Supplemental Tables and Figures

Supplemental Table 1. Characteristics of patients who were excluded within 100 days after allogeneic HSCT.

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Supplemental Table 3. Immune reconstitution after allogeneic HSCT represented as absolute cell numbers (cells /μL) and IgG (mg/dL) levels measured at various time points and classified according to graft sources. Median values of temporal measurements are listed according to graft sources.

Supplemental Table 4. Comparison of median and cut-off values, using Kruskal–Wallis one-way analysis and ROC according to graft sources, respectively.

Supplemental Figure 1. Distinct differences in recovery of NK cell and B cell subsets as a function of conditioning intensity and graft source. Regarding NK cell recovery, a reduced conditioning intensity resulted in rapid IR in patients who received UCB. By contrast, there was a significant difference in stem cell source, rather than conditioning intensity, important for B cell recovery.

Supplemental Figure 2. Heat map of temporal reconstitution of lymphocytes for OS at different landmark time points. Univariate analysis showing HRs and P-values for each lymphocyte at different time points. Median cell counts were used for landmark analyses. $*P < 0.05$; $**P < 0.01$; $***P < 0.001$. CD4$^+$ T cell subsets demonstrated clinical significance during the early phase. The counts of almost every cell type showed clinical difference on day 100 after allogeneic HSCT. CD20$^+$ B cell and NK cell subsets continued to have a clinical impact on long-term outcomes.

Supplemental Figure 3. Graft-validated outcomes at 2 years after allogeneic HSCT based on key cell subsets, namely, CD20$^+$ B cells, CD8$^+$CD11b$^-$ T cells, and CD16$^+$CD57- NK cells. $**P < 0.01$; $***P < 0.001$. Higher counts of these key cells conferred a survival benefit to all recipients regardless of the graft source.

Supplemental Table 1.
Characteristics of patients who were excluded within 100 days after allogeneic HSCT.

	excluded patients (N=48)	CB (N=17)	BM (N=18)	PBSC (N=13)	p value
Events, n (%)					
Early death	23 (47.8)	3	12	8	0.0078
Disease progression	4 (8.3)	2	2	0	NA
Non-relapse mortality	19 (39.5)	1	10	8	0.002
Primary graft failure	21 (44.8)	10	6	5	0.285
Absent of IR data at 100 days	4 (8.3)	4	0	0	NA

NA, no available P value by Fisher exact probability test.
CB, cord blood; BM, bone marrow; PBSC, peripheral blood stem cell IR; immune reconstitution.

Supplemental Table 2.
Incidence of posttransplant events such as acute GVHD, CMV reactivation, and infection within 100 days after allogeneic HSCT.

		ALL (N=310)	CB (N=136)	BM (N=119)	PBSC (N=55)	p value
Events, n (%)						
Acute GVHD						
Grade	0	140 (45.2)	69 (50.7)	42 (35.2)	29 (52.7)	<0.001
	I	40 (12.9)	18 (13.2)	17 (14.3)	5 (9.1)	
	II	101(32.6)	42 (30.9)	46 (38.7)	13 (23.6)	
	III	16 (5.2)	5 (3.7)	8 (6.7)	3 (5.5)	
	IV	13 (4.2)	2 (1.5)	6 (5.1)	5 (9.1)	
Target organs						
grade II to IV	Total	130 (42.0)	49 (36.0)	60 (50.4)	21 (38.2)	0.08
	Skin	81(26.1)	29 (21.3)	42 (35.3)	10 (18.2)	
	Liver	4 (1.3)	1 (0.7)	2 (1.7)	1 (1.8)	
	Gut	35 (11.3)	19 (13.9)	16 (13.4)	10 (18.2)	
CMV reactivation						
	Yes	169 (54.5)	83 (61.0)	64 (53.8)	22 (40.0)	0.029
	No	141 (45.5)	53 (39.0)	55 (46.2)	33 (60.0)	
Pretransplant infection						
	Yes	28 (9.0)	10 (7.4)	11 (9.2)	7 (12.7)	0.499
	No	282 (91)	126 (92.6)	108 (90.8)	48 (87.3)	
Severe infection						
	Yes	87 (28.1)	46 (33.8)	37 (31.1)	8 (14.5)	0.016
	No	223 (71.9)	90 (66.2)	82 (68.9)	47 (85.5)	

CB: cord blood, BM: bone marrow, PBSC: peripheral blood stem cell, HCT-CI: hematopoietic cell transplantation-specific comorbidity index, GVHD: graft-versus-host disease, CMV: cytomegalovirus.
CMV reactivation was defined as the start of CMV preemptive therapy.
Intravenous foscarnet (FCV), ganciclovir (GCV), or oral Valganciclovir were administered as CMV preemptive therapy. Pretransplantat infection was described when patients had treatment for active bacterial/fungial/viral infection at the time of allo-SCT. Severe Infection was defined as any clinical records of blood stream infections and/or requiring intensive care unit after allo-SCT.

Supplemental Table 3. Immune reconstitution after allogeneic HSCT represented as absolute cell numbers (cells/µL) and IgG (mg/dL)levels measured at various time points and classified according to graft sources. Median values of temporal measurements are listed according to graft sources.

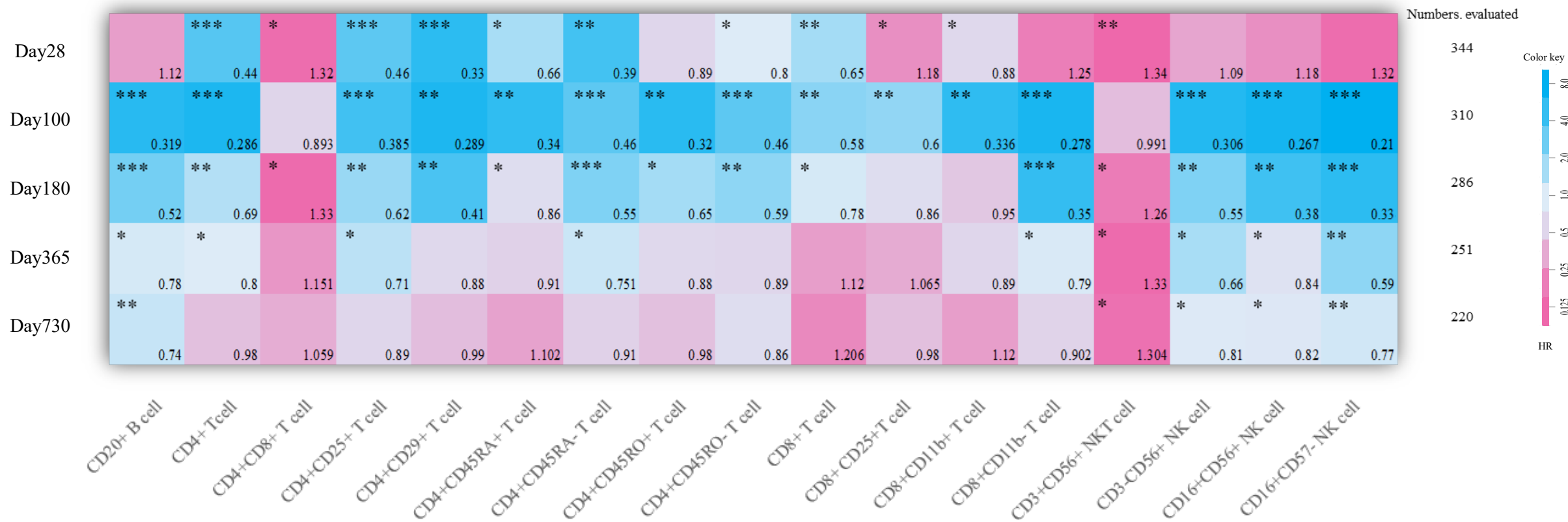| Cells#	Day28 Overall	Day28 CB	Day28 BM	Day28 PBSC	Day100 Overall	Day100 CB	Day100 BM	Day100 PBSC	Day180 Overall	Day180 CB	Day180 BM	Day180 PBSC	Day365 Overall	Day365 CB	Day365 BM	Day365 PBSC	Day730 Overall	Day730 CB	Day730 BM	Day730 PBSC
		Median (range), p value				Median (range), p value				Median (range), p value				Median (range), p value				Median (range), p value		
ALC	480 (27-3290)	420 (36-1888)	448 (27-2756)	755 (70-3290) P<0.001	1226 (20-3996)	1672 (84-1996)	1200 (20-2788)	977 (144-3996) P<0.001	1318 (84-5966)	2153 (84-1996)	1271 (152-5966)	1225 (78-4524) P<0.001	2015 (27-6864)	2524 (135-6864)	1416 (27-5150)	1656 (240-4902) P<0.001	2069 (405-6384)	2555 (988-6384)	1880 (405-5628)	1725 (620-5642) P<0.001
IgG	845 (85-2180)	843 (189-1600)	848 (88-2180)	832 (85-2010) P=0.683	806 (25-2226)	853 (75-2200)	780 (115-1940)	741 (25-2226) P=0.465	945 (105-2382)	1080 (205-2382)	860 (232-2079)	864 (105-1937) P<0.001	1089 (325-4010)	1185 (441-4010)	1055 (512-3110)	977 (325-2875) P=0.028	1070 (625-4402)	1067 (829-4018)	1075 (732-4402)	1051 (625-3511) P=0.951
CD20+ B cell	33 (2-410)	25 (2-142)	32 (6-245)	35 (10-410) P=0.410	110 (7-1970)	395 (125-1970)	50 (13-500)	86 (7-779) P<0.001	272 (5-1640)	318 (16-1640)	142 (5-1055)	99 (11-580) P<0.001	520 (2-3929)	873 (8-3929)	520 (2-1283)	143 (6-857) P=0.021	531 (8-2852)	876 (307-2852)	280 (8-1027)	315 (29-991) P=0.032
CD4+ T cell	95 (6-590)	86 (10-455)	111 (6-389)	185 (8-590) P=0.018	262 (3-952)	275 (16-952)	239 (4-946)	270 (3-655) P=0.002	356 (22-1624)	413 (28-1624)	257 (22-1079)	335 (25-1466) P<0.001	396 (14-1495)	513 (14-1496)	376 (69-950)	425 (31-784) P<0.001	472 (54-1577)	498 (155-1577)	491 (54-1310)	398 (193-849) P=0.21
CD4+CD8+ T cell	4 (0-188)	2 (0-12)	4 (0-14)	8 (2-188) P=0.020	6 (1-206)	6 (2-12)	5 (1-16)	6 (1-206) P=0.628	9 (1-36)	12 (3-36)	8 (3-22)	8 (1-31) P=0.162	15 (1-39)	22 (1-39)	13 (2-25)	10 (1-29) P=0.012	17 (2-30)	16 (2-29)	19 (4-30)	17 (7-26) P<0.001
CD4+CD25+ T cell	38 (2-319)	18 (2-98)	44 (6-120)	50 (6-319) P<0.001	67 (2-579)	78 (6-579)	53 (2-330)	96 (2-390) P<0.001	91 (8-381)	114 (10-381)	68 (8-318)	218 (12-321) P=0.146	134 (1-431)	141 (1-431)	159 (7-313)	118 (11-397) 0.005	165 (13-497)	183 (31-329)	167 (13-281)	108 (74-497) P=0.021
CD4+CD29+ T cell	92 (3-928)	44 (6-319)	118 (12-469)	162 (8-927) P=0.008	224 (3-1314)	247 (10-1314)	187 (3-935)	227 (5-640) P=0.005	310 (10-1484)	397 (10-1314)	245 (39-1108)	245 (24-1484) P<0.001	375 (17-1426)	489 (17-1411)	364 (47-924)	360 (31-1426) P=0.002	488 (10-1562)	491 (129-1562)	504 (10-1337)	473 (162-812) P=0.204
CD4+CD45RO+ T cell	89 (1-426)	28 (1-268)	101 (1-426)	124 (2-418) P=0.016	194 (2-881)	216 (10-881)	171 (2-841)	190 (5-489) P=0.002	260 (0-160)	333 (0-1602)	201 (37-898)	209 (21-959) P<0.001	341 (5-1263)	386 (5-1263)	330 (75-809)	291 (33-728) P=0.002	335 (21-3606)	368 (119-1439)	325 (21-3606)	340 (128-591) P=0.462
CD4+CD45RO- T cell	32 (0-342)	28 (0-112)	36 (0-288)	33 (3-185) P=0.680	31 (0-515)	42 (0-515)	23 (0-171)	38 (0-193) P<0.001	37 (0-538)	62 (0-416)	29 (3-137)	42 (3-538) P<0.001	55 (3-539)	70 (3-539)	45 (4-284)	56 (3-166) P=0.003	74 (3-435)	71 (14-435)	52 (3-228)	101 (35-307) P=0.024
CD4+CD45RA+ T cell	49 (1-115)	12 (1-42)	48 (4-98)	52 (8-115) P<0.001	114 (2-911)	154 (3-911)	85 (2-815)	139 (3-581) P<0.001	153 (0-1366)	255 (0-997)	102 (12-916)	138 (16-1366) P<0.001	205 (12-1507)	336 (12-1507)	163 (15-678)	219 (14-535) P<0.001	269 (43-1144)	308 (45-1144)	212 (43-737)	252 (121-559) P=0.053
CD4+CD45RA- T cell	38 (0-99)	18 (0-33)	42 (2-88)	38 (1-128) P=0.195	94 (2-610)	104 (3-610)	80 (2-325)	59 (3-281) P<0.001	183 (0-1450)	210 (6-1450)	155 (12-696)	164 (16-945) P<0.001	200 (12-1204)	360 (15-1204)	359 (15-987)	318 (14-1035) P=0.053	220 (45-1205)	235 (65-1205)	250 (43-899)	252 (61-559) P=0.58
CD8+ T cell	155 (2-610)	48 (2-98)	205 (6-320)	165 (6-610) P<0.001	465 (1-2904)	285 (8-2624)	320 (1-2904)	377 (6-762) P=0.21	575 (0-1640)	319 (0-1640)	652 (5-1055)	619 (11-850) P<0.001	599 (5-1330)	489 (45-1330)	570 (16-932)	610 (5-860) P<0.001	260 (18-1230)	716 (60-1230)	529 (18-1287)	585 (18-1387) P=0.086
CD8+CD11b+ T cell	133 (3-366)	30 (3-55)	104 (3-210)	115 (5-348) P=0.002	374 (7-3452)	285 (7-2246)	422 (13-3452)	374 (22-2368) P=0.006	432 (0-4152)	427 (0-2649)	471 (23-2239)	432 (7-4152) P=0.197	519 (1-3819)	499 (1-1985)	504 (122-3819)	629 (82-1542) P=0.318	485 (78-2184)	435 (78-1597)	440 (92-2184)	574 (171-1323) P=0.629
CD8+CD11b- T cell	30 (2-82)	24 (2-42)	32 (3-58)	36 (4-82) P=0.655	69 (0-937)	40 (1-937)	103 (0-712)	92 (1-746) P<0.001	83 (0-784)	56 (0-370)	119 (12-772)	112 (12-784) P<0.001	115 (1-1045)	96 (1-618)	133 (40-1045)	147 (24-367) P=0.036	154 (13-555)	317 (13-535)	166 (15-555)	140 (39-278) P=0.119
CD3+CD56+ NKT cell	48 (2-289)	12 (2-62)	46 (6-220)	62 (6-289) P<0.001	21 (1-1930)	12 (1-256)	83 (1-1930)	46 (1-261) P<0.001	21 (0-1832)	13 (0-208)	37 (3-1832)	47 (6-200) P<0.001	20 (0-1034)	17 (0-365)	20 (3-1034)	46 (11-210) P<0.001	52 (6-914)	19 (6-74)	56 (10-914)	82 (8-221) P<0.001
CD3-CD56+ NK cell	175 (1-780)	132 (1-641)	189 (5-334)	229 (3-780) P<0.001	223 (2-2150)	351 (17-2150)	170 (2-1945)	143 (2-1372) P<0.001	226 (0-2295)	350 (0-2295)	165 (16-1632)	131 (10-1395) P<0.001	298 (15-1352)	324 (32-1167)	181 (34-947)	166 (15-1352) P<0.001	305 (50-1512)	324 (97-675)	184 (50-1512)	250 (51-368) P=0.021
CD16+CD57+ NK cell	88 (2-491)	62 (2-328)	74 (4-310)	80 (6-398) P=0.059	156 (1-2934)	161 (6-2934)	152 (1-2227)	161 (5-1394) P=0.605	228 (0-2216)	296 (0-2407)	199 (18-2216)	165 (12-1498) P=0.016	342 (1-2563)	404 (1-2235)	344 (40-2563)	252 (30-1291) P=0.048	355 (2-1981)	403 (45-1981)	366 (2-1914)	279 (79-694) P=0.768
CD16+CD57- NK cell	44 (1-242)	22 (1-132)	26 (1-188)	25 (2-242) P=0.186	245 (3-1825)	439 (276-1825)	172 (3-1359)	158 (12-675) P<0.001	260 (0-3356)	460 (0-3356)	163 (34-817)	176 (16-252) P<0.001	226 (6-1672)	407 (6-1672)	188 (41-765)	190 (28-532) P<0.001	245 (4-1227)	317 (88-1227)	191 (4-549)	238 (103-597) P=0.019

Absolute cell counts (cells/µL)

Supplemental Table 4. Comparison of median and cut-off values, using Kruskal–Wallis one-way analysis and ROC according to graft sources, respectively.

| Cells#	Day100 median values of cell counts Overall	CB	BM	PBSC	Day100 cut-off values by ROC methods (OS) Overall	CB	BM	PBSC
	Overall	CB	BM	PBSC	Overall	CB	BM	PBSC
	Median (range), p value				cut-off [AUC] (95% CI)			
ALC	1226 (20-3996)	1672 (84-1996)	1200 (20-2788) P<0.001	977 (144-3996)	820 [0.682] (0.61-0.75)	1180 [0.62] (0.49-0.75)	544 0.695] (0.59-0.80)	1440 [0.6646] (0.51-0.81)
IgG	806 (25-2226)	853 (75-2200)	780 (115-1940) P=0.465	741 (25-2226)	617 [0.607] (0.53-0.68)	450 [0.619] (0.49-0.75)	575 [0.58] (0.48-0.69)	387 [0.622] (0.45-0.80)
CD20+ B cell	110 (7-1970)	395 (125-1970)	50 (13-500) P<0.001	86 (7-779)	140 [0.718] (0.66-0.78)	180 [0.68] (0.55-0.82)	120 [0.697] (0.60-0.79)	59 [0.562] (0.41-0.72)
CD4+ T cell	262 (3-952)	275 (16-952)	239 (4-946) P=0.002	270 (3-655)	111 [0.642] (0.57-0.71)	149 [0.56] (0.42-0.70)	106 [0.676] (0.58-0.78)	92 [0.607] (0.45-0.77)
CD4+CD8+ T cell	6 (1-206)	6 (2-12)	5 (1-16) P=0.628	6 (1-206)	3 [0.61] (0.54-0.68)	2.0 [0.59] (0.45-0.73)	3.0 [0.657] (0.55-0.76)	8 [0.457] (0.29-0.62)
CD4+CD25+ T cell	67 (2-579)	78 (6-579)	53 (2-330) P<0.001	96 (2-390)	33 [0.637] (0.57-0.71)	80 [0.521] (0.39-0.65)	50 [0.702] (0.61-0.80)	42 [0.597] (0.43-0.77)
CD4+CD29+ T cell	224 (3-1314)	247 (10-1314)	187 (3-935) P=0.005	227 (5-640)	117 [0.651] (0.58-0.72)	112 [0.579] (0.43-0.73)	143 [0.684] (0.58-0.79)	81 [0.618] (0.46-0.78)
CD4+CD45RO+ T cell	194 (2-881)	216 (10-881)	171 (2-841) P=0.002	190 (5-489)	128 [0.643] (0.57-0.72)	122 [0.57] (0.42-0.72)	128 [0.675] (0.57-0.78)	59 [0.619] (0.46-0.78)
CD4+CD45RO- T cell	31 (0-515)	42 (0-515)	23 (0-171) P<0.001	38 (0-193)	28 [0.64] (0.57-0.71)	15 [0.643] (0.52-0.76)	23 [0.621] (0.52-0.73)	10 [0.544] (0.38-0.71)
CD4+CD45RA+ T cell	114 (2-911)	154 (3-911)	85 (2-815) P<0.001	139 (3-581)	86 [0.693] (0.63-0.76)	86 [0.634] (0.50-0.77)	86 [0.744] (0.65-0.84)	41 [0.571] (0.41-0.74)
CD4+CD45RA- T cell	94 (2-610)	104 (3-610)	80 (2-325) P<0.001	59 (3-281)	65 [0.583] (0.51-0.66)	119 [0.489] (0.35-0.63)	52 [0.618] (0.51-0.73)	17 [0.622] (0.47-0.78)
CD8+ T cell	465 (1-2904)	285 (8-2624)	320 (1-2904) P=0.21	377 (6-762)	326 [0.595] (0.52-0.67)	410 [0.542] (0.42-0.67)	294 [0.647] (0.54-0.75)	326 [0.591] (0.43-0.75)
CD8+CD11b+ T cell	374 (7-3452)	285 (7-2246)	422 (13-3452) P=0.006	374 (22-2368)	256 [0.645] (0.57-0.72)	256 [0.61] (0.48-0.74)	254 [0.699] (0.60-0.80)	266 [0.644] (0.49-0.80)
CD8+CD11b- T cell	69 (0-937)	40 (1-937)	103 (0-712) P<0.001	92 (1-746)	43 [0.587] (0.51-0.66)	41 [0.615] (0.49-0.74)	48 [0.676] (0.57-0.78)	112 [0.432] (0.26-0.60)
CD3+CD56+ NKT cell	21 (1-1930)	12 (1-256)	83 (1-1930) P<0.001	46 (1-261)	31 [0.486] (0.41-0.56)	10 [0.508] (0.37-0.65)	16 [0.658] (0.56-0.76)	23 [0.534] (0.37-0.70)
CD3-CD56+ NK cell	223 (2-2150)	351 (17-2150)	170 (2-1945) P<0.001	143 (2-1372)	159 [0.693] (0.63-0.76)	248 [0.601] (0.47-0.74)	135 [0.72] (0.62-0.82)	159 [0.604] (0.44-0.77)
CD16+CD57+ NK cell	156 (1-2934)	161 (6-2934)	152 (1-2227) P=0.605	161 (5-1394)	103 [0.676] (0.61-0.74)	103 [0.628] (0.50-0.76)	159 [0.739] (0.64-0.83)	174 [0.655] (0.51-0.81)
CD16+CD57- NK cell	245 (3-1825)	439 (276-1825)	172 (3-1359) P<0.001	158 (12-675)	191 [0.729] (0.67-0.79)	205 [0.624] (0.49-0.75)	181 [0.76] (0.67-0.85)	168 [0.637] (0.48-0.80)

ALC, absolute cell counts (cells/μL); IgG, immunoglobulin G (mg/dL); AUC, area under the curve; 95% CI, 95% confidence interval.
CB, cord blood; BM, bone marrow; PBSC, peripheral blood stem cell.
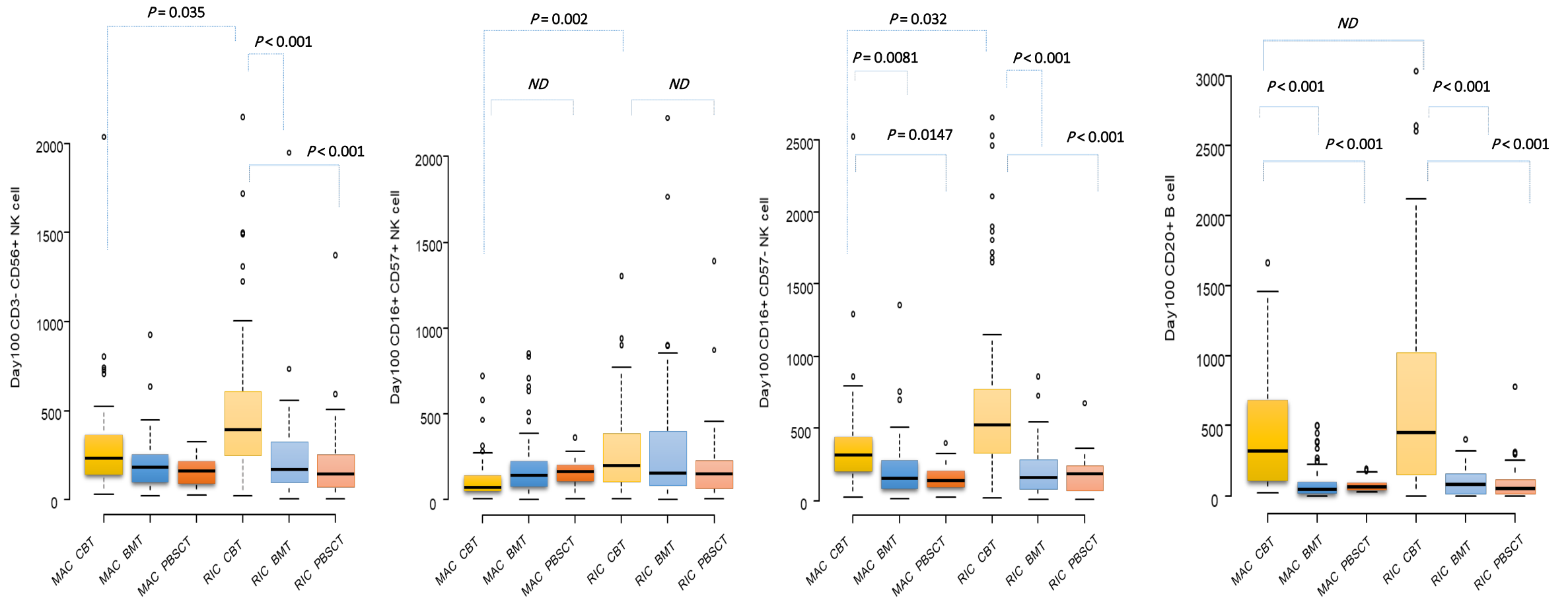
Supplemental Figure 1. NK cells and B cell recovery as a function of conditioning intensities among graft sources.

Heatmap of hazard ratios (HR) for overall survival by lymphocyte subset at different landmark time points. Values shown are hazard ratios; significance marks: $P < .05$ (*), $P < .01$ (**), $P < .001$ (***).

Cell type	Day28	Day100	Day180	Day365	Day730
CD20+ B cell	1.12	0.319 ***	0.52 ***	0.78 *	0.74 **
CD4+ T cell	0.44 ***	0.286 ***	0.69 **	0.8 *	0.98
CD4+CD8+ T cell	1.32 *	0.893	1.33 *	1.151	1.059
CD4+CD25+ T cell	0.46 ***	0.385 ***	0.62 **	0.71 *	0.89
CD4+CD29+ T cell	0.33 ***	0.289 **	0.41 **	0.88	0.99
CD4+CD45RA+ T cell	0.66 *	0.34 **	0.86 *	0.91	1.102
CD4+CD45RA- T cell	0.39 **	0.46 ***	0.55 ***	0.751 *	0.91
CD4+CD45RO+ T cell	0.89	0.32 **	0.65 *	0.88	0.98
CD4+CD45RO- T cell	0.8 *	0.46 ***	0.59 **	0.89	0.86
CD8+ T cell	0.65 **	0.58 **	0.78 *	1.12	1.206
CD8+CD25+ T cell	1.18 *	0.6 **	0.86	1.065	0.98
CD8+CD11b+ T cell	0.88 *	0.336 **	0.95	0.89	1.12
CD8+CD11b- T cell	1.25	0.278 ***	0.35 ***	0.79 *	0.902 *
CD3+CD56+ NKT cell	1.34 **	0.991	1.26 *	1.33 *	1.304
CD3-CD56+ NK cell	1.09	0.306 ***	0.55 **	0.66 *	0.81 *
CD16+CD56+ NK cell	1.18	0.267 ***	0.38 **	0.84 *	0.82 *
CD16+CD57- NK cell	1.32	0.21 ***	0.33 ***	0.59 **	0.77 **

Numbers evaluated — Day28: 344; Day100: 310; Day180: 286; Day365: 251; Day730: 220.

Supplemental Figure 2. A heatmap of timely reconstituting lymphocytes were shown for OS at different landmark time points.
Univariate analysis showed each hazard ratio and P value in every presented cells at different time points.
Median cell counts were used for landmark analyses. $P < .05$ (*), $P < .01$ (**), $P < .001$ (***).
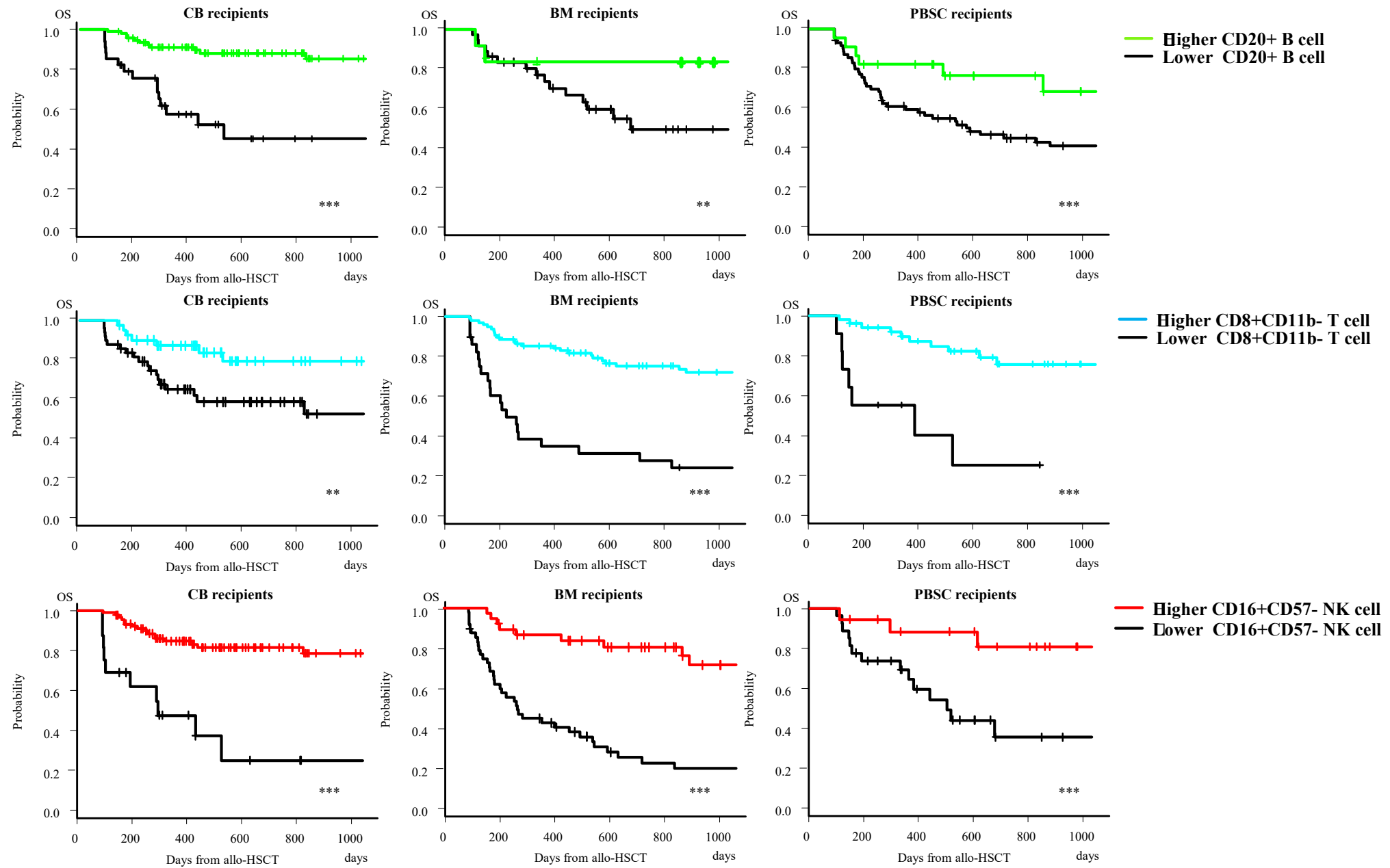
Supplemental Figure 3. Graft-validated outcomes at 2 years based on specific cell types, namely CD20+ B cells, CD8+CD11b- T cells, and CD16+CD57- NK cells. $P < .01$ (**), $P < .001$ (***).