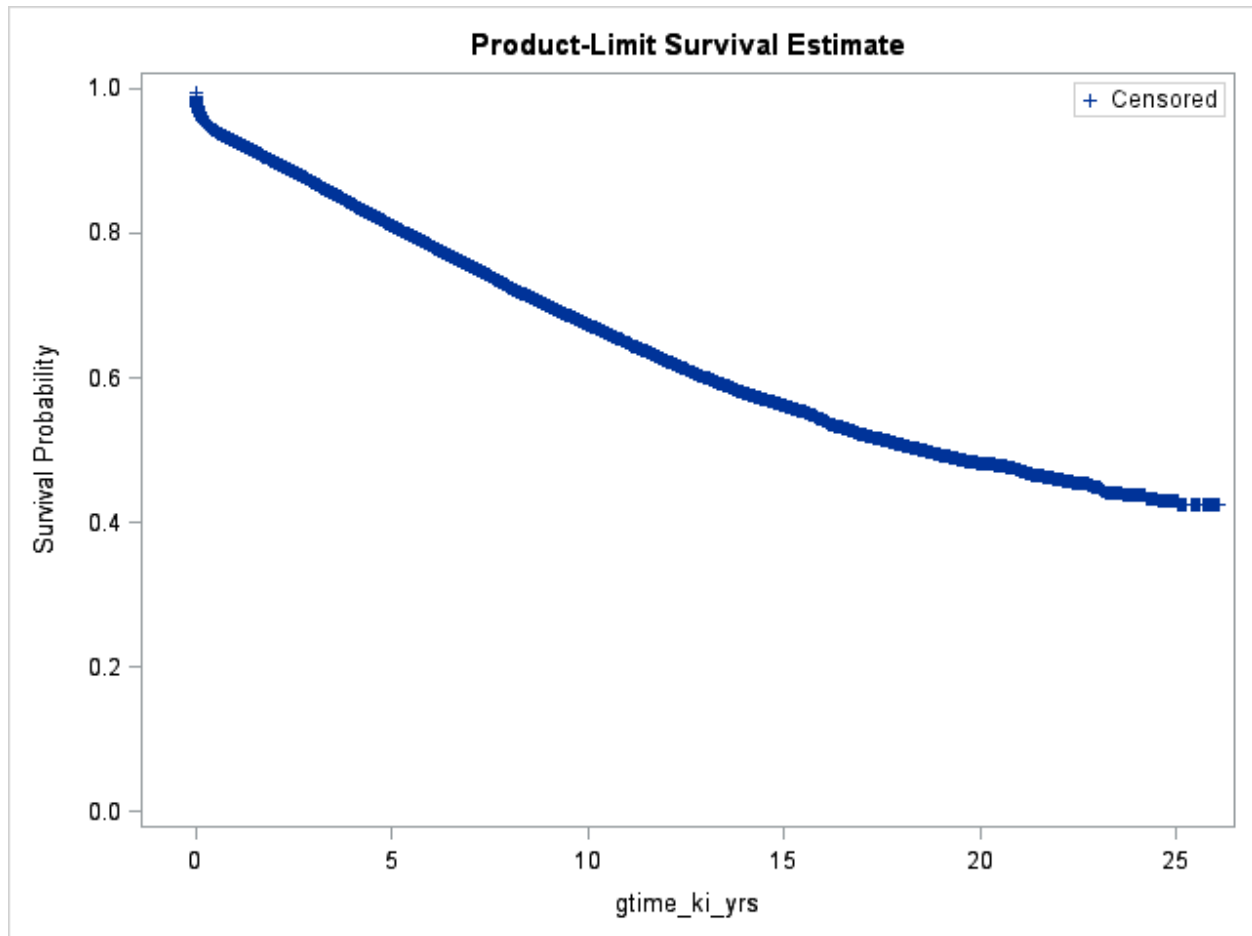


Supplementary Figure S1

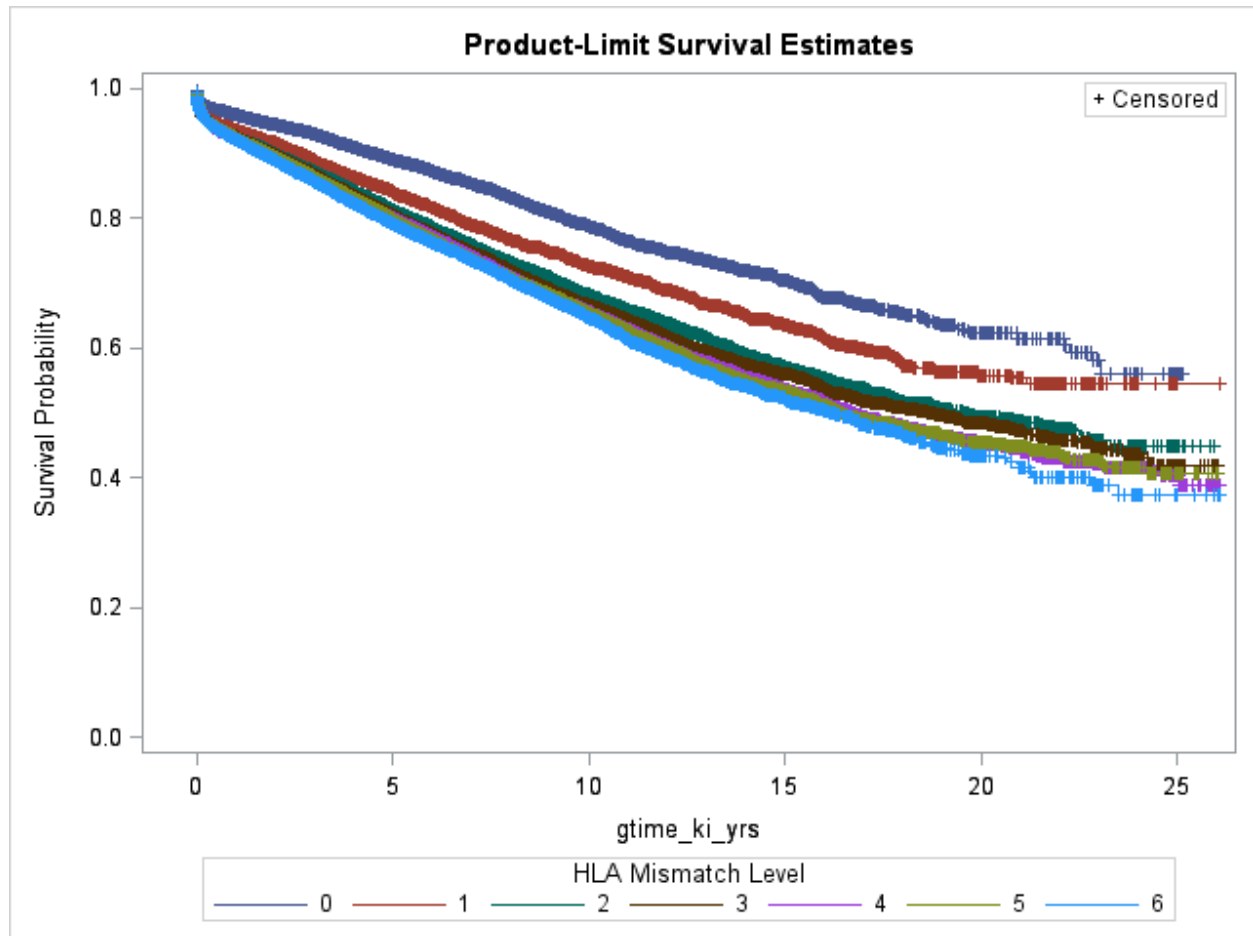
Projected Survival Time for All Allografts from Deceased Donors



Legend for Supplementary Figure 1: Illustrated is the unadjusted Kaplan-Meier curve for 189,141 allografts from deceased donors. The projected median survival is 18.0 years.

Supplementary Figure S2

Projected Survival Time for All Allografts Stratified by HLA Mismatch



Legend for Supplementary Figure 2: Here is illustrated the unadjusted Kaplan-Meier curves of the 189,141 allografts from deceased donors when stratified by HLA mismatch. For mismatch categories 0 and 1 the survival curve never reaches 0.5 probability, both having projected survival times greater than 25 years. Median survival for mismatch category 2 is 19.1 years; 3, 18.0 years; 4, 16.5 years; 5, 16.5 years; and 6 mismatches, 16.0 years.

Supplementary Figure S3

Histogram of the Z values from the 99 Groups that Approximates a $N(0,1)$ Normal Distribution

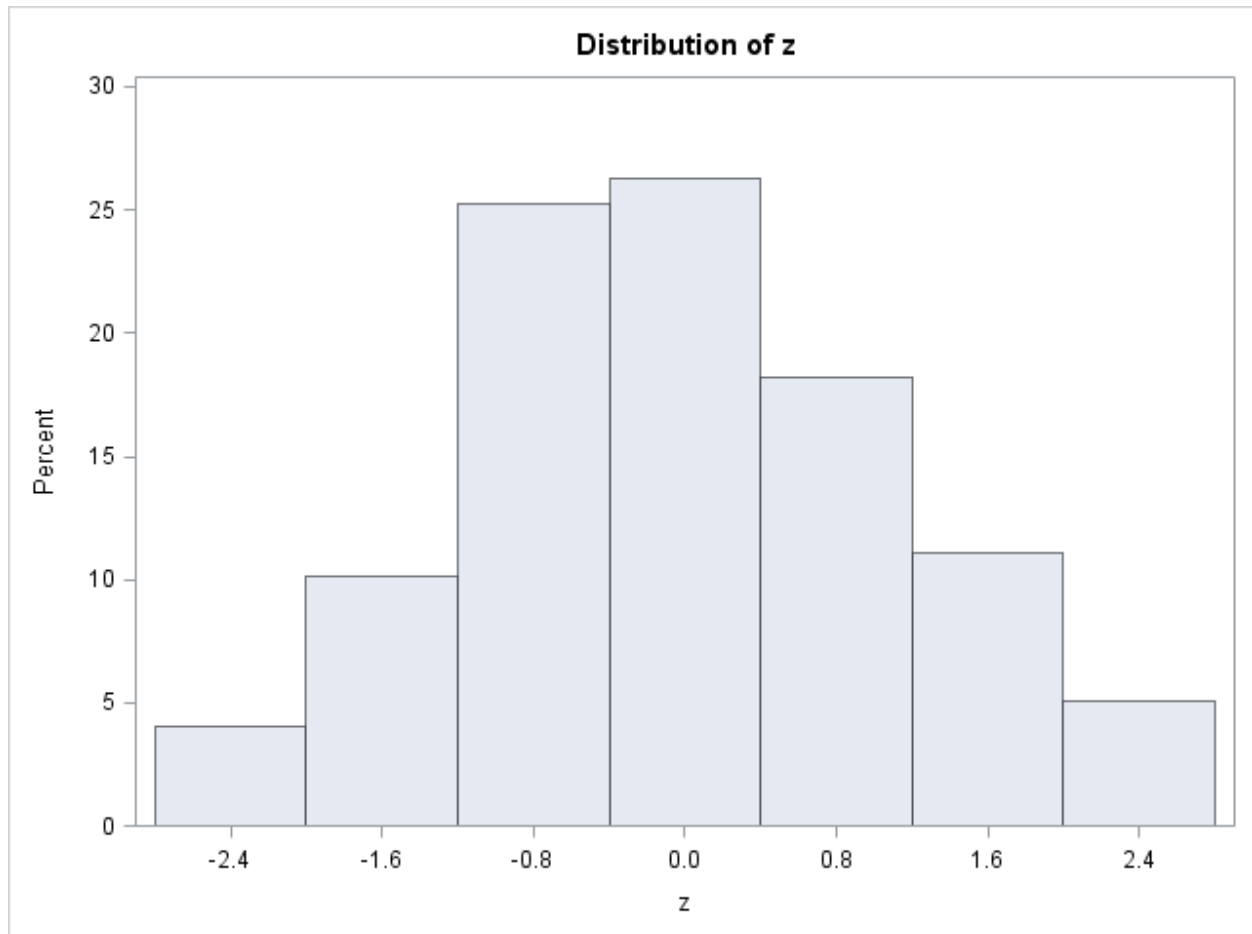
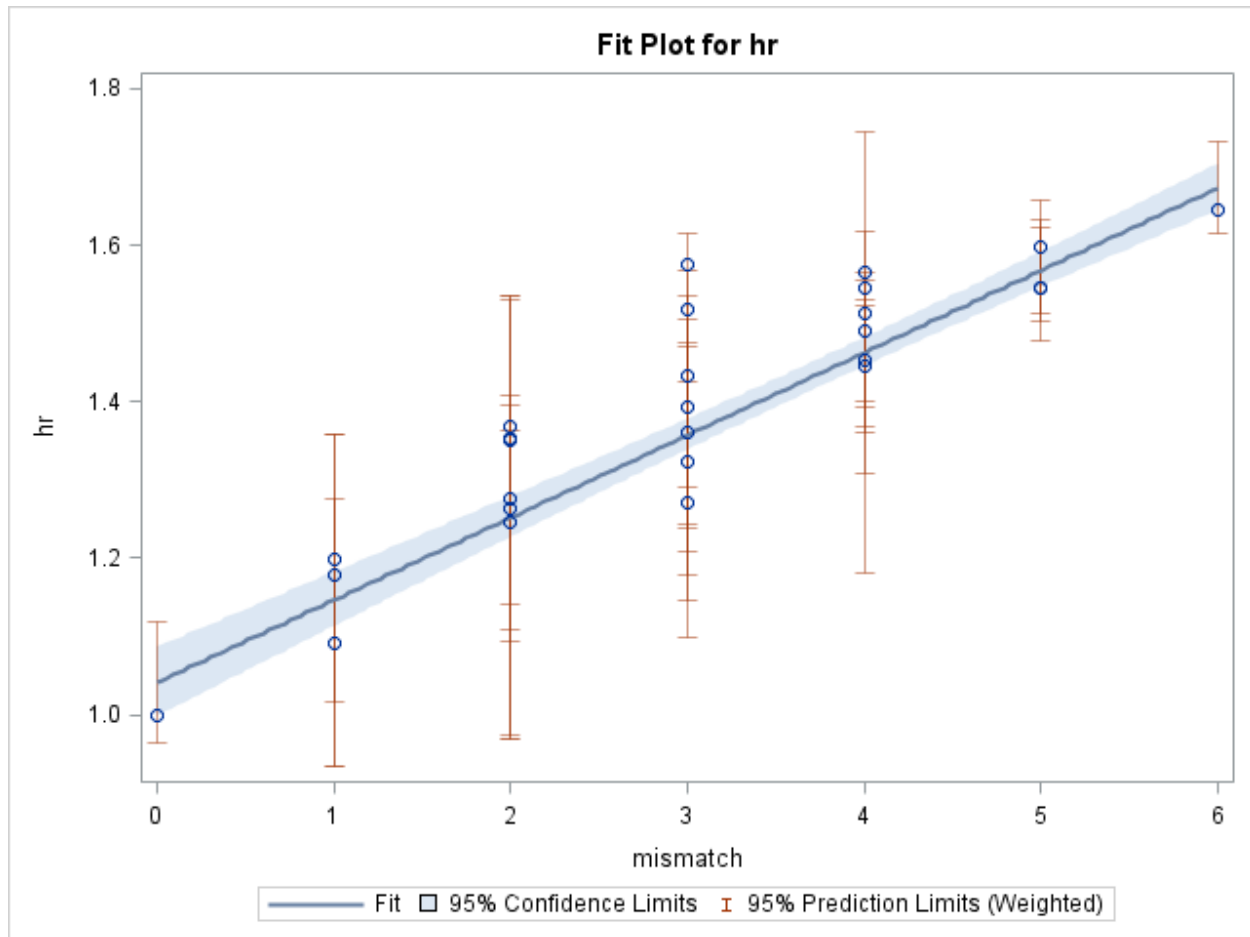


Figure Legend Supplementary Figure 3: The mean of the 99 z values was -0.04 and was not significantly different from 0.0 by t-test ($p = 0.75$); the standard deviation is 1.13, which, when the 95% empirical confidence interval is estimated with the bootstrap ($b=1000$), it includes 1.0 (0.98, 1.26); the tests for normality—Shapiro-Wilk ($p = 0.49$), Kolmogorov-Smirnov ($p = 0.15$), Cramer-von Mises ($p = 0.25$), and Anderson-Darling ($p = 0.25$)—do not reject the null hypothesis of a normal distribution, while the histogram appears normal.

Supplementary Figure S4



Supplementary Figure 4 Legend: A Cox multivariate regression was performed with the survival time of kidney allografts from deceased donors as the dependent variable and an HLA mismatch categorical variable with 27 ordered triples as the primary explanatory variable with [0,0,0] triple as the reference. HR values for the full model are presented in Table 3. The blue line is fitted to the full model observed values with intercept 1.04 (1.0, 1.09), $p < 0.0001$, and slope of 0.11 (0.09, 0.12), $p < 0.0001$. This is the same line that results from fitting a line to the collapsed HLA mismatch categories 0-6 in Figure 1. Blue shaded area is the 95% confidence limit for the fitted line while the brown lines are the weighted 95% confidence limits for the 27 triples in the model.

Supplementary Table S1

Distribution of first kidney transplants from deceased donors by UNOS region,
1987-2013

UNOS Region	Transplants	Kidney Failures	Censored	Percent Censored
1	7799	1742	6057	78
2	25924	6014	19910	77
3	27394	6001	21393	78
4	16932	3864	13068	77
5	29457	5749	23708	80
6	6816	1301	5515	80
7	15667	3431	12236	78
8	11717	2375	9342	80
9	11868	2880	8988	75
10	16767	4005	12762	76
11	18800	4625	14175	75
Total	189141	41987	147154	78

Supplementary Table S2

Creation of immunosuppression and maintenance at discharge variables

		Maintenance Drugs in Groups					
	Maintenance Group Permutation	<u>Group1</u> Cyclosporin Neoral® Sandimmune®	<u>Group2</u> Tacrolimus Prograf®	<u>Group3</u> Mycophenolate Cellcept® Myfortic®	<u>Group4</u> Azathioprine Imuran®	<u>Group5</u> Rapamycin Sirolimus Rapamune®	<u>Group6</u> Steroids ^a Prednisone Methylprednisolone
1	Maint236	No	Yes	Yes	No	No	Yes or No
2	Maint146	Yes	No	No	Yes	No	Yes or No
3	Maint136	Yes	No	Yes	No	No	Yes or No
4	Maint36	No	No	Yes	No	No	Yes or No
5	Maint16	Yes	No	No	No	No	Yes or No
6	Maint26	No	Yes	No	No	No	Yes or No
7	Maint156	Yes	No	No	No	Yes	Yes or No
8	Maint46	No	No	No	Yes	No	Yes or No

a: In order to test the difference in the use of steroids versus no steroids in the induction and immunosuppression variables, new categorical variables were created for each therapy that included 3 values: steroids, no steroids, and other therapy. Each was tested in a Cox model with age, sex, transplant era, ethnicity, and HLA mismatch as covariates with combined steroid therapy as the reference. For the induction variables there was no drug without steroids that had an HR significantly different from 1.0 when compared to the combined treatment. For the immunosuppression maintenance variables at discharge, 5 of the therapies without steroids had significant HRs different from 1.0 when compared to the reference: Maint1, Maint2, Maint23, Maint3, and Maint4. However, in spite of the differences just described, when the induction and maintenance variables were expanded to include values for both steroid and non-steroid use and incorporated into the full Cox model, the estimates of the hazard ratios for mismatch categories 1-6 were very close to those in Table 2 (data not shown).

Supplementary Table S3

Ordinary Least Square Regression of 41,987 Schoenfeld Residuals of Individual Cox Model Variables on Survival Time of First Adult Kidneys to Test the Proportional Hazards Assumption by Variable

Variable	Beta	Standard Error	R-Square	P
Recipient Age	6.12×10^{-6}	1.46×10^{-6}	0.0004	<.0001
Donor Age	1.44×10^{-6}	1.30×10^{-6}	0.0000	0.2665
Recipient Gender	-5.80×10^{-6}	1.17×10^{-6}	0.0006	<.0001
Five Year Intervals	6.08×10^{-6}	1.29×10^{-6}	0.0005	<.0001
Ethnicity	3.36×10^{-6}	1.34×10^{-6}	0.0001	0.0123
Cold Ischemia Time	-1.48×10^{-6}	1.44×10^{-6}	0.0000	0.3027
Peak PRA	-9.11×10^{-6}	1.60×10^{-6}	0.0008	<.0001
Education	1.14×10^{-5}	1.40×10^{-6}	0.0016	<.0001
Recipient BMI	1.96×10^{-6}	1.29×10^{-6}	0.0001	0.1304
Donor BMI	-1.14×10^{-7}	1.13×10^{-6}	0.0000	0.9195
Diabetes Before Tx	1.58×10^{-6}	7.26×10^{-7}	0.0001	0.0290
Working at Tx	3.17×10^{-6}	9.46×10^{-7}	0.0003	0.0008
Drug Treatment COPD	1.21×10^{-6}	5.89×10^{-7}	0.0001	0.0396
Dialysis Type	1.08×10^{-5}	1.51×10^{-6}	0.0012	<.0001
Induction	3.19×10^{-7}	3.01×10^{-7}	0.0000	0.2899
Immunosuppression	3.25×10^{-7}	1.99×10^{-7}	0.0001	0.1037
HLA Mismatch	-1.12×10^{-6}	7.54×10^{-7}	0.0001	0.1378

Supplementary Table S4

Results of the May and Hosmer (1998) Goodness of Fit Test for the Proportional Hazards Model. Group 100 is the Reference. Data Closely Approximate a Z-normal $N(0, 1)$ Distribution that Indicates a Well-Specified Cox Regression Model.

Risk Order Groups	Observed Events	Expected Events	z
1	36	41.22	-0.81274
2	53	53.08	-0.01148
3	43	60.71	-2.27264
4	70	68.96	0.12543
5	63	73.51	-1.22534
6	55	79.32	-2.73046
7	80	85.86	-0.63194
8	91	92.27	-0.13242
9	85	93.65	-0.89335
10	90	103.12	-1.29191
11	105	106.54	-0.14946
12	100	114.36	-1.34311
13	131	116.4	1.35281
14	125	120.41	0.41791
15	117	127.89	-0.96276
16	138	134.95	0.26215
17	134	136.61	-0.22321
18	144	140.2	0.32085
19	152	152.18	-0.01474
20	144	153.48	-0.76532
21	132	157.05	-1.99925
22	162	160.49	0.1192
23	170	161.86	0.63969
24	159	176.53	-1.31963
25	180	179.19	0.06058
26	174	188.68	-1.06883
27	200	189.09	0.79372
28	188	199.35	-0.80387
29	186	205.19	-1.3397
30	183	209.92	-1.85827
31	213	220.54	-0.50792
32	206	223.12	-1.14588
33	194	237.11	-2.79992
34	228	243.27	-0.97888
35	229	245.57	-1.05747
36	263	252.02	0.69178
37	262	260.81	0.07353
38	269	264.26	0.29154

39	270	275.39	-0.32485
40	293	277.08	0.9567
41	286	276.12	0.59452
42	274	290.46	-0.96555
43	324	286.96	2.18655
44	285	308.19	-1.32117
45	307	320.57	-0.75805
46	306	321.98	-0.89051
47	290	326.62	-2.02607
48	325	340.31	-0.82992
49	338	340.4	-0.13003
50	333	350.56	-0.93762
51	387	364.65	1.17038
52	380	354.76	1.33999
53	388	373.01	0.7762
54	386	367.67	0.95609
55	390	383.27	0.34395
56	410	409.66	0.01697
57	401	414.67	-0.67125
58	428	412.59	0.75884
59	451	417.71	1.6287
60	434	448.67	-0.69254
61	455	455.67	-0.03147
62	459	452.98	0.28277
63	474	475.23	-0.05646
64	501	484.62	0.744
65	501	489.13	0.53683
66	507	489.07	0.81099
67	522	495.21	1.20381
68	486	516.34	-1.33515
69	512	513.04	-0.04613
70	562	532.62	1.27315
71	569	540.76	1.2144
72	610	554.78	2.34422
73	626	581.22	1.85724
74	585	606.05	-0.85521
75	637	582.55	2.25612
76	618	628.25	-0.40896
77	632	623.66	0.33411
78	675	651.04	0.93898
79	657	659.79	-0.10843
80	701	644.67	2.21862
81	704	683.22	0.79484
82	715	677.46	1.44213
83	681	695.75	-0.55921

84	740	693.77	1.75506
85	721	705.91	0.56796
86	779	714.25	2.42292
87	779	742.4	1.34337
88	791	772.36	0.67065
89	785	780.07	0.17634
90	829	793.87	1.24692
91	840	819.66	0.71056
92	868	871.59	-0.12167
93	931	920.44	0.34823
94	912	940.89	-0.94183
95	948	982.1	-1.08822
96	983	1010.85	-0.87598
97	1023	1025.66	-0.08302
98	1057	1095.76	-1.17099
99	1127	1177.7	-1.47725

Supplementary Table S5

Test of 57 Within Mismatch Category Hazard Ratios^a Ordered by p Value in a Sequential Holm-Bonferroni Adjustment for Multiple Tests. Adjusted p (adj_p) = 0.05 / Adjustment N, the Inverse Ordered Number of the Test

Mismatch Category	Comparison Triples	Wald Chi-Square, 1 d.f.	p	adj_p	p < adj_p	Adjustment N
3	[0,1,2]:[2,1,0]	13.6589	0.0002	0.0009	Yes	57
3	[0,1,2]:[1,2,0]	8.5697	0.0034	0.0009	No	56
3	[0,1,2]:[1,1,1]	7.6354	0.0057	0.0009	No	55
3	[1,0,2]:[2,1,0]	7.1310	0.0076	0.0009	No	54
3	[0,2,1]:[2,1,0]	5.9690	0.0146	0.0009	No	53
3	[1,1,1]:[2,1,0]	4.2362	0.0396	0.0010	No	52
3	[1,0,2]:[1,2,0]	4.0962	0.0430	0.0010	No	51
3	[0,1,2]:[2,0,1]	3.3734	0.0663	0.0010	No	50
3	[2,0,1]:[2,1,0]	3.2952	0.0695	0.0010	No	49
3	[1,0,2]:[1,1,1]	3.0975	0.0784	0.0010	No	48
4	[1,1,2]:[2,1,1]	2.5522	0.1101	0.0011	No	47
3	[0,2,1]:[1,2,0]	2.4696	0.1161	0.0011	No	46
2	[0,1,1]:[1,0,1]	2.3397	0.1261	0.0011	No	45
5	[1,2,2]:[2,2,1]	2.2723	0.1317	0.0011	No	44
2	[0,1,1]:[1,1,0]	2.2280	0.1355	0.0012	No	43
3	[0,1,2]:[0,2,1]	2.1455	0.1430	0.0012	No	42
1	[0,0,1]:[1,0,0]	2.1107	0.1463	0.0012	No	41
4	[0,2,2]:[2,1,1]	2.0815	0.1491	0.0013	No	40
4	[1,2,1]:[2,1,1]	1.6713	0.1961	0.0013	No	39
1	[0,0,1]:[0,1,0]	1.4867	0.2227	0.0013	No	38
1	[0,1,0]:[1,0,0]	1.4867	0.2227	0.0014	No	37
4	[0,2,2]:[2,2,0]	1.4608	0.2268	0.0014	No	36
3	[0,2,1]:[1,1,1]	1.4597	0.2270	0.0014	No	35
4	[2,0,2]:[2,1,1]	1.4581	0.2272	0.0015	No	34
5	[1,2,2]:[2,1,2]	1.3473	0.2457	0.0015	No	33
3	[1,0,2]:[2,0,1]	1.3146	0.2516	0.0016	No	32
4	[1,1,2]:[2,2,0]	1.2923	0.2556	0.0016	No	31
2	[0,2,0]:[1,0,1]	1.2219	0.2690	0.0017	No	30
4	[2,0,2]:[2,2,0]	1.1521	0.2831	0.0017	No	29
2	[1,0,1]:[2,0,0]	1.1102	0.2920	0.0018	No	28
2	[0,2,0]:[1,1,0]	1.0043	0.3163	0.0019	No	27
3	[1,2,0]:[2,0,1]	0.9938	0.3188	0.0019	No	26
2	[1,1,0]:[2,0,0]	0.8892	0.3457	0.0020	No	25
3	[1,2,0]:[2,1,0]	0.8846	0.3469	0.0021	No	24
3	[0,2,1]:[1,0,2]	0.6301	0.4273	0.0022	No	23
4	[1,2,1]:[2,2,0]	0.6282	0.4280	0.0023	No	22

4	[0,2,2]:[1,2,1]	0.6246	0.4293	0.0024	No	21
3	[1,1,1]:[1,2,0]	0.6120	0.4340	0.0025	No	20
2	[0,0,2]:[0,1,1]	0.5799	0.4463	0.0026	No	19
4	[1,2,1]:[2,0,2]	0.5573	0.4553	0.0028	No	18
2	[0,0,2]:[0,2,0]	0.4972	0.4807	0.0029	No	17
2	[0,0,2]:[2,0,0]	0.3924	0.5310	0.0031	No	16
3	[1,1,1]:[2,0,1]	0.3002	0.5838	0.0033	No	15
4	[1,1,2]:[1,2,1]	0.2975	0.5855	0.0036	No	14
4	[1,1,2]:[2,0,2]	0.2430	0.6221	0.0039	No	13
3	[0,1,2]:[1,0,2]	0.2217	0.6377	0.0042	No	12
3	[0,2,1]:[2,0,1]	0.2157	0.6423	0.0046	No	11
4	[0,2,2]:[1,1,2]	0.1801	0.6713	0.0050	No	10
2	[0,0,2]:[1,0,1]	0.0874	0.7675	0.0056	No	9
2	[1,0,1]:[1,1,0]	0.0754	0.7837	0.0063	No	8
2	[0,1,1]:[0,2,0]	0.0270	0.8696	0.0071	No	7
4	[0,2,2]:[2,0,2]	0.0267	0.8702	0.0083	No	6
4	[2,1,1]:[2,2,0]	0.0259	0.8721	0.0100	No	5
2	[0,0,2]:[1,1,0]	0.0177	0.8942	0.0125	No	4
2	[0,2,0]:[2,0,0]	0.0126	0.9106	0.0167	No	3
2	[0,1,1]:[2,0,0]	0.0009	0.9765	0.0250	No	2
5	[2,1,2]:[2,2,1]	0.0002	0.9894	0.0500	No	1

a: adjustment for recipient age, donor age, donor sex, transplant era, recipient ethnicity, recipient diabetes, cold ischemia time, recipient peak PRA, recipient education, recipient BMI, donor BMI, recipient working for income at transplant, recipient COPD, recipient dialysis type, induction and immunosuppression at discharge.

Supplementary Table S6

Hazard Ratios and their 95% Confidence Intervals for Cox Variables in the Full Model
with Missing Values

Variable	Value	HR	95% C.I.	p
Cold Ischemia Time > 25 hrs	Unknown	0.99	0.96, 1.03	0.7636
Peak PRA > 50%	Unknown	0.99	0.95, 1.03	0.5976
Recipient Education Level	Unknown	0.98	0.95, 1.01	0.1796
Recipient BMI > 30	Unknown	1.02	0.98, 1.06	0.3087
Donor BMI > 30	Unknown	1.08	1.05, 1.10	<.0001
Diabetes before Transplant	Unknown	1.13	1.05, 1.21	0.0010
Working at Transplant	Unknown	0.87	0.83, 0.92	<.0001
Drug Treatment for COPD.	Unknown	0.98	0.93, 1.03	0.4566
Dialysis Type	Unknown	0.82	0.78, 0.86	<.0001