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The role of registries in hematological disorders☆

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☆ **Registry name**: Global Transplant Registry of the Worldwide Network for Blood and Marrow Transplantation (WBMT).

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ABSTRACT

Hematopoietic cell transplantation (HCT) was developed more than 65 years ago to treat malignant blood disorders and irreversible bone marrow failures, with the aim of replacing a diseased hematopoietic system with a healthy one (allogeneic HCT). Decades later, the procedure was adapted to apply maximal chemotherapy or radiotherapy, which would result in bone marrow failure, but could be remedied by an infusion of a patient's own cryopreserved bone marrow (autologous HCT). Both treatments are high-risk and complex, especially during the initial phases. However, concerted efforts, vision, and collaboration between physicians and centers worldwide have resulted in HCT becoming a standard of care for many hematological disorders with progressive improvements in outcomes. Registries and the collaboration of societies worldwide have enabled the delivery of this curative therapy to many patients with fatal hematological diseases. More than 1.5 million HCT were performed between 1957 and 2019, and activity is continuously increasing worldwide.

1. Introduction

Hematological malignancies are considered rare diseases, with an incidence of <1 in 1500 (FDA; https://www.fda.gov/patients/rare-diseases-fda#whatisraredis). Among them, acute and chronic leukemias have incidences of 0.3–2/10000 new diagnoses/year. Lymphoproliferative malignancies, including multiple myeloma and lymphoma, are more frequent, but are rare. Non-malignant hematological diseases, such as irreversible bone marrow failure, inborn errors, and hemoglobinopathies (e.g., thalassemia and sickle cell anemia), are also rare; however, the incidence in specific geographic areas can be relatively high. Rare diseases are challenging to treat because of the low number of patients, heterogeneity of the diseases, and limited prospective randomized trial evidence. Considerable progress has been made in understanding the pathophysiology of malignant and non-malignant hematological diseases, including the detection of molecular alterations and the development of targeted drugs against gene mutations, translocations, or deletions. Despite these developments including gene therapy and editing, hematopoietic cell transplantation (HCT) remains the only potential curative option. HCT is a highly complex and specialized treatment that makes the conduct of clinical trials challenging and impractical since only relatively small numbers of HCT are done at most centers in the world. Sir William Osler realized more than 100 years ago that "By observing, recording, tabulating and communicating, we increase our knowledge in the medical field" and that the development of registries follows these principles. Especially in HCT, registries are critical in contemporaneously and dynamically identifying risk factors that impact outcomes and responding with strategies to improve them.

The idea of replacing a malignant or irreversibly damaged hematopoietic system with a healthy one appeared in the early 1950s, and the first proof of hematopoietic engraftment was published in 1957 [1]. The path to success, however, was challenging because almost all 200 patients transplanted during the first 10 years died of rejection (destruction of the graft by the patient's remaining immune cells; HvGR) or graft-versus-host disease (damage of the host cells by the transplanted graft; GvHD) [2]. Only after unraveling the engraftment principles of HvGR and the opposite reaction, GvHD and the use of mixed lymphocyte culture-negative, litter donor dogs, was the concept proven successful in experimental HCT. With the availability of human leukocyte antigen (HLA) [3]-testing and the use of syngeneic donors, HCT became more successful albeit high risk so was reserved for patients with end-stage diseases. Continuous discoveries and advancements in basic and translational sciences have contributed to a decrease in treatment-related morbidity and mortality. The cooperation of many clinicians and researchers in the fields of immunology, genetics, gastroenterology, pulmonology, pharmacology, and immunology, and the experiential and scientific exchange of HCT pioneers in meetings augmented by analyses from registries, facilitated continuous outcome improvement in HCT. This is the cornerstone of the advances in HCT. Over time, the results from large studies and registry data, demonstrated the benefits of HCT in the early stages of several blood cancers, and HCT was adopted worldwide. Further outcome improvements came from the description of a potent graft-versus-tumor effect after allogeneic HCT [4,5], the use of chemotherapy based conditioning, the use of reduced or non-myeloablative conditioning in

elderly patients [5–7], establishment of worldwide unrelated donor registries (over 40 million stem cell donors), high-resolution typing, transplantation with mobilized peripheral blood stem cells over bone marrow as a source, the use of cryopreserved cord blood, the possibility of utilizing non-identical (HLA-mismatched) donors using in vitro T-cell depletion, and more recently, the use of cyclophosphamide post-HCT for *in vivo* T-cell depletion. The availability of effective immunosuppressive drugs to decrease the incidence and severity of GvHD and novel therapies to treat it are further examples of the continuous progress in HCT outcomes supported by worldwide scientific exchange from centers augmented by national and international registries.

Dedicated physicians, specialist societies, and scientific organizations internationally have recognized the importance of HCT data repositories and organized in country- and/or region-wide registries. These include the Center for International Blood and Marrow Research (CIBMTR) in the USA (https://cibmtr.org/), European Group for Blood and Marrow Transplantation (EBMT) in Europe (https://www.ebmt.org/), Eastern Mediterranean Blood and Marrow Transplant Group (EMBMT) in the Middle East (https://http://embmt.org), Asia Pacific Blood and Marrow Transplant Group (APBMT) in Asia Pacific (https://www.apbmt.org/), and Australia, and New Zealand Transplant and Cellular Therapies (ANZTCT) in Australia and New Zealand (https://anztct.org.au/). Registries were used to increase the knowledge of the scientific communities for the benefit of their patients accessing large datasets without the high cost involved in other formal clinical trial designs. Research datasets have also been made publicly available by the CIBMTR to allow secondary analyses and further refine our knowledge and understanding of HCT.

Table 1
Survey data form.

Name of Unit/region	Latin America																		
2022	**Family**									Unrelated				Auto			**Allo**	**Auto**	**Total**
Disease	HLA Id			HLA nonid			Twin		**total**	BM	PB	CB	**total**	BM	PB	CB	**Total**	**Total**	
	BM	PB	CB	BM	PB	CB	BM	PB											
AML 1st CR																			
AML non 1st CR																			
Total AML																			
ALL 1st CR																			
ALL non 1st CR																			
Total ALL																			
CML 1st cP																			
CML not 1st cP																			
Total CML																			
Other Leukemia																			
MDS/MD/MPN/ts AL																			
MPS/MPN																			
Total MDS/MPS																			
CLL incl. PLL																			
Total Leukemia																			
PCD - Myeloma																			
PCD - other																			
Total Plasma Cell Disorder																			
HD																			
NHL																			
Total Lymphoma																			
Other LPD																			
Total LPD																			
Neuroblastoma																			
Germ cell tumor																			
Breast Cancer																			
Ewing																			
Other solid tumor																			
Total Solid tumor																			
BMF - SAA																			
BMF - other																			
Total Bone Marrow Failure																			
Hemoglobinopathy																			
Primary Immune Deficiency																			
Inherited Dis of Metabolism																			
Auto Immune disease																			
Other Non Malignant disease																			
Total Non-malignant disease																			
Other																			
TOTAL (patients)																			

Despite the worldwide expansion of HCT, significant inequities in access remain, particularly in low-resource areas. In 2007, the CIBMTR, EBMT, APBMT, and Worldwide Marrow Donor Association (WMDA) founded the Worldwide Network for Blood and Marrow Transplantation (WBMT; https://www.wbmt.org/) with a mission to improve access to and quality of HCT worldwide. Twenty-one organizations are member societies of the WBMT as of 2024. Since the Network's mission was in line with the guiding principles of the World Health Organization (WHO), WBMT was appointed as one of its official non-governmental relationships. The WHO has declared that the transplantation of organs, cells, and tissues remains a global priority and has formed a task force to address worldwide quality, safety, and equity in HCT. Equity in HCT is especially threatened by a limited workforce, insufficient diagnostics, and lack of training in a field that requires increasing specialization and robust infrastructure to support potentially high medical acuity and immunocompromised patients. It also argues for the need and importance of a global transplant registry that can capture HCT activity and outcomes to minimize global inequity and maximize outcome improvement gains. This is especially relevant in the treatment of rare diseases, where pooled information from registries can provide data on access, dynamically identify potential negative outcome risk factors, and inform optimal strategies for outcome improvement, all of which are essential for improving the access, quality, and safety of HCT globally. Registries can also provide information on ideal HCT indications, the efficacy of different technologies, donor types, and trends over time, providing a data-driven evidence base for physicians to deliver appropriate patient counseling, and for health care agencies to develop the required infrastructure. For all these scientific, political and economic aspects, regular worldwide analyses of HCT activities and trends are essential and provide a basis for identifying regional differences, and helping to establish new or improve existing programs.

2. Type of registries and objective

Setting up a global registry is not trivial even if established registries exist. Definitions need to be standardized, and the rules must be accurately set. The WBMT has adopted a *center-based* (in contrast to patient-based) activity survey, which is known for its ease and acceptance. The annual activity collection of transplant types (autologous or allogeneic), donor relationship (related or unrelated), matching (matched or mismatched), and disease type and stage are reported on a single page (Table 1). A high capture rate and ease of reporting are crucial requirements for the efficiency of this type of registry, especially in developing countries. No patient-specific information or ethical approval is required, but rather an agreement on worldwide standardized definitions. For comparison, activities can be correlated to the population size and expressed as transplant rates (TR; transplants/10 million inhabitants) of the country or region, and further correlated with economic characteristics (gross national income/capita or health expenditure). Center-based registries may capture up to 100 % of HCT cases in a country or region.

Instead, outcome registries *(patient based)* contain individual-level information on diseases, patient and donor characteristics, and outcomes, and require extensive data management, which is also important, but time-consuming and expensive, making it almost impossible to maintain in low-resource sites. According to the extent of information collected, minimal essential data (named core data set or transplant essential data (TED)) or even more detailed data (comprehensive data set or Comprehensive Report Form (CRF)) are available in the outcome registries. More detailed information can be obtained with disease-specific forms (for example, MED-C/TED or CFR) and, if needed, by contacting the transplant center. The information for each patient must be updated at defined time intervals, requiring established data management. Ultimately, these registries are instrumental in analyzing the role of previous therapies, disease stage, donor type and HLA-matching, GvHD prophylaxis, incidence of complications on outcomes after HCT, and quality control and accreditation of single centers. Identification of risk scores for HCT outcomes in chronic myelogenous leukemia (CML) and other diseases [8,9], the importance of HLA high-resolution typing in unrelated HCT [10] and the impact of donor age [11] are just a few examples of how outcome registries influence practice and contribute to the success of HCT over time. These registries reflect "real-world" situations by collecting HCT information without strict clinical-trial-based exclusion or inclusion criteria, and may allow follow-ups for decades on thousands of patients. They may also contribute to big data, information on rare diseases, and the role of different ethnicities in the prevalence of diseases and treatment outcomes. Outcomes registries with hundreds of thousands of patients have been established by the CIBMTR and EBMT during the last decades and lately used also for benchmarking of survival outcomes and coverage with evidence determination [12,13]. Utilization of the registry to address regulatory requirements should be mentioned as well. Outcome registries are, however, not replacing the need for prospective studies, which have the advantage of being randomized and avoiding possible biases, but are expensive and require sophisticated logistics, making them unavailable in most low-resource regions.

3. Objective of the global transplant registry (GTR)

The Global Transplant Registry (GTR) started its activity in 2006 with the aim of collecting center-based activities worldwide, taking into account the heterogeneity of worldwide programs from low budget to high-end data management, and allowing maximal flexibility. The main objective of the GTR was to evaluate HCT activities worldwide, considering population size and economic characteristics, and draw comparisons between countries and regions. In line with the mission of the WBMT and the guiding principles of the WHO, the WBMT supported the establishment of registries within scientific societies in regions without such infrastructure (e.g., Latin America and Africa) using reports communicated directly to the WBMT by transplant centers. Newly established societies ensure the independent development and completeness of data and avoid reporting duplication without competing with registries of existing member societies. Centers may also report their activity to one or more other registries outside their region without duplication since GTR analyses can be performed by country.

GTR uses the regional reports of the member societies EBMT, CIBMTR, APBMT, EMBMT, and ANZTCT as well as reports of

individual transplant centers not included in regional societies that communicate directly to the WBMT data center. WBMT aggregates direct transplant center information by country, region, and globally. Aggregated data can be shared upon request for analyses within appropriate countries or regional societies (e.g., the Latin American Blood and Marrow Transplantation group (LABMT; https://www.wbmt.org/member-societies-of-wbmt/labmt/) and the African Blood and Marrow Transplantation Group; https://www.wbmt.org/member-societies-of-wbmt/afbmt/).

The WBMT collects the number of first HCT by country, year of HCT, disease, and donor type using a standardized form and has published HCT activities and trends in scientific journals biennially since 2006 [14–18]. Data were validated by a range of different independent systems through confirmation by the reporting teams, following receipt of a computer printout of the entered data, by selective comparison with patient-based core-dataset/TED-datasets in the EBMT/CIBMTR data system, or by crosschecking for double reporting with national registries. Data were validated by on-site visits to selected teams to verify the reported data as part of the quality control program within the European, North American, Latin American, and Asia-Pacific organizations. On-site visits to selected teams are part of the quality-control accreditation program of JACIE (www.ebmt.org/jacie-accreditation) and FACT (www.factweb.org). Based on quality controls and contacts with regulatory agencies or national offices, the data reporting rate for allogeneic HCT has been estimated to be >95 %, and that for autologous HCT is 80–90 %. Therefore, the number of potentially missing transplants is estimated to be less than 5 % for allogeneic HCT and less than 20 % for autologous HCT. Reporting may be higher in Australia, Canada, Europe, Japan, and the USA than in less-developed areas of the world. An analysis of the strengths and weaknesses of the GTR of WBMT is presented in Table 2

4. Development of the eGTR

In recent years, the need for web-based electronic GTR (eGTR) has become apparent because of the time needed to collect information from almost 2000 transplant centers worldwide, even if GTR reporting is relatively easy and efficient. Delays in recognizing clinical trends, especially during pandemics, and the potential of clinical improvement strategies identified during WBMT workshops and twining programs, and telemedicine opportunities prompted us to develop an eGTR program.

The program is accountable for reporting using different platforms (center, country, region, and global) and for responding to requests of the regions and countries, but at the same time also for ensuring personalized access, highest data quality, avoiding duplication, and compliance with local and international regulations. While the main objective is data entry at the center level, some WHO regions prefer hybrid data entry (center and country level). Only designated persons can enter center data and modify entries in the eGTR, which is open to centers and scientific societies active in the field and is free of charge. Data protection is maintained by granting restricted access to a single society or person associated with the relevant country or region. Data analyses must be agreed upon by the corresponding national or regional society. Constant interactions between different platforms ensure high data quality and completeness. The LABMT was at the forefront of the regional eGTR, with entry at the center and only one centralized reporting at the country level. An example of a successful country registry was recently established in Pakistan by using the eGTR for reporting to the APBMT.

5. Results

Since 1957, more than one and half million HCT have been counted [18]. During the last few decades, HCT activity has continuously increased and doubled from 2007 to 2018. The total annual increase was even higher in recent years than predicted (Fig. 1; expected dotted line and reported solid line). The increase in allogeneic HCT amounts to approximately 5 % per year in Europe and

Table 2
Strengths and weaknesses of the global transplant registry (GTR) modified from [17].

Strengths	Weaknesses
GTR relies on an established network of HCT organizations with global reach	GTR has limited funding
GTR is developed in the context of the WHO and information reported regularly to the WHO	No official link with local competent authorities or agencies. Some countries do not have operative health agencies.
eGTR web based is easy to access and will speed up reporting and analysis	Long delay from HCT to data collection, data analysis and dissemination using the GTR
Work in a field with continuing increase in transplants numbers, programs and active countries	No Quality Management System yet
Overview of numbers in all WHO countries for professionals and competent authorities	GTR has limited information without patient-specific data and no outcome
Identification of countries with low or absent activity and in need of improvement	Few countries do not participate yet
Identification of emerging or fading HCT technologies	Still many regulatory reporting issues (e.g. trials) in place
No competitor	
Tool to analyze HCT utilization worldwide for each disease and country	
Compare activities on a regional/country level and through cooperation with outcome registries make bench making	
Collection of other cellular therapies	
Chance to establish national organizations like in Pakistan	
No patient-specific information required and no need for ethical approval	

North America, and 17 % in the Asia-Pacific region. The increments were similar for autologous HCT (app.6 %/year) in Europe and the USA and around 15 % in Latin America.

In 2018, 1768 teams from 89 countries reported their activity to the WBMT, a sign of acceptance and motivation to contribute to the GTR [19]. The number of centers increased steadily, but not in parallel with HCT numbers, suggesting increased activity per center over the years rather than the establishment of new centers. Comparing world regions, the transplant rate was highest in North America (561 TR: 334 autologous and 227 allogeneic), followed by Europe (439 TR: 257 autologous and 182 allogeneic). TR was lower in Latin America (77 TR; 47 autologous and 30 allogeneic) and in the Southeast Asian Region (SEAR)/Western Pacific Region (WPR - 54 TR; 20 autologous and 34 allogeneic). The lowest TR was detected in the African/East Mediterranean regions with 28 TR (11 autologous and 17 allogeneic) (see Fig. 2 with permission of Haematologica from reference [18]).

In the preliminary 2019 dataset (90 % complete), more than 94,529 HCT were registered. Of these, 49,783 (52 %) were autologous and 44,746 (48 %) were allogeneic HCT, which is an increase in comparison to 2018 from 44,425 to 48,680 (total 93,105), respectively. Preliminary 2020 data are also available, showing a drop in activity parallel with the SARS-CoV-2 pandemic. Interestingly, reduction was more pronounced in autologous (n = −2782 HCT) than in allogeneic (n = −474) HCT and was observed in all world regions except in SEAR/WPR.

A total of 972,412 HCT were included in the database since 2006. Lymphoproliferative disorders (plasma cell disorders and lymphomas) treated with autologous HCT are the most common indication for HCT (approximately one-third of all activity), which may change in the following years with the emergence of chimeric antigen receptor (CAR)-T cell therapies, which would further increase the equity gap between high- and low-resource countries. Acute and chronic leukemias treated with allogeneic HCT account for a quarter of all HCT cases. Expected HCT activities are observed in myelodysplastic syndrome/myeloproliferative disorders, non-malignant diseases treated with allogeneic HCT, and solid tumors treated with autologous HCT [with permission of Haematologica reference [18]] (Fig. 3).

6. Discussion

Knowledge of worldwide HCT trends and activities is essential for progress and evaluation of aspects of quality, safety, equity, and treatment shifts. Remarkable changes were observed in the GTR with the introduction of novel therapies and HCT technologies. The abandonment of autologous HCT to treat breast cancer after a negative prospective randomized trial and the availability of tyrosine kinase inhibitors with a decline in HCT activity in patients with CML are just two examples. At the same time, the observation of a

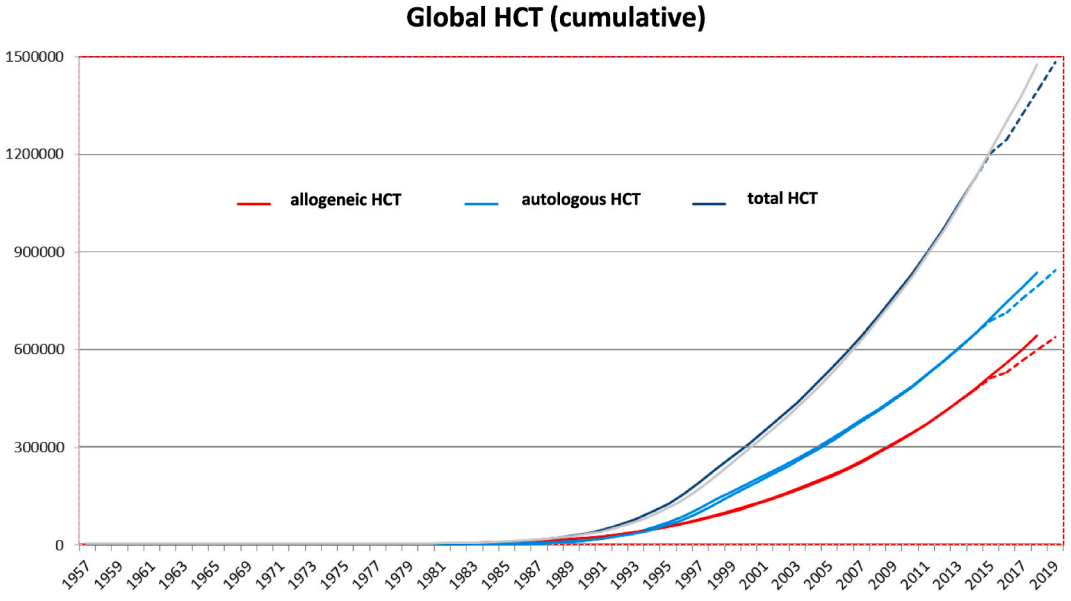

Fig. 1. Annual Hematopoietic Cell Transplantation (HCT) activity from 1957 to 2018. The dotted lines represent the predicted values in 2026, whereas the full line represents the actual registered activity.
European data were derived from the European Society for Blood and Marrow Transplantation (EBMT) database for 1965–89 and from the EBMT Annual Activity Survey Office since 1990; 21 non-European data were initially provided by the Center for International Blood and Marrow Transplant Research (CIBMTR) since 1964. They were supplemented or replaced by the activity surveys of the Asian Pacific Blood and Marrow Transplantation Group (APBMT) since 1974, the Australasian Bone Marrow Transplant Recipient Registry (ANZTCT) since 1982, the Eastern Mediterranean Blood and Marrow Transplantation Group (EMBMT) since 1984, the Cell Therapy Transplant Canada (CTTC) since 2002, the Latin American Bone Marrow Transplantation Group (LABMT) since 2009, and the African Blood and Marrow Transplant Group (AFBMT) since 2010. Unrelated donor and cord blood information were derived from the World Marrow Donor Association (WMDA) and Bone Marrow Donors Worldwide (BMDW) adapted with permission of Haematologica from Ref. [18].

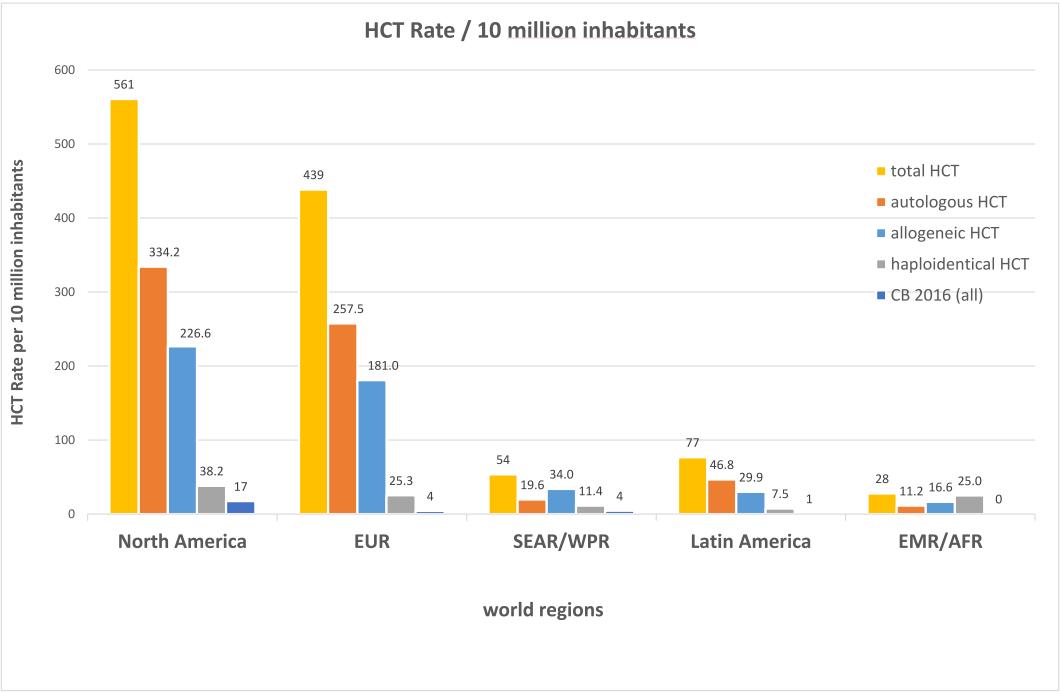

Fig. 2. Transplant rates (TR). Hematopoietic cell transplantation (HCT)/10 million population according to transplant type (autologous, allogeneic, related mismatched and cord blood) and world regions in 2016(18).

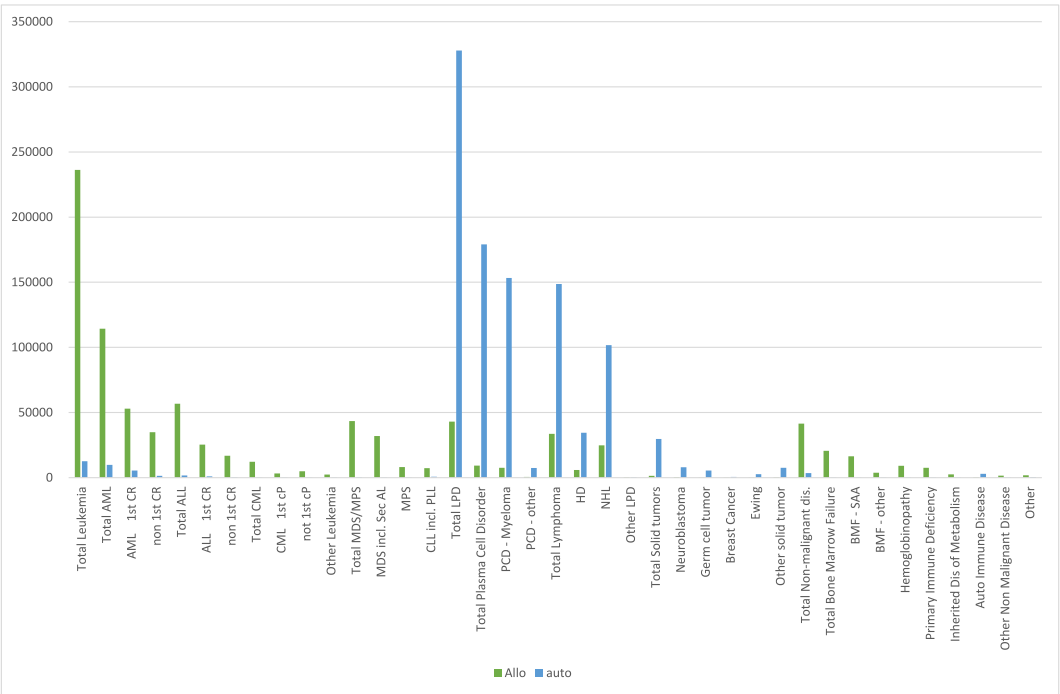

Fig. 3. Total HCT numbers collected from 2006 until 2016 (n = 697,934) divided by donor type (autologous and allogeneic) and indications [18].

higher percentage of CML patients transplanted in the non-first chronic phase than in the first chronic phase is a warning sign for earlier indication of HCT when medications fail [19]. As outcomes in the first chronic phase are superior to those in later stages of CML, this observation is important for optimal treatment recommendations [20]'. Other examples involve increased activity of HCT for

autoimmune diseases, hemoglobinopathies and other non-malignant diseases in certain regions [19]. The data reported here demonstrate significant but narrowing gaps between world regions; however, more effort is needed to continue this in the future.

GTR and eGTR are essential tools for analyzing, comparing, and improving HCT activity around the world. Based on the information provided by the registry, Paraguay was identified as one of many countries without allogeneic HCT activity. After organizing a workshop in cooperation with the WHO, training physicians in accredited centers and performing daily supervisory telemedicine, a sustainable allogeneic HCT program, was established. Similar results have been reported in Vietnam and Bangladesh. In Pakistan, after the latest WBMT workshop, the eGTR was used to establish a national registry and society even though individual centers reported since years to APBMT. Another example involves Ukraine, where before the invasion, telemedicine was started to establish an allogeneic HCT adult program in the country instead of sending patients abroad.

Using the GTR, the possibility of analyzing HCT utilization worldwide was launched by relating disease incidence from the Global Burden of Disease estimates with transplant activity for specific diseases and regions, providing information on treatment paths [21]. Such information is important for equity and quality aspects and was recently analyzed for patients with multiple myeloma and AML [22–24].

The limitations of center-based GTR are mainly related to the outcome analysis. However, such analyses can be performed in selected world regions and countries with an outcome registry, while GTR contextualizes the information into a global prospective and may estimate coverage and selection. This approach is exemplified in a study that collected outcome data of more than 60.000 patients with multiple myeloma treated with autologous HCT, representing more than 50 % of all patients transplanted worldwide [25]. The results showed the safety of autologous HCT, but a great heterogeneity in patient and disease characteristics at HCT in different regions and countries. The ultimate goal is to establish an outcome registry worldwide, not only for understanding disease characteristics in different regions but also for external and internal quality controls. The tools for such registries are available from societies, and financial coverage should be provided in each transplant center as an integral part of the HCT service infrastructure.

The eGTR-like HCT requires iterative improvement. Current reporting is restricted to the first HCT and does not cover the second or third HCT. Options to include multiple transplants are currently being investigated and tested at selected centers. Furthermore, separate pediatric activity reports currently piloted by the LABMT will be made available in the future. The global activity of cell therapies, not only related to CAR-T cells but also other cellular therapies, such as virus-specific T-cell infusions, donor lymphocyte infusions, and mesenchymal stem cells, are among the next steps, and we have already developed tools in the eGTR to collect this information worldwide. Cost and affordability not only HCT but also of new therapies are likely to increase inequality and the gap between high income and Low Middle Income Countries.

The worldwide WBMT biennial activity survey is of considerable interest to the WHO for scientific societies, physicians, nurses, patient associations, health authorities, and policymakers to use data-driven strategies to improve access to treatment. It is also important to measure the impact of WBMT interventions, such as workshops, webinars, and activity reports, that contribute to the global development of expertise in the field.

7. Practice points

- Hematopoietic cell transplantation (HCT) was developed more than 65 years ago to treat malignant blood disorders and irreversible bone marrow failures
- Concerted efforts, vision, and collaboration between physicians and centers worldwide have resulted in HCT becoming a standard of care for many hematological disorders with progressive improvements in outcomes.
- Registries and the collaboration of societies worldwide have enabled the delivery of this curative therapy to many patients with fatal hematological diseases.
- The WBMT has adopted a center-based (in contrast to patient-based) activity survey, which is known for its ease and acceptance.
- The annual activity collection of transplant types (autologous or allogeneic), donor relationship (related or unrelated), matching (matched or mismatched), and disease type and stage are reported on a single page in the Global transplant registry (GTR)
- The need for web-based electronic GTR (eGTR) has become apparent because of the time needed to collect information from almost 2000 transplant centers worldwide
- In the preliminary 2019 dataset (90 % complete), more than 94,529 HCT were registered.
- GTR and eGTR are essential tools for analyzing, comparing, and improving HCT activity around the world. Detailed information in the database on 972,412 HCT available
- More than 1.5 million HCT were performed between 1957 and 2019, and activity is continuously increasing worldwide.
- The worldwide WBMT biennial activity survey is of considerable interest to the WHO for scientific societies, physicians, nurses, patient associations, health authorities, and policymakers to use data-driven strategies to improve access to treatment.

8. Research Agenda

- The eGTR-like HCT requires iterative improvement.
- Current reporting is restricted to the first and does not cover the second or third HCT.
- Separate pediatric activity reports currently piloted by the LABMT will be made available in the future.
- The global activity of cell therapies, not only related to CAR-T cells but also other cellular therapies, such as virus-specific T-cell infusions, donor lymphocyte infusions, and mesenchymal stem cells, are among the next steps

- Cost and affordability not only of HCT but also of new therapies are likely to increase inequality and the gap between high income and Low Middle Income Countries.
- It is important to measure the impact of WBMT interventions, such as workshops, webinars, and activity reports, that contribute to the global development of expertise in the field.

CRediT authorship contribution statement

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Declaration of cometing interest

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.beha.2024.101556.

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