Year								
	1	0.77 (0.7,0.85)	1.31 (1.22,1.42)	1.18 (1.08,1.23)	1.12 (1,1.2)	1.21 (1.08,1.3)	1.15 (1.04,1.3)	1.07 (0.97,1.22)
	2	1.34 (1.28,1.41)	1.52 (1.49,1.6)	1.5 (1.44,1.55)	1.47 (1.42,1.53)	1.53 (1.49,1.58)	1.5 (1.46,1.55)	1.48 (1.41,1.56)
	3	2.35 (2.18,2.45)	1.81 (1.73,1.93)	2.05 (2,2.09)	2.07 (1.94,2.27)	1.78 (1.69,1.91)	1.93 (1.81,2.06)	2.02 (1.88,2.11)
	4	2.72 (2.59,2.82)	1.74 (1.61,1.84)	1.85 (1.72,1.96)	1.98 (1.85,2.13)	1.76 (1.68,1.89)	1.87 (1.75,1.96)	1.99 (1.85,2.13)
	5	1.7 (1.61,1.82)	1.64 (1.59,1.7)	1.69 (1.59,1.76)	1.78 (1.73,1.86)	1.66 (1.56,1.71)	1.68 (1.57,1.78)	1.74 (1.67,1.84)



Table 15: Outcome Counts and Rates by Scenario by OPTN Region

Outcome	OPTN Region	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
	6	1.18 (1.07,1.34)	1.08 (0.97,1.2)	1.05 (0.97,1.15)	1.05 (0.98,1.17)	0.99 (0.93,1.1)	0.95 (0.87,1.1)	1.03 (0.95,1.19)
	7	1.73 (1.61,1.82)	1.53 (1.46,1.6)	1.55 (1.41,1.65)	1.52 (1.47,1.56)	1.49 (1.41,1.56)	1.49 (1.43,1.56)	1.51 (1.44,1.61)
	8	2.12 (1.94,2.29)	1.38 (1.26,1.43)	1.45 (1.37,1.54)	1.52 (1.43,1.6)	1.34 (1.25,1.44)	1.39 (1.28,1.47)	1.48 (1.39,1.56)
	9	1.48 (1.39,1.57)	1.62 (1.53,1.71)	1.55 (1.42,1.63)	1.45 (1.35,1.55)	1.78 (1.67,1.84)	1.64 (1.56,1.75)	1.52 (1.45,1.59)
	10	1.7 (1.64,1.74)	1.59 (1.54,1.66)	1.61 (1.55,1.71)	1.59 (1.52,1.67)	1.48 (1.41,1.55)	1.54 (1.43,1.64)	1.52 (1.47,1.58)
	11	3.06 (2.88,3.17)	2.02 (1.94,2.1)	1.98 (1.88,2.11)	2.02 (1.9,2.22)	2.04 (1.98,2.12)	2.03 (1.94,2.1)	2.03 (1.96,2.08)
Transplant Distribution (Percent)								
	1	2.16 (2.04,2.26)	3.02 (2.88,3.14)	2.88 (2.76,2.97)	2.81 (2.67,2.93)	2.94 (2.79,3.01)	2.85 (2.75,3.04)	2.76 (2.63,2.93)
	2	15.52 (15.22,16)	17.29 (17.02,17.68)	17.01 (16.66,17.22)	16.84 (16.52,17.01)	17.25 (17.13,17.4)	17.09 (16.94,17.19)	16.86 (16.46,17.22)
	3	10.09 (9.79,10.28)	9.72 (9.53,9.96)	10.11 (10,10.21)	10.14 (9.94,10.58)	9.72 (9.46,10.01)	9.98 (9.86,10.16)	10.08 (9.87,10.28)
	4	11.84 (11.68,12.07)	10.61 (10.25,10.95)	10.77 (10.5,11.08)	11.01 (10.8,11.24)	10.68 (10.51,10.92)	10.83 (10.68,11.05)	11.08 (10.64,11.4)
	5	15.62 (15.34,15.88)	16.43 (16.1,16.63)	16.45 (16.12,16.67)	16.65 (16.44,16.86)	16.62 (16.26,17)	16.59 (16.26,16.91)	16.65 (16.3,16.99)
	6	2.48 (2.33,2.63)	2.42 (2.29,2.55)	2.37 (2.28,2.52)	2.39 (2.31,2.52)	2.36 (2.24,2.53)	2.29 (2.15,2.45)	2.4 (2.25,2.53)
	7	8.11 (7.82,8.28)	8.08 (7.91,8.3)	8.05 (7.83,8.29)	7.92 (7.86,8.04)	8 (7.83,8.14)	7.97 (7.73,8.17)	7.99 (7.82,8.22)
	8	6.11 (5.82,6.36)	5.24 (5,5.37)	5.35 (5.19,5.51)	5.49 (5.39,5.63)	5.19 (5.04,5.41)	5.24 (5.06,5.39)	5.39 (5.15,5.61)
	9	6.15 (5.98,6.32)	6.55 (6.36,6.74)	6.42 (6.15,6.68)	6.22 (6.05,6.36)	6.82 (6.65,7)	6.62 (6.4,6.79)	6.36 (6.18,6.5)
	10	12.51 (12.38,12.7)	12.25 (12.07,12.41)	12.25 (12.04,12.66)	12.14 (12,12.39)	11.96 (11.78,12.08)	12.07 (11.62,12.38)	12.03 (11.79,12.17)
	11	9.4 (9.12,9.62)	8.4 (8.25,8.57)	8.32 (8.22,8.51)	8.39 (8.18,8.67)	8.45 (8.26,8.59)	8.46 (8.38,8.71)	8.41 (8.33,8.53)

Table 15: Outcome Counts and Rates by Scenario by OPTN Region

Outcome	OPTN Region	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
Waitlist Mortality Count (N)								
	1	26 (21,31)	9 (7,11)	11 (7,14)	12 (8,13)	9 (7,11)	9 (7,11)	10 (8,13)
	2	100 (94,110)	58 (54,61)	59 (56,64)	62 (55,66)	53 (48,58)	53 (46,58)	57 (52,61)
	3	39 (33,45)	15 (13,17)	14 (10,19)	15 (11,18)	12 (10,16)	14 (10,16)	14 (12,18)
	4	35 (29,38)	26 (21,30)	28 (23,31)	28 (23,32)	24 (18,27)	24 (21,26)	25 (23,28)
	5	90 (82,98)	58 (53,65)	61 (55,66)	61 (57,68)	50 (46,56)	51 (44,58)	54 (49,58)
	6	13 (11,19)	10 (7,12)	12 (9,15)	12 (10,14)	8 (7,11)	8 (7,12)	9 (8,11)
	7	28 (22,32)	16 (14,18)	14 (10,17)	16 (13,20)	12 (11,14)	13 (11,15)	13 (11,18)
	8	19 (15,23)	14 (11,16)	14 (11,18)	15 (11,17)	13 (12,15)	14 (12,17)	14 (11,16)
	9	25 (20,27)	17 (13,19)	17 (15,21)	19 (15,21)	15 (11,18)	15 (13,18)	16 (13,19)
	10	43 (38,49)	27 (22,29)	28 (23,32)	30 (26,33)	25 (22,27)	26 (24,31)	25 (23,31)
	11	17 (12,22)	11 (8,13)	12 (9,14)	12 (9,15)	9 (7,12)	9 (6,11)	9 (7,13)
Percent Died by 2 Years Posttransplant								
	1	24.51 (17.54,33.64)	24.19 (18.87,26.71)	24.72 (19.21,29.17)	25.66 (20.55,29.53)	25.03 (23.03,29.33)	23.46 (16.31,28.57)	24.93 (20.83,31.25)
	2	23.6 (21.47,26.86)	23.37 (21.05,25.57)	23.11 (21.82,24.74)	24.5 (21.65,26.11)	23.82 (21.36,26.1)	23.87 (22.62,26.54)	24.22 (23.44,26.08)
	3	23.71 (19.33,27.79)	23.61 (20.24,27.71)	24.35 (22.46,26.52)	23.89 (22.18,26.86)	23.8 (20.24,27.03)	23.71 (20.32,26.92)	24.3 (22.11,27.88)
	4	23.02 (20.71,26.3)	24.77 (21.98,27.43)	23.56 (21.09,26.77)	25.03 (22.02,29.76)	23.66 (21.79,25.23)	24.38 (22.16,26.97)	24.95 (23.08,28.12)
	5	23.58 (21.47,24.84)	23.27 (20.82,26.87)	24.05 (21.54,26.32)	23.95 (22.06,25.52)	23.59 (21.39,25.53)	24.77 (21.55,27.74)	23.48 (20.67,26.71)



Table 15: Outcome Counts and Rates by Scenario by OPTN Region

Outcome	OPTN Region	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
	6	22.7 (19.2,27.69)	22.2 (20.49,28.12)	24.68 (15.45,35.25)	24.51 (17.65,30.08)	23.82 (19.01,31.78)	23.6 (18.97,29.46)	23.86 (16.81,28.93)
	7	22.11 (19.46,25.36)	21.21 (19.29,24.2)	22.69 (19.85,25.44)	23.67 (19.51,27.48)	23.33 (18.09,26.05)	23.2 (21.32,26.63)	22.6 (19.61,25.12)
	8	23.29 (22.22,24.68)	24.75 (21.27,27.24)	25.35 (21.17,29.6)	24.77 (21.17,30.99)	23.81 (19.85,26.56)	25.11 (22.22,27.72)	23.21 (19.42,27.17)
	9	24.18 (20.32,27.27)	25.06 (19.94,32.93)	23.43 (20.61,28.12)	23.46 (20.81,26.32)	23.28 (20.06,27.35)	24.5 (20.41,29.34)	22.93 (18.4,28.26)
	10	23.38 (20.83,25.76)	23.12 (20.99,25.93)	23.16 (20.81,25.97)	23.31 (19.97,25.77)	24.55 (21.41,29.22)	24.02 (22.54,26.94)	24.65 (21.65,26.71)
	11	23.34 (20.38,25.78)	22.6 (18.88,25.41)	23.17 (19.86,25.35)	23.36 (21.09,25.48)	22.72 (20.05,25.29)	23.43 (21.26,26.39)	22.86 (19.49,24.41)
Median Donor-to-Recipient Distance								
	1	198 (163,221)	430 (405,523)	357 (301,545)	284 (225,352)	441 (342,533)	378 (294,429)	296 (225,348)
	2	186 (181,193)	313 (296,336)	235 (221,256)	198 (178,222)	311 (288,324)	257 (241,279)	211 (195,228)
	3	169 (161,178)	429 (403,476)	341 (299,368)	272 (252,284)	413 (386,444)	330 (297,358)	289 (268,318)
	4	202 (198,207)	351 (320,373)	249 (216,287)	209 (199,218)	330 (296,365)	251 (211,294)	219 (209,230)
	5	117 (102,146)	312 (301,321)	256 (232,281)	208 (196,222)	313 (298,331)	268 (229,289)	224 (205,258)
	6	201 (198,223)	611 (579,639)	462 (351,566)	301 (198,425)	600 (548,627)	483 (351,627)	303 (217,500)
	7	212 (206,221)	374 (353,397)	311 (284,342)	261 (228,286)	370 (349,406)	305 (270,342)	246 (234,258)
	8	217 (210,223)	405 (362,449)	339 (293,371)	295 (259,334)	394 (339,429)	336 (310,374)	301 (272,343)
	9	156 (142,165)	349 (277,421)	231 (194,256)	182 (168,215)	289 (244,386)	232 (206,276)	193 (178,231)
	10	205 (195,211)	335 (307,354)	280 (266,307)	245 (227,262)	327 (306,351)	280 (267,293)	256 (235,272)
	11	198 (192,205)	365 (347,382)	314 (299,345)	290 (262,312)	351 (330,379)	315 (296,335)	287 (270,302)



Table 15: Outcome Counts and Rates by Scenario by OPTN Region

Outcome	OPTN Region	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
Percent Expected to Fly (>75 NM)								
	1	86.55 (80.53,89.81)	79.24 (75.32,83.02)	74.3 (71.23,79.17)	68.18 (65.49,71.23)	79.75 (74,83.1)	74.67 (72.26,79.05)	70.89 (67.39,74.31)
	2	81.02 (79.69,82.09)	75.85 (73.77,77.98)	68.34 (66.67,70.45)	64.4 (61.59,65.36)	74.81 (71.77,76.26)	69.81 (67.85,71.35)	66.07 (63.82,68.01)
	3	83.31 (80.63,86.41)	84.45 (82.73,85.98)	78.59 (76.02,81.55)	75.01 (71.96,79.05)	83.38 (81.63,84.47)	78.06 (76.18,79.8)	76.2 (75.1,77.84)
	4	83.9 (81.19,85.52)	76.83 (75.79,79.1)	72.43 (70.95,73.73)	69.06 (67.33,72.01)	76.13 (74.23,79.12)	72.7 (70.09,76.47)	70.99 (68.37,73.11)
	5	62.86 (61.82,64.29)	70.12 (68.19,71.79)	64.28 (62.37,65.65)	60.64 (58.52,62.08)	70.57 (67.89,72.92)	65.71 (62.48,67.05)	62.62 (60.58,64.6)
	6	69.67 (64.75,75.19)	77.54 (73.11,81.2)	74.98 (72.13,78.05)	70.44 (65.04,75)	76.03 (73.28,79.2)	73.58 (68.75,79.17)	71.29 (69.84,72.73)
	7	82.35 (79.24,86.55)	80 (77.56,82.18)	73.5 (71.36,75.43)	69.91 (67.5,72)	79.5 (77.59,81.27)	73.17 (71.19,75.38)	69.62 (67.16,70.98)
	8	87.43 (85.4,88.71)	84.55 (81.27,86.99)	78.49 (76.53,81.34)	76.25 (74.19,79.2)	83.46 (80.08,84.82)	79.87 (75.19,84.29)	76.93 (74.09,80.94)
	9	76.47 (73.48,80.07)	74.75 (71.85,77.41)	68.88 (66.36,72.5)	64.65 (62.42,66.77)	73.92 (71.35,76.7)	69.3 (66.77,73.41)	66.5 (64.16,70.03)
	10	91.65 (89.12,93.39)	84.23 (81.96,85.85)	77.65 (76.03,79.36)	73.46 (70.95,75.73)	82.23 (80.81,83.82)	76.55 (73.87,78.72)	73.08 (72.3,73.92)
	11	93.49 (92.15,94.12)	91.11 (89.23,93.47)	86.5 (84.96,89.02)	83.52 (80.19,85.99)	89.78 (88.32,92.34)	87.09 (84.95,89.02)	84.74 (83.33,86.57)

## Outcomes by Candidate Urbanicity

Candidate urbanicity was defined based on the candidate's permanent ZIP code. Candidates were classified as living in a metropolitan or non-metropolitan area.

As with overall data, simulated outcomes by candidate urbanicity demonstrated declines in transplant rates under continuous allocation rules compared with current rules (Table 16, Figure 60). For metropolitan candidates, those declines were similar under all continuous allocation scenarios, and for non-metropolitan candidates, declines were slightly larger under the 2:1 LAS scenarios than the 1:1 LAS scenarios.

The number of waitlist deaths declined considerably under continuous allocation compared with current rules for metropolitan and non-metropolitan candidates (Table 16, Figure 62). For metropolitan candidates, the declines were slightly larger for the 2:1 LAS scenarios than the 1:1 LAS scenarios and for scenarios with less PE weight. These small differences among continuous allocation scenarios were not observed for non-metropolitan candidates, though the number of non-metropolitan candidates was small enough that we would not expect to be able to detect that unless the differences were very large.

The percent of 2-year posttransplant deaths was similar across scenarios for metropolitan and non-metropolitan recipients (Table 16, Figure 63).

The patterns of median distance from donor to recipient by candidate urbanicity were similar to overall patterns, in which distances under current rules were shortest, and lower PE weight had longer distances. For a given PE weight, distances under the 1:1 LAS and 2:1 LAS scenarios were similar.

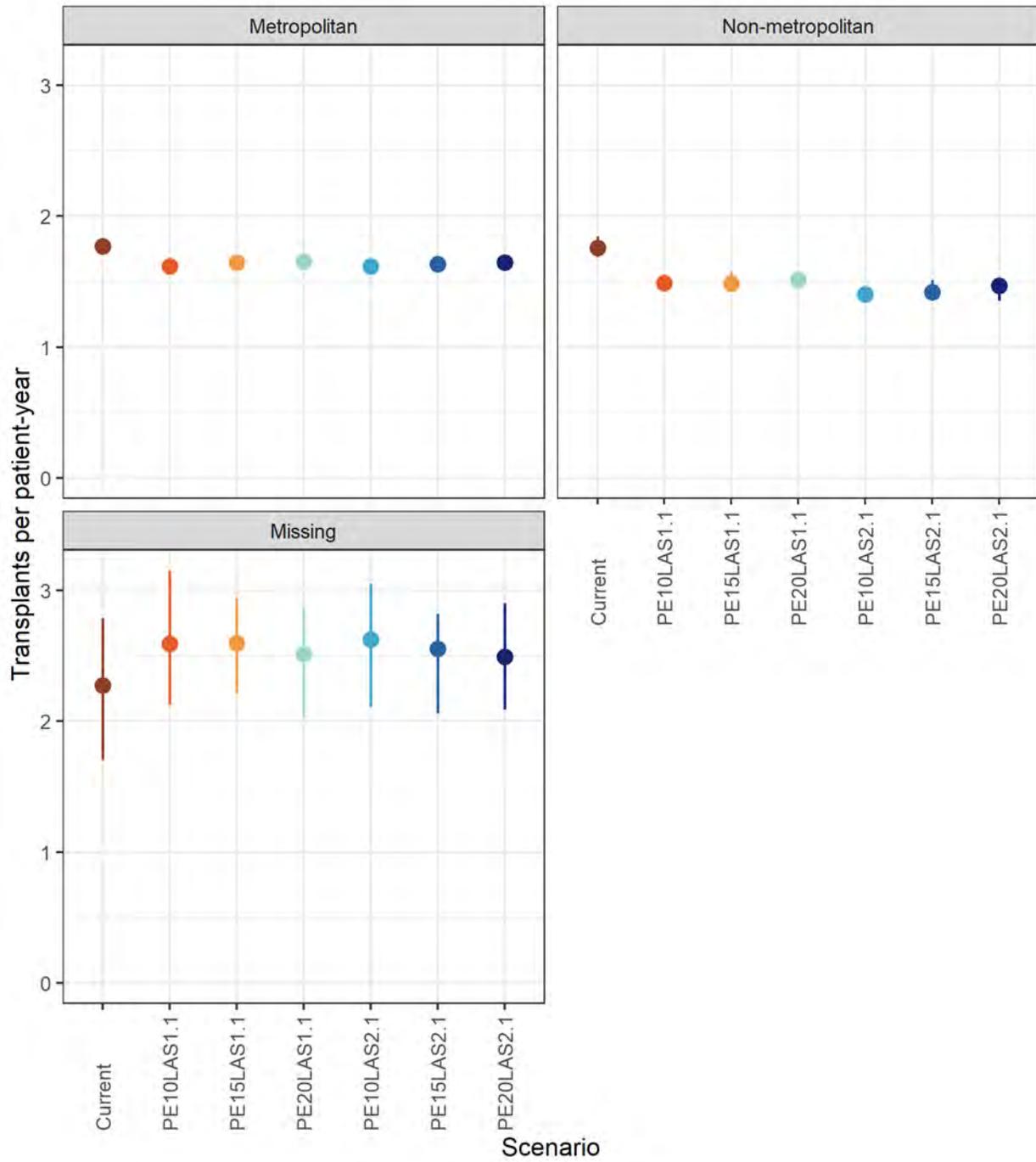


Figure 60: Transplant Rates - By Candidate Urbanicity

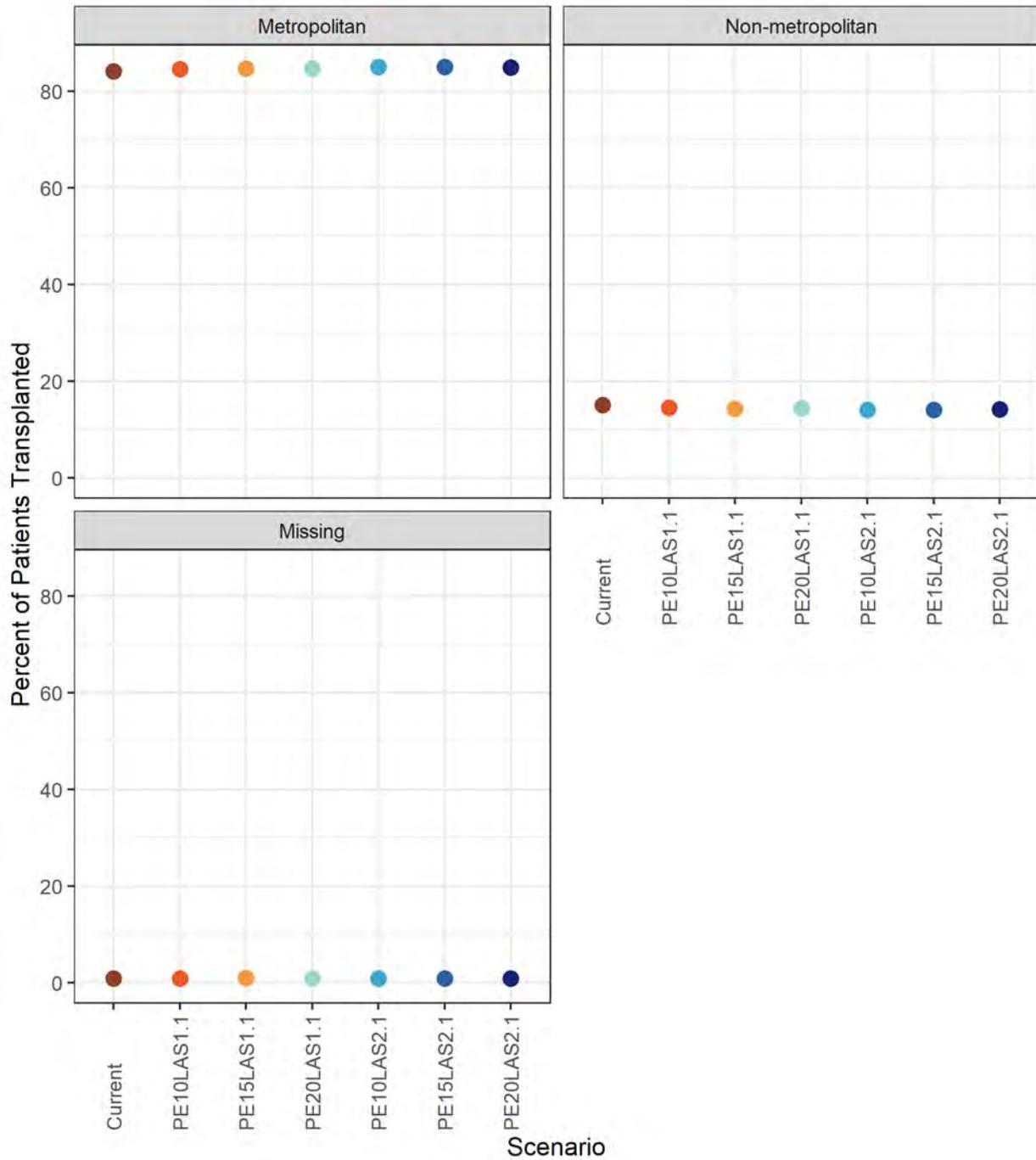


Figure 61: Transplant Distribution - Percent By Candidate Urbanicity

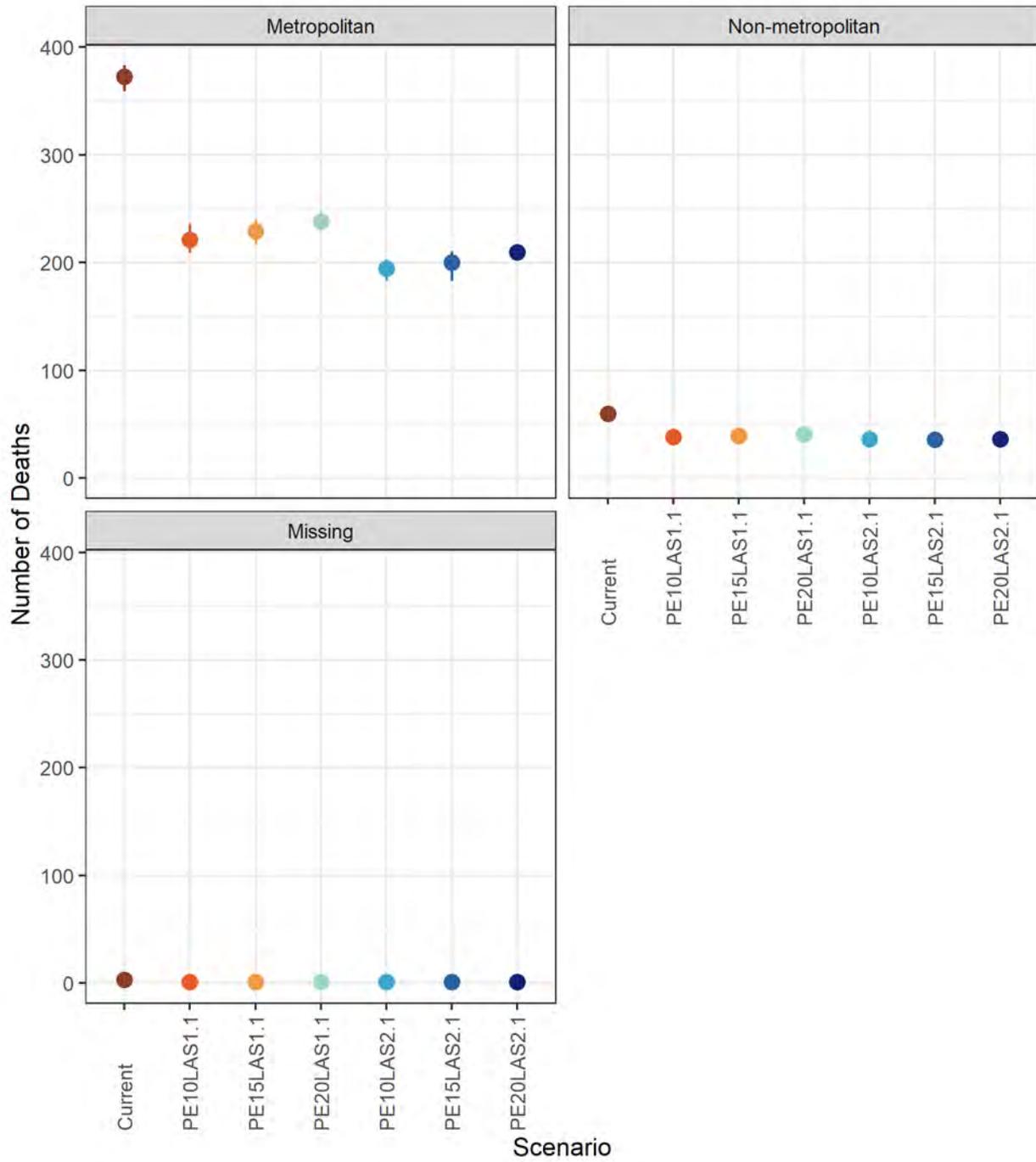


Figure 62: Waitlist Death Counts - By Candidate Urbanicity

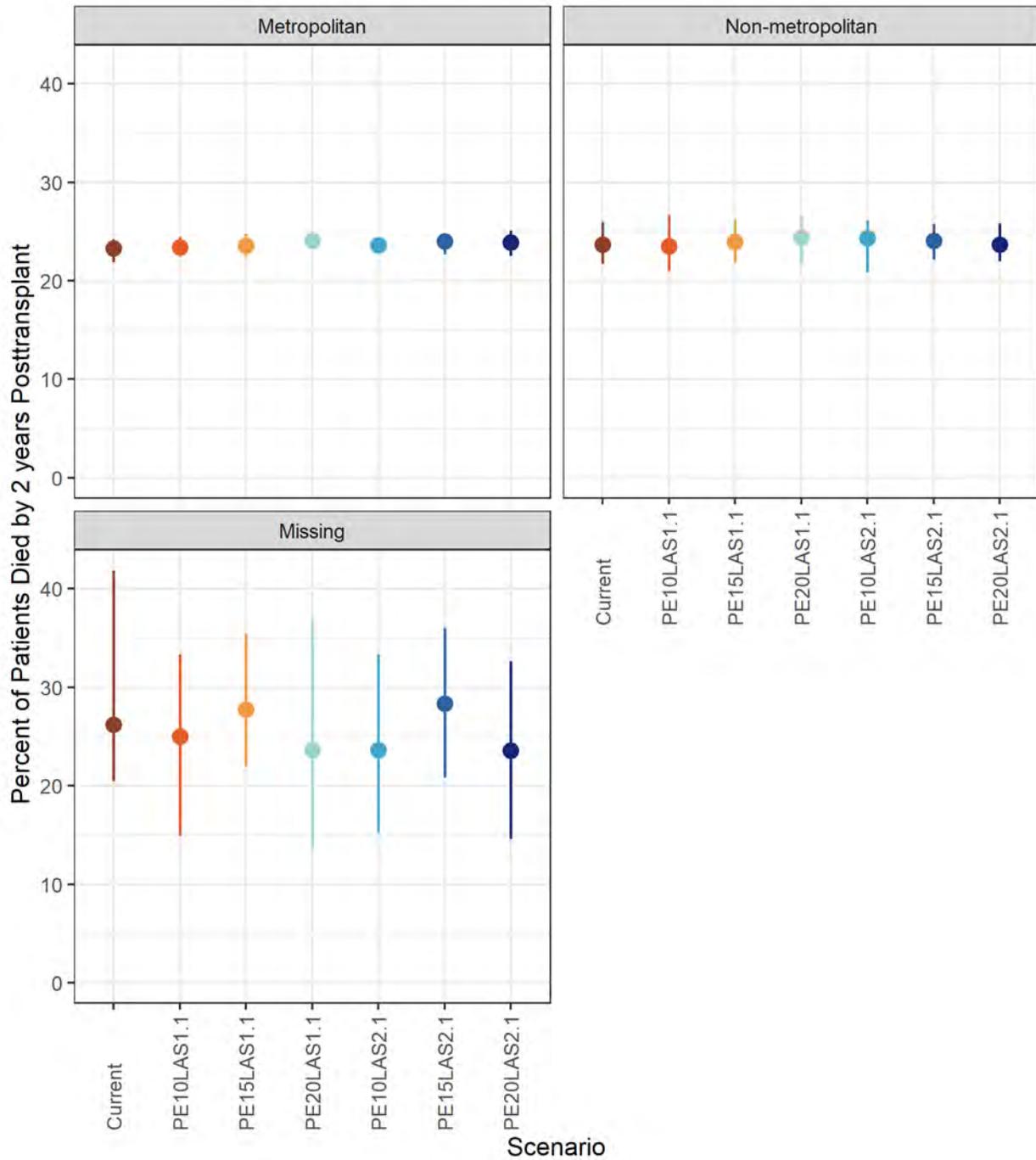


Figure 63: Percent Died by 2 Years Posttransplant - By Candidate Urbanicity

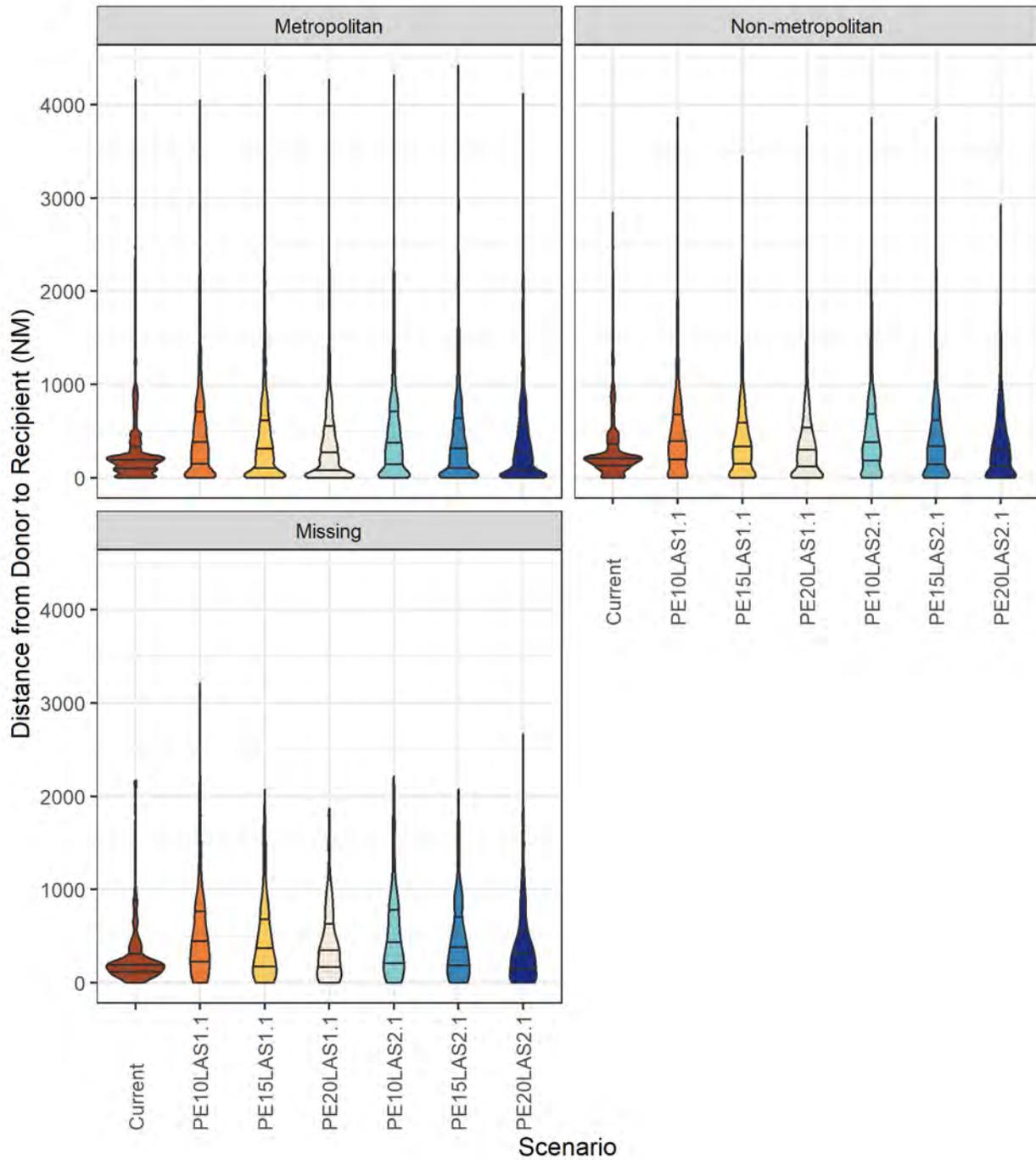


Figure 64: Distribution of Distance from Donor - By Candidate Urbanicity



Table 16: Outcome Counts and Rates by Scenario by Candidate Urbanicity

Outcome	Urbanicity Category	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
Transplant Count (N)								
	Metropolitan	4251 (4229,4262)	4284 (4271,4294)	4303 (4287,4312)	4306 (4292,4321)	4320 (4311,4331)	4331 (4308,4349)	4329 (4305,4353)
	Non-metropolitan	762 (749,779)	732 (724,743)	728 (712,749)	731 (721,749)	717 (703,724)	718 (707,738)	726 (704,738)
	Missing	44 (40,47)	48 (45,51)	49 (47,51)	47 (44,49)	48 (45,49)	48 (46,50)	47 (43,50)
Transplant Rate per Patient-Year								
	Metropolitan	1.77 (1.74,1.79)	1.62 (1.61,1.63)	1.65 (1.64,1.66)	1.66 (1.64,1.67)	1.62 (1.6,1.63)	1.63 (1.6,1.66)	1.65 (1.62,1.66)
	Non-metropolitan	1.76 (1.69,1.84)	1.49 (1.43,1.54)	1.49 (1.43,1.57)	1.51 (1.46,1.57)	1.4 (1.35,1.44)	1.42 (1.36,1.51)	1.47 (1.35,1.5)
	Missing	2.27 (1.71,2.79)	2.59 (2.13,3.15)	2.6 (2.22,2.94)	2.51 (2.03,2.87)	2.63 (2.11,3.05)	2.55 (2.06,2.82)	2.49 (2.09,2.9)
Transplant Distribution (Percent)								
	Metropolitan	84.07 (83.84,84.29)	84.6 (84.34,84.79)	84.7 (84.31,85.02)	84.69 (84.34,84.91)	84.96 (84.83,85.21)	84.97 (84.57,85.22)	84.85 (84.64,85.29)
	Non-metropolitan	15.06 (14.82,15.37)	14.45 (14.31,14.66)	14.34 (14.05,14.73)	14.38 (14.17,14.72)	14.1 (13.83,14.21)	14.09 (13.85,14.49)	14.22 (13.79,14.46)
	Missing	0.87 (0.79,0.93)	0.95 (0.89,1.01)	0.96 (0.92,1)	0.93 (0.87,0.96)	0.94 (0.88,0.96)	0.94 (0.9,0.98)	0.93 (0.84,0.98)
Waitlist Mortality Count (N)								
	Metropolitan	372 (359,383)	221 (209,236)	229 (217,240)	238 (229,248)	194 (183,203)	200 (183,210)	210 (202,217)
	Non-metropolitan	60 (52,66)	38 (33,43)	39 (35,43)	41 (33,45)	36 (32,42)	35 (31,38)	36 (31,38)
	Missing	3 (1,4)	1 (1,1)	1 (1,1)	1 (1,2)	1 (1,1)	1 (1,1)	1 (1,2)
Percent Died by 2 Years Posttransplant								
	Metropolitan	23.3 (21.87,24.24)	23.41 (22.47,24.42)	23.54 (22.47,24.78)	24.03 (23.28,24.97)	23.61 (22.89,24.24)	24.03 (22.69,24.85)	23.9 (22.52,25.13)
	Non-metropolitan	23.7 (21.7,25.99)	23.49 (20.92,26.68)	23.95 (21.77,26.25)	24.38 (21.63,26.58)	24.34 (20.86,26.15)	24.04 (22.14,25.76)	23.7 (21.96,25.8)



Table 16: Outcome Counts and Rates by Scenario by Candidate Urbanicity

Outcome	Urbanicity Category	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
	Missing	26.22 (20.45,41.86)	25.02 (14.89,33.33)	27.72 (22,35.42)	23.65 (13.64,36.96)	23.64 (15.22,33.33)	28.33 (20.83,36)	23.6 (14.58,32.61)
Median Donor-to-Recipient Distance								
	Metropolitan	192 (188,196)	348 (328,360)	277 (263,283)	229 (219,240)	343 (333,353)	283 (268,293)	238 (228,244)
	Non-metropolitan	208 (201,215)	370 (349,384)	306 (289,320)	266 (229,294)	353 (326,373)	309 (293,337)	274 (256,288)
	Missing	185 (167,200)	405 (285,501)	319 (199,393)	314 (168,435)	396 (285,600)	338 (266,401)	270 (227,352)
Percent Expected to Fly (>75 NM)								
	Metropolitan	80.36 (79.59,81.24)	78.24 (77.12,79.37)	72.28 (71.42,73.16)	68.67 (67.72,69.45)	77.57 (76.81,78.31)	72.92 (72,74.27)	69.88 (69.03,70.69)
	Non-metropolitan	86.32 (84.95,88.58)	83.2 (81.68,84.5)	77.43 (76.32,78.93)	73.22 (71.45,75.07)	81.39 (78.95,83.7)	76.58 (74.96,78.22)	74.62 (72.99,76.7)
	Missing	87.41 (82.5,93.48)	84.92 (72.92,96)	82.65 (74,87.76)	78.89 (63.27,87.23)	84.64 (79.59,91.11)	82.44 (77.55,89.8)	78.05 (72.92,84.78)

## Outcomes by Center Volume (transplants/year)

Center volumes were computed by taking the average of each program's volume in 2018 and 2019.

Compared with the current rules scenario, transplant rates among the lowest-volume centers, those performing 1-15 transplants per year, increased under all continuous allocation scenarios, while rates at centers with higher volumes declined (Table 17, Figure 65). This likely resulted from increases in transplant rates among pediatric candidates. Pediatric centers are often low-volume centers. Those performing 16 or more transplants per year followed the same pattern as the overall data, in which transplant rates declined under continuous allocation compared with current rules. Among centers performing 16-40 transplants per year, declines in transplant rates were largest in scenarios with lowest PE weight, but for centers performing more than 100 transplants per year, declines in transplant rates were largest when PE weight was largest. The distribution of transplants by center volume remained substantially similar across all scenarios (Table 17, Figure 66).

At all center volumes, waitlist deaths declined under all continuous allocation scenarios compared with current rules (Table 17, figure 67). For the highest- and lowest-volume groups, declines in waitlist deaths were similar across continuous distribution scenarios, while for centers performing 16-100 transplants per year, reductions in death were larger under the 2:1 LAS scenarios compared with 1:1 LAS scenarios.

The percent of 2-year posttransplant deaths was similar across scenarios for centers performing 16 or more transplants per year. Low-volume centers had higher point estimates for 2-year posttransplant deaths, demonstrating the artifact of higher posttransplant deaths in pediatric candidates, who are overrepresented in small centers (Table 17, Figure 68).

The patterns of median distance from donor to recipient by center volume were similar to overall patterns, in which distances under current rules were shortest, and lower PE weight had longer distances (Table 17). Distances were longest under current rules and continuous allocation scenarios for centers performing 1-15 transplants per year, again reflecting the overrepresentation of pediatric candidates.

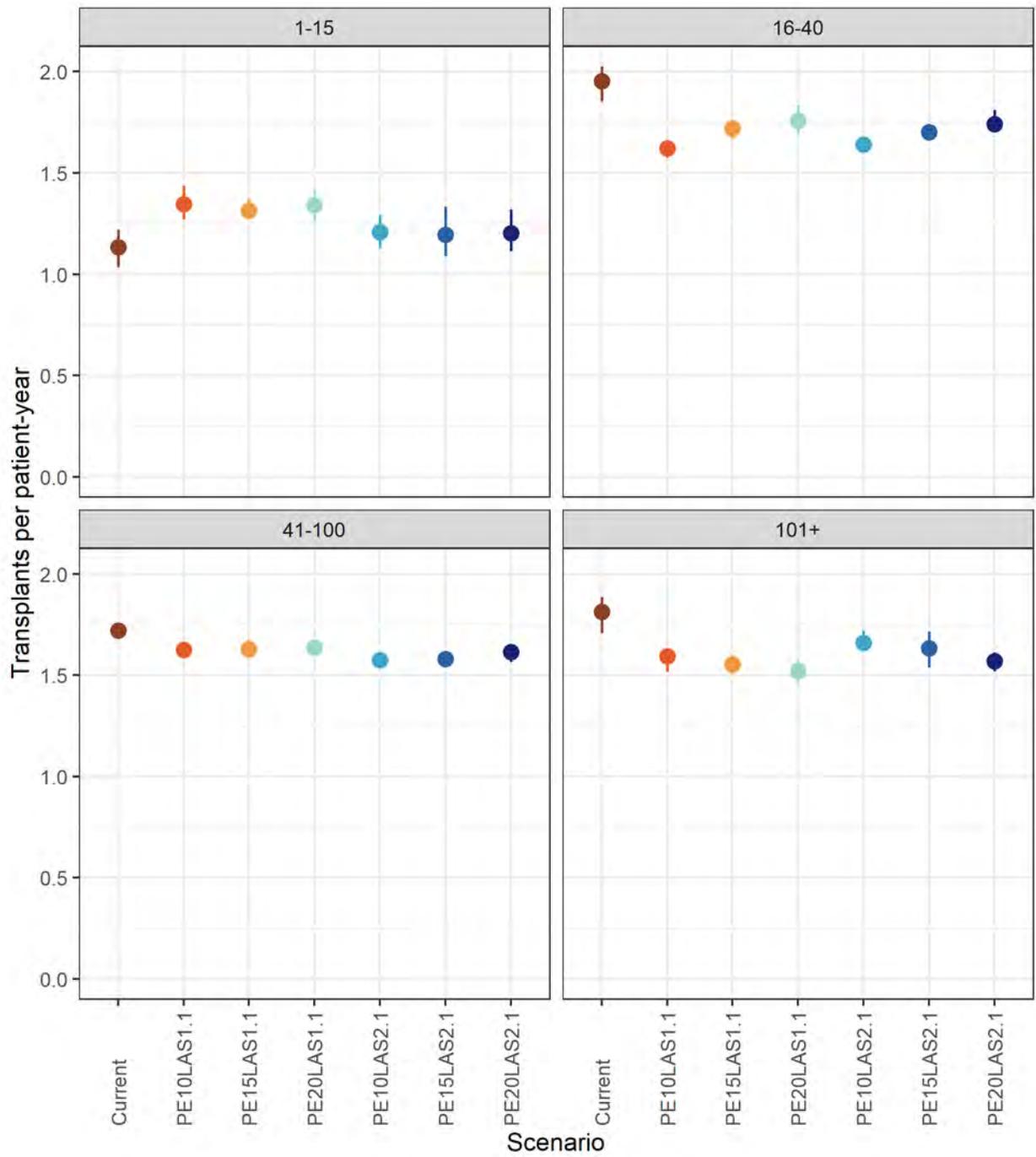


Figure 65: Transplant Rates - By Center Volume

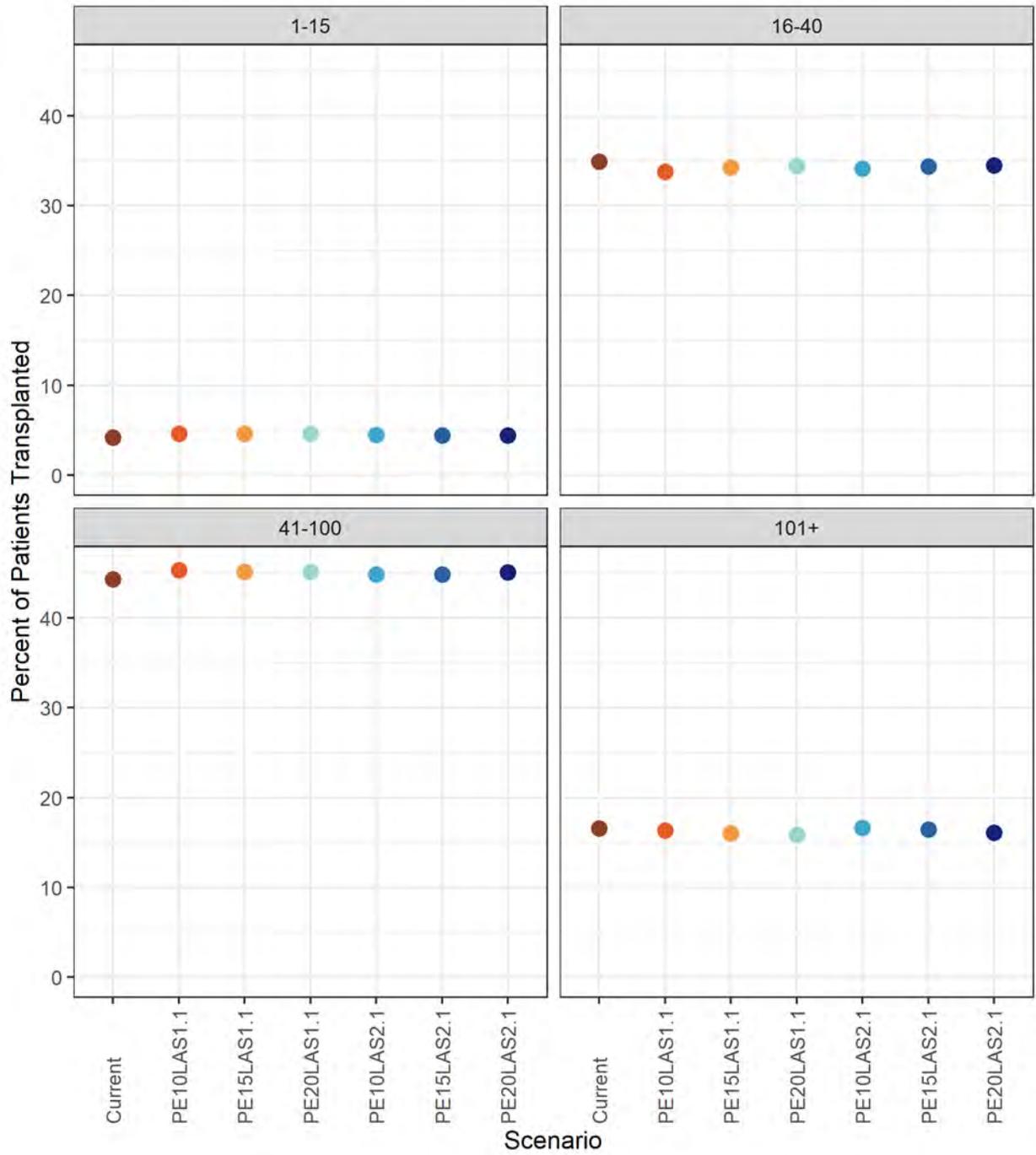


Figure 66: Transplant Distribution - Percent By Center Volume

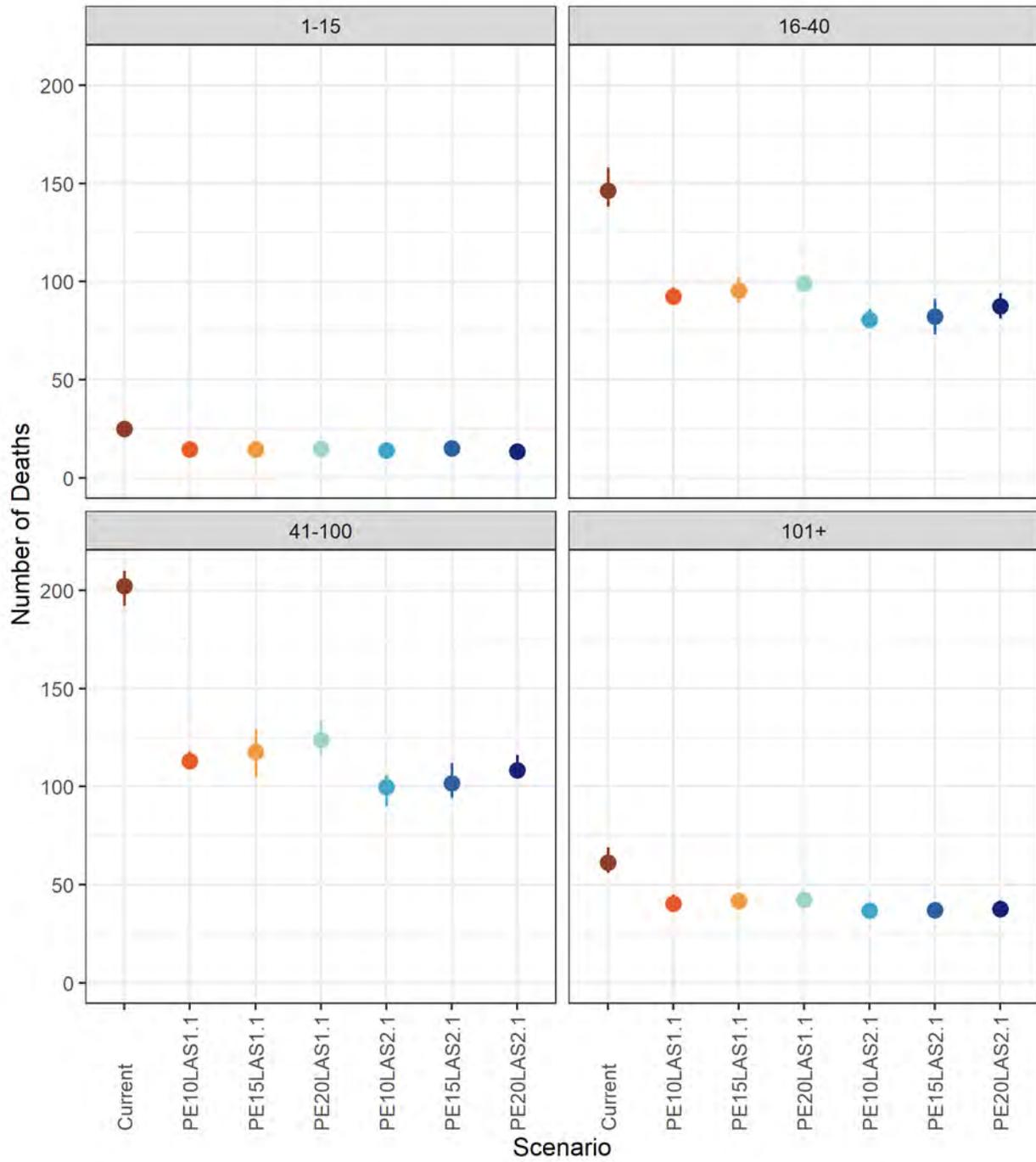


Figure 67: Waitlist Death Counts - By Center Volume

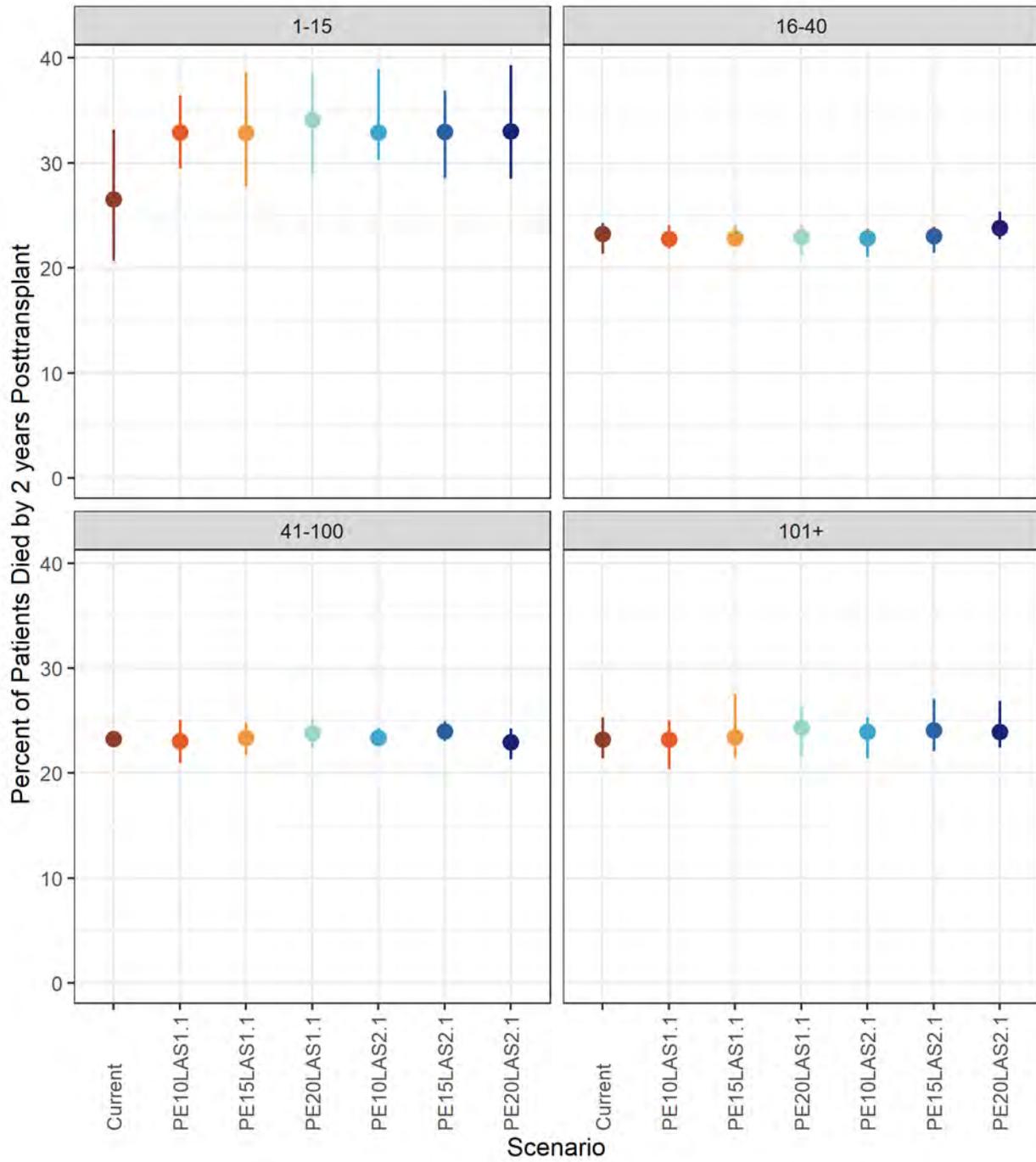


Figure 68: Percent Died by 2 Years Posttransplant - By Center Volume

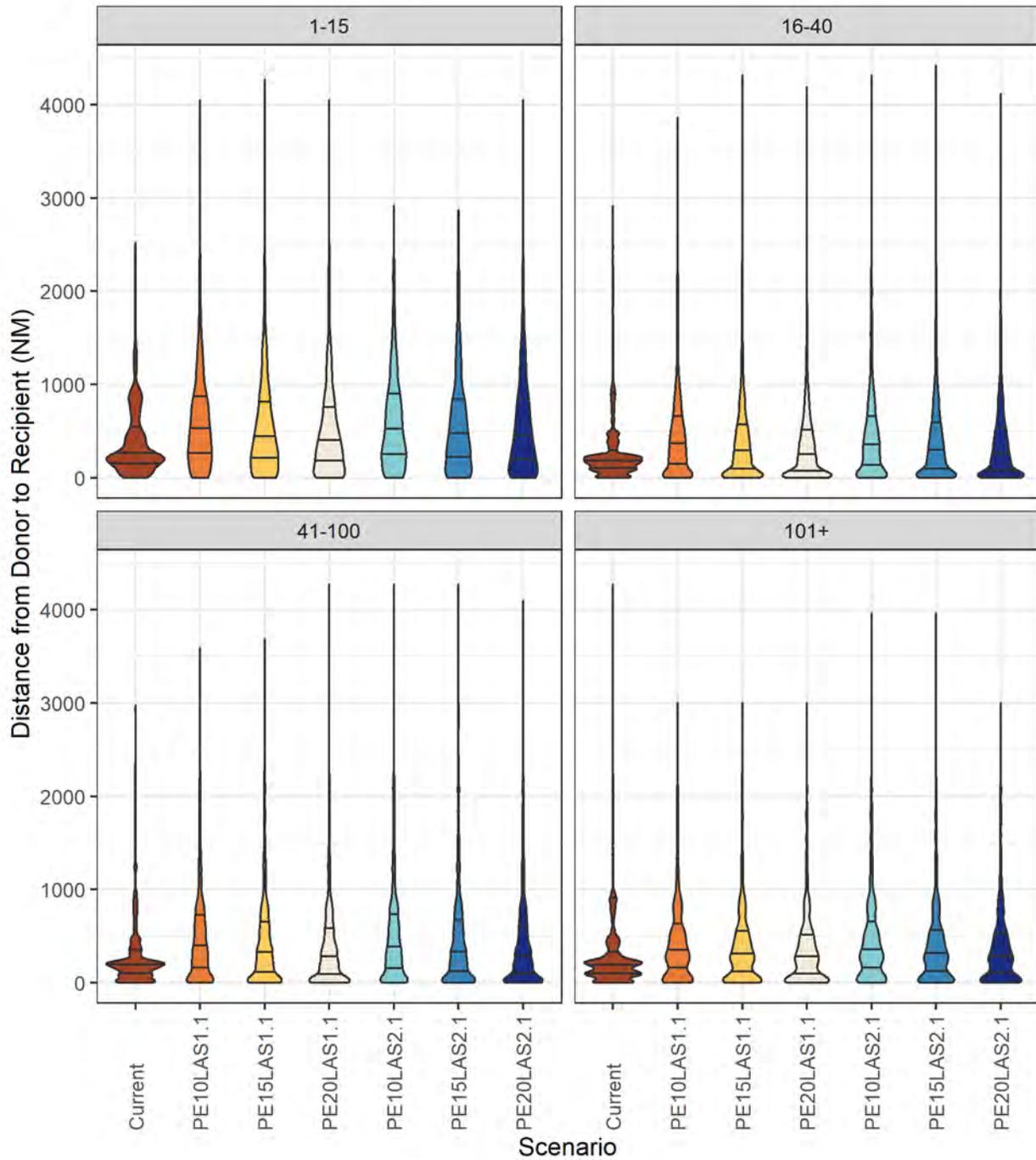


Figure 69: Distribution of Distance from Donor - By Center Volume



Table 17: Outcome Counts and Rates by Scenario by Center Volume

Outcome	Center Volume	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
Transplant Count (N)								
	1-15	212 (202,219)	233 (228,240)	232 (227,238)	232 (225,239)	226 (219,233)	224 (210,236)	224 (214,236)
	16-40	1766 (1739,1793)	1712 (1694,1736)	1742 (1719,1764)	1750 (1726,1770)	1734 (1720,1745)	1751 (1737,1762)	1758 (1742,1788)
	41-100	2240 (2221,2263)	2294 (2283,2309)	2293 (2280,2319)	2297 (2276,2323)	2280 (2262,2295)	2285 (2276,2295)	2300 (2273,2311)
	101+	839 (818,853)	825 (814,837)	814 (802,823)	806 (796,819)	845 (838,862)	837 (819,854)	820 (812,834)
Transplant Rate per Patient-Year								
	1-15	1.13 (1.03,1.22)	1.35 (1.27,1.44)	1.32 (1.27,1.37)	1.34 (1.26,1.41)	1.21 (1.13,1.29)	1.2 (1.09,1.33)	1.2 (1.11,1.32)
	16-40	1.95 (1.85,2.02)	1.62 (1.57,1.66)	1.72 (1.67,1.76)	1.76 (1.69,1.83)	1.64 (1.63,1.67)	1.7 (1.67,1.74)	1.74 (1.7,1.81)
	41-100	1.72 (1.69,1.75)	1.63 (1.59,1.64)	1.63 (1.6,1.68)	1.64 (1.6,1.68)	1.57 (1.54,1.6)	1.58 (1.57,1.6)	1.62 (1.56,1.64)
	101+	1.81 (1.71,1.89)	1.59 (1.52,1.63)	1.55 (1.5,1.6)	1.52 (1.47,1.57)	1.66 (1.62,1.72)	1.63 (1.54,1.71)	1.57 (1.52,1.61)
Transplant Distribution (Percent)								
	1-15	4.19 (3.99,4.34)	4.61 (4.5,4.74)	4.57 (4.46,4.69)	4.57 (4.42,4.7)	4.45 (4.3,4.58)	4.39 (4.12,4.63)	4.39 (4.21,4.62)
	16-40	34.93 (34.52,35.38)	33.8 (33.47,34.25)	34.28 (33.92,34.74)	34.41 (33.93,34.78)	34.11 (33.84,34.28)	34.36 (34.08,34.6)	34.46 (34.22,35.03)
	41-100	44.29 (43.82,44.8)	45.3 (45.1,45.61)	45.13 (44.81,45.53)	45.17 (44.76,45.65)	44.83 (44.54,45.16)	44.84 (44.69,45)	45.08 (44.53,45.3)
	101+	16.58 (16.19,16.86)	16.29 (16.06,16.53)	16.03 (15.81,16.2)	15.85 (15.64,16.11)	16.61 (16.44,16.97)	16.42 (16.05,16.75)	16.07 (15.88,16.31)
Waitlist Mortality Count (N)								
	1-15	25 (22,28)	14 (12,16)	14 (12,19)	15 (11,18)	14 (12,17)	15 (12,17)	13 (10,16)
	16-40	146 (138,158)	92 (89,97)	95 (89,102)	99 (96,101)	81 (77,86)	82 (73,91)	87 (81,94)



Table 17: Outcome Counts and Rates by Scenario by Center Volume

Outcome	Center Volume	Current	PE10LAS1.1	PE15LAS1.1	PE20LAS1.1	PE10LAS2.1	PE15LAS2.1	PE20LAS2.1
	41-100	202 (192,210)	113 (109,118)	118 (105,129)	124 (116,134)	100 (90,106)	102 (94,112)	108 (104,116)
	101+	61 (56,69)	40 (36,45)	42 (40,44)	42 (38,47)	37 (34,41)	37 (35,39)	38 (34,42)
Percent Died by 2 Years Posttransplant								
	1-15	26.54 (20.66,33.18)	32.94 (29.49,36.4)	32.88 (27.71,38.66)	34.11 (28.94,38.5)	32.94 (30.3,38.94)	32.99 (28.57,36.86)	33.04 (28.5,39.29)
	16-40	23.25 (21.33,24.27)	22.78 (21.85,24.08)	22.86 (21.99,24.01)	22.93 (21.24,24.06)	22.85 (21.06,23.78)	23.04 (21.44,23.92)	23.83 (22.75,25.38)
	41-100	23.26 (22.61,23.96)	23.04 (20.96,25.05)	23.38 (21.7,24.8)	23.85 (22.45,25.15)	23.39 (22.57,24.31)	23.97 (23.04,24.96)	22.97 (21.33,24.25)
	101+	23.19 (21.39,25.33)	23.22 (20.37,25.03)	23.42 (21.45,27.56)	24.34 (21.62,26.39)	23.91 (21.42,25.33)	24.09 (22.06,27.07)	23.94 (22.41,26.88)
Median Donor-to-Recipient Distance								
	1-15	239 (227,248)	500 (428,599)	415 (357,495)	360 (336,388)	482 (396,547)	425 (387,469)	403 (314,439)
	16-40	184 (181,188)	339 (320,367)	256 (238,275)	212 (196,230)	329 (312,348)	257 (240,273)	221 (211,232)
	41-100	198 (196,201)	361 (346,373)	295 (277,306)	243 (221,254)	351 (339,361)	298 (281,307)	245 (226,259)
	101+	194 (188,200)	317 (306,334)	280 (261,298)	249 (231,261)	322 (306,353)	289 (278,306)	258 (231,273)
Percent Expected to Fly (>75 NM)								
	1-15	85.78 (83.41,89.86)	88.3 (85.91,91)	83.36 (79.91,87.07)	79.77 (76.55,83.76)	86.71 (83.12,91.44)	82.55 (80.09,84.07)	80.07 (76.79,83.47)
	16-40	82.94 (82.01,84.3)	78.07 (76.46,80.89)	70.3 (68.89,71.4)	66.32 (65.03,67.74)	76.66 (75.25,77.78)	70.85 (69.74,72.59)	68.12 (67.02,69.4)
	41-100	79.46 (78.52,80.44)	78.49 (77.66,79.26)	73.54 (72.07,74.85)	70.04 (68.94,71.31)	77.71 (76.62,78.36)	73.65 (72.52,74.6)	70.74 (70.03,71.68)
	101+	81.71 (80.19,83.33)	79.82 (78.72,81.51)	75.06 (73.93,76.86)	71.43 (70.25,72.49)	80.25 (79.12,81.5)	76.4 (74.82,77.55)	73.11 (70.14,75.3)

## Appendix

TSAM was rebuilt for the lung continuous distribution project; model cohorts were updated to include candidates and donors January 1, 2018-December 31, 2019. Models underlying the TSAM were updated as well.

The offer acceptance model is a logistic model predicting whether an offered organ will be accepted for transplant. The offer acceptance models included offers from donors recovered between January 1, 2018, and December 31, 2019. The match runs had at least 1 acceptance, and offers after the last acceptance were excluded. The lung offer acceptance model included candidate factors (age, sex, blood type, smoking history, prior malignancy, prior cardiac surgery, hypertension, LAS, diagnosis group), donor factors (age, sex, blood type, BMI, cause of death, smoking history, history of hypertension, height, donor-to-recipient height and weight ratios, public health service increased risk of disease transmission, HBV and HCV status, PO2, DCD status, offer number). Three separate lung offer acceptance models were estimated: (1) a model for offers to pediatric candidates; (2) a model for offers to adult candidates from donors without a previous acceptance; and (3) a model for offers to adult candidates willing to accept single lungs from donors with a previous acceptance. The second model was used when a donor had 2 lungs available, and the third model was used when a donor had only 1 lung available.

Distance has been included in previous TSAM acceptance models but was explicitly excluded in the current acceptance models. Models are based on historic data, and historically, nearby offers were prioritized. Thus, offers accepted at greater distances would likely have been rejected by many before being accepted. In a continuous allocation system, this may no longer be the case.

The adult lung posttransplant model included recipient factors (age, sex, prior transplant, LAS, diagnosis group) and donor factors (age, cause of death, smoking history, pH, DCD status, donor-recipient weight ratio). Ischemia time was not included, as TSAM cannot estimate this value. Previous analyses suggested that distance was an insufficient proxy for ischemia time to use in posttransplant models. The pediatric lung posttransplant model included only donor age. The small number of pediatric recipients did not support a more complex model.

The estimation of both the offer acceptance and posttransplant models used the least absolute shrinkage and selection operator (LASSO). The LASSO 'shrinks' covariate effects towards 0, which can improve predicted error and set effects to exactly 0, effectively performing model selection. Linear splines estimated the effect of continuous covariates, and knots were evenly spaced throughout the covariate distribution.