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CURRENT USE AND OUTCOMES OF HEMATOPOIETIC CELL TRANSPLANTATION: BRAZILIAN SUMMARY SLIDES – 2025

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ABSTRACT

The development of the Brazilian Registry of Hematopoietic Cell Transplantation (HCT) in collaboration with the Center for International Blood and Marrow Transplant Research (CIBMTR) continues to provide a comprehensive assessment of the activity and general outcomes of HCT in Brazil. In this paper, we report an update of such activity. Brazilian transplant centers report their data to the CIBMTR, using the FormsNet3 platform. The data then return to the Brazilian Cellular Therapy and Bone Marrow Transplant Society (SBTMO) through the Data Back to Centers (DBtC) tool. Data from patients who received an HCT from 2012 to 2024 from Brazilian centers were extracted from the CIBMTR. A descriptive analysis was carried out using patient, disease and transplant-specific variables and overall survival analysis using the Kaplan Meier method. A total of 14,331 patients were eligible for this study (6,583 autologous and 7,748 allogeneic HCTs). The number of reporting centers increased from 40 to 45 during the period. The most common HCT indication in Brazil for allogeneic HCT was AML, with 171 HCTs per year and, for autologous HCT, multiple myeloma, with 273 HCTs per year. Among allogeneic HCT, in the last 4 years, mismatched related donor was the main source of donors. Regarding the graft source for allogeneic HCTs, bone marrow (BM) was the most frequent among pediatric HCTs, while peripheral blood (PB) was the most used in adults. Infections were the leading cause of death in the first 100 days after all types of HCTs. Patients with acute leukemia who underwent HCT at an advanced disease stage had lower survival rates compared to those at earlier stages. Despite the differences in the number of cases and follow-up time, the results in this study were similar to those presented in the United States (USA) Summary Slides.

Keywords: Data Management, Hematopoietic Cell Transplant, CIBMTR, SBTMO, Brazilian Summary Slides.

INTRODUCTION

Hematopoietic cell transplantation (HCT) is often the only curative option for several malignant and non-malignant hematologic diseases, as well as for prolonging the survival of a number of patients[1]. Brazil has a large number of HCT centers, with 126 transplant programs in 86 centers recognized by the Brazilian Ministry of Health.

The first national results on this treatment modality were published in 1985[2]. In 1997, a Brazilian center took part for the first time in an international multicenter study[3]. Over the following years, a few national multicenter studies were developed. Back then, the process for establishing the Hematopoietic Cell Transplantation Brazilian Registry (HCTBR) had already begun[4].

In 2024, it is estimated that over 4,000 HCTs were performed in Brazil. However, due to the lack of mandatory reporting, the exact total remains unclear.

The CIBMTR is a research collaboration between the Medical College of Wisconsin and the NMDP (formerly National Marrow Donor Program), which captures activity and outcomes of HCTs in the USA and worldwide. Brazilian centers started to report to the IBMTR in 1989. The number of Brazilian CIBMTR-reporting centers varied over the years, making it difficult to assess the actual activity of HCTs in the region. In 2016, with a collaboration between the Brazilian Cellular Therapy and Bone Marrow Transplant Society (SBTMO) and the CIBMTR, a program to train professionals for data collection was begun, and the number of reporting centers steadily increased[5]. This collaboration led to the development of the Brazilian Transplant Registry, where data reported from Brazilian centers are consolidated and returned to the SBTMO. As a result, HCT activity from Brazilian centers is now published annually on the SBTMO website as a resource for the transplant community[6,7,8,9]. Additionally, this registry has enabled the publication of national data on cellular therapy, with the first summary having been recently released[10].

OBJECTIVE

The objective of this report is to report the trends in HCT activity from Brazilian transplant centers over the last decade.

METHODS

Data Sources

Brazilian transplant centers report their data to the CIBMTR, using the electronic FormsNet3 platform. That process is protected by double authentication entry requirements for all system users. The compiled, standardized and codified data returns to SBTMO through the Data Back to Centers (DBtC) tool, enabling the analysis of HCT outcomes throughout the country.

Selection

Data from 14,331 HCTs performed between 2012 and 2024 were extracted from the CIBMTR portal using the DBtC, gathering information from the 45 Brazilian centers that had sent their HCT data to the CIBMTR. This total included both autologous (6,583) and allogeneic (7,748) HCTs.

The analysis of overall survival (OS) included 11,236 patients who underwent a 1st HCT between 2012-2024, and those without follow-up data after transplantation or undergoing a 2nd HCT were excluded (Table 1).

The spreadsheet was imported into Power BI Desktop (PBI). Functions were updated to count the number of HCTs performed and the number of participating centers, to translate columns into Portuguese, to categorize and classify diseases, to group variables, and for performing global survival analyses.

Definitions and Outcomes

Patients were classified as pediatric (0-17 years of age) and adults (≥ 18 years of age).

Allogeneic HCTs were categorized as matched related donor, mismatched related donor (including haploidentical and related donors with one mismatch), and unrelated donor.

Grafts were classified as bone marrow (BM), peripheral blood (PB) and umbilical cord blood (UCB).

The disease stage for acute leukemias was classified as 1st remission, 2nd or further remission and patients who underwent HCT with active disease.

Patients with Myelodysplastic Syndrome (MDS) were divided into early disease, comprising refractory anemia (RA); refractory anemia with ring sideroblasts (RARS); refractory cytopenia with multilineage dysplasia (RCMD); and MDS with del(5q) alone, or Advanced disease, including refractory anemia with excess blasts (RAEB) and Chronic Myelomonocytic Leukemia (CMML).

Patients with Lymphoma were categorized as chemosensitive and chemoresistant disease by the response to treatment prior to HCT.

Classification of conditioning regimens was based on the agents and doses used, as follows: myeloablative conditioning (MAC) for patients who received total body irradiation (TBI) ≥500 cGy in a single dose or >800 cGy in fractionated doses; busulfan >9 mg/kg oral or ≥7.2 mg/kg IV or melphalan >150 mg/m^2 as a single agent or in combination with other drugs. The conditioning regimens that did not fill the criteria for MAC were classified as reduced intensity/non-myeloablative (RIC/NMA)[11,12].

Causes of death were classified using the standard classification from DBtC. The main causes of death between 2019-2023 were separated between deaths 0-100 days and deaths >100 days up to 3 years after HCT.

Statistical analysis

Descriptive statistics were used to describe categorical data, with number of cases and percentage, and median and range were used for numerical variables. Overall survival was estimated by the Kaplan Meier method, and the log-rank test was used to compare survival between groups. Graphics were generated by PBI and exported to Microsoft PowerPoint for publication. Survival analyses were performed using R Statistical Software (Version 4.4.1).

Ethical considerations

Ethics approval for utilization of the CIBMTR platform for the Brazilian Registry for research was obtained from the national Institutional Review Board (IRB) in 2019 (Conep CAAE: 65575317.5.1001.0071, principal investigator Dr. Nelson Hamerschlak).

RESULTS

Between 2012 and 2024, 14,331 HCTs were reported from 45 Brazilian centers (Table 2), of which 21 (47%) were located in the state of São Paulo; 5 in Distrito Federal, 4 in Paraná, 4 in Minas Gerais, 3 in Rio de Janeiro; 3 in Rio Grande do Sul; and 1 in each of the following states: Ceará, Espirito Santo, Rio Grande do Norte, Pernambuco and Santa Catarina.

The number of active CIBMTR centers increased over the last few years, reaching 32 in 2024 (Figure 1), which has greatly contributed to the increase in the number of Brazilian HCTs registered in the CIBMTR since 2016, reaching more than 1,900 HCTs per year in the last three years (Figure 2).

Between 2012 and 2024, 38.2% of the allogeneic HCTs performed in Brazil used a matched related donor, followed by a mismatched related donor (33.7%) and an unrelated donor (28.1%). In the last 5 years, the main type of allogeneic HCTs performed in the country used a mismatched related donor (Figure 3).

Regarding the graft source for allogeneic HCTs, BM was used in most pediatric HCTs, while the main source in adults was PB, from 2018 onwards (Table 3).

Mismatched related donors were used to treat Acute Myelogenous Leukemia (AML; 31.9%), followed by Acute Lymphoblastic Leukemia (ALL; 24.4%) and non-malignant diseases (23.5%); 53% of them used MAC, and 47% used RIC/NMA.

The main global indications for HCT in Brazil in 2024 were Multiple Myeloma (MM; 525; 28%), followed by AML (281; 15%), ALL (238; 12%), Non-Hodgkin Lymphoma (NHL; 192; 10%) and Hodgkin Disease (HD; 164; 9%) (Figure 4). In pediatric allogeneic HCTs, the main diseases were ALL (34%), Primary Immune Deficiency (13%), and AML (12%). In adults, the main indications for allogeneic HCTs were AML (36%), ALL (20%) and MDS (13%).

Even though acute leukemias continue to be the main indication for allogeneic transplantation in

the country, an increase was observed, from 2016 on, in HCTs performed for non-malignant diseases and MDS/Myeloproliferative Neoplasms (MPN). The main indications for autologous HCTs remain multiple myeloma (MM) and lymphomas in adults, while neuroblastoma is the primary indication for autologous HCTs in children.

In patients with acute leukemias, 52% of those with AML and 50% with ALL were in 1st remission. Most HCTs were from a matched related donor in both AML (41%) and ALL (35%) (Table 4).

Infections were the leading cause of death in the first 100 days after HCT. For autologous HCTs, infections were the leading cause of death in both adult (66%) and pediatric patients (50%). Similarly, for allogeneic HCTs, infections were the leading cause of death in adults (54%) and pediatric patients (41%). After 100 days, the most common cause of death was the primary disease. For autologous HCTs, the primary disease was the leading cause of death in adults (67%) and pediatric patients (69%). Similarly, for allogeneic HCTs, the primary disease was the leading cause of death in adults (41%) and pediatric patients (59%).

For survival analyses, the median follow-up was 24 months in allogeneic and 17 months in autologous HCT. Patients with acute leukemia who underwent HCT with advanced stage disease had lower survival rates compared to those at other stages (Table 5).

Adults had higher survival rates after HCT from matched sibling donors when having HCT for AML (p=0.0002; Figure 6), ALL (p=0.022; Figure 7), MDS (p<0.001; Figure 8) and aplastic anemia (p<0.001; Figure 9), but donor type had no impact in pediatric patients with acute leukemias and aplastic anemia.

The 2-year OS for MDS was similar despite disease risk and donor type (Figure 10). Patients with CML had a 2-year OS of 63.8% with a matched related donor, 61.6% with a mismatched related donor, and 55.8% with an unrelated donor (p=0.320; Figure 11). Patients with myelofibrosis had a survival of 58.0% in 2 years (Figure 12).

Patients undergoing autologous HCTs to treat chemosensitive lymphomas had a significantly better 2-year OS than those with chemoresistant disease: 89.5% versus 76.4% in HD (p=0.014) and 77.0% versus 54.5% in NHL (p=0.0013) (Figure 13). The 2-year OS was 84.2% for patients with MM (Figure 14). Patients aged 0-65 years had a better overall survival compared to those aged 65 years or older, with a 2-year OS of 85.1% versus 81.5%, respectively (p=0.0061; Figure 15).

DISCUSSION

The analyses presented herein showed an increase in the number of Brazilian CIBMTR participating centers compared to what was seen in the first publications. Forty-five centers contributed with the information regarding new HCTs between 2012 and 2024. In 2024, 32 centers reported new HCT data to the CIBMTR. Despite the lower number of active centers last year, 45 centers were active throughout the whole period analyzed. This shows that, over the years, centers have intermittently started and paused data reporting.

We observed an increase in the number of HCTs with a mismatched related donor since 2012 and a decrease in unrelated UCB HCTs in the same period, most likely due to the use of haploidentical donors with post-transplantation cyclophosphamide.

Comparing our data with those of the USA Summary Slides published in the CIBMTR website[13], matched related donor HCTs are the main type of HCTs performed in Brazil, followed by those using a mismatched related donor, while unrelated BM/PBSC HCTs predominate in the USA.

Among pediatric patients, the main graft source was BM in Brazil, following the same trend in the USA; on the other hand, there was an increase in PB use over the years, and it has been the main choice of graft source for adult recipients in Brazil since 2018 and, since 2000, in the USA, for all types of allogeneic HCTs.

In 2024, the main indications for adult HCTs in Brazil were MM, AML, NHL, HD, and ALL, while in the USA, in 2022, those were MM, AML, NHL, MDS/MPN and ALL. For pediatric patients, the main indications in Brazil were ALL, primary immune deficiency, and AML, as compared to ALL, AML and neuroblastoma in the USA.

Another important comparison between these countries was the cause of early death (0 to 100

days after transplantation). In Brazil, infection was the leading cause of early mortality across all four groups: pediatric and adult autologous HCTs, as well as pediatric and adult allogeneic HCTs. In contrast, in the USA, the primary cause of early death varied by group: organ failure was the main cause for pediatric autologous and allogeneic HCTs, while primary disease was the leading cause for adult autologous HCTs, and infection remained the main cause for adult allogeneic HCTs. Comparing the 2-year OS in our study with the 3-year OS shown in the USA Summary Slides, the Brazilian data are similar to the survival rates reported by USA centers (Table 6), despite the socioeconomic differences.

The Brazilian Summary Slides are fully available to active centers in the HCTBR through the SBTMO data request flow (Figure 16).

CONCLUSION

The partnership between the SBTMO and the CIBMTR has made the HCTBR possible. The Brazilian HCT data analyses presented here have resulted in these updated Brazilian Summary Slides, which contributes to a better understanding of our nationwide HCT outcomes, by making the results available to centers as a both national and international benchmark. The Brazilian Summary Slides are updated once a year and published at the SBTMO website. Despite the differences in the number of cases and follow-up time, the results in this study were similar to those presented in the USA Summary Slides, as discussed above.

Consolidating the HCTBR has yielded positive results, as witnessed by the increase in the number of Brazilian centers affiliated to the CIBMTR and the higher qualification of DMs across the country. Nonetheless, there is still a lot to be done. It is necessary to improve the commitment of the HCT centers toward data reporting, in order to optimize the registry of HCTs, the accomplishment of long-term follow-up and the continuing education of DMs, thus stimulating good quality data retrieval within the national registry. Government support (through resources, infrastructure and qualification) is also essential to achieve such goals. Continual and tireless efforts in this regard may help in the constant improvement of the HCTBR, and, in the long run, result in the provision of better care to patients.

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TABLE 1. Exclusion criteria for overall survival

Exclusion criteria	n
Patients without follow-up update	1,828
≥2nd HCT	1,267
Complete data	**11,236**

TABLE 2. HCT centers

Participating Centers
A.C. Camargo Cancer Center
Albert Einstein Hospital
Associação Hospitalar Moinhos de Vento
Bio Sana's Serviços Médicos
Bio Sana's São Camilo
Centro De Pesquisa Clinica Hospital 9 De Julho
Centro de Pesquisas Oncológicas Dr. Alfredo Daura Jorge (CEPON)
Complexo Hospitalar de Niterói
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Fundação Faculdade Regional de Medicina de São José do Rio Preto (FUNFARME)
Fundação Pio XII - Hospital de Câncer de Barretos
Hospital Amaral Carvalho
Hospital Brasília
Hospital da Criança de Brasília José Alencar
Hospital das Clínicas - Faculdade de Medicina de Botucatu, UNESP
Hospital de Clínicas - UFPR
Hospital de Clínicas de Porto Alegre
Hospital DF Star
Hospital Erasto Gaertner
Hospital Leforte Liberdade
Hospital Mãe de Deus
Hospital Monte Sinai
Hospital Nossa Senhora das Graças - IP
Hospital Pequeno Príncipe
Hospital Samaritano
Hospital Santa Rita de Cássa
Hospital São Camilo - Mooca
Hospital São Camilo - Pompéia
Hospital São Camilo - Santana
Hospital Sírio Libanês
Hospital Sírio Libanês em Brasília
Hospital Universitário Clementino Fraga Filho, Univ. Fed. RJ
Hospital Universitario da Universidade Federal de Juiz de Fora
Hospital Universitário Walter Cantídio/UFC
Instituto da Criança - Hospital das Clínicas da Faculdade de Medicina Universidade de São Paulo
Instituto de Cardiologia do Distrito Federal - Unidade de TMO Pietro Albuquerque
Instituto de Oncologia Pediátrica - GRAACC
Instituto Nacional de Câncer
Natal Hospital Center
Real e Benemérita Sociedade de Beneficiência Portuguesa de São Paulo
Real Hospital Português
Santa Casa de Montes Claros
UFMG Hospital das Clínicas Servico de Transplante de Medula Óssea
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Universidade Federal de São Paulo - Hospital São Paulo

TABLE 3. Source of cells used by donor type, age and year of HCT

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Patients <18 Years													
Matched Related Donor (N=570)													
PB	2%	4%	2%	3%	9%	5%	9%	6%	3%	12%	15%	10%	12%
BM	93%	87%	96%	94%	91%	93%	85%	92%	97%	88%	76%	89%	85%
UCB	5%	9%	2%	3%	0%	2%	6%	2%	0%	0%	9%	1%	3%
Unrelated Donor (N=962)													
PB	5%	3%	16%	12%	7%	7%	13%	4%	23%	24%	23%	26%	29%
BM	56%	75%	78%	76%	86%	87%	81%	91%	74%	69%	72%	73%	68%
UCB	39%	22%	6%	12%	7%	6%	6%	5%	3%	7%	5%	1%	3%
Mismatched Related Donor (N=1,004)													
PB	25%	10%	27%	14%	25%	21%	33%	26%	23%	23%	20%	15%	13%
BM	71%	90%	73%	86%	75%	79%	67%	74%	77%	77%	80%	85%	87%
UCB	4%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Patients ≥18 Years													
Matched Related Donor (N=2,391)													
PB	49%	47%	44%	50%	46%	52%	54%	57%	64%	64%	74%	72%	79%
BM	51%	53%	56%	50%	54%	48%	46%	43%	36%	36%	26%	28%	21%
UCB	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Unrelated Donor (N=1,216)													
PB	40%	31%	38%	52%	51%	48%	58%	55%	59%	80%	78%	76%	80%
BM	43%	62%	62%	47%	49%	52%	42%	44%	38%	20%	22%	24%	20%
UCB	17%	7%	0%	1%	0%	0%	0%	1%	3%	0%	0%	0%	0%
Mismatched Related Donor (N=1,605)													
PB	18%	33%	43%	34%	42%	44%	63%	65%	70%	76%	79%	82%	88%
BM	82%	67%	57%	66%	58%	56%	37%	35%	30%	24%	21%	18%	12%

TABLE 4. Acute Leukemia by disease stage, donor type and HCT year

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
AML													
Disease Stage													
1st complete remission	36%	46%	47%	44%	59%	51%	54%	54%	52%	54%	55%	55%	55%
2nd or subsequent complete remission	36%	27%	39%	40%	31%	30%	27%	26%	31%	19%	23%	25%	25%
Relapsed disease/Never in CR	28%	27%	14%	16%	10%	19%	19%	20%	17%	27%	22%	20%	20%
Donor Type													
Matched Related Donor	52%	57%	65%	49%	50%	50%	44%	42%	43%	37%	38%	30%	31%
Mismatched Related Donor	15%	7%	10%	17%	23%	23%	33%	33%	42%	47%	45%	50%	45%
Unrelated Donor (BM/PBSC)	29%	27%	21%	33%	27%	27%	22%	25%	15%	15%	17%	20%	24%
Unrelated Donor (UCB)	4%	9%	4%	1%	0%	0%	1%	0%	0%	1%	0%	0%	0%
ALL													
Disease Stage													
1st complete remission	45%	42%	56%	59%	52%	40%	53%	39%	45%	45%	50%	60%	54%
2nd or subsequent complete remission	50%	52%	37%	40%	39%	52%	34%	50%	46%	45%	38%	34%	39%
Relapsed disease/Never in CR	5%	6%	7%	1%	9%	8%	13%	11%	9%	10%	12%	6%	7%
Donor Type													
Matched Related Donor	44%	53%	52%	44%	40%	36%	38%	32%	33%	29%	27%	33%	26%
Mismatched Related Donor	7%	3%	2%	8%	16%	25%	27%	29%	39%	47%	51%	48%	48%
Unrelated Donor (BM/PBSC)	31%	36%	45%	43%	42%	38%	34%	36%	27%	23%	22%	19%	26%
Unrelated Donor (UCB)	18%	8%	1%	5%	1%	1%	1%	3%	1%	1%	0%	0%	0%

TABLE 5. Overall survival of AML/ALL patientsALL

A. AML

	N	OS in 2 years (%)	p
AML			
Patients Age 0-17 Years			
Donor Type			
Matched Related Donor	83	48.9% (39-62)	
Mismatched Related Donor	121	59.8% (51-70)	0.240
Unrelated Donor	89	59.5% (50-71)	
Patients Age ≥18 Years			
Donor Type			
Matched Related Donor	708	57.1% (53-61)	
Mismatched Related Donor	499	50.1% (45-55)	0.0002
Unrelated Donor	314	59.3% (54-66)	
Matched Related Donor			
Patients Age 0-17 Years			
Disease Stage			
1st complete remission	38	58.0% (44-77)	
2nd or subsequent complete remission	26	49.3% (33-75)	0.017
Relapsed disease/Never in CR	19	26.6% (11-65)	
Patients Age ≥18 Years			
Disease Stage			
1st complete remission	480	64.1% (60-69)	
2nd or subsequent complete remission	136	48.4% (40-59)	<0.001
Relapsed disease/Never in CR	92	33.9% (25-46)	
Mismatched Related Donor			
Patients Age 0-17 Years			
Disease Stage			
1st complete remission	47	71.6% (59-87)	
2nd or subsequent complete remission	47	67.1% (54-83)	0.003
Relapsed disease/Never in CR	27	30.9% (17-57)	
Patients Age ≥18 Years			
Disease Stage			
1st complete remission	280	60.1% (54-67)	
2nd or subsequent complete remission	121	55.4% (46-66)	<0.001
Relapsed disease/Never in CR	98	13.9% (7-26)	
Unrelated Donor			
Patients Age 0-17 Years			
Disease Stage			
1st complete remission	39	79.2% (67-94)	
2nd or subsequent complete remission	29	60.3% (44-82)	<0.001
Relapsed disease/Never in CR	21	20.3% (8-53)	
Patients Age ≥18 Years			
Disease Stage			
1st complete remission	143	72.0% (64-81)	
2nd or subsequent complete remission	106	58.8% (50-70)	<0.001
Relapsed disease/Never in CR	65	32.7% (22-48)	

B. ALL

	N	OS in 2 years (%)	p
ALL			
Patients Age 0-17 Years			
Donor Type			
Matched Related Donor	150	57.8% (50-68)	
Mismatched Related Donor	239	56.5% (49-65)	0.780
Unrelated Donor	280	61.8% (56-68)	
Patients Age ≥18 Years			
Donor Type			
Matched Related Donor	413	57.8% (53-63)	
Mismatched Related Donor	263	53.4% (47-61)	0.022
Unrelated Donor	230	48.3% (42-56)	
Matched Related Donor			
Patients Age 0-17 Years			
Disease Stage			
1st complete remission	53	70.7% (58-86)	
2nd or subsequent complete remission	76	48.8% (38-63)	0.078
Relapsed disease/Never in CR	21	61.4% (41-91)	
Patients Age ≥18 Years			
Disease Stage			
1st complete remission	307	64.8% (59-71)	
2nd or subsequent complete remission	83	38.1% (28-52)	<0.001
Relapsed disease/Never in CR	23	-	
Mismatched Related Donor			
Patients Age 0-17 Years			
Disease Stage			
1st complete remission	60	75.5% (64-90)	
2nd or subsequent complete remission	160	53.8% (45-64)	0.0028
Relapsed disease/Never in CR	19	28.5% (12-68)	
Patients Age ≥18 Years			
Disease Stage			
1st complete remission	168	60.7% (53-70)	
2nd or subsequent complete remission	77	42.5% (32-57)	0.041
Relapsed disease/Never in CR	18	28.1% (10-83)	
Unrelated Donor			
Patients Age 0-17 Years			
Disease Stage			
1st complete remission	86	74.2% (65-85)	
2nd or subsequent complete remission	169	58.4% (51-67)	0.0047
Relapsed disease/Never in CR	25	37.1% (19-74)	
Patients Age ≥18 Years			
Disease Stage			
1st complete remission	150	52.1% (44-62)	
2nd or subsequent complete remission	64	46.2% (35-61)	0.0022
Relapsed disease/Never in CR	16	19.4% (6-60)	

TABLE 6. Comparison of overall survival – Brazil and USA

Acute leukemia

	Brazilian Registry (2012-2024)		US Summary Slides (2016-2021)	
	N	OS in 2 years (%)	N	OS in 3 years (%)
AML				
Patients Age 0-17 Years				
Allogeneic HCTs				
Disease Stage				
1st complete remission	124	68.6% (60-78)	897	68.0% (65-71)
2nd or subsequent complete remission	102	60.2% (51-71)	393	70.1% (65-75)
Relapsed disease/Never in CR	67	26.3% (17-41)	146	35.6% (28-45)
Patients Age ≥18 Years				
Matched Related Donor				
Disease Stage				
1st complete remission	480	64.1% (60-69)	2,915	61.7% (60-64)
2nd or subsequent complete remission	136	48.4% (40-59)	544	59.9% (56-64)
Relapsed disease/Never in CR	92	33.9% (25-46)	586	38.3% (34-43)
Unrelated Donor				
Disease Stage				
1st complete remission	143	72.0% (64-81)	5,525	59.6% (58-61)
2nd or subsequent complete remission	106	58.8% (50-70)	1,135	57.1% (54-60)
Relapsed disease/Never in CR	65	32.7% (22-48)	1,188	35.0% (32-38)
Mismatched Related Donor				
Disease Stage				
1st complete remission	280	60.1% (54-67)	2,108	56.8% (55-59)
2nd or subsequent complete remission	121	55.4% (46-66)	514	58.5% (54-63)
Relapsed disease/Never in CR	98	13.9% (7-26)	431	33.4% (29-38)
ALL				
Patients Age 0-17 Years				
Allogeneic HCTs				
Disease Stage				
1st complete remission	199	73.5% (67-81)	598	80.0% (77-83)
2nd or subsequent complete remission	405	55.2% (50-61)	1,072	71.5% (69-74)
Relapsed disease/Never in CR	65	42.6% (30-60)	51	62.6% (51-78)
Patients Age ≥18 Years				
Matched Related Donor				
Disease Stage				
1st complete remission	307	64.8% (59-71)	1,244	71.4% (69-74)
2nd or subsequent complete remission	83	38.1% (28-52)	355	54.7% (49-61)
Relapsed disease/Never in CR	23	-	80	52.7% (43-65)
Unrelated Donor				
Disease Stage				
1st complete remission	150	52.1% (44-62)	1,719	67.4% (65-70)
2nd or subsequent complete remission	64	46.2% (35-61)	481	54.1% (50-59)
Relapsed disease/Never in CR	16	19.4% (6-60)	102	37.4% (29-49)
Mismatched Related Donor				
Patients Age ≥18 Years				
Disease Stage				
1st complete remission	168	60.7% (53-70)	821	70.6% (67-74)
2nd or subsequent complete remission	77	42.5% (32-57)	368	46.9% (41-53)
Relapsed disease/Never in CR	18	28.1% (10-83)	67	44.3% (33-59)

MDS and Aplastic Anemia	Brazilian Registry (2012-2024)		US Summary Slides (2016-2021)	
	N	OS in 2 years (%)	N	OS in 3 years (%)
MDS (Adults)				
Matched Related Donor				
Disease Stage				
Early disease	153	59.7% (52-69)	289	51.5% (46-58)
Advanced disease	121	54.4% (46-65)	928	53.7% (50-57)
Unrelated Donor				
Disease Stage				
Early disease	77	53.5% (42-68)	780	54.1% (51-58)
Advanced disease	62	50.8% (39-66)	2,346	48.7% (47-51)
Aplastic Anemia				
Patients Age 0-17 Years				
Donor type				
Matched Related Donor	77	85.0% (77-94)	288	98.6% (97-100)
Mismatched Related Donor	109	77.1% (69-86)	104	88.9% (83-95)
Unrelated Donor	84	81.3% (73-90)	268	92.5% (89-96)
Patients Age ≥18 Years				
Donor type				
Matched Related Donor	190	83.2% (78-89)	350	88.8% (85-92)
Mismatched Related Donor	77	75.4% (66-86)	206	85.9% (81-91)
Unrelated Donor	103	60.8% (52-71)	451	78.3% (64-87)

FIGURE 1. Active Brazilian centers in the CIBMTR by year

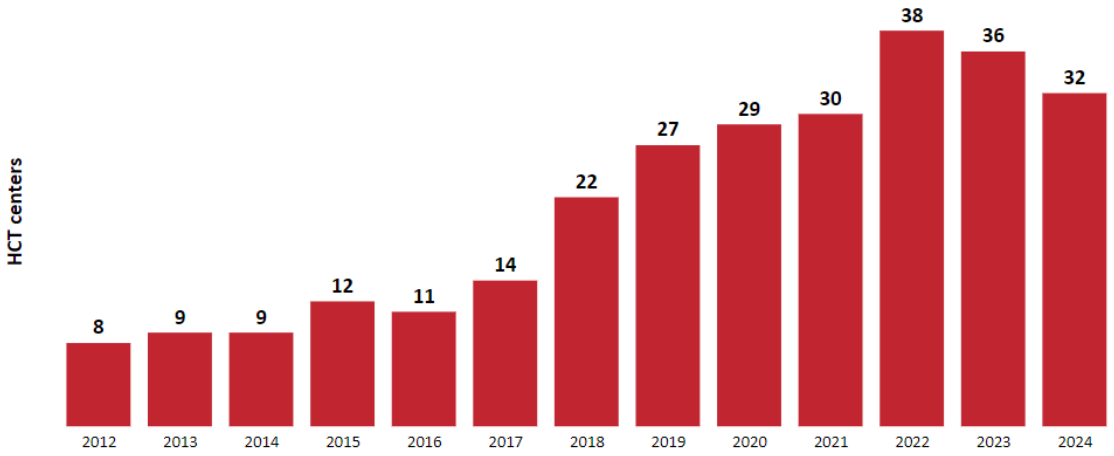


FIGURE 2. HCTs performed in Brazil and reported in the CIBMTR

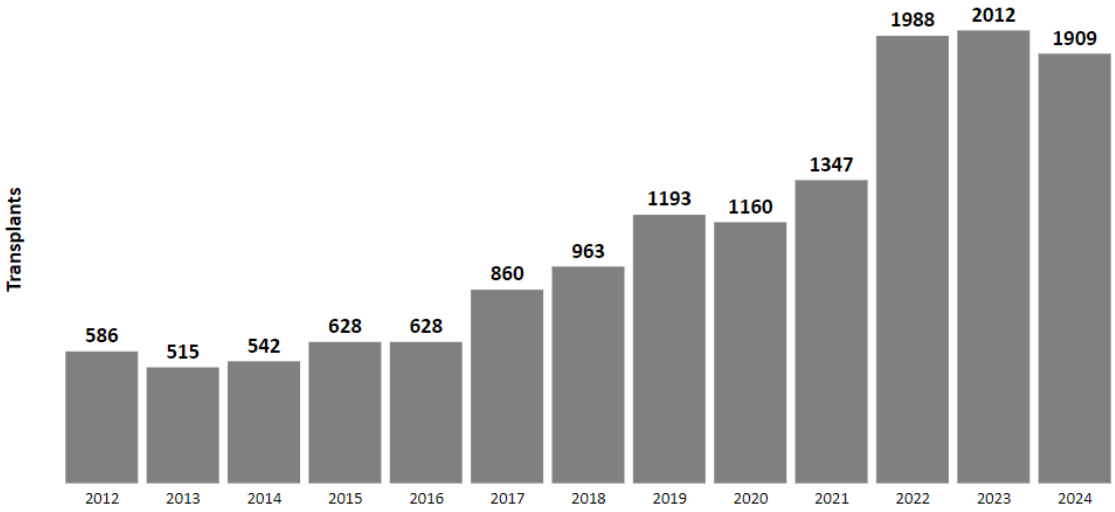


FIGURE 3. Relative proportion of allogeneic HCTs in Brazil by donor type

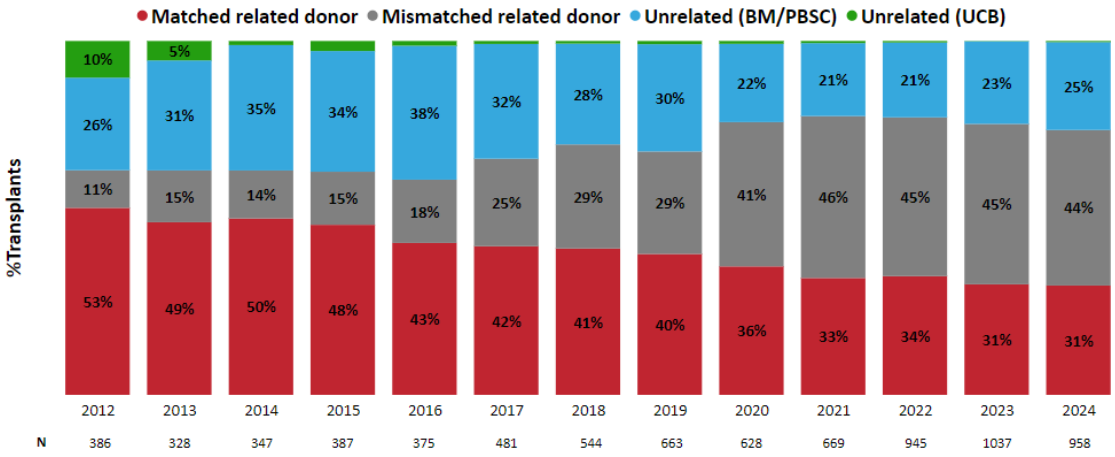


FIGURE 4. **Global indications for HCT in Brazil, 2024 (n=1,909)**

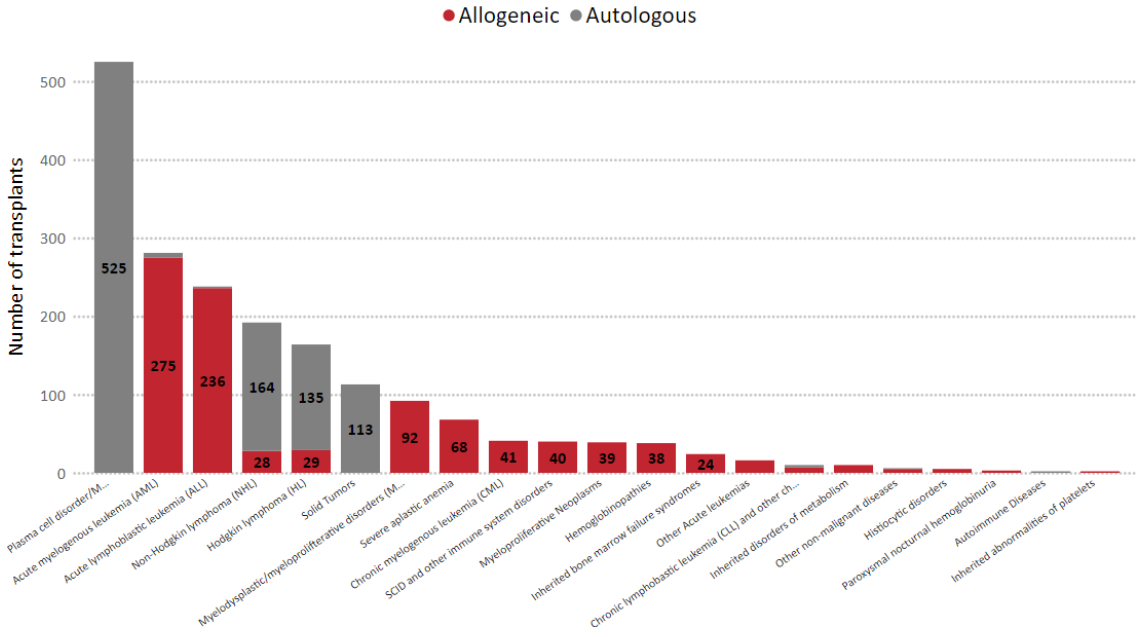
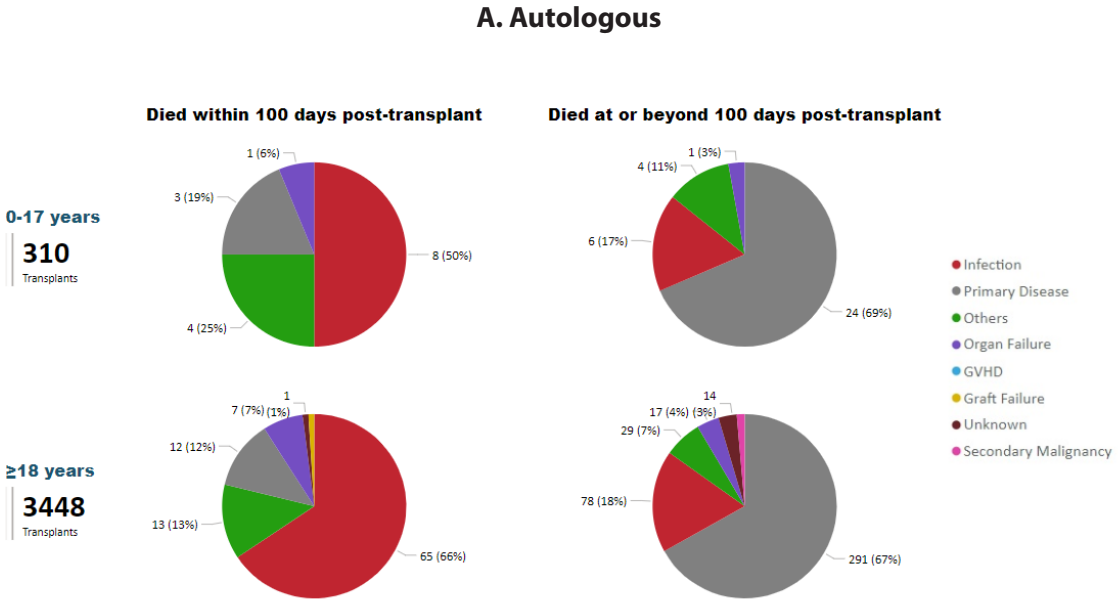


FIGURE 5. **Causes of Death after HCT in Brazil, 2019-2023**



B. Allogeneic

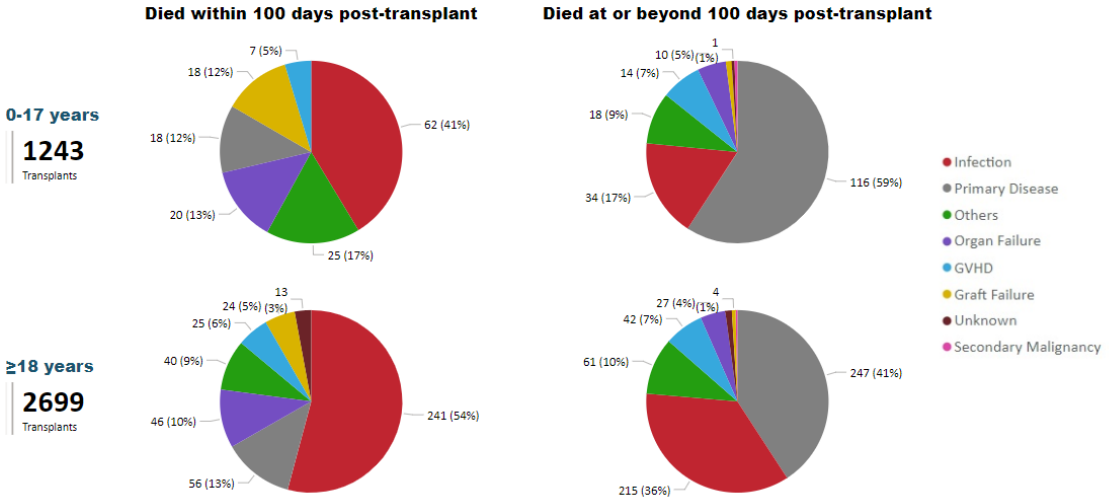


FIGURE 6. **AML, overall survival after 1st allogeneic HCT by donor type**

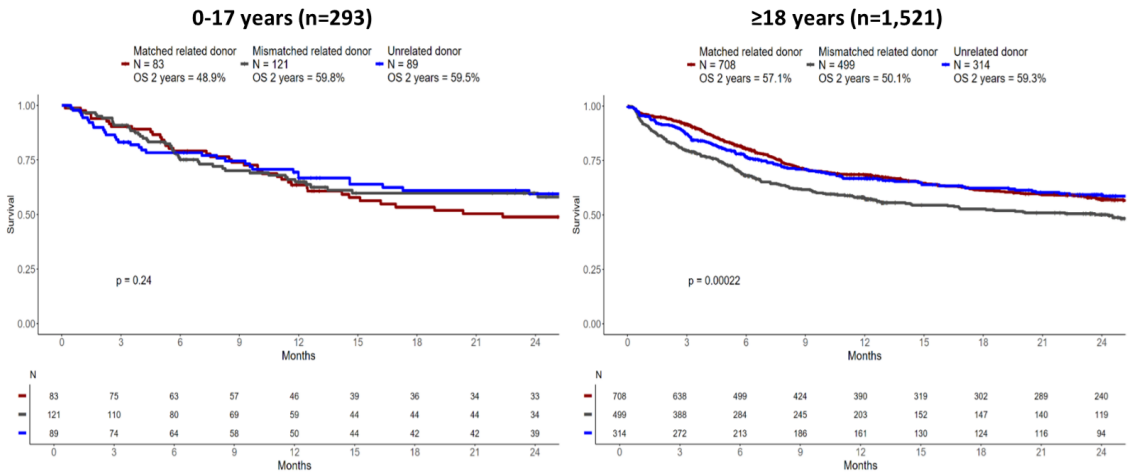


FIGURE 7. **ALL, overall survival after 1st allogeneic HCT by donor type**

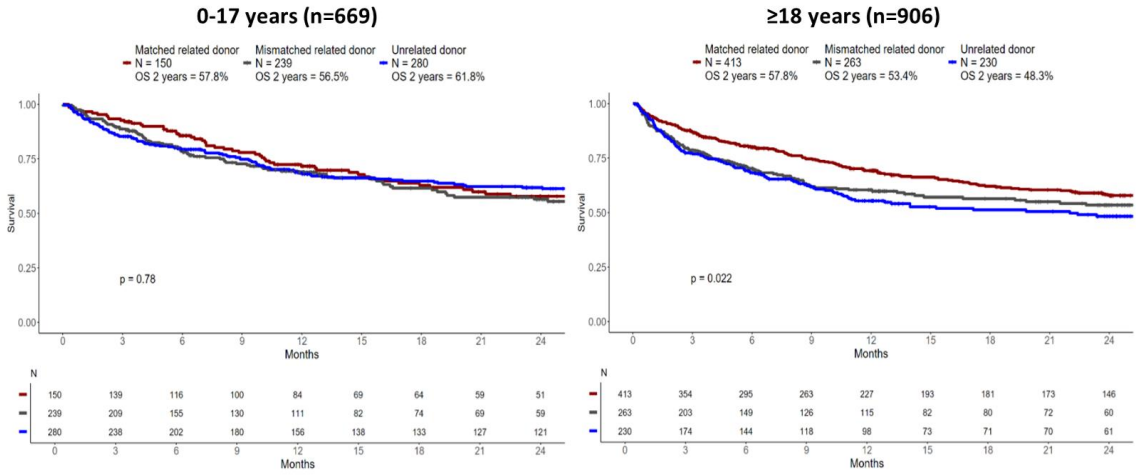


FIGURE 8. **MDS, overall survival after 1st allogeneic HCT by donor type**

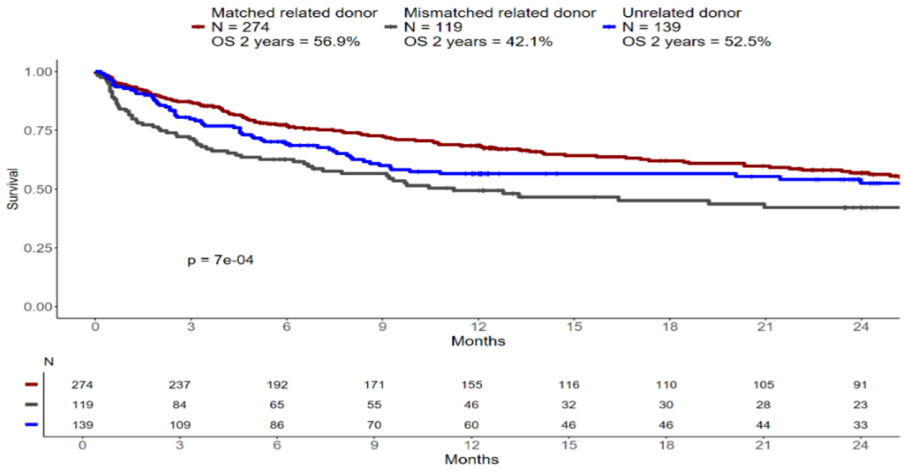


FIGURE 9. **Aplastic Anemia, overall survival after 1st allogeneic HCT by donor type**

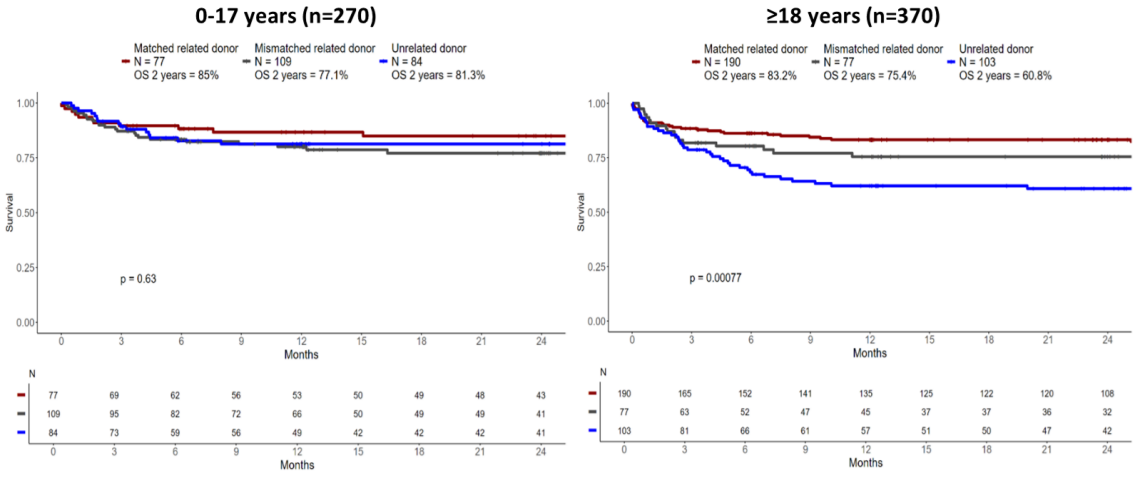


FIGURE 10. **MDS, overall survival after 1st allogeneic HCT by disease risk**

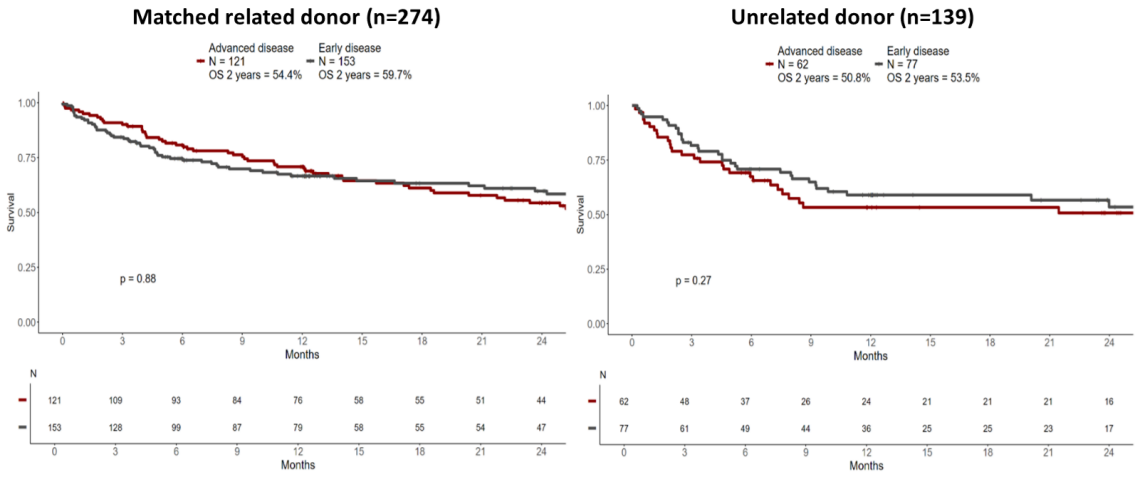


FIGURE 11. **CML, overall survival after 1st allogeneic HCT by donor type**

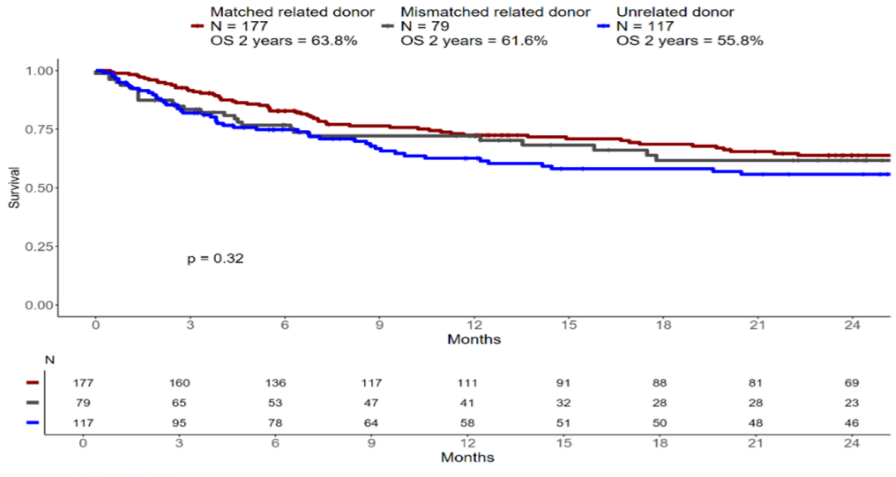


FIGURE 12. **Myelofibrosis, overall survival after 1st allogeneic HCT**

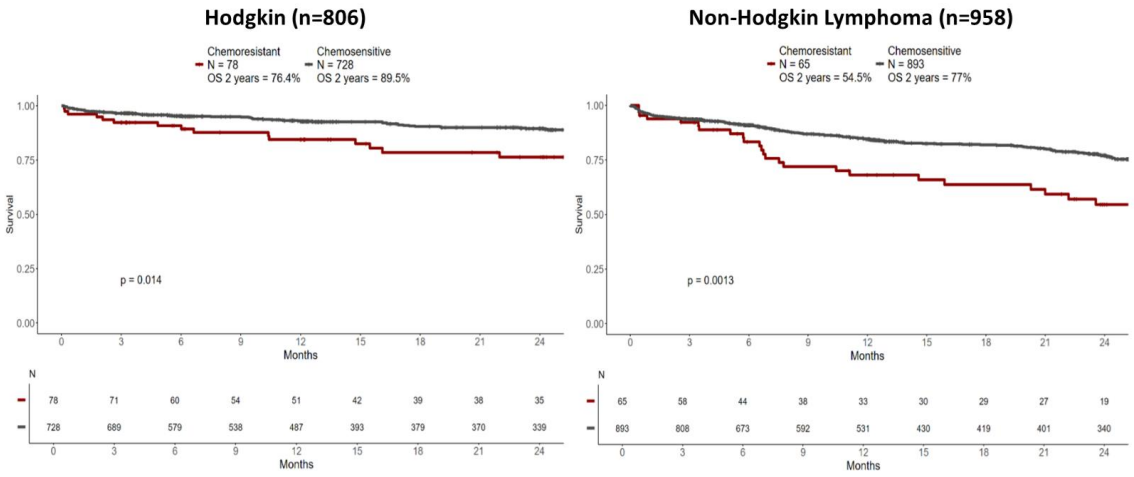


FIGURE 13. **Lymphomas, overall survival after 1st autologous HCT**

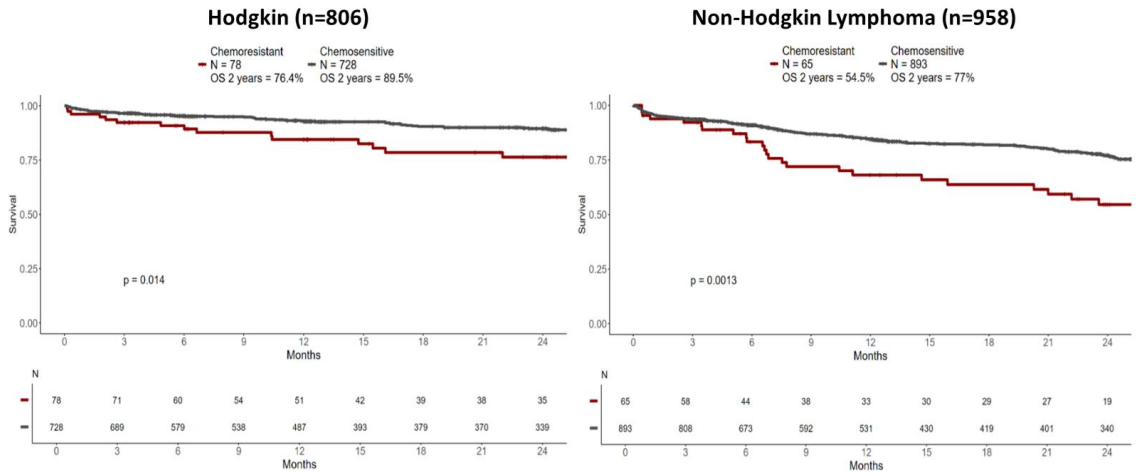


FIGURE 14. **Multiple Myeloma/ Plasma Cell Leukemia, overall survival after 1st autologous HCT**

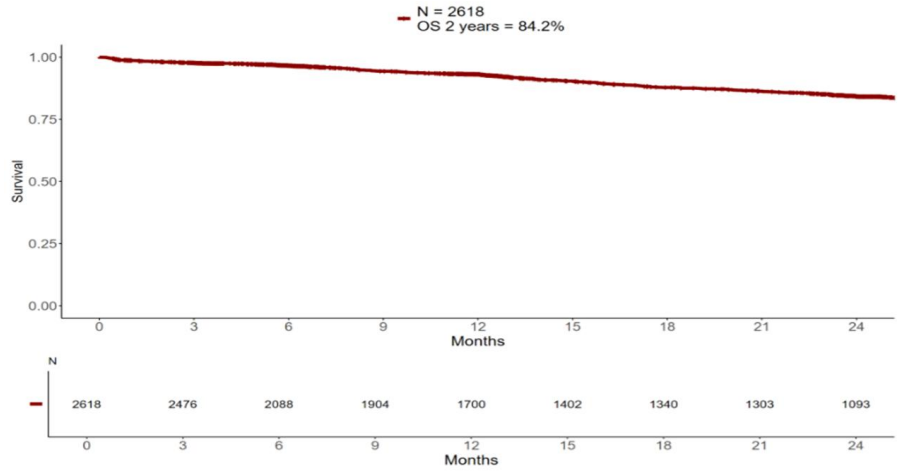


FIGURE 15. **Multiple Myeloma/ Plasma Cell Leukemia, overall survival after 1st autologous HCT by age at HCT**

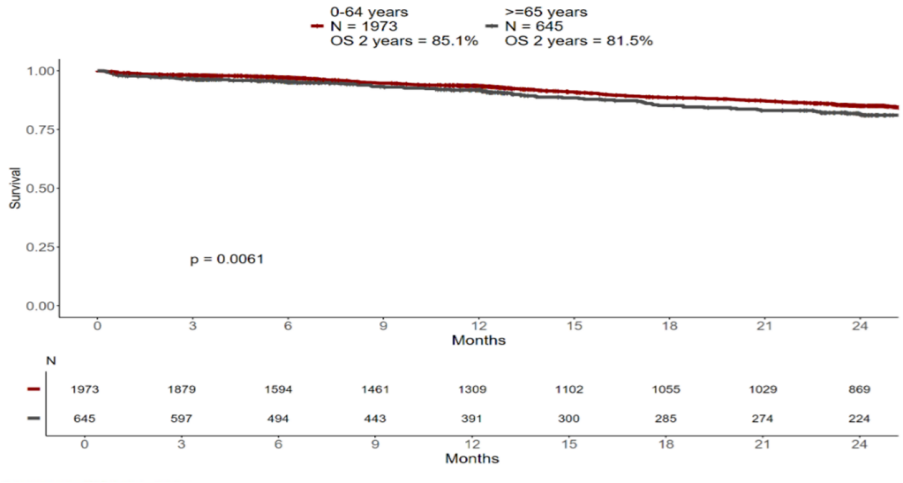
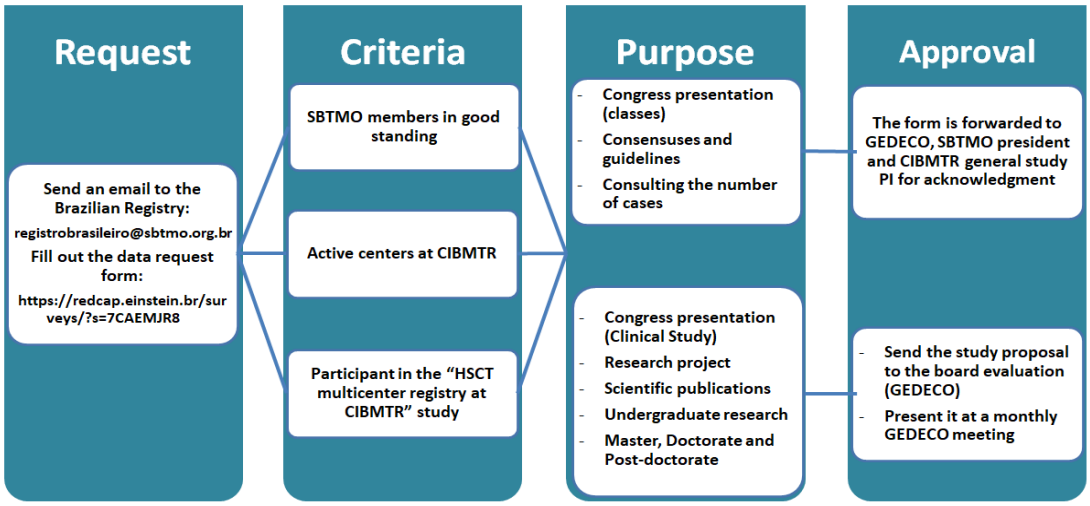


FIGURE 16. **Data request flow**



REFERENCES

1. Kanate AS, Majhail NS, Savani BN, et al. Indications for Hematopoietic Cell Transplantation and Immune Effector Cell Therapy: Guidelines from the American Society for Transplantation and Cellular Therapy. Biol Blood Marrow Transplant. 2020;26(7):1247-56.

2. Ferreira E, Dulley FL, Morsoletto F, et al. Bone marrow transplantation in Brazil. R. Hum Immunol. 1985;14(3):324-32.

3. Gluckman E, Rocha V, Boyer-Chammard A, et al. Outcome of cord-blood transplantation from related and unrelated donors. Eurocord Transplant Group and the European Blood and Marrow Transplantation Group. N Engl J Med . 1997 Aug 7;337(6):373-81.

4. Portal SBTMO - Sociedade Brasileira de Terapia Celular e Transplante de Medula Óssea. Registro Multicêntrico de TCTH (RBTCTH) – Atualização do Summary Slides: SBTMO [Internet]. Rio de Janeiro; 2022 [Accessed on 08/05/2025]. Available from: https://sbtmo.org.br/reportar-e-preciso-em-webinar-sbtmo-apresenta-novos-dados-do-registro-multicentrico-brasileiro-de-tcth

5. Silva CC, Neves HR, Simione AJ, et al. Challenges and strategies used to increase the report of Brazilian Hematopoietic Stem Cell Transplantation (HSCT) data to the Center for International Blood and Marrow Transplant Research (CIBMTR). JBMTCT. 2020;1(1):46–52.

6. Simione AJ, Neves HR, Silva CC, et al. Current use and outcomes of hematopoietic stem cell transplantation: The first Brazilian summary slides. JBMTCT. 2021;2(2):p99.

7. Simione AJ, Neves HR, Silva CC, et al. Current use and outcomes of hematopoietic stem cell transplantation: Brazilian summary slides. JBMTCT. 2022;3(2):p171.

8. Simione AJ, Neves HR, Silva CC, et al. Current use and outcomes of Hematopoietic Stem Cell Transplantation: Brazilian Summary Slides – 2023. JBMTCT. 2023;4(2):p200.

9. Simione AJ, Silva CC, Sabaini PM, et al. Current use and outcomes of Hematopoietic Stem Cell Transplantation: Brazilian Summary Slides – 2024. Journal of Bone Marrow Transplantation and Cellular Therapy. 2024; 5(1):p228.

10. Silva, CC, Simione, AJ, Sabaini, PM, et al. Emerging activity of Cellular Immunotherapy for treatment of cancer in Brazil Report from the Brazilian registry. Journal of Bone Marrow Transplantation and Cellular Therapy. 2024; 5(2):p235.

11. Bacigalupo A, Ballen K, Rizzo D, et al. Defining the intensity of conditioning regimens: working definitions. Biol Blood Marrow Transplant. 2009;15(12):1628-33.

12. Giralt S, Ballen K, Rizzo D, Bacigalupo A, Horowitz M, Pasquini M, et al. Reduced-intensity conditioning regimen workshop: defining the dose spectrum. Report of a workshop convened by the center for international blood and marrow transplant research. Biol Blood Marrow Transplant. 2009;15(3):367-9.

13. Bolon YT, Atshan R, Allbee-Johnson M, et al. Current use and outcome of hematopoietic stem cell transplantation: CIBMTR summary slides, 2022. Available at: https://cibmtr.org/CIBMTR/Resources/Summary-Slides-Reports