

## Improved graft-versus-host disease-free, relapse-free survival associated with bone marrow as the stem cell source in adults

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Received: November 9, 2015.

Accepted: March 22, 2016.

Pre-published: April 1, 2016.

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Supplemental Table 1A: Univariate Estimates of DFS in Adults (Age≥21 years)

Factor	Strata	Total N	At 1-year				At 2-years			
			Event N	Survival Estimate		Log Rank	Event N	Survival Estimate		Log Rank
				Estimate	95% CI	P-value		Estimate	95% CI	P-value
<b>Overall</b>		1466	673	54%	51- 57%		785	46%	43- 49%	
<b>Conditioning</b>	MA	704	301	57%	53- 61%	0.02	351	50%	46- 53%	0.01
	RIC with ATG	297	137	54%	48- 59%		165	43%	38- 49%	
	RIC without ATG	465	235	49%	45- 54%		269	42%	37- 46%	
<b>Donor/Graft Type</b>	BM-MSD	123	37	70%	61- 77%		48	61%	52- 69%	<0.01
	PBSC-MSD	540	236	56%	52- 60%		281	47%	43- 52%	
	Other related donor	33	17	48%	31- 64%	<0.01	18	45%	28- 61%	
	BM- Matched URD	104	50	52%	42- 61%		57	44%	35- 54%	
	PBSC- Matched URD	120	54	55%	45- 63%		60	49%	40- 58%	
	BM- Mismatched URD	30	16	47%	28- 63%		17	43%	26- 60%	
	PBSC- Mismatched URD	104	47	55%	45- 64%		53	49%	39- 58%	
	UCB	412	216	48%	43- 52%		251	39%	34- 43%	
<b>Gender</b>	Male	858	397	54%	50- 57%	0.87	469	45%	41- 48%	0.47
	Female	608	276	55%	51- 58%		316	48%	44- 52%	
<b>Diagnosis</b>	ALL	246	113	54%	47- 60%	0.12	137	43%	37- 50%	0.10
	AML	568	248	56%	52- 60%		285	49%	45- 53%	
	MDS/MPN/CML	423	201	52%	48- 57%		231	45%	40- 50%	
	NHL/HL/ CLL/Myeloma	206	95	54%	47- 60%		115	44%	37- 50%	
	Other Malignancy	23	16	30%	14- 49%		17	26%	11- 45%	

Factor	Strata	Total N	At 1-year				At 2-years			
			Event N	Survival Estimate		Log Rank	Event N	Survival Estimate		Log Rank
				Estimate	95% CI	P-value		Estimate	95% CI	P-value
<b>Disease Risk</b>	Standard Risk	892	381	57%	54- 60%	<0.01	445	50%	46- 53%	<0.01
	High Risk	574	292	49%	45- 53%		340	40%	36- 44%	
<b>Recipient CMV Serostatus</b>	Negative	637	270	58%	54- 61%	0.04	317	50%	46- 54%	0.03
	Positive	829	403	51%	48- 55%		468	43%	40- 47%	
<b>GVHD Prophylaxis</b>	CsA/MMF	838	408	51%	48- 55%	0.02	483	42%	38- 45%	<0.01
	CsA/MTX	538	221	59%	55- 63%		252	53%	48- 57%	
	Tac +/- Sirolimus	33	15	55%	36- 70%		15	55%	36- 70%	
	Other/unknown	57	29	49%	36- 61%		35	39%	26- 51%	
<b>Year of transplantation</b>	2000-2007	816	408	50%	46- 53%	<0.01	467	43%	39- 46%	<0.01
	2008-2013	650	265	59%	55- 63%		318	50%	46- 54%	

Abbreviations: ALL, acute lymphoblastic leukemia; AML, acute myeloid leukemia; ATG, anti-thymocyte globulin; BM, bone marrow; CI, confidence interval; CLL, chronic lymphocytic leukemia; CML, chronic myeloid leukemia; CMV, cytomegalovirus; CsA, cyclosporine; GVHD, graft versus host disease; HL, Hodgkin lymphoma; IQR, inter-quartile range; MA, myeloablative; RIC, reduced intensity conditioning; MDS, myelodysplastic syndrome; MM, multiple myeloma; MMF, mycophenolate mofetil; MPN, myeloproliferative neoplasm; MSD, matched sibling donor; MTX, methotrexate; MUD, matched unrelated donor; NHL, non-Hodgkin lymphoma; PBSC, peripheral blood stem cells; RR, relative risk; Tac, tacrolimus; UCB, umbilical cord blood; URD, unrelated donor.

Supplemental Table 1B: Univariate Estimates of DFS in Pediatric patients (Age &lt;21 years)

			At 1-year				At 2-years			
			Survival Estimate		Log Rank	Survival Estimate			Log Rank	
Factor	Strata	Total N	Event N	Estimate	95% CI	P-value	Event N	Estimate	95% CI	P-value
<b>Overall</b>		435	167	62%	57- 66%		190	56%	51- 61%	
<b>Conditioning</b>	MA	418	156	63%	58- 67%	<0.01	179	57%	52- 62%	<0.01
	RIC with ATG	5	4	20%	1- 58%		4	20%	1- 58%	
	RIC without ATG	12	7	42%	15- 67%		7	42%	15- 67%	
<b>Donor/Graft Type</b>	BM-MSD	124	39	68%	59- 76%	0.30	45	63%	54- 71%	0.15
	PBSC-MSD	12	3	75%	41- 91%		4	67%	34- 86%	
	Other related donor	22	7	68%	45- 83%		7	68%	45- 83%	
	BM- Matched URD	34	13	62%	43- 76%		15	56%	38- 71%	
	PBSC- Matched URD	23	7	70%	47- 84%		8	65%	41- 81%	
	BM- Mismatched URD	18	9	50%	26- 70%		12	33%	14- 55%	
	PBSC- Mismatched URD	12	5	58%	27- 80%		5	58%	27- 80%	
	UCB	190	84	56%	48- 63%		94	50%	43- 57%	
<b>Gender</b>	Male	275	103	63%	56- 68%	0.60	121	56%	50- 61%	0.98
	Female	160	64	60%	52- 67%		69	57%	49- 64%	
<b>Diagnosis</b>	ALL	212	85	60%	53- 66%	0.72	96	54%	47- 61%	0.71
	AML	144	56	61%	53- 69%		64	55%	47- 63%	
	MDS/MPN/CML	56	17	70%	56- 80%		20	64%	50- 75%	
	NHL/HL/ CLL/Myeloma	23	9	61%	38- 77%		10	57%	34- 74%	
<b>Disease Risk</b>	Standard Risk	361	131	64%	58- 68%	0.02	151	58%	53- 63%	0.04

			At 1-year				At 2-years			
			Survival Estimate		Log Rank		Survival Estimate		Log Rank	
Factor	Strata	Total N	Event N	Estimate	95% CI	P-value	Event N	Estimate	95% CI	P-value
	High Risk	74	36	51%	39- 62%		39	47%	36- 58%	
<b>Recipient CMV Serostatus</b>	Negative	195	64	67%	60- 73%	0.04	74	62%	55- 68%	0.04
	Positive	240	103	57%	50- 63%		116	51%	45- 58%	
<b>GVHD Prophylaxis</b>	CsA/MMF	137	56	59%	50- 67%	<0.01	61	55%	47- 63%	<0.01
	CsA/MTX	222	72	68%	61- 73%		82	63%	56- 69%	
	Other/unknown	76	39	49%	37- 59%		47	38%	27- 49%	
<b>Year of transplantation</b>	2000-2007	307	120	61%	55- 66%	0.75	138	55%	49- 60%	0.58
	2008-2013	128	47	63%	54- 71%		52	59%	50- 67%	

Abbreviations: ALL, acute lymphoblastic leukemia; AML, acute myeloid leukemia; ATG, anti-thymocyte globulin; BM, bone marrow; CI, confidence interval; CLL, chronic lymphocytic leukemia; CML, chronic myeloid leukemia; CMV, cytomegalovirus; CsA, cyclosporine; GVHD, graft versus host disease; HL, Hodgkin lymphoma; IQR, inter-quartile range; MA, myeloablative; RIC, reduced intensity conditioning; MDS, myelodysplastic syndrome; MM, multiple myeloma; MMF, mycophenolate mofetil; MPN, myeloproliferative neoplasm; MSD, matched sibling donor; MTX, methotrexate; MUD, matched unrelated donor; NHL, non-Hodgkin lymphoma; PBSC, peripheral blood stem cells; RR, relative risk; Tac, tacrolimus; UCB, umbilical cord blood; URD, unrelated donor.

Supplemental Table 2A: Univariate Estimates of OS in Adults (Age≥21 years)

Factor	Strata	Total N	At 1-year				At 2-years			
			Event N	Survival Estimate		Log Rank	Event N	Survival Estimate		Log Rank
				Estimate	95% CI	P-value		Estimate	95% CI	P-value
<b>Overall</b>		1466	554	62%	60- 65%		676	53%	51- 56%	
<b>Conditioning</b>	MA	704	259	63%	59- 67%	0.57	308	56%	52- 60%	0.27
	RIC with ATG	297	109	63%	57- 68%		141	51%	45- 57%	
	RIC without ATG	465	186	60%	55- 64%		227	51%	46- 55%	
<b>Donor/Graft Type</b>	BM-MSD	123	30	76%	67- 82%	<0.01	40	67%	58- 75%	<0.01
	PBSC-MSD	540	183	66%	62- 70%		230	57%	52- 61%	
	Other related donor	33	16	52%	34- 67%		17	48%	31- 64%	
	BM- Matched URD	104	42	59%	49- 68%		49	52%	42- 61%	
	PBSC- Matched URD	120	45	62%	53- 70%		53	55%	45- 63%	
	BM- Mismatched URD	30	13	57%	37- 72%		14	53%	34- 69%	
	PBSC- Mismatched URD	104	42	60%	50- 68%		50	52%	42- 61%	
	UCB	412	183	56%	51- 60%		223	46%	41- 50%	
<b>Gender</b>	Male	858	325	62%	59- 65%	0.88	398	53%	50- 56%	0.97
	Female	608	229	62%	58- 66%		278	54%	50- 58%	
<b>Diagnosis</b>	ALL	246	97	60%	54- 66%	0.10	115	53%	46- 59%	0.14
	AML	568	200	65%	61- 68%		258	54%	50- 58%	

				At 1-year			At 2-years				
				Survival Estimate		Log Rank			Survival Estimate		Log Rank
Factor	Strata	Total N	Event N	Estimate	95% CI	P-value	Event N	Estimate	95% CI	P-value	
	MDS/MPN/CML	423	174	59%	54- 63%		206	51%	46- 56%		
	NHL/HL/ CLL/Myeloma	206	71	65%	59- 72%		83	59%	52- 66%		
	Other Malignancy	23	12	48%	27- 66%		14	39%	20- 58%		
<b>Disease Risk</b>	Standard Risk	892	310	65%	62- 68%	<0.01	387	56%	53- 59%	<0.01	
	High Risk	574	244	57%	53- 61%		289	49%	45- 53%		
<b>Recipient CMV Serostatus</b>	Negative	637	216	66%	62- 70%	0.01	261	58%	54- 62%	<0.01	
	Positive	829	338	59%	56- 62%		415	50%	46- 53%		
<b>GVHD Prophylaxis</b>	CsA/MMF	838	330	61%	57- 64%	0.06	410	51%	47- 54%	0.01	
	CsA/MTX	538	186	65%	61- 69%		223	58%	54- 62%		
	Tac +/- Sirolimus	33	11	67%	48- 80%		12	63%	44- 77%		
	Other/unknown	57	27	53%	39- 65%		31	46%	32- 58%		
<b>Year of transplantation</b>	2000-2007	816	337	59%	55- 62%	<0.01	408	50%	46- 53%	<0.01	
	2008-2013	650	217	67%	63- 70%		268	58%	54- 62%		

Abbreviations: ALL, acute lymphoblastic leukemia; AML, acute myeloid leukemia; ATG, anti-thymocyte globulin; BM, bone marrow; CI, confidence interval; CLL, chronic lymphocytic leukemia; CML, chronic myeloid leukemia; CMV, cytomegalovirus; CsA, cyclosporine; GVHD, graft versus host disease; HL, Hodgkin lymphoma; IQR, inter-quartile range; MA, myeloablative; RIC, reduced intensity conditioning; MDS, myelodysplastic syndrome; MM, multiple myeloma; MMF, mycophenolate mofetil; MPN, myeloproliferative neoplasm; MSD, matched sibling donor; MTX, methotrexate; MUD, matched unrelated donor; NHL, non-Hodgkin lymphoma; PBSC, peripheral blood stem cells; RR, relative risk; Tac, tacrolimus; UCB, umbilical cord blood; URD, unrelated donor.

Supplemental Table 2B: Univariate Estimates of OS in Pediatric patients (Age &lt;21 years)

			At 1-year				At 2-years			
				Survival Estimate		Log Rank		Survival Estimate		Log Rank
Factor	Strata	Total N	Event N	Estimate	95% CI	P-value	Event N	Estimate	95% CI	P-value
<b>Overall</b>		435	133	69%	65- 74%		159	63%	58- 68%	
<b>Conditioning</b>	MA	418	125	70%	65- 74%	0.22	150	64%	59- 68%	0.26
	RIC with ATG	5	2	60%	13- 88%		3	40%	5- 75%	
	RIC without ATG	12	6	50%	21- 74%		6	50%	21- 74%	
<b>Donor/Graft Type</b>	BM-MSD	124	26	79%	71- 85%	0.06	34	72%	63- 79%	0.05
	PBSC-MSD	12	2	83%	48- 96%		3	75%	41- 91%	
	Other related donor	22	6	73%	49- 87%		6	73%	49- 87%	
	BM- Matched URD	34	13	62%	43- 76%		13	62%	43- 76%	
	PBSC- Matched URD	23	5	78%	55- 90%		6	74%	50- 87%	
	BM- Mismatched URD	18	7	61%	35- 79%		9	50%	26- 70%	
	PBSC- Mismatched URD	12	4	67%	34- 86%		4	67%	34- 86%	
	UCB	190	70	63%	56- 70%		84	56%	48- 62%	
<b>Gender</b>	Male	275	84	69%	64- 75%	0.98	101	63%	57- 68%	0.95
	Female	160	49	69%	62- 76%		58	63%	55- 70%	
<b>Diagnosis</b>	ALL	212	64	70%	63- 75%	0.72	81	61%	55- 68%	0.49
	AML	144	48	67%	58- 74%		55	62%	53- 69%	
	MDS/MPN/CML	56	14	75%	61- 84%		15	73%	59- 83%	



			At 1-year				At 2-years			
				Survival Estimate		Log Rank		Survival Estimate		Log Rank
Factor	Strata	Total N	Event N	Estimate	95% CI	P-value	Event N	Estimate	95% CI	P-value
	NHL/HL/ CLL/Myeloma	23	7	70%	47- 84%		8	65%	42- 81%	
<b>Disease Risk</b>	Standard Risk	361	103	71%	66- 76%	0.03	126	65%	60- 70%	0.07
	High Risk	74	30	59%	47- 70%		33	55%	43- 66%	
<b>Recipient CMV Serostatus</b>	Negative	195	54	72%	65- 78%	0.26	64	67%	60- 73%	0.17
	Positive	240	79	67%	61- 73%		95	60%	54- 66%	
<b>GVHD Prophylaxis</b>	CsA/MMF	137	44	68%	59- 75%	<0.01	53	61%	52- 69%	<0.01
	CsA/MTX	222	55	75%	69- 80%		66	70%	63- 76%	
	Other/unknown	76	34	55%	43- 66%		40	47%	36- 58%	
<b>Year of transplantation</b>	2000-2007	307	96	69%	63- 74%	0.67	112	63%	58- 69%	0.93
	2008-2013	128	37	71%	62- 78%		47	62%	53- 70%	

Abbreviations: ALL, acute lymphoblastic leukemia; AML, acute myeloid leukemia; ATG, anti-thymocyte globulin; BM, bone marrow; CI, confidence interval; CLL, chronic lymphocytic leukemia; CML, chronic myeloid leukemia; CMV, cytomegalovirus; CsA; cyclosporine; GVHD, graft versus host disease; HL, Hodgkin lymphoma; IQR, inter-quartile range; MA, myeloablative; RIC, reduced intensity conditioning; MDS, myelodysplastic syndrome; MM, multiple myeloma; MMF, mycophenolate mofetil; MPN, myeloproliferative neoplasm; MSD, matched sibling donor; MTX, methotrexate; MUD, matched unrelated donor; NHL, non-Hodgkin lymphoma; PBSC, peripheral blood stem cells; RR, relative risk; Tac, tacrolimus; UCB, umbilical cord blood; URD, unrelated donor.

**Supplemental Table 3: Conditioning regimens used at the two institutions.**

<b>UMN</b>		<b>Saint-Louis</b>	
<b>TBI-based</b>	<b>Non TBI -based</b>	<b>TBI-based</b>	<b>Non TBI -based</b>
Bu +/- Cladribine	Bu/Cy	Bu +/- Cy +/- Mel	Bu +/- Clo
Bu/Flu	Bu/Flu	Cy +/- Flu +/- Mel +/- Etoposide	Bu/Cy +/- Ara-C +/- Flu +/- Mel +/- Ara-C
Cy +/- Etoposide		Flu +/- Mel	Bu/Flu
Cy/Flu		Mel	Bu/Mel +/- Ara-C
		Etoposide +/- Thiotepa	Cy +/- Flu
			Flu +/- Mel +/- Thiotepa
			Mel

Abbreviations: Ara-C, arabinofuranosyl cytidine (cytarabine); Bu, busulfan, Clo, clofarabine; Cy, cyclophosphamide; Flu, fludarabine, Mel, melphalan, TBI, total body irradiation.

**Supplemental Figure 1:** Events occurring after grade III-IV acute GVHD in (A) adults and (B) pediatric patients.

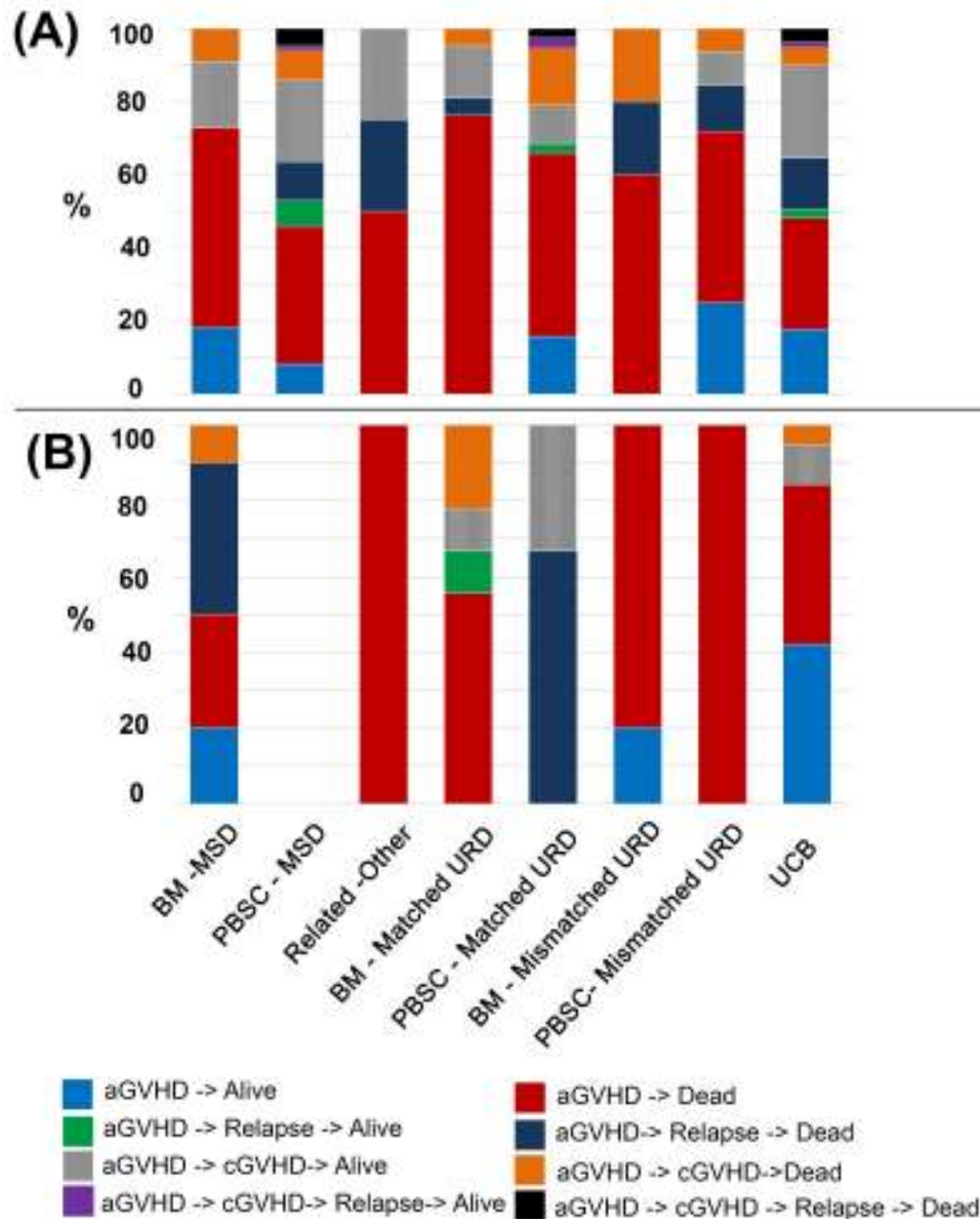
**Supplemental Figure 2:** Events occurring after chronic GVHD (LEFT PANEL) and relapse (RIGHT PANEL) in (A) adults and (B) pediatric patients.

**Supplemental Figure 3:** Causes of death by donor/graft source in (A) adults and (B) pediatric patients.

# Supplemental figures

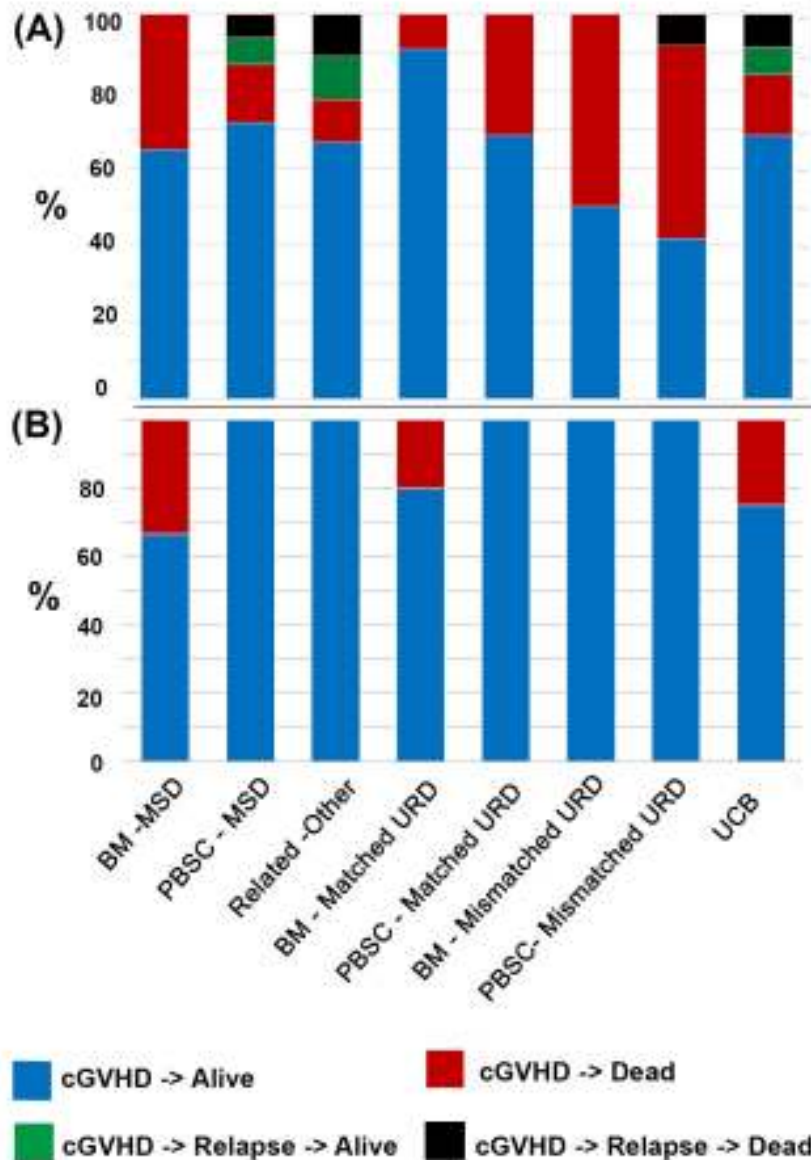
# Supplemental Figure 1

## Events after Acute GVHD in (a) Adults and (b) Pediatric patients

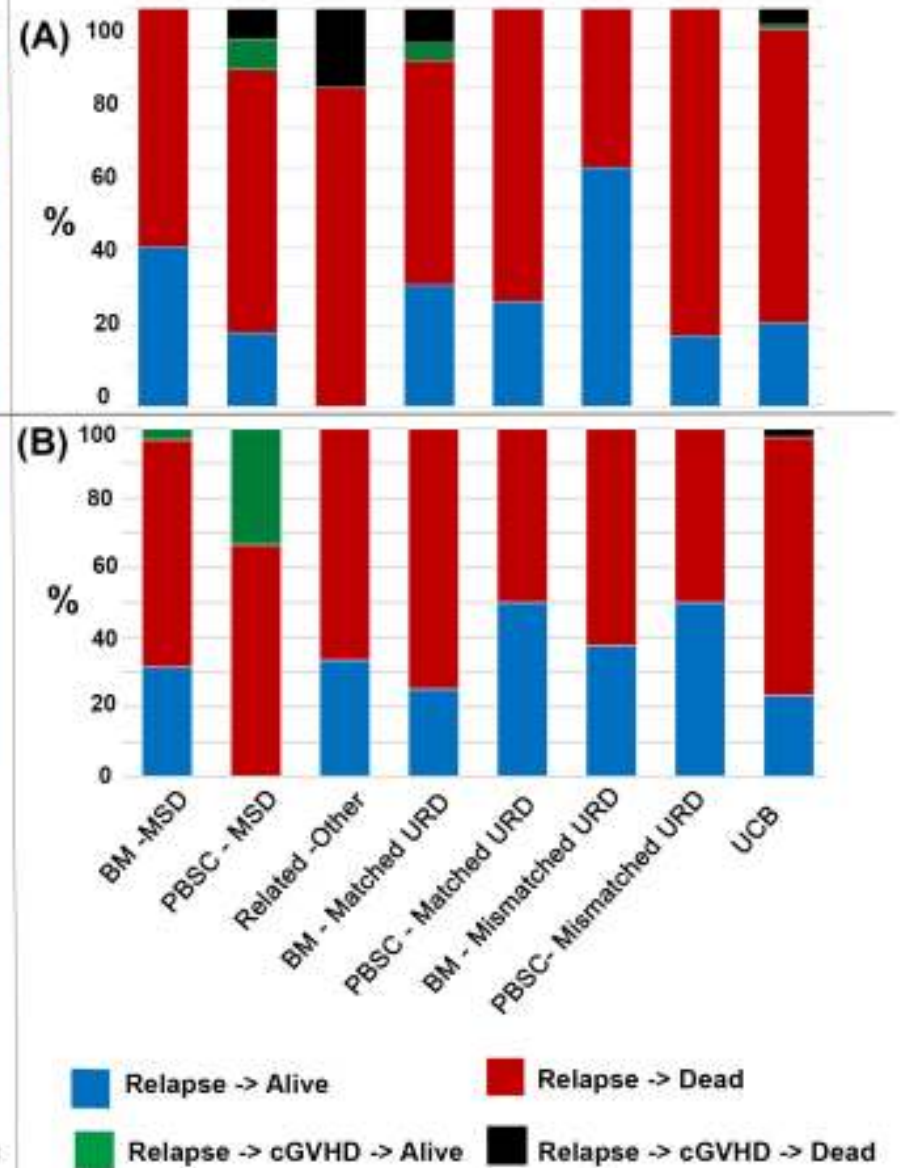


# Supplemental Figure 2

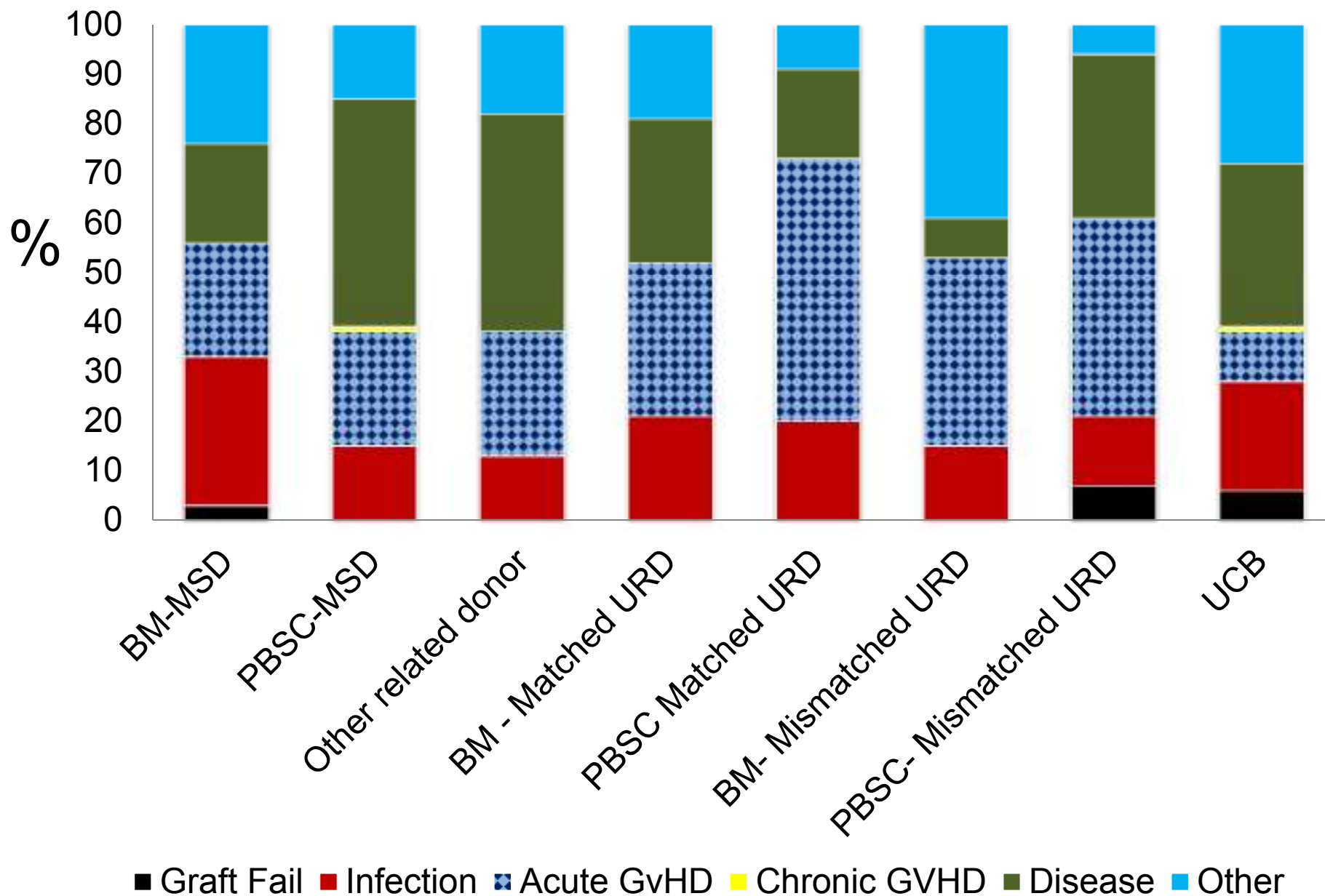
Events after cGVHD in (A) Adults and (B) Pediatric patients



Events after Relapse in (A) Adults and (B) Pediatric patients



# Supplemental Figure 3A Causes of death - Adults



# Supplemental Figure 3B

# Causes of death - Pediatric patients

