Refining Transplant-Related Factors Included in Risk Adjustment

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Risk Adjustment and Center Characteristics

- The main purpose of the Center Specific Survival Analysis is to provide an equitable, balanced, scientific performance measurement tool(s) that can be used by centers to define and improve quality
- Risk adjustment (at the person level) is intended to provide a fair comparison of entity performance by controlling for confounding factors (differences in the population of interest) when modeling for measured performance. EG “How would the performance of centers compare if they had the same mix of patients?”
- Variation in performance may be due to variation in quality (different treatment choices), or in factors independent of quality (age, severity of illness, etc).

Risk Adjustment and Center Characteristics

- Risk adjustment is appropriate for factors that are independent of quality/center performance. However, adjusting for factors that are not independent of quality (e.g. center decisions) may serve to mask the impact of that factor on center performance.
- Current modeling includes patient-, disease-, and some transplant-related characteristics.
  - Risk factors that may represent a center's decisions (which relates to its quality) should be carefully considered for inclusion in the risk adjustment model.
- CIBMTR has typically excluded some transplant characteristics that represent center treatment decisions/choices –
  - Preparative regimen,
  - GVHD prophylaxis

Risk Adjustment and Center Characteristics

- We have previously adjusted for HLA matching/donor/graft source for alternative donors
  - Expected outcomes were substantially lower (e.g. “ceiling effect”)
  - Choices of alternative donors for HCT were limited and expected outcomes varied considerably.
  - Intent to “protect” centers from lower performance in setting of limited choices with lower outcomes that may otherwise negatively influence patient access to HCT

- Considering advances in choices available to centers for alternative donors, and improving outcomes, should we modify our risk adjustment approach?
  - How should we “adjust” the potential center impacts of donor selection?

Current Risk adjustment - 2025

HLA matching by donor and graft type	.	.	.	.	0.0018
Matched sibling	4918	1.00	.	.	.
Syngeneic twin	54	1.71	0.66	4.43	0.2730
Matched relative	125	1.16	0.67	2.00	0.6008
Relative with 1 mismatch	208	1.38	0.89	2.14	0.1466
Relative with ≥ 2 mismatches[a]	5577	0.90	0.78	1.05	0.1670
URD 8/8[c]	10780	0.95	0.86	1.06	0.3583
URD 7/8[c]	2058	0.94	0.81	1.08	0.3732
URD ≤ 6/8[c] and URD mismatched[d]	212	0.67	0.48	0.95	0.0261
URD well-matched[d]	229	0.93	0.66	1.31	0.6783
URD partially matched[d]	48	0.69	0.35	1.36	0.2843
URD unknown matching	247	1.27	0.56	2.92	0.5667
Single UCB 8/8[c]	47	1.64	0.52	5.11	0.3957
Single UCB 7/8[c]	112	0.90	0.49	1.64	0.7247
Single UCB 6/8[c]	168	0.57	0.37	0.87	0.0084
Single UCB ≤ 5/8[c] or ≤ 4/6[e]	233	0.55	0.39	0.77	0.0004
Single UCB ≥ 5/6[e]	15	1.21	0.16	9.41	0.8525
Single UCB unknown match or related UCB	47	0.95	0.40	2.25	0.9076
Multiple UCB ≥ 5/6[f]	52	0.70	0.33	1.48	0.3480
Multiple UCB ≤ 4/6[af]	168	0.52	0.36	0.75	0.0005

Risk Adjustment and Center Characteristics

- Considering advances in choices available to centers for alternative donors, and improving outcomes, should we modify our risk adjustment approach?
  - How should we "adjust" the potential center impacts of donor selection in current era?
  - Are there sufficient choices among alternative donors for most recipients?

Potential risk adjustment

- Matched sibling and matched relative
- Syngeneic Twins
- Matched unrelated
- Alternative donor (includes 1, 2 or more mismatched relative or mismatched unrelated or any unrelated cord blood)

- With or without donor age ?

Current Risk adjustment - 2025

Unfavorable pairwise comparisons among alternative donor HCT

- Less matched UCB (4/6, 5/8) OR ~ 0.4-0.6 vs URD 7/8, single or 2+ mismatch relative
- Less matched URD (6/8) vs single mismatch relative or 8/8 URD (OR 0.7)
- 2+ mismatch haplo vs 1 mismatch relative (OR 0.65)

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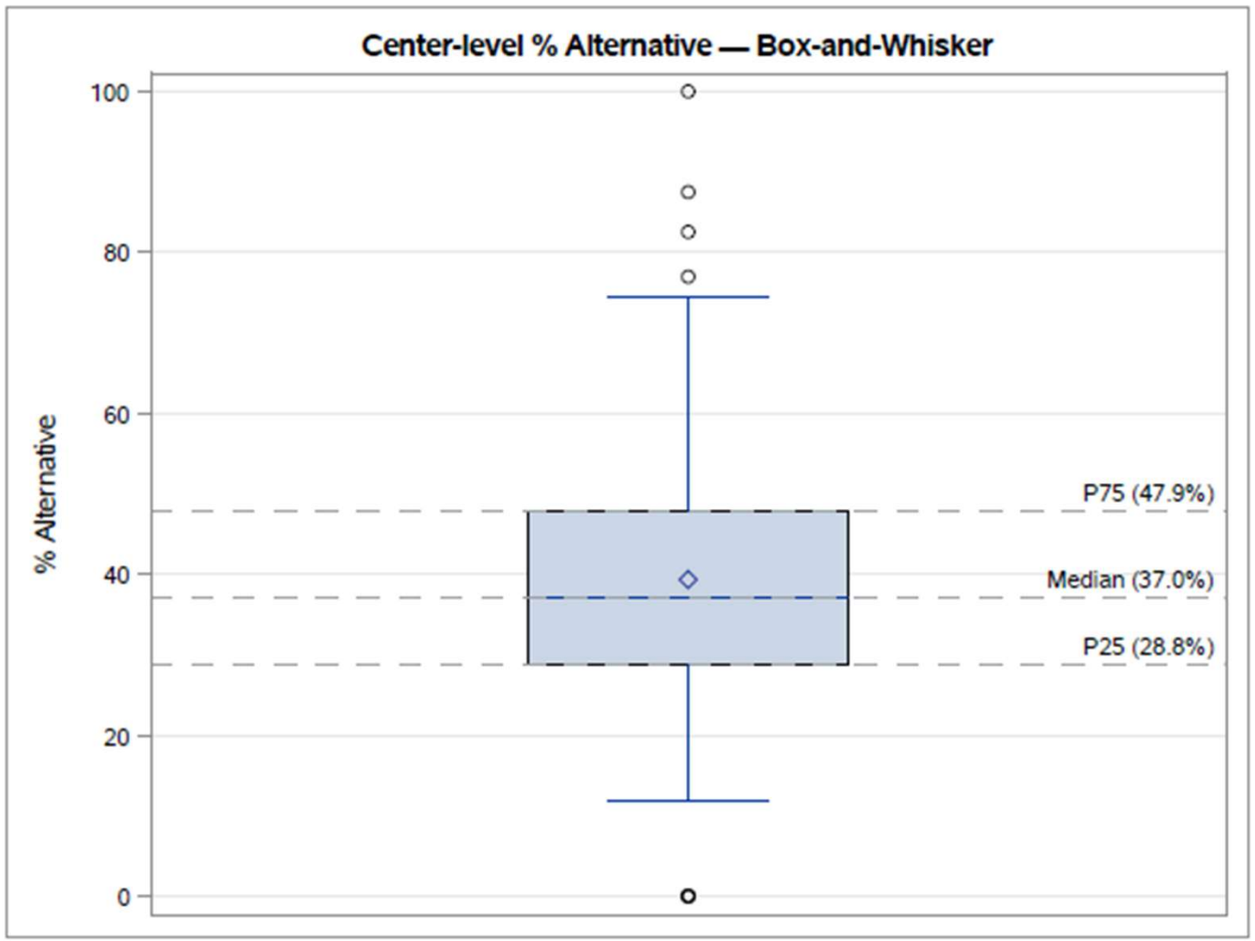
Discussion

How are centers using alternative donors?

- Of the 176 centers included in 2025
  - Median % of alternative donors = 37%
  - 25th -75th %ile = 29 – 48%
  - Outliers at small centers range 0% and 90%

How are centers using alternative donors?



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Donor type and recipient age

Table of prop_dnr by agegp												
prop_dnr(Proposed Donor Type)	agegp(Recipient age at HCT)											
Frequency Percent Row Pct Col Pct	1 < 1-9	2 10-17	3 18-29	4 30-39	5 40-49	6 50-59	7 60-64	8 65-69	9 70-74	10 75-79	11 80 or older	Total
1 Matched sibling/relative	615 2.43 12.20 28.30	485 1.92 9.62 29.48	597 2.36 11.84 24.16	531 2.10 10.53 25.89	604 2.39 11.98 23.95	917 3.62 18.18 20.96	597 2.36 11.84 17.81	451 1.78 8.94 12.18	212 0.84 4.20 8.69	34 0.13 0.67 6.22	0 0.00 0.00 0.00	5043 19.93
2 Syngeneic Twins	8 0.03 14.81 0.37	4 0.02 7.41 0.24	5 0.02 9.26 0.20	2 0.01 3.70 0.10	7 0.03 12.96 0.28	10 0.04 18.52 0.23	6 0.02 11.11 0.18	4 0.02 7.41 0.11	8 0.03 14.81 0.33	0 0.00 0.00 0.00	0 0.00 0.00 0.00	54 0.21
3 Matched unrelated	520 2.06 4.72 23.93	396 1.57 3.60 24.07	783 3.10 7.11 31.69	777 3.07 7.06 37.88	1008 3.98 9.16 39.97	1933 7.64 17.56 44.19	1671 6.61 15.18 49.85	2077 8.21 18.87 56.09	1466 5.79 13.32 60.11	362 1.43 3.29 66.18	16 0.06 0.15 76.19	11009 43.52
4 Alternative	1030 4.07 11.21 47.40	760 3.00 8.27 46.20	1086 4.29 11.81 43.95	741 2.93 8.06 36.13	903 3.57 9.82 35.80	1514 5.98 16.47 34.61	1078 4.26 11.73 32.16	1171 4.63 12.74 31.62	753 2.98 8.19 30.87	151 0.60 1.64 27.61	5 0.02 0.05 23.81	9192 36.33
Total	2173 8.59	1645 6.50	2471 9.77	2051 8.11	2522 9.97	4374 17.29	3352 13.25	3703 14.64	2439 9.64	547 2.16	21 0.08	25298 100.00

Unrelated donor age and donor type

Table of urdbmpbdagegpnew by prop_dnr					
urdbmpbdagegpnew(Unrelated donor age at HCT, for BM or PBSC)	prop_dnr(Proposed Donor Type)				
Frequency Percent Row Pct Col Pct	1 Matched sibling/relative	2 Syngeneic Twins	3 Matched unrelated	4 Alternative	Total
.	5043 19.93 43.01 100.00	54 0.21 0.46 100.00	0 0.00 0.00 0.00	6627 26.20 56.53 72.10	11724 46.34
1 18-29	0 0.00 0.00 0.00	0 0.00 0.00 0.00	7420 29.33 83.67 67.40	1448 5.72 16.33 15.75	8868 35.05
2 30-39	0 0.00 0.00 0.00	0 0.00 0.00 0.00	2710 10.71 80.68 24.62	649 2.57 19.32 7.06	3359 13.28
3 40-49	0 0.00 0.00 0.00	0 0.00 0.00 0.00	689 2.72 76.39 6.26	213 0.84 23.61 2.32	902 3.57
4 50+	0 0.00 0.00 0.00	0 0.00 0.00 0.00	190 0.75 80.85 1.73	45 0.18 19.15 0.49	235 0.93
Unknown	0 0.00 0.00 0.00	0 0.00 0.00 0.00	0 0.00 0.00 0.00	210 0.83 100.00 2.28	210 0.83
Total	5043 19.93	54 0.21	11009 43.52	9192 36.33	25298 100.00

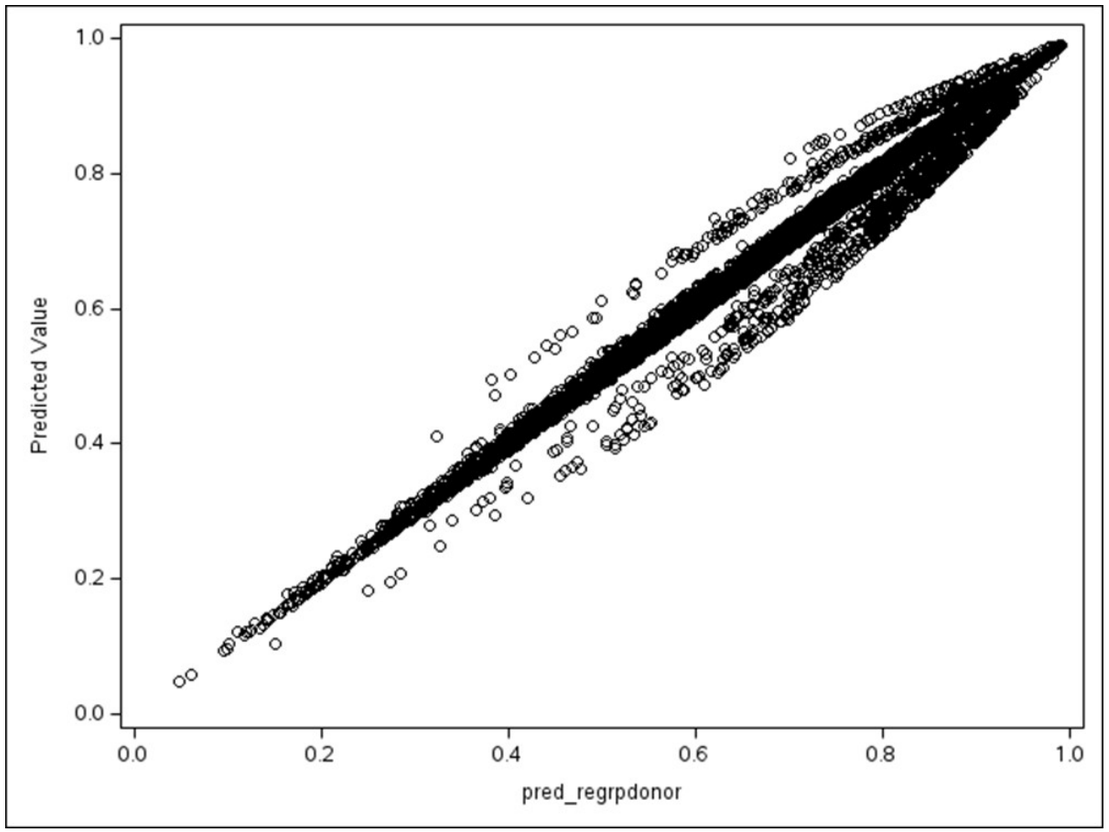
Related donor age and donor type

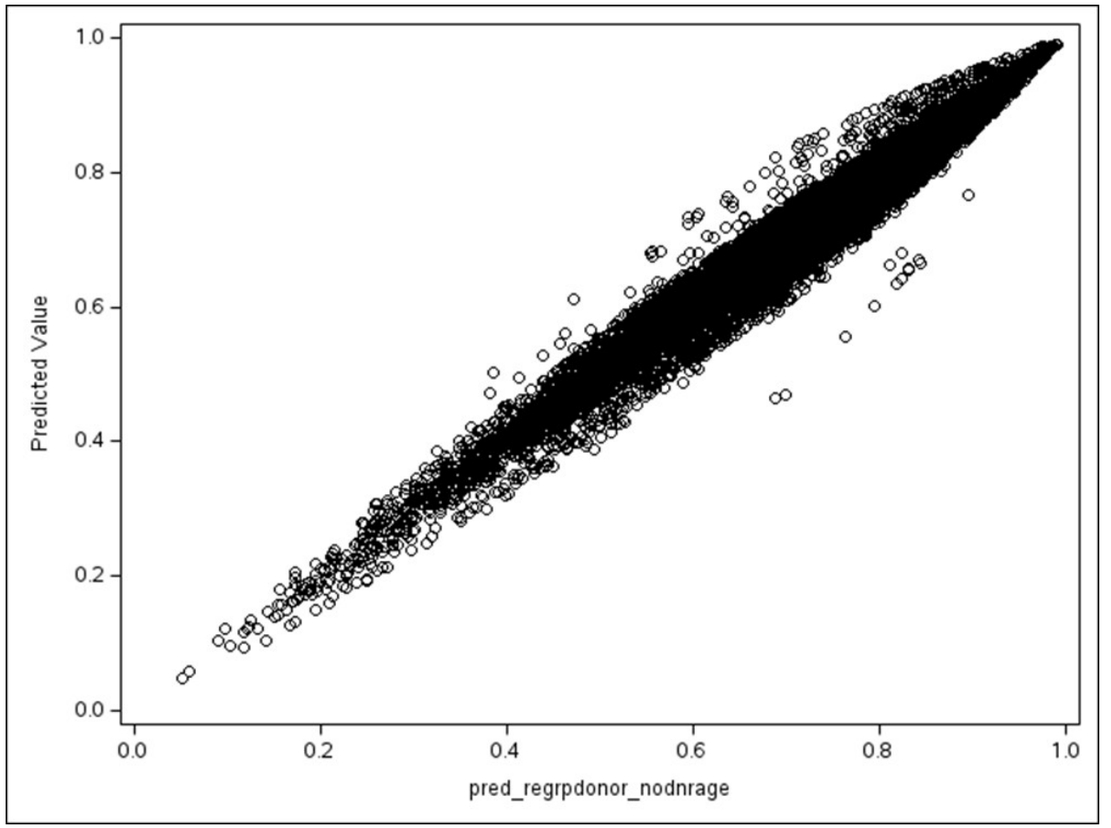
urdbmpbdagegpnew2(Related donor age at HCT, for BM or PBSC, excluding siblings and twins)	prop_dnr(Proposed Donor Type)				
Frequency Percent Row Pct Col Pct	1 Matched sibling/relative	2 Syngeneic Twins	3 Matched unrelated	4 Alternative	Total
.	4918 19.44 25.37 97.52	54 0.21 0.28 100.00	11009 43.52 56.78 100.00	3407 13.47 17.57 37.06	19388 76.64
0 0-18	9 0.04 2.13 0.18	0 0.00 0.00 0.00	0 0.00 0.00 0.00	414 1.64 97.87 4.50	423 1.67
1 18-29	32 0.13 1.70 0.63	0 0.00 0.00 0.00	0 0.00 0.00 0.00	1850 7.31 98.30 20.13	1882 7.44
2 30-39	44 0.17 2.39 0.87	0 0.00 0.00 0.00	0 0.00 0.00 0.00	1797 7.10 97.61 19.55	1841 7.28
3 40-49	27 0.11 2.31 0.54	0 0.00 0.00 0.00	0 0.00 0.00 0.00	1141 4.51 97.69 12.41	1168 4.62
4 50+	13 0.05 2.20 0.26	0 0.00 0.00 0.00	0 0.00 0.00 0.00	579 2.29 97.80 6.30	592 2.34
Unknown	0 0.00 0.00 0.00	0 0.00 0.00 0.00	0 0.00 0.00 0.00	4 0.02 100.00 0.04	4 0.02
Total	5043 19.93	54 0.21	11009 43.52	9192 36.33	25298 100.00

Potential Models and fit

- Current model: QIC=4052.9168, QICu=4308.7662
- Model 1: Regroup donor types: QIC=4053.0012, QICu=4284.2899
- Model 2: Regroup donor types, remove adjustment for donor age: QIC=4056.5841, QICu=4275.0974

Predicted Pt Outcomes Current vs Proposed models





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New vs existing model - centers

Table of outintvl by outintvl_regrpdonor				
outintvl	outintvl_regrpdonor			
Frequency	-1	0	1	Total
-1	14	1	0	15
0	0	153	0	153
1	0	0	8	8
Total	14	154	8	176

Using new alternative donor categories and including donor age, no change in center performance

Table of outintvl by outintvl_regrpdonor_nodnrage				
outintvl	outintvl_regrpdonor_nodnrage			
Frequency	-1	0	1	Total
-1	14	1	0	15
0	3	148	2	153
1	0	2	6	8
Total	17	151	8	176

Using new alternative donor categories and excluding donor age, 4.5% of centers' performance changes

Wrap up/Next steps

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COF Summary and Recommendations

- Executive Summary and Detailed Summary including discussion and recommendations are posted and archived for all COF since 2008

- https://cibmtr.org/CIBMTR/Meetings/Materials-Archive/Center-Outcomes-Forum

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Tandem 2026

Beyond the Report Card – Advancing Research and Quality through Center Specific Outcomes Reporting

- Methodology Overview
- Research informing risk adjustment
- Impact of public reporting – research findings
  - Impact on center volumes
  - Impact on patient selection
- Using the survival calculator
- Panel Discussion: How can the benefits of Center Outcomes Reporting enhance research and high quality care
- Wed Feb 4, 2026; 10:30 A – 12:00 P

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Thank you