2010 Biennial Report of the C.W. Bill Young Cell Transplantation Program

(January 2008 – December 2009)

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List of Abbreviations

The following table lists the abbreviations and acronyms that appear in this document.

ABBREVIATION	DEFINITION
AABB	(formerly known as American Association of Blood Banks)
ALL	Acute Lymphoblastic Leukemia
AML	Acute Myelogenous Leukemia
ASBMT	American Society for Blood & Marrow Transplantation
BMCC	Bone Marrow Coordinating Center
BMT	Bone Marrow Transplant
CBCC	Cord Blood Coordinating Center
CBU	Cord Blood Unit
CIBMTR	Center for International Blood and Marrow Transplant Research
CLL	Chronic Lymphocytic Leukemia
CML	Chronic Myelocytic Leukemia
CPI	Continuous Process Improvement
DLBCL	Diffuse Large B-Cell Lymphoma
EBMT	European Group for Blood & Marrow Transplantation
FACT	Foundation for the Accreditation of Cellular Therapy
FDA	Food and Drug Administration
FL	Follicular Lymphoma
GVHD	Graft-Versus-Host Disease
HCT	Hematopoietic Stem Cell Transplantation
HD	Hodgkin Disease
HHS	U.S. Department of Health and Human Services
HLA	Human Leukocyte Antigen
HRSA	Health Resources and Services Administration
IBMTR	International Bone Marrow Transplant Registry
IRB	Institutional Review Board
MCL	Mantle Cell Lymphoma
MCW	Medical College of Wisconsin
MDS	Myelodysplastic Syndrome
MM	Multiple Myeloma
NIH	National Institutes of Health
NMDP	National Marrow Donor Program
OPA	Office of Patient Advocacy
PBSC	Peripheral Blood Stem Cells
QOL	Quality of Life
RITN	Radiation Injury Treatment Network®
SCTOD	Stem Cell Therapeutic Outcomes Database
SPA	Single Point of Access
TED	Transplant Essential Data

Section 1: Introduction

1.0 Overview of the C.W. Bill Young Cell Transplantation Program

Every year, thousands of men, women and children are diagnosed with life-threatening diseases such as leukemia and lymphoma. Many of them will die unless they get a bone marrow, peripheral blood stem cell or cord blood transplant from a genetically matched donor. While some will find a donor within their family, most do not and need help to find an unrelated bone marrow, peripheral blood stem cell or cord blood donor. They also need their physicians to know and use the latest, most effective transplant practices. This knowledge comes from analyzing the outcomes of many transplants from centers around the world. All of these patients depend on the knowledge and services provided by the C.W. Bill Young Cell Transplantation Program. Additional general information about hematopoietic stem cell transplantation (HCT) can be found in section 2.4.4.

This Biennial Report describes the activities of the C.W. Bill Young Transplantation Program and its predecessor, the National Bone Marrow Donor Registry, for the period January 2008 through December 2009. It is an overview of the operation of this extensive network of medical organizations that provides patients and providers with the hematopoietic stem cells and information they need to combat life-threatening diseases.

1.1 History

In December 2005, the Stem Cell Therapeutic and Research Act of 2005 (Public Law 109-129) established the C.W. Bill Young Cell Transplantation Program (the Program). The Health Resources and Services Administration (HRSA) of the U.S. Department of Health and Human Services (HHS) is responsible for overseeing this Program.

The C.W. Bill Young Cell Transplantation Program (the Program) is the successor to the National Bone Marrow Donor Registry (the Registry). The Registry was begun in 1987 through a grant from the U.S. Navy. In 1990, the Registry was formally established under HHS, with oversight initially by the National Heart, Lung, and Blood Institute (NHLBI), and since 1994 under HRSA. The first transplant under the Registry's auspices took place in 1987. While some of the activities of the Program are similar to those of the Registry, the Program has the added responsibility of collecting, analyzing and reporting on outcomes for all allogeneic transplants (those from a donor other than the patient him/herself) and on other therapeutic uses of blood stem cells. The Program was designed to help patients who need a transplant from an unrelated adult marrow or peripheral blood stem cell (PBSC) donor or cord blood unit (CBU) by:

- Making information about bone marrow and cord blood transplantation available to patients, families, health care professionals and the public
- Providing efficient, effective processes for identifying unrelated matched marrow and PBSC donors and cord blood units through one electronic system
- Increasing the numbers of unrelated marrow donors and cord blood units that are available
- Expanding research to improve patient transplant outcomes

1.2 Legislation and Components

The Stem Cell Therapeutic and Research Act of 2005 covers several components:

- The C.W. Bill Young Cell Transplantation Program. The Program's infrastructure is composed of:
    - The Office of Patient Advocacy and Single Point of Access (OPA/SPA),

  - The Bone Marrow Coordinating Center (BMCC),
  - The Cord Blood Coordinating Center (CBCC), and
  - The Stem Cell Therapeutic Outcomes Database (SCTOD).
- The Program expands on what the National Bone Marrow Donor Registry was doing to increase the number of marrow donors and cord blood units.
- The National Cord Blood Inventory (NCBI). NCBI umbilical cord blood banks will collect and store 150,000 new, high-quality umbilical cord blood units that will be made available to patients. The NCBI banks will also make some CBUs that do not meet the criteria for transplant available to researchers.
- The Stem Cell Therapeutic and Research Act also authorized establishment of an Advisory Council on Blood Stem Cell Transplantation (Advisory Council). This council makes recommendations on issues about the Program to the Secretary of Health and Human Services and HRSA.

Figure 1 shows how the Program is organized.

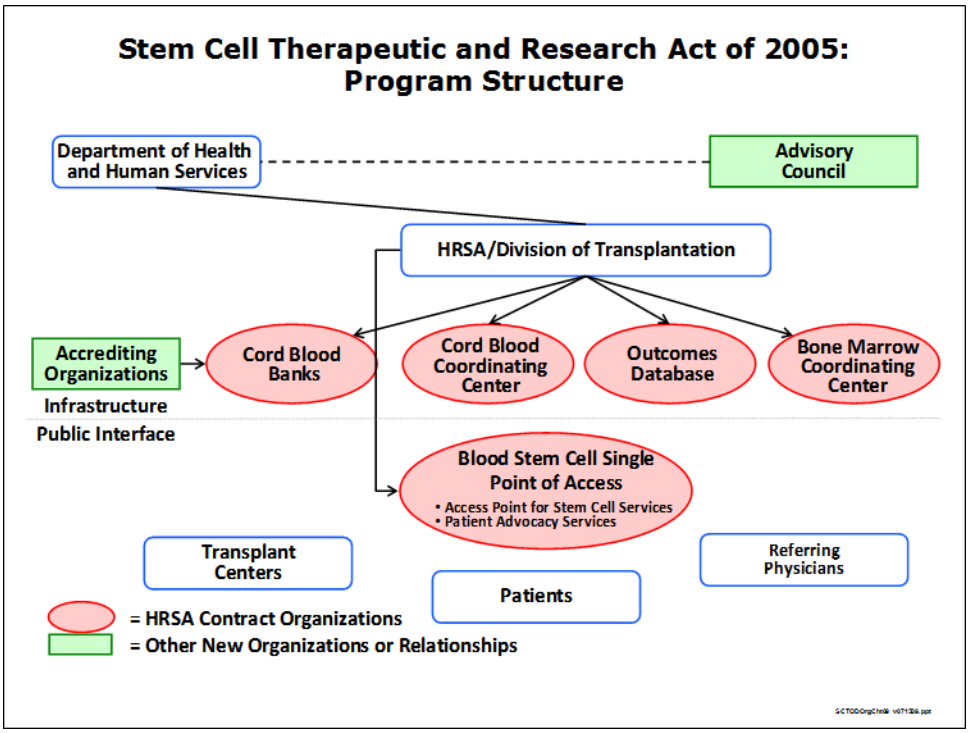

Figure 1. Organizational Structure for the Program under the Stem Cell Therapeutic and Research Act of 2005

1.3 Responsibilities

The four Program components work together to:

- Operate an electronic system for identifying, matching and facilitating the distribution of blood stem cells
- Allow transplant physicians, health care professionals and patients to search electronically for available cord blood units and unrelated adult PBSC or marrow donors
- Educate and reach out to the public to increase the numbers of volunteer adult PBSC, bone marrow and cord blood donations to ensure genetic diversity
- Promote the availability of cord blood units as a transplant option
- Analyze transplant trends and support research to help more transplant recipients live longer, healthier lives

1.4 Program Contractors

The **National Marrow Donor Program® (NMDP)** operates three of the Program components: the Office of Patient Advocacy and Single Point of Access (OPA/SPA), the Bone Marrow Coordinating Center (BMCC) and the Cord Blood Coordinating Center (CBCC).

NMDP is a nonprofit organization based in Minneapolis, Minnesota, which operated the National Bone Marrow Donor Registry under a series of contracts from the Federal Government. The NMDP is dedicated to creating opportunities for all patients to receive a bone marrow, PBSC or umbilical cord blood transplant from an unrelated donor when they need it. The Registry has grown to include more than eight million donors and more than 120,000 CBUs. It is the largest and most racially and ethnically diverse registry of its kind in the world. Medical advances are making marrow, peripheral blood and cord blood transplants available to more patients all the time. Since the first unrelated transplant was facilitated in 1987, NMDP has facilitated more than 38,000 transplants. It now facilitates more than 4,800 transplants a year, analyzes the outcomes of the donation process for unrelated donors, and maintains a repository of donor-recipient blood samples for a large proportion of these transplants.

The **Center for International Blood and Marrow Transplant Research (CIBMTR)** began as the International Bone Marrow Transplant Registry (IBMTR) at the Medical College of Wisconsin in 1972. By 2004, the IBMTR had grown to become a voluntary network of more than 400 hematopoietic stem cell transplant (HCT) centers in 47 countries that shared data and conducted scientific studies to improve transplant outcomes. The physicians and scientists of IBMTR had generated more than 200 scientific peer-reviewed publications by 2004. At that time, the CIBMTR was created through an affiliation between IBMTR and the research arm of NMDP.

The CIBMTR operates the fourth component of the Program: the Stem Cell Therapeutic Outcomes Database (SCTOD). CIBMTR analyzes the outcomes of all reported transplants, including since 2006, those transplants using unrelated donors facilitated by NMDP. The affiliation between IBMTR and NMDP-Research specified that the two organizations will conduct all of their HCT-related research activities together. This has led to coordinated data collection, management and analytic procedures. It takes advantage of the strengths of each of the two organizations to substantially enhance the resources that are available to the transplant community.

The IBMTR brought a strong track record of statistical and clinical HCT expertise and an international network of data on autologous, related and unrelated donor transplants. NMDP-Research brought expertise in HLA[1] matching, bioinformatics, computer systems and repository maintenance. Integrating these operations allows more efficient data management, enhances electronic data collection capabilities and gives opportunities to link clinical data with biologic specimens.

1 Human leukocyte antigen (HLA) typing is used to match patients and donors. HLAs are proteins—or markers—found on most cells in your body. The immune system uses these markers to recognize which cells belong in your body and which do not. A close match between a patient's and donor's HLA can reduce the risk that the patient's immune cells will attack the donor cells or that the donor's immune cells will attack the patient's body after the transplant.

Section 2: Contract Components

2.0 C.W. Bill Young Cell Transplantation Program

The four components of the C.W. Bill Young Cell Transplantation Program are:

- Office of Patient Advocacy and Single Point of Access (OPA/SPA)
- Bone Marrow Coordinating Center (BMCC)
- Cord Blood Coordinating Center (CBCC)
- Stem Cell Therapeutic Outcomes Database (SCTOD)

2.1 Office of Patient Advocacy and Single Point of Access (OPA/SPA)

Patients who are facing a life-threatening illness may need help in understanding their disease and their treatment options. When a patient needs a bone marrow, peripheral blood stem cell or cord blood transplant, the OPA can help the patients, their families and health care providers make sense of the options that are available. The C.W. Bill Young Cell Transplantation Program was created to help more patients have a successful HCT. As one of the four components of the C.W. Bill Young Cell Transplantation Program, the OPA/SPA provides help and support to patients and families.

The OPA helps by providing case management services and information directly to the patient and their physician from the time of diagnosis through survivorship. OPA also increases access to transplants by reducing barriers and providing services that are linguistically and culturally sensitive. Having a Single Point of Access means that doctors, transplant center coordinators, patients and patient families can use one electronic system to search the Registry for unrelated marrow and peripheral blood stem cell donors as well as for CBUs.

2.1.1 New Mission/Contract Requirements

Since it was started in 1991, the NMDP's OPA has supported patients, families and caregivers throughout the transplant journey. The field of transplantation continues to evolve as the number and diversity of patients who receive a transplant from an unrelated donor or CBU grows, the average age of patients continues to increase, and the number of transplant survivors in the United States grows. However, disparities exist for patients and families from some groups. Barriers and burdens prevent access to transplant and prevent some patients from receiving the best medical care, information and advocacy after their transplant.

The services that are available for patients, families and health care professionals through the OPA/SPA include:

- Culturally and linguistically sensitive information about diseases, treatment options and transplant centers. This information takes the form of:
  - Programs and tools such as Webcasts, teleconferences and online tools that reach a wider national audience
  - Educational resources in a variety of formats (e.g. patient teleconferences, audio and video, print, Web)
- Individualized case management services to help patients deal with a variety of issues, locate resources and access educational information
- Services to identify and resolve barriers for patients needing a transplant, including barriers associated with the financial coverage of costs to perform a donor search and to receive a transplant
- Partnerships with other professional and patient advocacy organizations to expand public awareness

- Preliminary search access for transplant centers, patients and physicians to look for unrelated bone marrow, peripheral blood or cord blood matches
- Collaboration with the bone marrow and cord blood coordinating centers to provide a single point of access to transplant-related services:
  - Compiling search results received from the coordinating centers
  - Providing customized search assistance
  - Providing consultation about tissue type matching (HLA) as needed

The OPA/SPA patient advocacy goals are to:

- Provide a system to support individual patients and their efforts to identify and work with a transplant center
- Provide technical assistance to help patients at transplant centers and to supplement patient advocacy services at transplant centers that have limited resources
- Identify barriers to patients receiving a transplant, especially transplants from unrelated donors, and to provide assistance for overcoming them
- Assist individuals in obtaining insurance support and other sources of financial aid
- Assess the post-transplant needs of patients (as a group) and provide educational materials to help them understand and meet those needs
- Provide support and information to caregivers of patients, and
- Increase awareness of the services offered through the OPA

Details about how the OPA and SPA are working toward meeting these goals follow.

2.1.2 Patient advocacy services and case management

2.1.2.1 Contacts with the Office of Patient Advocacy (Statistics)

Information is tracked about how patients, families, health care professionals and other patient advocacy organizations are connected to the OPA, whether that is through patient services coordinators, search advocacy and patient assistance program contacts, customer satisfaction survey responses or requests for materials. Patient demographics, insurance denials, requests for financial assistance and changes in transplant volume for various age groups and diseases are also studied. The OPA uses this information to develop, evaluate and improve patient programs and services. Table 1 illustrates these OPA contacts throughout the transplant process for 2008-09.

- *Direct* patient contacts are made in person, by phone, mail or e-mail.
- *Indirect* patient contacts are through health care professionals or patient organizations and via visits (hits) to the MatchView® Web site page.

Table 1 describes the Office of Patient Advocacy contacts.

NMDP Office of Patient Advocacy Contact	2008 Amount	2009 Amount
Physician preliminary search: Helping referring physicians not associated with an NMDP transplant center run a preliminary search for their patient	856	555
Performance of a non-network search (formerly called compassionate)	386	285
MatchView® Web hits (unique visitors to this page)	9,262	9,787
MatchView application button pressed	(1,152[2])	(5,098)
Preliminary search packets: A packet sent to all patients in the U.S. who have had a preliminary search for an unrelated donor performed on their behalf. It contains the following information: *Step One* booklet, *Mapping the Maze* (financial guide), letter from the OPA director, patient satisfaction survey and materials order form.	7,829	8,417
Attendance at case manager telephone education workshop entitled *An Introduction to Marrow & Cord Blood Transplant* held quarterly, survivorship workshops held annually, and fundraising workshop (2009)	199	502
Requests for case management: Contacts with patients, family members, and others acting on behalf of patients (phone calls and emails)[3]	17,588	18,870
Educational material requests filled and sent to patients (and others)	1,690	1,406
Formal search packets: OPA sends a packet of information to patients involved in a formal search	5,517	5,899
Office of Patient Advocacy Survey: mail surveys returned. These surveys are sent to those who contact OPA or sent to those who were contacted as part of the Outreach Program	238	216
Patient Assistance Program (Search Assistance Funds): contact is through the transplant center coordinator or social worker who works directly with the patient/family to apply for financial assistance for search-related costs	720 grants	863 grants
Patient Assistance Program (Transplant Support Assistance): contact is through the transplant center coordinator or social worker who works directly with the patient/family to apply for modest financial assistance for post-transplant needs	3,124 grants	4,381 grants
Living Now Newsletter—Post-transplant educational newsletter sent to NMDP patients at 6 intervals after the transplant (3 months, 6 months, 9 months, 12 months, 18 months and 2 years)	10,705	12,033
TOTALS	**58,114**	**63,214**

Table 1. Office of Patient Advocacy contacts

2 A report to track online submission of the MatchView application was begun in October 2008.

3 These numbers reflect contacts made as part of the Patient Services outreach program.

2.1.2.2 Using MatchView®

In May 2007, the NMDP launched a new Web-based resource for patients called MatchView, available at the NMDP website (http://www.marrow.org/). This allows patients to enter their HLA typing and view the number of potential matches (donors and CBUs) on the NMDP Registry. Patients can print a summary to use in discussions with their physician. The purpose of MatchView is to help patients and their oncologists or primary care physicians discuss unrelated donor transplantation and the appropriate next steps if a transplant is an option. This resource helps people interpret the results of their preliminary search for a matched donor, including information about whether donors and CBUs are available, and if they need to work with a transplant center to initiate a more comprehensive unrelated donor search. NMDP patient services coordinators and search advocates also help patients access MatchView by mail or fax, and will help them interpret the search reports by phone. Interpreter services are available for those who need assistance.

Non-network searches. Some potential transplant recipients do not live close enough to an NMDP transplant center to use its services. If a patient must temporarily move to be near an NMDP transplant center, they may face financial barriers or not have a caregiver available. A patient may also live in a country that does not currently have an NMDP transplant center. The non-network search process helps non-NMDP transplant programs search the NMDP Registry and perform a transplant for their patients with an NMDP donor or CBU. Transplant programs that request non-network searches are pursuing membership with the NMDP, but have not been approved yet because the application is in process.

2.1.2.3 Providing Transplant Information for Patients

The OPA/SPA gives information and educational materials to patients and family members that are tailored to specific ages, cultures and languages. This includes information about the following topics:

- Diseases that are treatable by a transplant
- The search and transplant process
- Patient-focused donor drives
- Financial resources
- Information about specific transplant centers
- Post-transplant information and resources

Patients can find these programs and services in a variety of ways, including through one-to-one contact with an NMDP patient services coordinator, materials distributed to referring physicians and transplant centers, partnerships with other patient organizations, and through two Web sites http://www.marrow.org and http://bloodcell.transplant.hrsa.gov.

2.1.2.4 Transplant center-specific survival data

Survival data from specific transplant centers is available to patients, families and health care providers through the publication entitled Choosing a Transplant Center: a Patient's Guide. This guide is published each year in print and online, and lists every NMDP transplant center in the United States. Contact information, the number and type of transplants the center performs (e.g. marrow, peripheral blood stem cells, cord blood, pediatric and/or adult), match criteria, estimated costs, and financial services for each center are all included in the guide.

A description of each center looks at many factors that are known to influence transplant success, such as the age of the patient, their diagnosis, disease stage, general health, etc. The results that are shown in the Center-Specific Analysis section of the guide can be used to compare the performance of a particular center with other NMDP U.S. transplant centers. The results that are considered in each center's performance are:

- The disease conditions of patients who receive a transplant at the center
- The predicted one-year survival rate
- The actual one-year survival rate of patients who receive a transplant

The online version of the guide can be found at http://www.marrow.org/access. Current center-specific survival data focuses on transplants with unrelated donors at U.S. centers.

2.1.2.5 Surveys of Patient Satisfaction

The OPA/SPA administers two surveys to patients who interact with NMDP: a Patient Satisfaction Survey and an Office of Patient Advocacy Survey. The information from these surveys is used to plan and develop future programs and services. It also helps OPA/SPA determine if they are meeting patients' needs and find ways to improve their services.

- The Patient Satisfaction Survey is mailed to all U.S. patients who have participated in a preliminary or formal search of the NMDP Registry. These patients are sent OPA/SPA's education and information packets, which include the Patient Satisfaction Survey.
- The Office of Patient Advocacy Survey is sent to anyone who has direct contact with a patient services coordinator and for whom a mailing address is available.

The Patient Satisfaction Survey allows the OPA/SPA to learn whether individuals who have received a transplant information packet from NMDP are satisfied, and if the information and services the office has provided are meeting patient needs. A total of 22,896 surveys were mailed between January 2008 and December 2009. Of these, 2,464 were returned (10.8% response rate). Survey respondents are not given an incentive for returning the survey and surveys are sent only once to each individual. However, a study to examine the impact of incentive and follow-up was conducted from July 2009 to September 2009. Response rates significantly increased with both approaches. The experimental group had a 50.5% response rate compared to the control group, which had a 12.8% response rate ($p<.05$).

Responses to a few of the Patient Satisfaction Survey's most important questions are provided in the tables below.

Table 2 shows the responses to the question: How have you used the information from the NMDP's Office of Patient Advocacy?

Survey Question: How have you used the information from the NMDP's OPA?	2008 Responses	2009 Responses
It is my main source of information	216 (21%)	293 (22%)
I use this as well as other information	795 (75%)	980 (73%)
I do not use this information	43 (4%)	68 (5%)

Table 2. How have you used the information from the NMDP's Office of Patient Advocacy?

Table 3 shows the responses to the question: What will you do because of this information from the NMDP's OPA?

Survey Question: What will you do because of this information from the NMDP's OPA?	2008* Responses	2009* Responses
Use as reference	882 (83%)	1110 (82%)
Share with family	838 (78%)	1095 (81%)
Review with doctor	577 (54%)	698 (51%)
Visit http://www.marrow.org	559 (52%)	685 (50%)
Contact additional resources	331 (31%)	448 (33%)
Review with hospital staff	288 (27%)	355 (26%)
Contact OPA	256 (24%)	312 (23%)
Nothing further	16 (2%)	27 (2%)

Table 3. What will you do because of this information from the NMDP's OPA?

Figure 2 shows how patients use OPA materials.

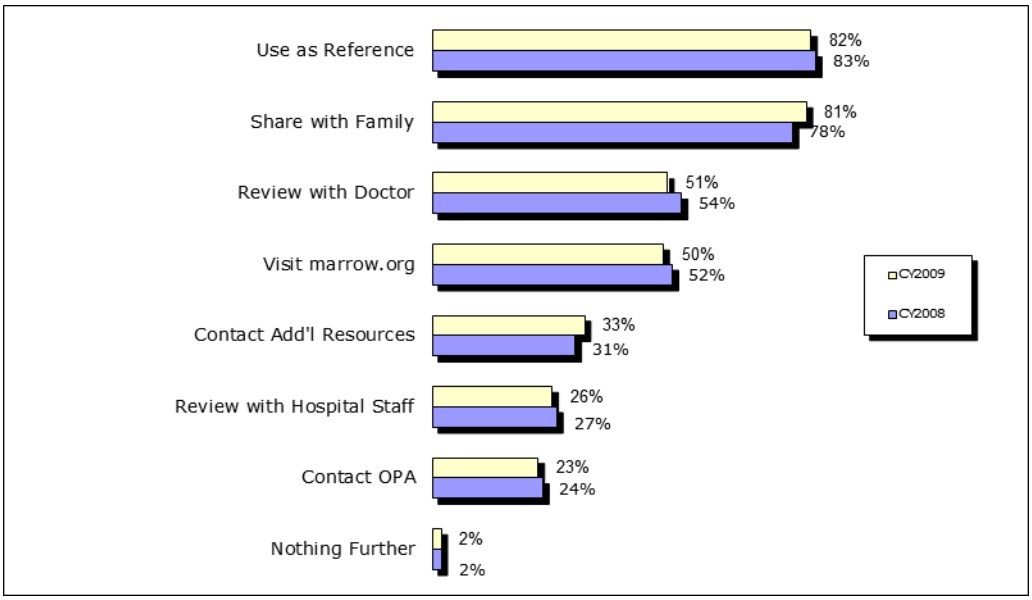

Figure 2. How patients use OPA materials.

The Office of Patient Advocacy Survey is an important tool for the OPA to elicit feedback from patients, caregivers and others who use their case management services. A total of 1,870 surveys were mailed between January 2008 and December 2009 to people who had direct contact with a patient services coordinator. Of these, 454 were returned (24% response rate), which includes 11 responses to the 77 Spanish surveys distributed (14% response rate). The tables below provide responses to selected questions taken from the survey. Table 4 gives a breakdown of whether the survey was filled out by the patient, relative/friend or other person.

* 2008 number of responses = 1082; 2009 number of responses = 1382

Question: Who completed the survey?	2008 Responses	2009 Responses
Patient	121 (54%)	128 (61%)
Relative or friend	104 (46%)	79 (38%)
Other	1 (<1%)	2 (1%)

Table 4. Person filling out the OPA survey

Table 5 shows the responses regarding what other information might be helpful. The request with the highest response was for post-transplant information. A post-transplant annual teleconference and other initiatives are also being offered to meet this need. All of the survey information is presented to the NMDP's Patient-Focused Initiatives Committee to help them plan future programs and services that OPA can offer to benefit patients.

Question: What other information or services might be helpful?	2008* Responses	2009* Responses
Post-transplant information	104 (59%)	105 (64%)
Talking to another person	93 (53%)	81 (50%)
Age or disease-specific information	77 (44%)	87 (53%)
Information for caregivers	65 (37%)	46 (28%)
Support group	58 (33%)	56 (34%)
Teleconferences	22 (12%)	26 (16%)
Other	13 (7%)	13 (8%)

Table 5. What other information/services regarding transplant would be helpful? (Respondents were asked to check all that apply and could add other recommendations.)

Table 6 shows the responses to the question: Would you recommend the OPA to someone else in your situation?

Question: Would you recommend the OPA to someone else in your situation?	2008 Responses	2009 Responses
Yes	214 (94%)	200 (94%)
Maybe	8 (4%)	8 (4%)
Don't know	4 (2%)	3 (1%)
No	2 (<1%)	1 (<1%)

Table 6. Would you recommend the Office of Patient Advocacy (OPA) to someone else in your situation?

2.1.2.6 Patient Advocacy Efforts

Following are the major undertakings of the OPA/SPA each year:

1. Provide a system to support individual patients and their efforts to identify and work with a transplant center.

The OPA/SPA provides a variety of individual advocacy services to patients, families, caregivers and health care professionals throughout the transplant process. This is a priority area, so the OPA/SPA offers the following services:

- One-to-one telephone support to patients, families and health care professionals who contact the OPA.
- Problem resolution for patients and their physicians searching for an unrelated donor or CBU.

- Guidance and modest financial assistance to patients and families in need, for donor searches and post-transplant costs.
- Advocacy and telephone outreach for transplant families, to help them find additional resources (through the Patient Outreach Program).
- Resource finding, such as locating fund-raising organizations, travel and lodging assistance, and other disease-specific organizations that can provide direct services to patients and their physicians.

The number of individual contacts made in calendar year 2008-09 through these services is highlighted in Table 1 (above).

2. Provide technical assistance to enhance patient advocacy programs at transplant centers and supplement advocacy services at transplant centers that have limited resources.

The OPA/SPA develops new programs and improves existing programs to help patients throughout the transplant process. These programs provide services that are appropriate to different patient demographics such as age, language, culture, literacy and learning preferences.

New programs and tools that have been created or are in development include:

- **Online clearinghouse**. Throughout FY 2009, the OPA and nine partner organizations worked to develop an online information clearinghouse tool for transplant patients, caregivers and family members. The envisioned online "clearinghouse" will serve as the central place to manage transplant information and make it more available. The clearinghouse is intended to better serve transplant patients and their families throughout the treatment continuum by providing them targeted, relevant information; to help them learn what "they need to know now." The launch of the clearinghouse is planned for early summer of 2010.
- **Words of Experience. Stories of Hope**. This DVD, intended for adult patients and caregivers, focuses on various components of the transplant process within a hospital setting. It features interviews with patients, caregivers, physicians and other transplant center staff to help viewers understand what to anticipate during orientation to their transplant center, the preparative regimen, the actual transplant procedure, engraftment, and early recovery. Special features include information on such procedures as chemotherapy and radiation. The DVD can be viewed in English and Spanish. More than 30 transplant center staff volunteered to serve as content reviewers throughout the development of this resource.

3. Identify barriers to transplant, especially non-HLA-related (tissue type) obstacles, and provide assistance for overcoming them.

The transplant process that patients and family members experience—from diagnosis through survivorship—may include barriers and burdens that limit their access to transplant services or impact its success. Each year, the OPA assesses the educational needs of the patients, families, and caregivers served by the Program.

The NMDP's Health Services Research (HSR) program was formally established in FY 2008. HSR is the multidisciplinary field of scientific investigation that studies how social factors, financing systems, organizational structures and processes, health technologies, and personal behaviors affect access to health care, the quality and cost of health care, and ultimately health and well-being (Academy Health, 2000). The HSR team engages in collaborative research with CIBMTR; consults with OPA staff concerning research designs and methodologies; evaluates OPA programs, services and materials; assesses patient satisfaction with OPA services and

materials; helps translate research into practice, seeks to optimize practice through research; and disseminates evaluation and research results.

In April 2009, a new Payor Relations Manager was hired. This person focuses on building relationships with payor stakeholders, public and private, and developing tactical strategies for identifying and removing financial barriers facing patients. During the remaining months of FY 2009, the majority of the Payor Relations Manager's time was spent discussing major coverage and reimbursement policy concerns expressed by network transplant centers and patient families.

4. Assist individuals in obtaining insurance support and other sources of financial aid.

The OPA/SPA receives numerous calls each week from patients and families about their financial or insurance concerns, including requests for financial assistance. The OPA/SPA helps patients who:

- Have no insurance and need information on insurance programs;
- Are underinsured or lack adequate insurance coverage for donor search costs;
- Have been denied coverage for a transplant by their insurer; or
- Have financial barriers after their transplant, including difficulty paying insurance premiums, paying for drugs, or other non-medical post transplant costs associated with their care.

One of the key services offered through the OPA/SPA is the Patient Assistance Program. The Patient Assistance Program provides financial grants to patients who need an unrelated marrow or cord blood transplant and are in need of assistance. This program offers a Search Assistance Fund and a Transplant Support Assistance Fund.

The goal of the Search Assistance Fund is to increase access to transplants for patients who have inadequate insurance coverage. Fifty-eight percent of patients who received Search Assistance Funds in 2009 (57 percent in 2008) went on to have an NMDP-facilitated transplant.

Patients and families often have significant increases in their expenses after a transplant, at the same time they are experiencing a reduction in income. On average, patients and families reported a 31 percent reduction in monthly household income at the time they apply for financial assistance. The Transplant Support Assistance Fund provides grants to patients or families who have expenses that are not covered by insurance during the period following their transplant. Eligible expenses include food, ground transportation, temporary lodging, prescriptions and clinic co-pays, and insurance premiums.

In addition, OPA is a member of the Cancer Financial Assistance Coalition (C-FAC), which consists of 12 national financial and/or prescription assistance programs. This coalition, facilitated by CancerCare, came together in 2007 in order to:

- Facilitate communication and collaboration among member organizations;
- Educate patients and providers about existing resources and linking to other organizations that can disseminate information about the collective resources of the member organizations; and
- Advocate on behalf of cancer patients who continue to bear financial burdens associated with the costs of cancer treatment and care.

With the realization that each organization participating in the coalition offered lists of other financial resources to approach for help, in 2009 C-FAC developed a clearinghouse to provide a single, extensive listing of local and national financial resources to help patients and their families more easily access this information. This clearinghouse is available at: http://www.cancerfac.org.

5. Assess and meet the post-transplant needs of patients.

More patients live longer after a transplant than in the past, but many have ongoing health problems. After a transplant, patients and their caregivers can face many physical, financial and emotional challenges. Most transplant survivors have long-term effects or complications. These can include chronic and debilitating immune system disorders, fatigue, memory and concentration problems, infertility, and an increased risk of secondary cancers. The medical, financial and emotional costs of a transplant continue well into recovery and can burden patients and caregivers for years.

Programs and resources that have been developed in 2008 and 2009 to respond to these post-transplant needs of patients include:

- **Emotional Health after Transplant for Survivors and Caregivers brochure**. This brochure provides information for survivors on how to address emotional health issues after transplant, but its audience now includes both survivors and caregivers. It discusses the anticipated emotional responses to transplant for survivors and caregivers, methods to improve and maintain their emotional health throughout the transplant continuum, and questions to discuss with their physicians. The brochure also provides a list of national resources and support dedicated to addressing mental and emotional health needs throughout the transplant process. This brochure was developed with content support from CancerCare and The Wellness Community national offices.
- **Survivorship telephone education workshop.** Based on feedback from post-transplant patients and evaluation results from a 2008 survivorship event, another survivorship telephone education workshop was developed and offered in FY 2009. The goal of this year's program was to expand existing resources for patients who had a marrow or cord blood transplant and to provide information on a topic that survivors had indicated is of interest to them. The free telephone education workshop entitled Living Now: Your Post-Transplant Road Map was held in Sept. 2009. The primary speaker for this workshop was Willis H. Navarro, MD, Medical Director, Transplant Services, at the NMDP. Objectives included learning more about possible late effects; recommendations for prevention and monitoring for late effects of transplant; how to take an active role in post-transplant care; and survivorship resources. The majority of the 203 participants in this education program indicated they were marrow and cord blood transplant survivors.

6. Provide ongoing support and information to caregivers of patients.

Providing direct care for a recovering transplant patient is easily a full-time job, often involving a significant amount of psychological and emotional stress for the caregiver. It is not uncommon for a transplant caregiver to experience symptoms of depression and anxiety, even post-traumatic stress disorder, at numerous points throughout the transplant continuum[4]. Because there is often more focus on the patient's needs, the caregiver's needs often go unaddressed.

Several new programs and resources were developed in FY 2009 to focus on information for caregivers and health professionals who work with caregivers. They include:

- A research pilot study was conducted through the OPA in conjunction with Michelle Bishop, PhD, University of Florida Department of Medicine, for caregivers of transplant recipients. The purpose of the study was to evaluate a caregiver self-care toolkit for

4 Bishop, M., Beaumont, J.L., Hahn, E.A., Late Effects of Cancer and Hematopoietic Stem-Cell Transplantation on Spouses or Partners Compared with Survivors and Survivor-Matched Controls. Journal of Clinical Oncology. Vol. 15, No. 11, Apr 10, 2007.

content, feasibility, mode of administration (self-administered versus coach-facilitated) and effects of caregiver stress and coping. The University of Florida arm was self-directed while the OPA arm of the pilot study utilized a coach-assisted model.
- In order to respond to the unmet needs of the caregiver community, the OPA developed a special Living Now issue for caregivers. The primary goal of the caregiver issue is to provide transplant caregivers with an educational and directional resource to help them better care for themselves throughout the transplant continuum. Thus, this issue focused on supporting the caregiver's needs – and not on what the caregiver needs to do to support their loved one. This special issue was completed in September 2009.

7. Publicize the services offered by OPA/SPA.

OPA/SPA participates in numerous national activities to increase awareness about its resources and services to various audiences, including patients, families and caregivers, health care professionals, and other patient-focused organizations. These activities allow the OPA to reach these other groups, identify collaborative opportunities and gain knowledge to use for new projects and resources.

Some of OPA/SPA's publicity activities include:

- Conducting site visits to transplant centers.
- Participating in national and local patient-advocacy, payor and financial, and professional association conferences and events as presenters, exhibitors and attendees. The primary objectives for participating are to increase awareness of marrow and cord blood transplantation; increase the visibility of OPA programs, services and materials; network with internal and external contacts; and identify new partnership opportunities.
- Creating national teleconferences that provide greater access to transplant information for patients and families across the country.
- Providing a comprehensive catalog of OPA/SPA resources.
- Collecting stories from patients – sharing tips and advice with other patients, families and caregivers.

2.1.3 Provide a Single Point of Access (SPA)

As the point of access for physicians and patients to initiate searches of all registered adult donors and CBUs in the United States and internationally (through cooperative agreements with international registries), the NMDP provides an efficient search process through one electronic system. Doctors, transplant center coordinators as well as patients and their families can use this system to search the Registry. This process includes:

- Allowing patients and doctors to explore the possibility of finding a donor or CBU using an easily accessed electronic interface
- Worldwide searching for all sources of blood stem cells
- Allowing doctors and transplant centers to reserve a CBU or initiate further testing of a potential volunteer donor
- Providing updates of the search progress to patients, doctors and transplant centers

2.1.3.1 Compile Search Results Received from Coordinating Centers

NMDP consolidates search results from the Bone Marrow Coordinating Center (BMCC, Section 2.2) and Cord Blood Coordinating Centers (CBCC, Section 2.3). It provides electronic search reports to transplant centers for donors and CBUs listed on its Registry through an Internet search program called Traxis™. The program is used by transplant centers to manage and

track the entire search process and to access unrelated adult donors and CBUs worldwide, from initial search to transplantation.

- **HapLogic^{SM}**. In 2006, NMDP introduced an enhanced matching program that automatically identifies the donors or CBUs on the NMDP Registry with the highest potential to match a patient. This allows transplant physicians searching the Registry to identify more quickly and efficiently the best matched donor or CBU for their patients. The matching formula, referred to as HapLogicSM, is based on analyses of the tissue types (HLA) of millions of donors on the NMDP Registry. HapLogic uses advanced computer logic to predict the likelihood of finding matching donors or CBUs. In FY09, the NMDP initiated the planning process for the next enhancement of the HapLogic algorithm. This phase will work to establish HLA matching predictions for donors and CBUs that will utilize more extensive population genetics data and improve the donor sort to meet the clinical standard practice in transplantation.
- **Search services support**. NMDP provides several services at no charge to transplant centers or patients to help them rapidly identify the best potential donor or CBU for further testing. NMDP staff with HLA matching expertise review preliminary search results and suggest search strategies for those patients with HLA types that are difficult to match. HLA consultations are available at any time in the search process. Consultants may be contacted at the request of transplant center staff or when an NMDP search coordinator identifies a problem with a search, such as too few donors or no sufficient matches among the donors already tested. NMDP also provides a centralized search management service for transplant centers that choose to request donor selection and monitoring services from NMDP. Transplant centers using this service have noted a decrease in search costs, reduction in search times, and increase in transplants.

2.1.3.2 Monitor Progress of Searches and Follow Up on Dormant Searches

The OPA, Search and Transplant Services, and Scientific Services staff members from NMDP work together to ensure that patients' searches can lead to a transplant without delay. Staff members who are involved in the search monitoring process have expertise in the biology of HCT, the unrelated donor search process and in tissue (HLA) compatibility. Staff members from the various teams coordinate their efforts to eliminate barriers throughout the search process:

- Patients with inadequate financial resources for search fees may receive patient assistance funds or help working with their insurer.
- Searches with only a few potential donors are referred for an HLA consultation to identity the best donors available. The HLA consultant can offer insights into the patient's HLA typing and the probability of finding a suitable donor or CBU for a transplant.
- Patients searching via network transplant centers usually get search status updates from their transplant center coordinator. This gives the transplant center an opportunity to work with their patients on both search and non-search related issues (e.g. patient's health status, housing for family members during the transplant, etc.). Transplant centers get instant updates on their patients' searches through the Traxis™ software application. NMDP provides search status updates to patients through its OPA/SPA case management staff.

2.1.3.3 Quality Control Plan

NMDP has quality monitoring and control processes in place for many of its activities, including HLA typing laboratories, transplant center search management proficiency, computer searching enhancements, and blood stem cell collection and shipping. NMDP's application testing process includes documentation, manual testing and automated testing.

2.1.3.4 Protecting the Confidentiality of Donors and Patients

NMDP complies with federal privacy laws to ensure that data and search reports protect the confidentiality of donors and patients. It maintains strict confidentiality policies through documented procedures, employee training, and published Donor and Patient Confidentiality Guidelines. All employees participating in human subject research studies have completed training in how to ensure patient privacy and safeguard the rights of research subjects with an online course through the Collaborative Institutional Training Initiative (CITI) program.

2.1.4 Patient Education Plan

It is a priority for the OPA/SPA to provide accurate and accessible educational resources for patients, families and health professionals on all aspects of the transplant process. This ensures that people who are considering or receiving a marrow, peripheral blood stem cell or cord blood transplant can make thoughtful, informed decisions. OPA gives special consideration to the varied learning styles and cultural needs of patients, families and care givers, especially those from medically underserved communities. Patients from special populations may experience greater challenges in accessing quality care and information about their disease. The OPA seeks to provide readily understood, medically accurate information for all individuals, in a variety of formats that respond to the broad range of learners' abilities, needs and preferences.

Each year, the OPA/SPA develops a plan that outlines the educational resources available through NMDP and OPA/SPA for patients, families and caregivers. The plan covers the four areas of the C.W. Bill Young Cell Transplantation Program: the BMCC, CBCC, SCTOD and the OPA/SPA. It also describes the OPA/SPA approach to evaluating the effectiveness of patient materials and resources.

2.1.5 Professional Education Plan

The NMDP, through the OPA/SPA, delivers significant and sustained professional medical education programs and resources to support physicians who refer patients for a transplant and who treat patients following transplantation. These educational programs focus on four key areas: refer, select, streamline and care.

2.1.5.1 Refer

Educate and enable referring physicians to refer appropriately. The referring physician plays a key role in positive outcomes for transplant patients. Data about outcomes clearly show the importance of the timing of the transplant. For most diseases, there is a survival advantage for patients transplanted earlier in their disease process. Research conducted by NMDP showed that referring physicians often do not have sufficient education about the role and timing of transplants[5]. Those physicians with greater knowledge about transplant were more likely to recommend it to their patients. Referring physicians also showed a strong allegiance to their local transplant center's expertise. In response to what was learned in this study, NMDP has developed and implemented an outreach program to educate referring physicians on three key messages: 1) transplant outcomes have improved, 2) appropriate timing of the referral improves outcomes, and 3) patient eligibility has expanded.

The OPA/SPA provides education and resources to referring physicians in two ways: directly from NMDP and by supporting network transplant centers in their local educational activities with community physicians. NMDP provides both logistical support and educational materials that have been specifically developed to overcome barriers to referral.

5 NMDP Market Research Findings 2006.

Educational resources that are available include the Quick Reference Guidelines tool kit. This kit includes the referral guidelines, Recommended Timing for Referral Consultation and Post-Transplant Guidelines, and a slide presentation that can be tailored to center-specific processes. National efforts in the past two years have included more promotion of the online resources, sponsoring numerous national Continuing Medical Education (CME) programs on the role and timing of transplantation. Currently seven online CME programs are available and additional programs are planned, to provide frequent updates on advances and recent outcomes data.

NMDP has also partnered with an education provider to expand viewership, resulting in a 400% increase compared with previous methods. Newsletters, mailings that promote these resources and mailings that reinforce messages from the CME programs offer guidance and support to community physicians. Recent advances in cord blood transplantation, including better outcomes and better access to transplantation, have been important elements of these communications. In addition, NMDP has led a collaboration among several other transplant societies and organizations to raise awareness of the advances in transplantation.

2.1.5.2 Select

Lead the transplant field in understanding and applying the best practices in donor and cord blood selection. The OPA/SPA educates participants in the transplant field to: 1) improve the knowledge and application of best practices in donor/cord selection among network transplant center teams, 2) raise awareness and understanding of CIBMTR and NMDP research findings about donor selection, and 3) increase knowledge of advances in cord blood selection.

In-person conferences and webinars on cord blood selection, best practices and on understanding HLA matching have received outstanding ratings. Participants said the information was helpful and could be applied to their clinical practices. The Advances in Transplantation electronic and print newsletter provides relevant and timely access to the most recent research and publications by summarizing important findings in this area. Subscriptions have grown dramatically and NMDP is looking to build its subscription base (http://www.marrow.org/Physicians/Medical_Education/Medical_Education.aspx). In addition, the newly redeveloped website for CIBMTR, http://www.cibmtr.org, provides improved access to relevant publications and research findings.

2.1.5.2 Streamline

Support transplant centers' ability to streamline searches and help patients progress to their transplant efficiently and cost-effectively. Each year, the OPA/SPA develops and introduces new services and enhances its existing educational programs. To help network transplant centers understand how the organization can help their center, NMDP delivers instruction through in-person educational conferences, exhibit booths at conferences, focused group meetings and webinars. Following are some of the educational programs that have helped physicians and their teams adopt and use the key services and resources of the NMDP:

- Custom Search Support, which provides expertise and logistic support for the donor and cord blood search process.
- Referral Outreach, with provides support for transplant centers to educate local referring physicians to improve access.
- HLA Nomenclature Education, which enables transplant centers and other clinicians to adapt their processes and systems to accommodate changes.

2.1.5.3 Care

Influence and enable referring and transplant physicians to provide the best in post-transplant care to their patients. NMDP research with referring physicians showed that referring physicians were uncomfortable with managing their patients' post-transplant care. Some said they refer fewer patients for a transplant because of this issue. A lack of thorough post-transplant care leads to complications and poorer transplant outcomes, which reinforces a physician's negative perceptions and limits future referrals. While NMDP cannot eliminate complications, it can increase physician knowledge of, and therefore comfort with, patient management.

When patient and physician resources are coordinated, this helps ensure that both are better equipped to talk to each other about what care is needed and how to recognize early complications. In the past two years, NMDP developed the Quick Reference Guidelines for referral and post-transplant care, which can be found at http://www.marrow.org/md-guidelines, to teach physicians about transplant care for their patients. These resources have been promoted at large medical conferences such as the American Society of Hematology and the BMT Tandem Meetings. The NMDP online Physician Resource Center: http://www.marrow.org/Physicians also contains helpful information on post-transplant care, and provides ready access for physicians seeking to learn more. The Advances in Transplantation electronic e-newsletter also routinely communicates the latest advances in post-transplant care information to a growing list of subscribers. The Professional Education team also helped promote a patient version of the post-transplant care guidelines, which is now featured prominently on the CIBMTR Web site.

2.1.6 Develop and Maintain a Website for the Program

The Program's Web site (http://www.bloodcell.transplant.hrsa.gov) is an official U.S. Government Web site managed by the Health Resources and Services Administration, U.S. Department of Health & Human Services. It was developed during the summer of 2007 for the C.W. Bill Young Cell Transplantation Program by representatives of the four Program areas and HRSA staff. The site has information for patients, health care providers, and other members of the public about the C.W. Bill Young Cell Transplantation Program, transplant resources, marrow and cord blood donation, and research and outcomes data.

2.2 Bone Marrow Coordinating Center

The Bone Marrow Coordinating Center (BMCC) is another of the components of the C.W. Bill Young Cell Transplantation Program that is administered by NMDP.

2.2.1 New Mission/Contract Requirements

The BMCC is charged with:

- Recruiting more marrow donors, especially those of racially and ethnically diverse backgrounds. This includes making sure there are sufficient numbers of potential donors of specific races and ethnicities to meet the needs of patients who require a transplant.
- Coordinating a network of national and international centers that work together to provide safe bone marrow transplants. NMDP maintains standards that govern donor recruitment, donor screening, collection, storage, processing, release, transportation, and administration of marrow, peripheral blood, and cord blood hematopoietic stem cells it facilitates. Staff members regularly monitor each center's performance to make sure it complies with these standards. This includes an annual renewal process for all members of the network. The network is made up of:

  - Donor centers and/or recruitment organizations for raising awareness, recruiting potential marrow donors, and managing donors throughout the donation process.
  - Cooperative registries (registries in other countries that have agreements with the BMCC) for identifying marrow donors and cord blood units outside of the United States.
  - Laboratories for identifying tissue types (HLA) and infectious diseases.
  - Tissue repositories for storing samples.
  - Collection centers (or hospitals) for bone marrow donation and apheresis centers for PBSC donations.
  - Transplant centers (hospitals with experienced transplant teams) for taking care of patients who receive a bone marrow, PBSC or cord blood transplant.
- Providing an efficient system for collecting samples and identifying and matching tissue types through one electronic system (SPA). This includes:
  - Collecting and identifying the tissue types of donors and patients.
  - Maintaining a national registry so that a potential marrow donor who matches a patient's tissue type can be found quickly.
  - Providing more extensive tissue typing and medical evaluations of potential marrow donors to protect donor and patient safety.
- Collaborating with the OPA to provide educational information for patients, the public and medical professionals, and to help patients throughout the transplant process. This includes:
  - Allowing patients and physicians to electronically explore the possibility of finding a marrow donor or CBU.
  - Searching worldwide for all tissue sources through one electronic system.
  - Providing search progress updates to patients and health care professionals at transplant centers.
- Ensuring data about transplant outcomes is collected and provided to researchers. This is meant to improve the availability, efficiency and safety of transplants from unrelated donors and to explore ways to reduce transplant associated costs.
- Protecting patient and donor confidentiality throughout the search and transplant process, as well as when providing outcomes and research data.
- Planning for public health emergencies requiring bone marrow transplants.

2.2.2 Demographic Data on the Donor Registry

NMDP's Donor Registry has grown to include more than eight million registered volunteer donors and more than 100,000 cord blood units, which represents the largest and most racially and ethnically diverse registry of its kind in the world.

Because tissue types are inherited, patients are more likely to match someone from their own race or ethnicity. Adding more donors and CBUs from diverse racial and ethnic backgrounds to the Registry increases the likelihood that all patients will find the match they need. Efforts are also targeted at recruiting younger donors, since they are healthier and have a longer time to be a qualified donor.

The following charts show the distribution of the Registry by donor gender (Figure 3), age (Figure 4), and race or ethnicity (Figure 5) as of December 31, 2009.

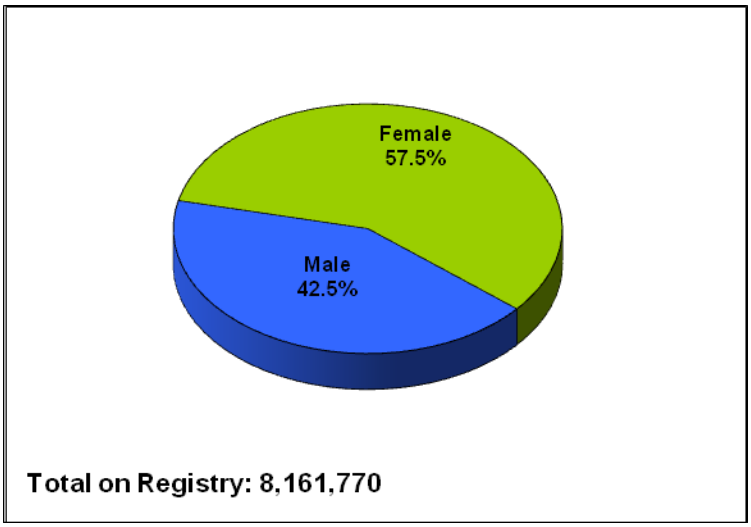

Figure 3. Distribution of NMDP donor registry by donor gender, as of 12/31/2009

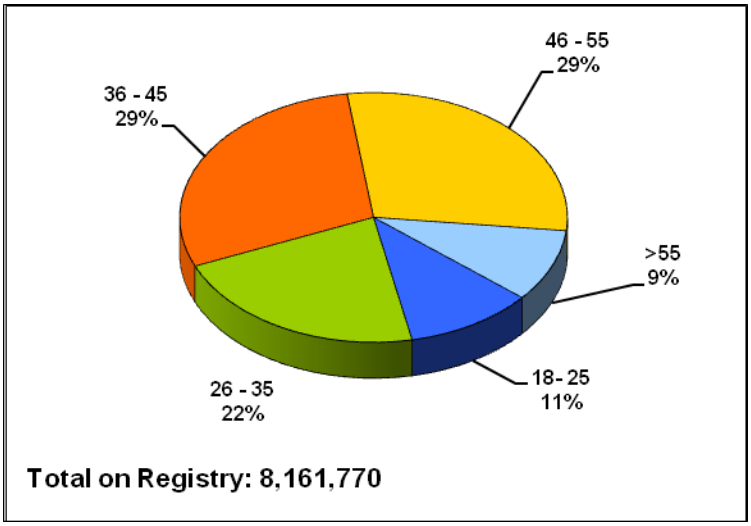

Figure 4. Distribution of NMDP donor registry by donor age, as of 12/31/2009

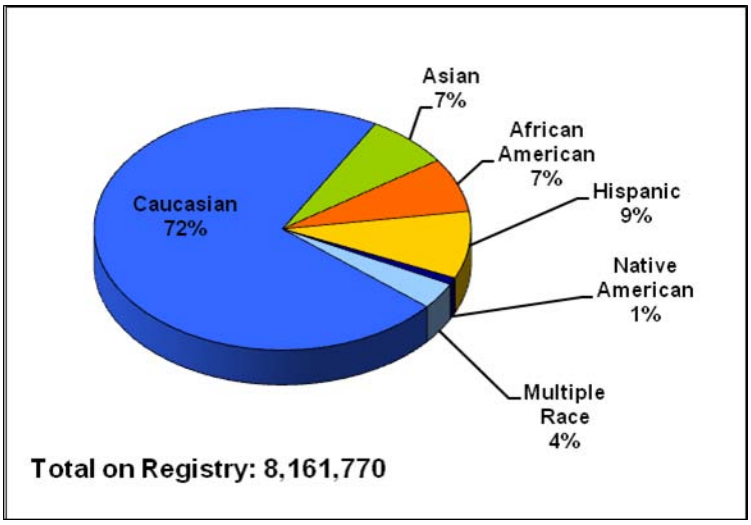

Figure 5. Distribution of NMDP donor registry by donor race/ethnicity, as of 12/31/2009

2.2.3 Selection and Use of Adult Blood Cells

Every year, thousands of men, women and children are diagnosed with life-threatening diseases such as leukemia and lymphoma. Many of them will die unless they get a bone marrow or cord blood transplant from a genetically matched donor. Some people find a match in their family, but 70 percent do not. These patients depend on the NMDP to help them find an unrelated PBSC, marrow or CBU donor.

2.2.3.1 Total Number of Transplants for Calendar Years 2008-09

Since it began operations in 1987, NMDP has facilitated more than 38,000 marrow and cord blood transplants for patients who do not have matching donors in their families. On average, NMDP facilitates more than 400 transplants each month, with more than 4,800 marrow and cord blood transplants taking place in fiscal year 2009.

Figure 6 shows the steady growth of transplants facilitated by NMDP and the distribution by donation type (graft): marrow, peripheral blood stem cell and cord blood.

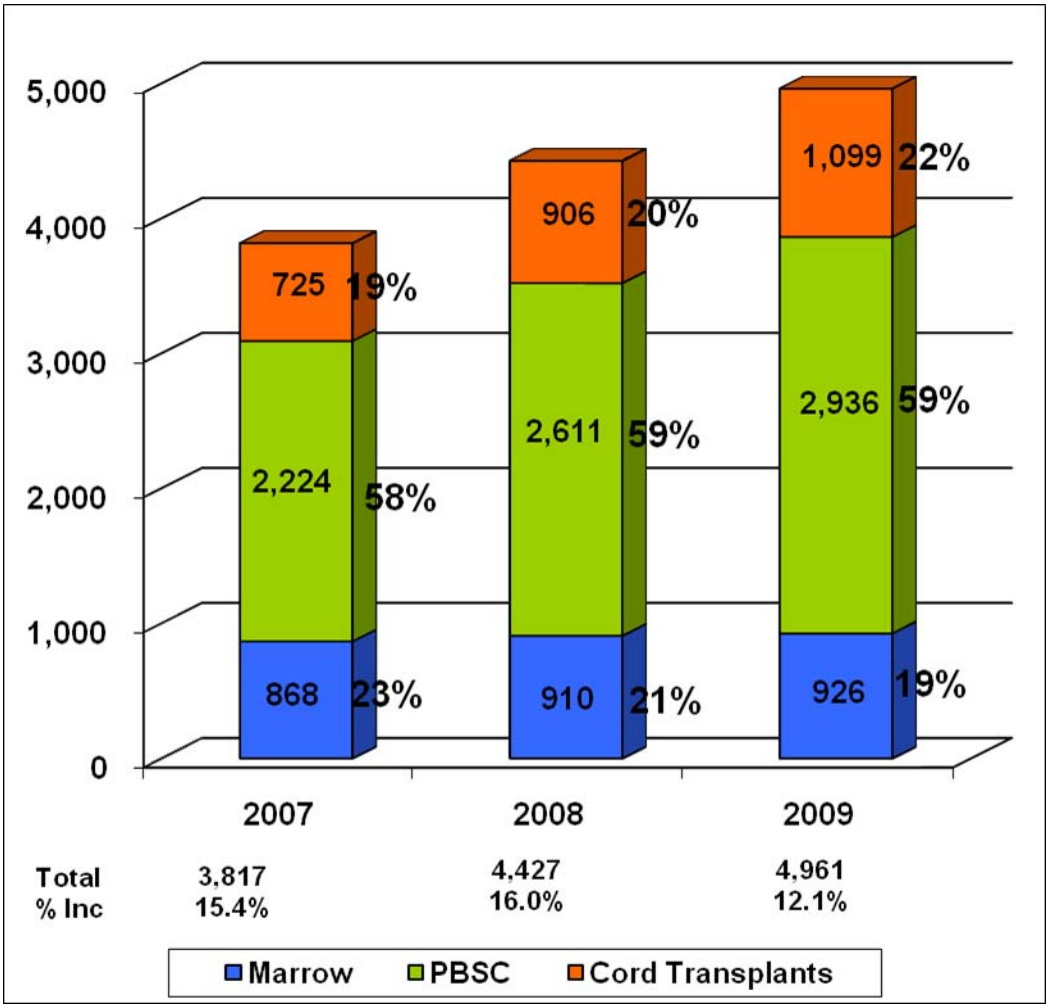

Figure 6. NMDP transplants and distribution by donation type, fiscal years 2007-2009.

Using two cord blood units to increase the cell dose has become an increasingly important option for adult patients. In 2009, the NMDP facilitated more than 300 multicord transplants, more than twice as many as in 2007.

2.2.3.2 Race and Age of Recipients

Advances such as reduced-intensity preparation and conditioning prior to a transplant have made it a treatment option for more patients, particularly older patients. In 2009, 40 percent of NMDP facilitated transplants occurred in patients over the age of 50. The following charts show the distribution of transplants by patient race or ethnicity (Figures 7 and 9) as well as by patient age (Figures 8 and 10) during calendar years 2008 and 2009.

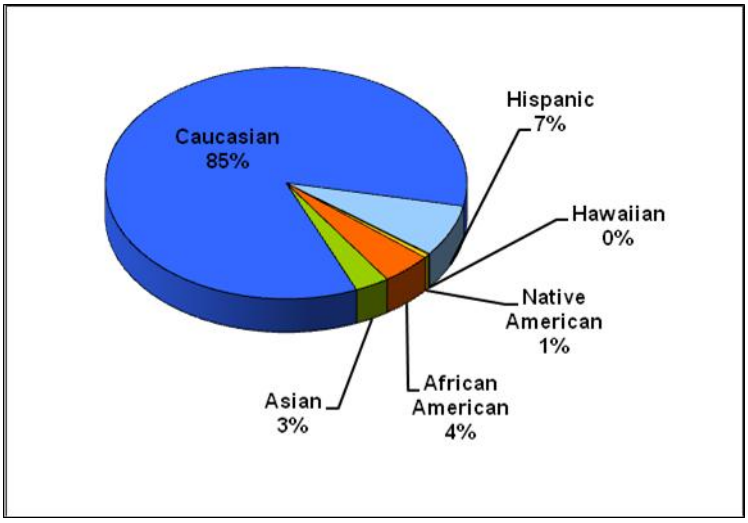

Figure 7. Race/ethnicity of NMDP transplant recipients in fiscal year 2008

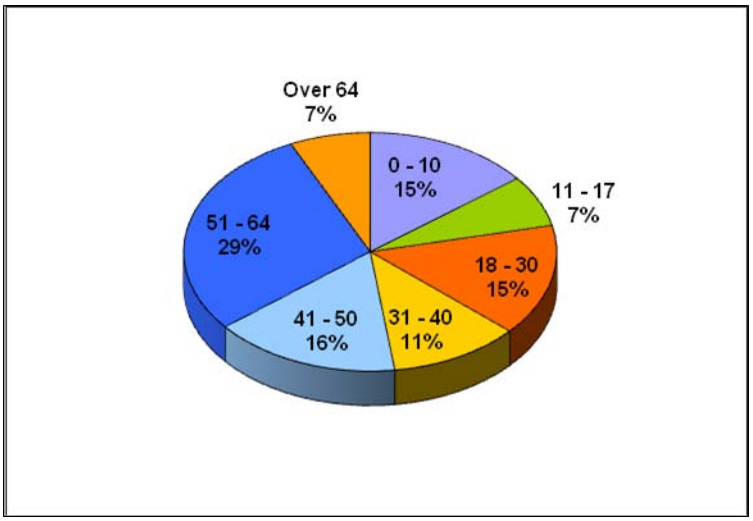

Figure 8. Age of NMDP transplant recipients in fiscal year 2008

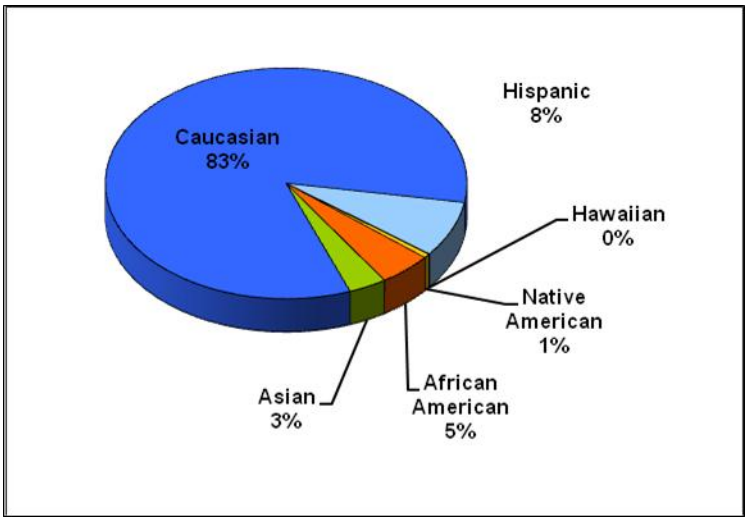

Figure 9. Race/ethnicity of NMDP transplant recipients in fiscal year 2009

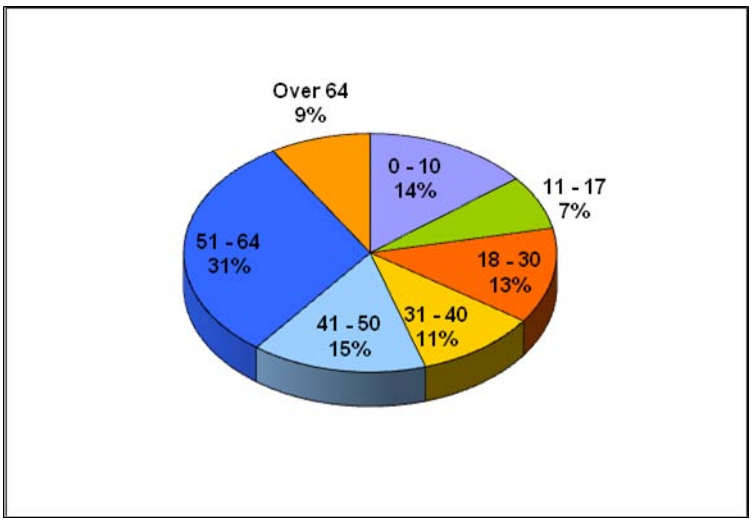

Figure 10. Age of NMDP transplant recipients in fiscal year 2009.

2.2.4 Donor Recruitment

On average, 48,000 new potential donors join NMDP's Be The Match Registry each month. NMDP works with civic, community, corporate and faith-based organizations to recruit volunteer donors from diverse communities. Groups of individuals identified by NMDP for focused recruitment are: American Indian, Alaska Native, Asian/Native Hawaiian and other Pacific Islanders, Black or African-American, and Hispanic or Latinos.

Table 7 shows the race/ethnicity of newly recruited donors.

Ethnicity of Newly Recruited Donors	2008	2009
African-American	43,834	46,111
Hispanic/Latino	55,701	77,150
Asian/Pacific Islander	9,381	54,948
American Indian/Alaska Native	2,774	3,206
Multi Race	36,386	47,165
Caucasian	202,659	252,509
Total Recruitment	**400,735**	**481,089**

Table 7. Race/ethnicity of newly recruited donors, calendar years 2008-09.

Forty-two percent—more than 245,000—of the potential donors who joined NMDP's Be The Match Registry in 2009 were from diverse racial and ethnic communities.

2.2.4.1 Donor Recruitment and Registry Diversification

NMDP periodically performs an analysis of the size of the Registry, most recently in 2009, to determine the effect of their recruitment activities on successful donor matching for patients. Specific recommendations from this analysis were provided to HRSA. NMDP's goal is to identify geographic regions where it is most likely to recruit subjects to balance the Registry with the HLA types that are needed. NMDP continues to improve its use of donor HLA data and population research so that patients can make best use of the Registry.

2.2.4.2 Online Donor Registration

Online donor registration, or "Do-It-Yourself" recruitment (http://www.marrow.org/JOIN/index.html), continues to evolve via enhancements in technology.

Through this online method, donors can join the registry by confirming they meet basic registry guidelines, completing the form, ordering the registration kit, following the instructions in the kit to collect a swab of cheek cells and returning the kit for HLA typing. Online social media will play a greater role in communicating with potential donors in the future. As communities evolve within the "virtual" environment, do-it-yourself donor registration will enable NMDP to target key audiences efficiently, educate them on its mission, and engage them in its lifesaving work. Much like what patient families, community groups, corporations and national partnerships are doing, NMDP will increasingly use Web-based recruitment services.

2.2.4.3 Recruitment Performance Management System

NMDP continually monitors its own efforts to recruit a diverse and committed group of donors on its Registry. One tool it uses is performance management programs, including the Tiered Recruitment Performance Management System. The intent of a performance management system is to identify areas of strength and opportunities for improvement in donor recruitment processes. The NMDP uses four measurements to evaluate its own performance and that of its recruitment partners:

- Percent of Caucasian recruitment goal achieved
- Percent of total minority goal achieved
- Caucasian availability as measured by the Post Recruitment Survey
- The availability of minority donors as measured by the Post Recruitment Survey

The Post Recruitment Survey asks some recently-recruited NMDP donors to assess their understanding of the donation process, and their likelihood to participate if they were formally activated during a search in the future. It is a tool developed by NMDP in conjunction with vendor, Westat. Approximately 1,000 donors are interviewed by phone monthly 6-8 weeks following their recruitment onto the Registry. This survey seeks to assess donor knowledge, commitment and feedback regarding their experience with the recruitment process. Donor responses to a series of questions from the survey, pertaining to donor commitment to proceed if requested (e.g. availability), are compiled into a donor commitment score. This commitment score is factored at the individual recruiter and recruitment group level and is half the total weighting of the Tiered Recruitment Performance Management system.

2.2.4.4 DNA-based HLA-A, HLA-B and HLA-DR Typing at Time of Recruitment

Donors provide tissue samples at the time they join the Registry, a portion of which is used for immediate DNA-based HLA testing. The remainder is then stored at the NMDP Repository for future testing. Most donors provide four buccal (cheek) swabs, while a small percent provide a blood sample. Samples are shipped to testing laboratories to be evaluated for HLA-A, HLA-B, and HLA-DRB1. Approximately 30 percent of new donors are now also typed for HLA-C.

HLA-C typing was begun because a recent study showed that it might be valuable to collect this information when the donor is recruited. That study showed that this information was likely to be needed, especially for minority marrow and PBSC donors. Transplant centers prefer to have this additional information available when evaluating adult blood stem cell donors for their patients. Given this finding, NMDP is adding HLA-C typing to its processing for approximately 34 percent of new donors, starting in late 2008.

HLA typing results are reported to the NMDP within two weeks of the laboratory receiving the sample. All laboratories are certified for HLA testing, have strict internal quality control programs, and participate in the NMDP Quality Control Sample Testing Program. All samples are given Intermediate Resolution typing, and 38 percent are given higher resolution typing. Contracts to laboratories for HLA typing services are based on the following goals:

- Increasing the resolution of HLA typing
- Receiving high-quality, accurate reports
- Reporting results in 14-days or less
- Decreasing the cost of HLA typing

2.2.4.5 Volunteer Donor Retention

Since the beginning of its operations, NMDP has contracted with scientists to support research on what motivates donors and how best to follow up on patient-directed donation requests. NMDP has used these research findings to:

- Develop training programs for staff and volunteers from donor centers and recruitment organizations
- Produce educational materials that provide donors with the information they want
- Create opportunities for potential donors to make informed, committed decisions about joining the Registry

NMDP also analyzes variables that may have an impact on donor availability. It then sends out monthly data to member centers to allow them to regularly assess their donor registration performance.

NMDP's ability to recruit donors that are willing to continue on to the stage of confirmatory tissue type testing (HLA typing) has declined across all broad race categories. In order for a donor to be considered "available" for this purpose, the donor must pass a health screening and consent to provide a blood sample for testing. Figure 11 shows donor availability by donor race for the years 2007, 2008 and 2009, where a slight decrease in availability has occurred.

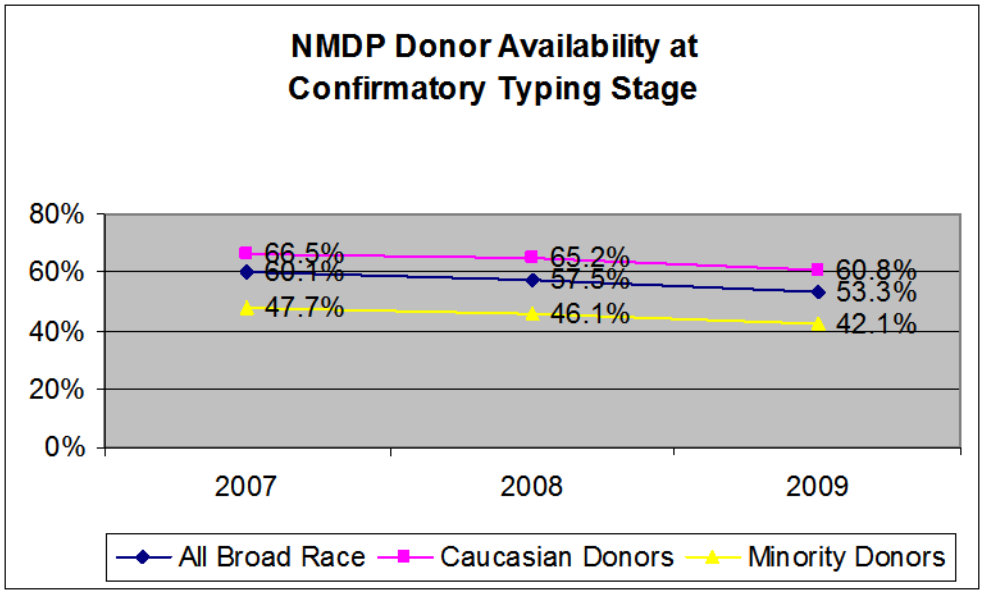

Figure 11. Available donors at the confirmatory typing stage, 2007-09.

To address this slightly declining trend in donor availability, NMDP proactively communicates with existing donors and conducts Registry data cleanup. NMDP communicates with its member organizations in order to: 1) maintain current member contact information for faster searches, and 2) strengthen member awareness, interest and commitment to the donor registry. This strategy also provides opportunities for members to volunteer and stay engaged with the Registry.

2.2.5 Search Process Improvement

2.2.5.1 Donor Management Performance System

NMDP strives to improve its performance at every step of the search and donation process. The NMDP Donor Management Performance system (similar to the recruitment management performance system) was designed to improve the organization's capabilities, by evaluating the donor management process as part of an integrated model of timeliness, availability and excellent customer service. This system defines clear performance expectations, and rewards donor centers when their performance meets and exceeds goals.

The NMDP uses five measures to evaluate how well donor centers are doing:

- Sample collection timelines
- Caucasian donor availability
- Minority donor availability
- Donor clearance timelines
- Donor satisfaction customer service score

Donor clearance timelines are measured from the day the donor is contacted and requested to have typing done as a potential donor, until the day they receive final approval to become a donor. This process includes an information session and medical evaluation of the prospective donor.

The donor satisfaction customer service score comes from a post donation satisfaction survey distributed to donors the month after their donation. Its purpose is to find out how satisfied donors are with their experience and to identify areas where the process can be improved. Service access, service quality and the donor's experience with program staff are all evaluated.

2.2.5.2 Analysis of Search Completion

NMDP routinely analyzes the timelines and outcomes for the donor search process. An evaluation of donor searches done between May 2006 and June 2007 revealed some important information. It showed that certain racial/ethnic groups were more likely to continue in the process from preliminary search to formal search and from formal search to transplant within six months. Caucasian, Hispanic and Asian/Pacific Islander recipients continued to the formal search phase more often than Black/African-American recipients did. Hispanic patients, followed by Caucasian patients, were most likely to proceed from the formal search stage to the transplant.

Older recipients had much better percentages advancing to the formal search stage, but were less likely to receive a transplant than younger patients. Comparison of data between 2005 and 2007 showed an encouraging trend: more patients progressed from the formal search stage to a transplant, although this improvement was not statistically significant. The analysis also showed a trend toward shorter times for the search stage to progress from the preliminary and formal search stages to a transplant.

It also showed that many (42 percent) of the cord blood units that were ordered had previously been confirmatory typed, and were available for immediate shipment. This demonstrates the benefits of having a centralized cord typing laboratory and confirming CBU typing ahead of time. NMDP will continue to evaluate and analyze these important aspects of the search process.

2.2.5.3 Customized HLA Typing

NMDP launched a Customized HLA Typing service in August 2002. This was created in response to requests from transplant centers for more flexibility in the search process. It allows transplant centers to request tailored, or specific HLA typing, from the NMDP laboratories. The

Customized HLA Typing service was designed to reduce search times and increase flexibility. Transplant centers using this service can select particular factors that they would like to hone in on to match a particular patient's HLA (tissue) type. Figure 12 shows the number of customized searches by fiscal year.

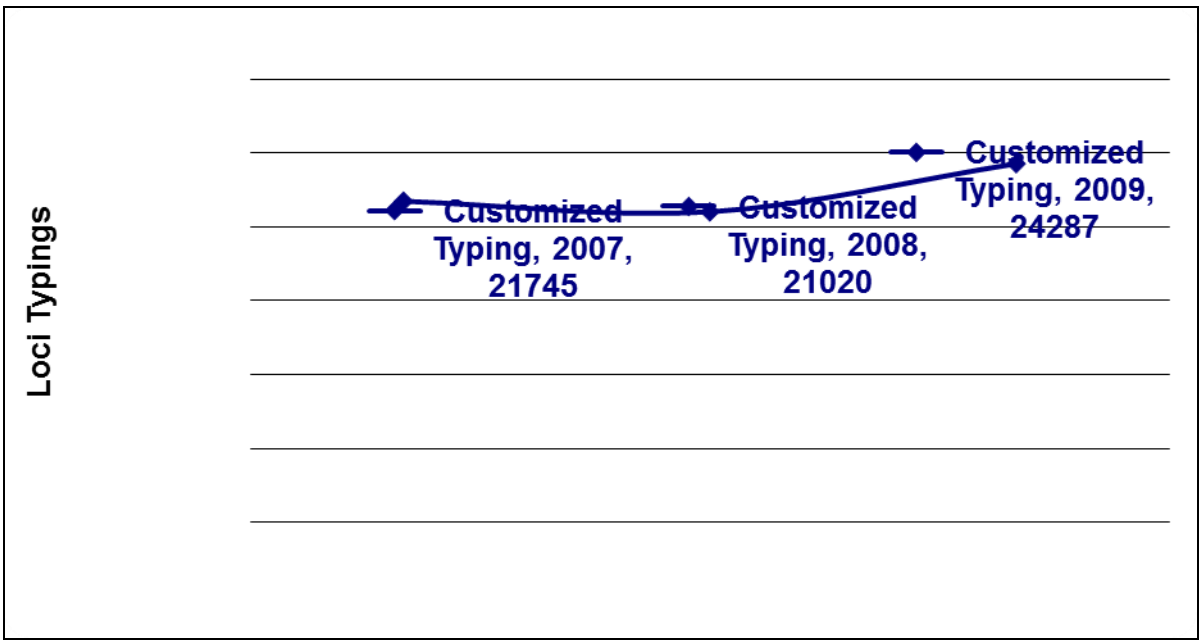

Figure 12. Customized donor data searches, fiscal years 2007-09

2.2.6 Other Projects

2.2.6.1 Quality Assurance Efforts to Safeguard Donors and Patients

Protecting the health, confidentiality and good will of donors and patients is critical to NMDP's mission and purpose. NMDP continually works to improve the recovery monitoring process for any donor that is experiencing post-donation complications. The goal is to ensure that donors receive adequate support, including medical care or disability coverage, until they recover. Serious and unexpected adverse events are reported to HRSA. Since PBSCs and CBUs are collected as part of an Investigational New Drug study with the Food and Drug Administration (FDA), serious and unexpected adverse events related to these donations and transplants are also reported to the FDA.

2.2.6.2 Contingency Planning

The NMDP Emergency Preparedness program is responsible for organizational emergency preparedness, business continuity, Coordinating Center security and organizational emergency communications. This function was formally established in June 2005 to support NMDP's efforts to plan for public health emergencies that might require bone marrow transplants.

NMDP also collaborates with the American Society for Blood and Marrow Transplantation (ASBMT) to coordinate the Radiation Injury Treatment Network® (RITN). It is made up of 56 NMDP centers (transplant centers, donor centers and cord blood banks) that receive ongoing training for a mass casualty marrow-toxic incident (such as exposure to ionizing radiation or mustard gas). RITN, in collaboration with other experts at the U.S. Department of Health and Human Services, provides for comprehensive evaluation and treatment for victims of radiation exposure or other marrow-toxic injuries. They are developing treatment guidelines, educating health care professionals, working to expand the network and coordinating appropriate disaster

specific responses. These materials are available to health care professionals on CD-ROM and a Web site (http://www.ritn.net/).

2.3 Cord Blood Coordinating Center

The Cord Blood Coordinating Center (CBCC) was established as one of the four components of the C.W. Bill Young Cell Transplantation Program to help more patients receive a successful umbilical cord blood transplant. It is administered by NMDP.

2.3.1 New Mission/Contract Requirements

Umbilical cord blood (cord blood) is recognized as an established alternative to bone marrow and peripheral blood stem cells as a transplant source for many of the same diseases. Cord blood units (CBUs) are used more often for pediatric recipients, but are also used increasingly in adults. The relative ease of CBU collection, along with less stringent HLA matching requirements, makes cord blood more accessible for patients from racial and ethnic minority populations and for those with rare HLA types.

The CBCC was established to:

- Increase access to transplantation by providing a comprehensive registry of CBUs;
- Facilitate the search and distribution of CBUs on the Registry;
- Support efforts to educate health professionals and the public about CBU transplantation, and reduce barriers to this therapy; and
- Manage the related cord blood donor program for families that are having a baby, and who have a first-degree (close) relative diagnosed with a disease that may be treated by a cord blood transplant.

The CBCC coordinates a national registry of CBUs through agreements with transplant centers, cord blood banks, international registries and laboratories. It also works closely with the other Program operators to coordinate and serve patients in need of a transplant.

2.3.2 Growth of Cord Blood Unit Registry

The NMDP has operated a registry of cord blood banks since 2000. Over time, there has been a steady increase in the number of CBUs available for transplantation (Figure 13). NMDP and HRSA sponsor programs to encourage cord blood banks to collect and process more CBUs from families of diverse ethnic and racial backgrounds (Figure 14).

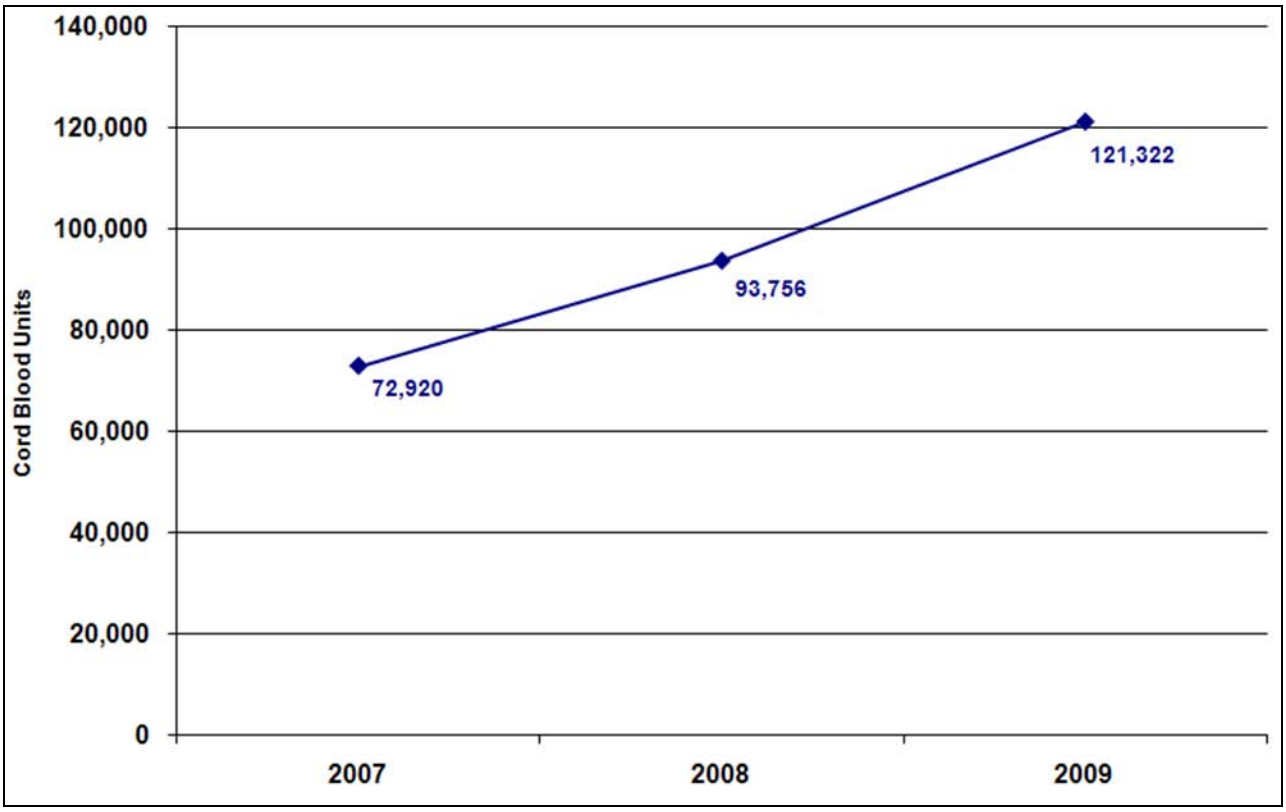

Figure 13. Cord blood units on the Registry - Calendar Years 2007 – 2009

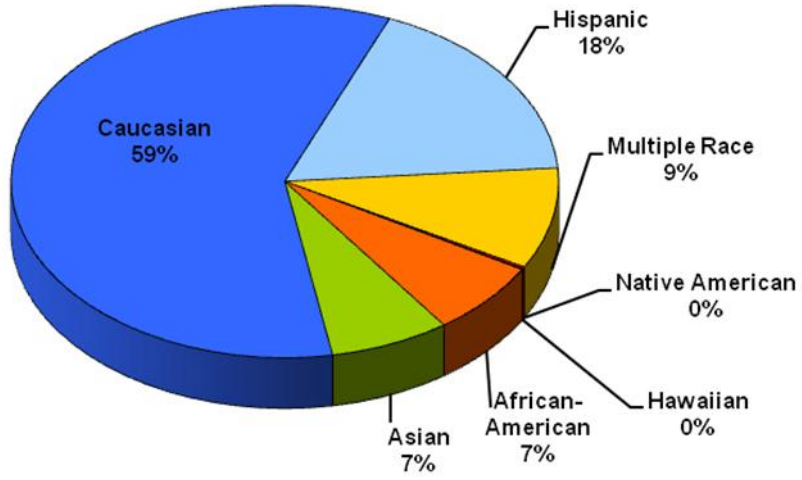

Figure 14. Race/ethnicity of cord blood units on the Registry as of 12/31/09

Note: Caucasian includes patients who chose a broad race of Caucasian, Declined, Other or Unknown without Hispanic ethnicity. Hispanic includes patients who chose a broad race of Hispanic or Caucasian, Declined, Other or Unknown with Hispanic ethnicity.

2.3.3 Recruitment Programs through NMDP: Challenges to Recruitment

Although the number of cord blood donors has increased significantly since 2000, there are several factors that make recruiting them and storing the CBUs for clinical use challenging.

The first is expense: although there is no cost to families for donating cord blood to a public cord blood bank, there is considerable cost for collecting, processing and storing the CBUs. The total costs average $1,500-$2,000 per unit.

The second challenge to the use of CBUs is that they must be processed within 48-hours of collection. These two factors mean that many cord blood banks focus on efficiency by recruiting new mothers who deliver in hospitals with large, active obstetrics programs that are physically close to their facility. However, the majority of pregnant women do not give birth at a hospital associated with a public cord blood bank. In some cases, it is possible for women to receive a collection kit through the mail, have their physician perform the collection and return the CBU to the cord blood bank. NMDP is currently conducting a pilot program for non-fixed site collections with three cord banks. The results of the pilot will be evaluated to determine the feasibility of expanding the program network-wide.

Funding that is available through the NCBI program (see 2.3.5 below) is helping increase the national inventory of CBUs. Between 2007 and 2009, HRSA provided funds to cord blood banks to help build their inventories of high quality CBUs. This funding has enabled the addition of over 9,400 CBUs during this reporting period, of which about half were from ethnic and racial minority donors.

2.3.4 Selection and Use of Cord Blood Units

Every search of the NMDP Registry on behalf of a patient identifies potentially matched cord blood units and unrelated PBSC and bone marrow donors. When a patient needs a transplant for a life-threatening disease, his or her doctor considers many factors:

- Should the cells come from the patient (autologous transplant) or from a donor (allogeneic transplant)? The type of transplant to be used depends on which works best for that disease.
- Which graft source (bone marrow, peripheral blood or cord blood) is best for the patient? Each source has advantages and disadvantages.

Cord blood is especially useful for:

- Patients who need a transplant quickly, because CBUs are stored frozen and ready to use.
- Patients who have a hard time finding a matched bone marrow or PBSC donor. Cord blood does not have to match a patient's HLA type as closely as donated bone marrow or peripheral blood stem cells.

The use of cord blood for transplantation has been steadily growing. Approximately 22 percent of transplants facilitated by the NMDP in fiscal year 2009 used cord blood (Figure 6).

2.3.4.1 Race and Age of Cord Blood Transplant Recipients

The use of cord blood in transplants has increased for both children and adults. Cord blood is used more often in children because the umbilical cord and placenta hold a limited amount of blood and blood-forming cells. The number of blood-forming cells that a transplant recipient needs is relative to their size—smaller patients need fewer cells and larger patients need more cells. Some CBUs may not have enough blood-forming cells for larger patients (Figure 15).

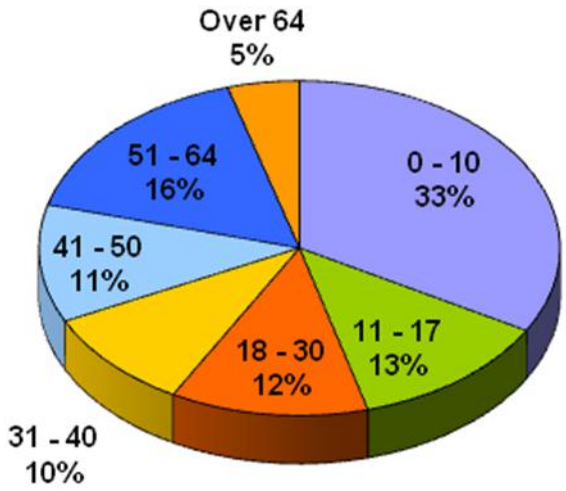

Figure 15. Age distribution of cord blood recipients, calendar year 2009

For a successful transplant, the tissue type of a bone marrow, PBSC donor or a CBU should match the patient's as closely as possible. Tissue types are inherited, so patients are more likely to match the HLA type of someone who shares their racial or ethnic heritage. Often, patients from racially or ethnically diverse communities have a harder time finding a match. Because cord blood does not need to match a patient as closely as donated bone marrow does, cord blood transplants may offer hope to these patients. In 2009, 33 percent of cord blood transplants were for patients from racially or ethnically diverse communities (Figure 16).

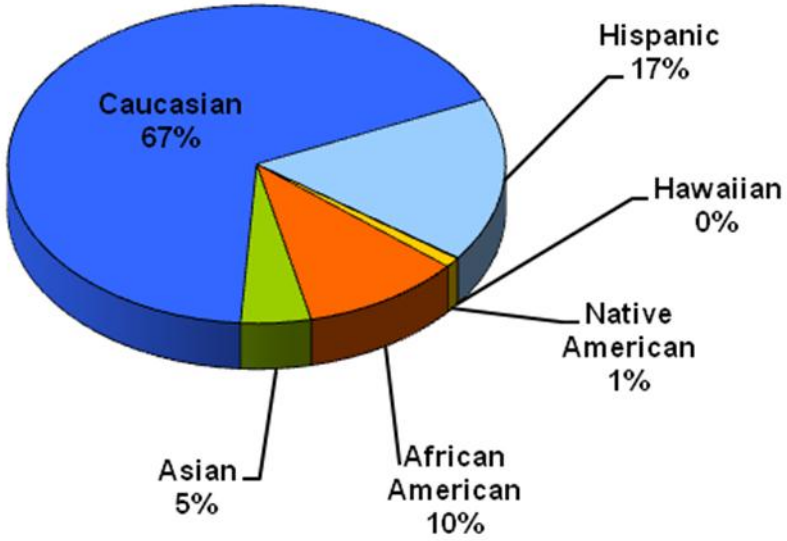

Figure 16. Race/ethnicity distribution of cord blood recipients, calendar year 2009

2.3.4.2 Increasing Transplants for Adults

Researchers are trying different ways to increase the number of cells in a CBU so they can use cord blood for larger patients. One method being studied is a way to increase the number of cells in a CBU in a laboratory before giving the unit to a patient. Another method being investigated is the use of two (or more) CBUs for a single patient. The use of dual CBUs for single recipients has increased in recent years (Figure 17).

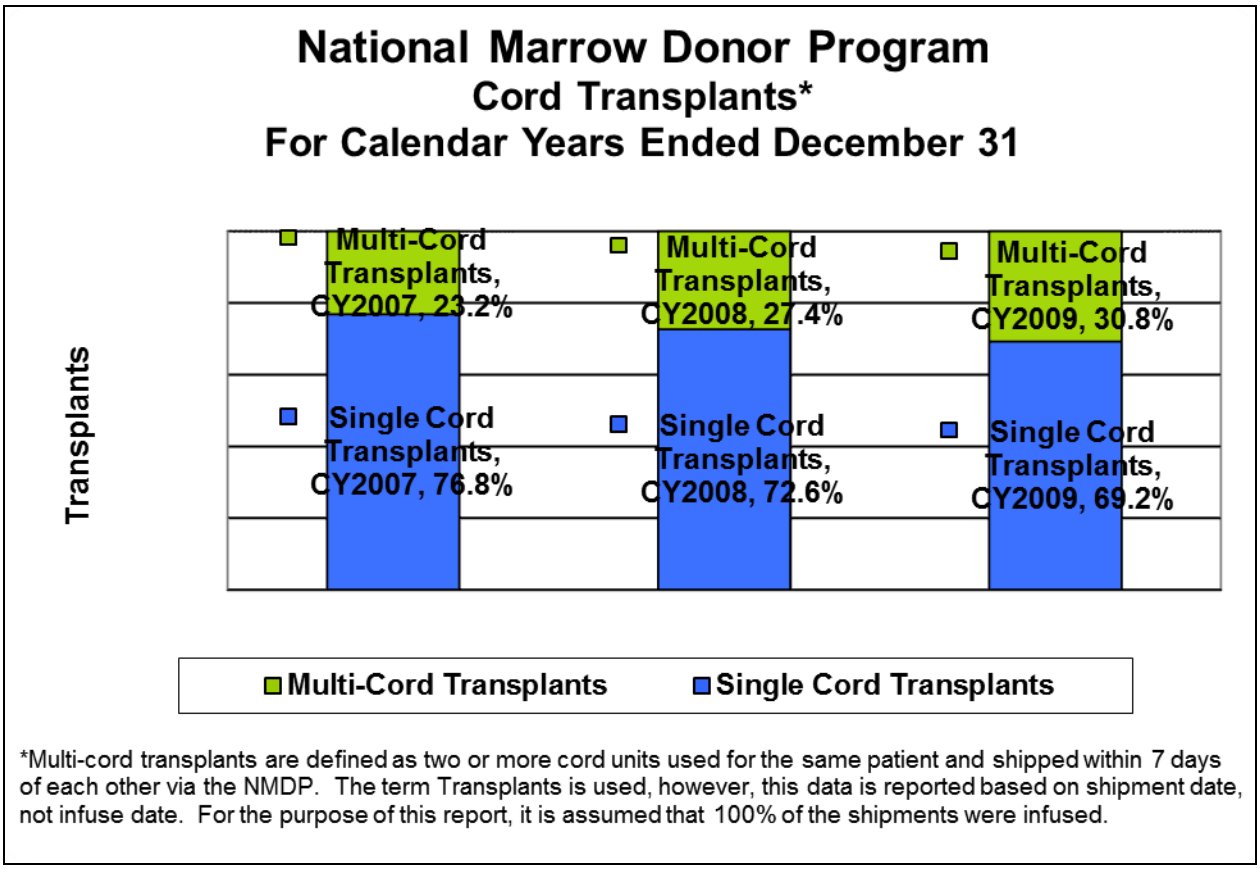

Figure 17. Single and multi-cord transplants, calendar year 2007-09

2.3.4.3 International Exchange of Cord Blood Units

Finding the best CBU for a patient often means getting it from an international cord blood bank or registry. Almost 45 percent of CBUs used for transplants come from a country other than the country of the patient receiving the unit.

In fiscal year 2009, 233 CBUs used in transplants for U.S. patients facilitated by the NMDP were imported from other countries. Similarly, 272 CBUs were exported from the United States for patients in another country. This international cooperation is critical to providing the best options for patients who need transplants.

2.3.5 National Cord Blood Bank Inventory (NCBI)

The NCBI portion of the Stem Cell Therapeutic and Research Act of 2005 provides funds for collecting and storing 150,000 new units of high-quality cord blood. These CBUs are made available through the C.W. Bill Young Cell Transplantation Program to treat patients who need a transplant.

Cord blood banks that receive contracts to help build the inventory of CBUs will:

- Encourage more cord blood donations, with special emphasis on parents of racially or ethnically diverse backgrounds.
- Collect and store CBUs and make them available through the Program.
- Ensure the CBUs are of high quality and that they meet certain standards, such as having enough blood-forming cells. Cord blood units that do not meet these criteria may be made available for research studies intended to improve patient transplant outcomes.

- Protect the rights of donating mothers and their babies by obtaining informed consent from the mother to donate and by maintaining confidentiality of the mother and baby.
- Provide CBU data to the SCTOD contractor.

2.3.5.1 NCBI Participating Cord Blood Banks

Starting in late 2006, HRSA began entering into contracts with cord blood banks to participate in the NCBI program. These contracts are awarded through a competitive process. As of the end of fiscal year 2009, 12 banks had received contracts. They are:

- Carolinas Cord Blood Bank
- M.D. Anderson Cord Blood Bank
- New York Blood Center National Cord Blood Program
- Puget Sound Blood Center
- St. Louis Cord Blood Bank
- StemCyte International Cord Blood Center
- Texas Cord Blood Bank
- University of Colorado Cord Blood Bank
- LifeCord
- CORD:USE
- New Jersey Cord Blood Bank
- Cleveland Cord Blood Center

HRSA and each of the NCBI banks contract for specific recruitment goals. To better meet the needs of all patients, there is a heavy emphasis on recruiting donors of diverse ethnic and racial backgrounds.

2.3.5.2 Number of NCBI Units Used for Transplant

Before cord blood banks are permitted to start collecting CBUs under their NCBI contract, they need to make changes to their consent forms and sometimes other changes to their operations. After a slow start because of these requirements, NCBI recruitment is steadily increasing.

As of 12/31/2009, approximately 30,000 NCBI units have been added to the registry, of which 633 have been shipped for transplantation, as shown in Table 8 and Figure 18.

Patient Race	2007	2008	2009	Total to Date
AFA	3	16	47	66
API	1	7	19	27
CAU	7	72	222	301
DEC	0	0	6	6
HAW	0	0	0	0
HIS	0	0	0	0
NAM	0	1	4	5
OTH	0	0	1	1
UNK	2	63	162	227
Total	**13**	**159**	**461**	**633**
Minority*	4	24	70	98
HIS Ethnicity**	2	18	89	109
Total Minority/Ethnicity	**6**	**42**	**159**	**207**

Table 8. National Marrow Donor Program. Cord Shipments Using NCBI Funded Units by Patient Race For Calendar Years Ended December 31

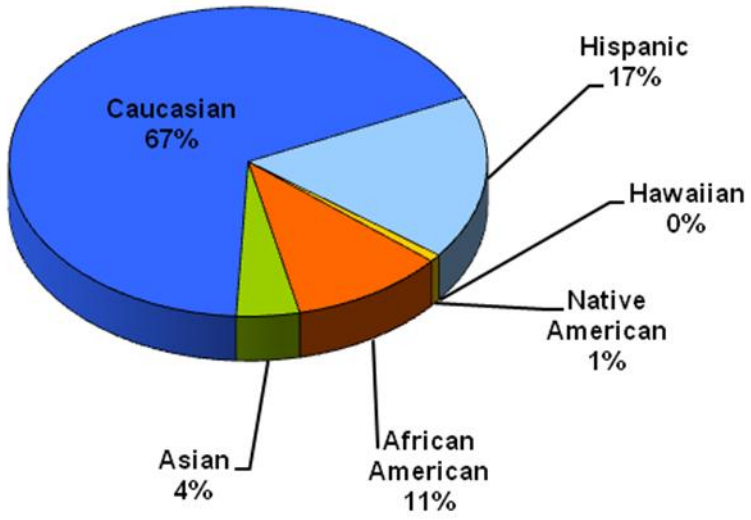

Figure 18. Race/ethnicity distribution of NCBI cord blood units, calendar year 2009

* * Minority includes the broad races of AFA, API, HAW, HIS, and NAM.

** ** HIS Ethnicity includes only patients who chose a racial group of CAU, OTH, DEC, or UNK and an ethnic group of HIS. HIS Ethnicity is updated on a quarterly basis so the data for prior months may change. Broad race does not change.

2.3.6 Developing Standardized Unit Inventory Requirements

The NCBI banks and NMDP have been working together since 2000 to identify and adopt practices to improve the quality of stored CBUs. Together, they have established standards for:

- Testing for infectious diseases
- The minimum number of cells in new units for the supplier to be eligible for reimbursement. (This recognizes the fact that larger units are more likely to be chosen and useful for more patients.)
- The level of HLA typing that is needed to provide the best information to patients and their physicians for their search reports
- Screening questions that should be asked of mothers and what should be included in the baby's family medical history

Much of the information obtained through these criteria is available in the NMDP database to make selection of units for patients easier and faster.

2.3.7 HLA-related Projects

It is important that high-quality, timely tissue-typing information is available to patients and their physicians, so that suitable CBUs can be identified. NMDP offers several programs to improve information about available CBUs to physicians.

2.3.7.1 Use of a Central Confirmatory Typing Laboratory

One of the challenges for cord blood banks and transplant centers is that a limited number of samples are available for additional testing. Since CBUs are small, the cord banks need to save as many of the cells as possible in the CBU itself. To make best use of the samples and the information that additional testing might provide, NMDP has a contract with one central laboratory to do additional and confirmatory testing on CBU samples. The advantages of this process are:

- A rigorous quality control program is maintained. Results are reported each quarter. The central laboratory has a more than 99 percent accuracy rate for typing.
- The central laboratory keeps a small number of extra cells for potential future use.
- Typing results are available electronically through the SPA search (see Section 2.1.3). Once this confirmatory typing is done, it does not have to be performed again and the unit can be ordered quickly, if needed.

2.3.7.2 Prospective Cord Blood Unit Typing

Many patients who receive transplants have aggressive diseases. They may be medically unstable, which means that they must receive a transplant very quickly. By prospectively performing the second (confirmatory) level of tissue typing before the unit is actually requested on behalf of a specific patient, it becomes available immediately. More than 21,000 CBUs in the Registry are already confirmatory typed, making them more quickly available when needed.

2.3.7.3 Search Process Improvements

Continuing to improve processes or operations is an important goal for the CBCC and NMDP as a whole. Several projects have helped streamline operations:

- **Multi-cord tool**. When a transplant center is searching for two CBUs for a single recipient, each unit must match the patient and the other CBU. NMDP developed an electronic tool to compare the match between units and the recipient to make it easier to identify and order CBUs.
- **Online cord blood unit eligibility assessment**. The FDA has established requirements for determining "eligibility status" of CBUs. They are based on the results of maternal

donor screening, medical history and infectious disease marker test results. The CORD Link Web® software that NMDP developed and provides free to cord blood banks includes an automated assessment of this eligibility status. This application also generates the form that accompanies the unit when it is shipped.

- **Providing additional shippers to banks**. The increase in number of cord blood transplants has resulted in an increased need for the special shipping containers used to transport CBUs from the bank to the transplant center. NMDP has provided more than 80 “dry shippers” to network cord blood banks to better meet this need.

2.3.8 Cord Blood Education for Physicians and the Public

Professional medical education programs help physicians learn about appropriate timing and referring of patients for consultation and treatment; best practices for donor and cord blood selection; streamlining the search process; and providing post-transplant care when patients return home. Further information about professional education is contained in Section 2.1.5.

Cord blood recruitment education plan: NMDP works with network cord blood banks to help them achieve their recruitment goals. NMDP supports awareness and education programs for expectant parents and others to increase the number of cord blood donors, including:

- Expectant parents and public/media: NMDP has asked potential cord blood donors to identify what might be barriers and what might make them willing to donate. Based on that information, NMDP worked with cord blood banks to develop recruitment and educational materials. NMDP’s online resource center (http://www.bethematch.org/cord) helps educate expectant parents about their options for cord blood storage and helps them understand public cord blood donation. NMDP has also worked closely with the media to help disseminate accurate information to the public about cord blood.
- OB/GYN and labor/delivery staff: Discussions with cord blood recruitment staff, obstetricians and labor/delivery staff have indicated that these individuals need more education before they will support public umbilical cord donation. They need to be motivated before they will become involved. This process involves additional efforts on their part to educate their patients and support collection. Obstetricians and labor/delivery staff also need education to help ensure that they collect the CBUs correctly. An instructional DVD on correct collection techniques has been developed. An extensive market research study with expectant parents to learn about their current levels of understanding of and attitudes toward public cord blood donation has been completed.

2.3.9 Quality Assurance Activities

NMDP staff review data across the network of cord blood banks and transplant centers to identify areas of concern. These concerns might not be apparent if the information were collected at only one center. This review helps the network improve its collection, storage and search processes so that patients are receiving the highest quality transplant possible. NMDP has provided financial assistance to help cord blood banks receive and maintain accreditation by AABB (formerly American Association of Blood Banks) and/or the Foundation for the Accreditation of Cellular Therapy (FACT).

- Incident reporting, investigation and trending. NMDP receives reports from cord blood banks and transplant centers if an unusual or unexpected event takes place. These include difficulties with the thaw procedure or a reaction to the infusion of a CBU. These reports are investigated and monitored. Depending upon the severity of the incident, NMDP may notify HRSA and the FDA. NMDP reviews the reported incidents quarterly, and looks for trends in the data to identify patterns that may require changes to practice.

This regular review is done to ensure that quality improvements continue throughout the network.

- Proficiency program. The NMDP has formed a partnership with StemCell Technologies (Vancouver, BC) to develop the first cord blood proficiency program. This program provides participants the opportunity to assess their individual competency in testing for nucleated cells, colony forming units, viability and CD34+ cells. It is available to all U.S. cord blood banks.

2.3.10 Making Cord Blood Units Available for Research

Individual cord blood banks make CBUs available for research studies to investigate how to improve outcomes for transplant patients. Cord blood banks providing these CBUs for research have different requirements about their use for studies. Most cord banks will ship CBUs to transplant facilities anywhere within the United States. NMDP provides an annual report to HRSA about the number of units provided for research by network cord blood banks.

2.3.11 Contingency Planning

Network cord blood banks also participate in activities related to the NMDP emergency response process. An Emergency Response Plan has been developed to help cord blood banks respond appropriately in the event of an emergency that might be marrow toxic, either natural or man-made. Drills and staff training are given regularly to assure that operations continue and patients are able to receive the transplants they need.

2.3.12 Related Cord Blood Donor Program

The Stem Cell Therapeutic and Research Act of 2005 called for establishing a three-year pilot program for banking CBUs from related donors. It was designed to help families in which a biological sibling or parent has been diagnosed with a medical condition that might be improved by a cord blood transplant. When a baby is born to an eligible family, there is no charge to the family to have that baby's umbilical cord blood collected and stored. It is estimated that as many as 2,500-5,000 families per year might benefit from this program.

The Related Donor Cord Blood Program launched on October 1, 2008, with the NMDP OPA serving as the central clearinghouse for information about the Related Donor Cord Blood Program to the public and professional organizations. HRSA is overseeing this process. In January 2010, a new version of the CORD Link Web application was successfully released, which included enhancements to accommodate the registration of cord blood units collected and banked for the purpose of related donor transplantation.

2.4 Stem Cell Therapeutic Outcomes Database

The Stem Cell Therapeutic Outcomes Database (SCTOD) is the fourth component of the C.W. Bill Young Cell Transplantation Program. It is administered by the Center for International Blood and Marrow Transplant Research (CIBMTR) at the Medical College of Wisconsin. The goal of the SCTOD is to collect, store and analyze data about bone marrow, peripheral blood stem cells (PBSC) and cord blood transplants and provide information for research to help improve outcomes for patients.

2.4.1 Background and Purpose

The purpose of the SCTOD is to collect data on all allogeneic (related and unrelated donor) hematopoietic stem cell transplants (HCTs) done in the United States to advance the field. It also collects information on all HCTs done with products received through the C.W. Bill Young Cell Transplantation Program but performed outside the United States.

Another part of the SCTOD contract with HRSA requires establishing a related donor-recipient sample repository in addition to the existing repository for unrelated donor-recipient samples. This new feature was launched in December 2007 along with the FormsNetTM 2.0 electronic data collection system.

2.4.2 Responsibilities

In its role as SCTOD contractor, CIBMTR:

- Provides an electronic database of scientific information about outcomes of allogeneic bone marrow, PBSC and cord blood transplants, to be used by researchers and health care professionals.
- Establishes a quality control program for the database functions including:
  - Quality assurance of data
  - Performance monitoring
  - Training and assistance to data contributors
- Collects and analyzes information about:
  - Medical diagnoses for which transplant may be a treatment option
  - Transplant preparation and procedures
  - Patient outcomes
  - Patients' quality of life
  - New uses for cells found in bone marrow, peripheral blood, and umbilical cord blood
- Works with transplant centers to reduce the burden of data reporting.
- Reports information about:
  - The need for donors and CBUs to policymakers, based on data from the Program.
  - Cost-benefit analyses of the size, composition and growth rate of the NCBI and Adult Donor Registry, in order to provide specific recommendations for recruitment activities, and determine the probability that patients of specific racial/ethnic groups will find suitable HLA-matched cells.
  - Annual patient outcomes for each transplant center.
  - Transplant research to the public, researchers, and health care professionals.
- Stores blood samples from donors and patients that will be used for transplant research.

2.4.3 What is the Center for International Blood and Marrow Transplant Research (CIBMTR)?

The CIBMTR was created to collaborate with the worldwide scientific community, to advance the fields of hematopoietic (blood) stem cell transplantation (HCT) and cellular therapy research. As a combined research program of the Medical College of Wisconsin (MCW) in Milwaukee and the National Marrow Donor Program (NMDP) in Minneapolis, the CIBMTR facilitates important clinical research to increase survival and enrich the quality of life for thousands of HCT patients.

The CIBMTR is a unique resource of data and statistical expertise. Its services are available to the scientific community for addressing important issues in HCT. It is made up of two parts: a network of more than 450 transplant centers that share data on HCT outcomes, and a Statistical Center that maintains a clinical database with information about more than 300,000 transplants (as of the end of 2009). This database and the analytic support provided by the Statistical Center have led to successful completion of hundreds of studies that have had an important impact on clinical practice.

The CIBMTR has campuses in Milwaukee and Minneapolis, with staff consisting of more than 135 medical, statistical, clinical research and administrative personnel, including 13 MD

Scientific Directors with advanced training in biostatistics and related fields, 15 Masters-level biostatisticians, and seven PhD statisticians.

CIBMTR has a system of committees that was designed to obtain a broad range of input, to ensure that its activities match the priorities of the scientific community it serves. As of December 2009, there were 225 observational research studies in progress using the CIBMTR databases. The research agenda of CIBMTR is accomplished within the framework of 19 Working Committees that are responsible for:

- Designing and conducting studies relevant to their subject area and involving CIBMTR data, statistical resources, networks and/or centers;
- Considering proposals to use CIBMTR data for studies pertinent to their subject area;
- Periodically assessing and revising relevant sections of CIBMTR data collection forms;
- Planning and conducting workshops at CIBMTR meetings; and
- Setting priorities for future CIBMTR studies.

CIBMTR serves the public and the biomedical community in diverse and evolving ways. One is through its historic role of providing estimates about how well HCT will work for a particular condition by analyzing the information on past transplants from many centers. It also determines the potential benefits and adverse effects of emerging technologies and identifies uncommon events that may occur in long-term transplant survivors. Statistical Center personnel have a strong record of expert, innovative analyses of these and other data. CIBMTR Working Committees include representatives from hundreds of HCT centers around the globe. CIBMTR data and statistical resources are sought and used by scientists, clinicians, health policy-makers and the public.

2.4.4 What is Hematopoietic Stem Cell Transplantation (HCT)?

Hematopoietic (blood) cell transplants are widely used to treat several malignant and non-malignant diseases. They include hematologic malignancies (e.g. leukemia, lymphoma, multiple myeloma and others), neuroblastoma, ovarian and testicular cancer, myelodysplasia (MDS), aplastic anemia, congenital immune deficiencies, inborn errors of metabolism and recently, autoimmune diseases.

HCT may use cells from a related or unrelated donor (allogeneic transplants) or from patients themselves (autologous transplants). The cells may be collected from bone marrow, peripheral (circulating) blood or umbilical cord blood. Before the cells are infused into the recipient, chemotherapy and/or radiation (conditioning) is used to suppress the recipient's immune system so that the donor cells will engraft (become a working part of the recipient's body) and/or eradicate the malignant disease.

Conditioning processes (therapy given to prepare the recipient for transplantation) vary and are evolving rapidly, as are the strategies for collecting donor cells. New techniques are also being developed for treating graft-versus-host disease (GVHD, a common complication of transplantation) and for treating patients after their HCT. New technologies hold promise for decreasing the toxicity of chemotherapy, while maintaining or even enhancing the anti-tumor effects of the transplant. This has led to wider use of HCT for treating more patients. HCT can be life-saving in that it cures at least some patients who are considered incurable with other therapies.

HCT is also intensive, costly and carries high risks of morbidity (side effects) and mortality (death). Risks early in the process include infection, mucositis (painful inflammation of the lining of the digestive tract), non-engraftment (failure of the cells to grow in the recipient), acute GVHD and organ toxicity. Transplant-related mortality ranges from 3 percent to greater than 50

percent, depending on the underlying disease, the recipient's age and medical status and the type of graft. Most transplant-related deaths occur in the first year after the HCT.

HCT is also associated with a risk for long-term negative physical, psychological and psychosocial effects. Some of the potential later complications include chronic (ongoing) GVHD, infection, respiratory diseases, cataracts, bone degeneration, endocrine disturbances, cognitive difficulties, relapse and therapy-related cancers. These late effects lead to persistently high death rates for HCT recipients and may negatively affect their performance of daily activities, interpersonal relationships and sense of well-being.

The challenge for physicians is to identify the patients who are most likely to benefit from HCT and to select the treatment strategies most likely to lead to good outcomes. The challenge for clinical scientists is to pursue the most promising avenues for improving outcomes in the most efficient manner. The CIBMTR plays a vital role in providing the information they need to meet these challenges.

2.4.5 What is Outcomes Analysis?

Assessing HCT outcomes is challenging for many reasons, including the following:

- The diseases treated with HCT are uncommon, so statistical analysis is difficult.
- New HCT technologies are being rapidly developed, so the results of some clinical (investigational) trials may be obsolete before they are even published.
- Some important HCT issues cannot be tested with randomized trials. These include the influences of HLA matches or how gene profiles affect the success of a transplant.
- Most clinical trials focus on short- and intermediate-term outcomes (1-5 years). Yet, HCT may have important effects, such as therapy-related cancers, that occur many years after transplantation.

A database that includes the results of research from many centers (observational database), such as the one managed by CIBMTR for the SCTOD, helps scientists understand HCT outcomes by addressing questions that cannot be studied through randomized trials or single transplant center studies. These include:

- Describing HCT results for particular diseases and patient groups;
- Determining what factors are most important in a patient's prognosis;
- Defining what will vary between centers as far as diagnosis and practice, and how that may affect outcomes;
- Evaluating long-term outcomes, including quality of life (QOL); and
- Developing analytic approaches to evaluating HCT outcomes.

An observational database can be an asset in planning clinical trials. It helps by: 1) identifying the most promising questions (hypothesis generation); 2) providing realistic estimates of baseline outcomes and whether enough patients in the appropriate groups might be available for the study (eligibility criteria); and 3) allowing different statistical designs to be simulated. An observational database can also be used to study whether the results of one study can be generalized to other patient groups who did not participate in that study.

Analyzing HCT outcomes poses challenges that cannot be met by standard statistical methods. They include:

- The complexity of creating statistical models for the post-HCT period, when patients are transitioning between numerous states of health, including episodes of engraftment, GVHD, relapse, and a variety of post-HCT therapies.

- Competing risks that must be accounted for in the statistical analysis. These result when the occurrence of one outcome (e.g., death from regimen toxicity), prevents the occurrence of another (e.g., relapse).
- Secondary variables, such as GVHD or immune suppressive treatment, which may change over time and affect the outcomes at different times.
- Treatments started at varying stages in the disease for different patients.
- Potential effects and biases in treatment assignment from one center to another (center effects).
- Patients for whom HCT was intended but not delivered because of intervening medical problems.

These statistical problems require development or extension of new statistical tools by investigators with expertise in both the clinical and statistical challenges of HCT.

2.4.6 CIBMTR Data Collection

Data collected for the SCTOD includes:

- Allogeneic HCTs performed in the United States using related or unrelated donors;
- Allogeneic HCTs using U.S. donors, whether the transplant is performed in the United States or elsewhere; and
- Use of allogeneic hematopoietic stem cells for emerging clinical applications other than hematopoietic cell recovery.

2.4.6 1 Privacy and Confidentiality

CIBMTR is fully committed to and appreciates the importance of maintaining the privacy and confidentiality of all patients and donors. CIBMTR and NMDP are fully compliant with Federal Regulations regarding privacy and confidentiality, including the Common Rule and the Privacy Rule.

The SCTOD contract authorized CIBMTR as a Public Health Authority to collect the information needed by the SCTOD. HCT centers, regardless of their status as a “covered entity,” are allowed to disclose protected health information to CIBMTR without an individual’s written consent or authorization, to allow CIBMTR to fulfill its statutory obligations as a Public Health Authority.

In addition to reporting to the government about the C.W. Bill Young Cell Transplantation Program, CIBMTR is also expected to use the data collected for the Program, whenever possible, for research to advance the field. All observational studies use existing data from the records of patients treated in participating CIBMTR institutions. The CIBMTR does not direct or suggest how patients in participating institutions are treated. The observational database of the CIBMTR and the studies performed using this database have been reviewed and approved annually by the Institutional Review Board (IRB) of MCW since 1987, in compliance with the Common Rule for the protection of human subjects.

Physical and technical security measures at CIBMTR comply with federal security standards defined by the SCTOD contract. The CIBMTR information network infrastructure is completely segregated from other departments at MCW. A systems security plan was developed, and in December 2008, CIBMTR achieved HRSA Office of Information Technology Authority to Operate based on documentation provided since October 2006.

2.4.6.2 Data Collection Standards

Basic information is collected for all allogeneic and autologous HCTs on a form called the Transplant Essential Data (TED) form. TED forms were developed by CIBMTR in collaboration

with the European Group for Blood and Marrow Transplantation (EBMT). This minimizes work for centers that participate in both organizations (approximately 30 percent of CIBMTR centers) and allows for better collaboration between the two organizations. The TED forms were revised to accommodate the needs of the SCTOD with input from representatives of the EBMT, Asian-Pacific Blood and Marrow Transplant Group, Australia-New Zealand Registry, the ASBMT, FACT, and other national and international HCT organizations. TED forms represent international consensus on a basic data set for all HCT recipients.

The data collection forms required by the SCTOD include:

- Pre-Transplant Essential Data Form
- Post-Transplant Essential Data Form
- Unique ID Assignment Form
- Recipient Death Form

The following forms are also required in some cases, including cord blood and related donor transplants:

- Infectious Disease Markers
- Confirmation of HLA Typing
- Hematopoietic Stem Cell Transplant (HCT) Infusion

CIBMTR data collection forms can be found at:
http://www.cibmtr.org/DataManagement/DataCollectionForms/index.html.

An electronic data collection system, FormsNet™ 2.0 (a Web-based application designed specifically for the SCTOD), is used to provide a single electronic platform to collect all data requested by the CIBMTR. FormsNet2 is available to all U.S. transplant centers and non-U.S. CIBMTR transplant centers to help them submit the outcomes data required by the Stem Cell Therapeutic and Research Act of 2005.

FormsNet2 allows bi-directional communication between centers, including handling notifications for expected or missing data. It includes automated validation checks within and between forms, and it automatically generates error reports. In the future, FormsNet2 will make pre-programmed queries available to transplant centers for several of the outcomes reports and will allow customized reports to be produced.

2.4.6.3 Data Collection Efforts of CIBMTR

The CIBMTR collects data on large numbers of transplant recipients every year, including information on new patients and follow-up information on previously reported patients. In the past, the data came from two sources: CIBMTR centers, which voluntarily registered consecutive transplant recipients; and NMDP transplant centers that were required to provide comprehensive outcome data on all transplants facilitated by NMDP.

Now, all U.S. transplant centers are required to submit outcomes data on allogeneic transplants to a single national registry: CIBMTR. CIBMTR continues to receive voluntarily submitted data from its international centers and from centers performing autologous transplants not covered by the new law. Collection of this new level of data (SCTOD pre- and post-Transplant Essential Data) began on December 3, 2007. The system was not available to 100 percent of U.S. centers until early 2008, so data received via the new electronic system was not fully representative of all contributing centers until then.

A list of institutions that are reporting data to CIBMTR is in Appendices B and C. CIBMTR estimates that it now collects data on nearly all allogeneic HCTs done in the United States. It also receives data on about 25 percent of allogeneic transplants done elsewhere and about 60 percent of autologous HCTs done in North and South America through the end of 2008. With

the launch of the C.W. Bill Young Cell Transplantation Program, CIBMTR began collecting data on all allogeneic HCTs in the United States in 2008.

Figure 19 shows the number of allogeneic transplants done per year since data collection began in 1970, and autologous transplants done since data collection began in 1990.

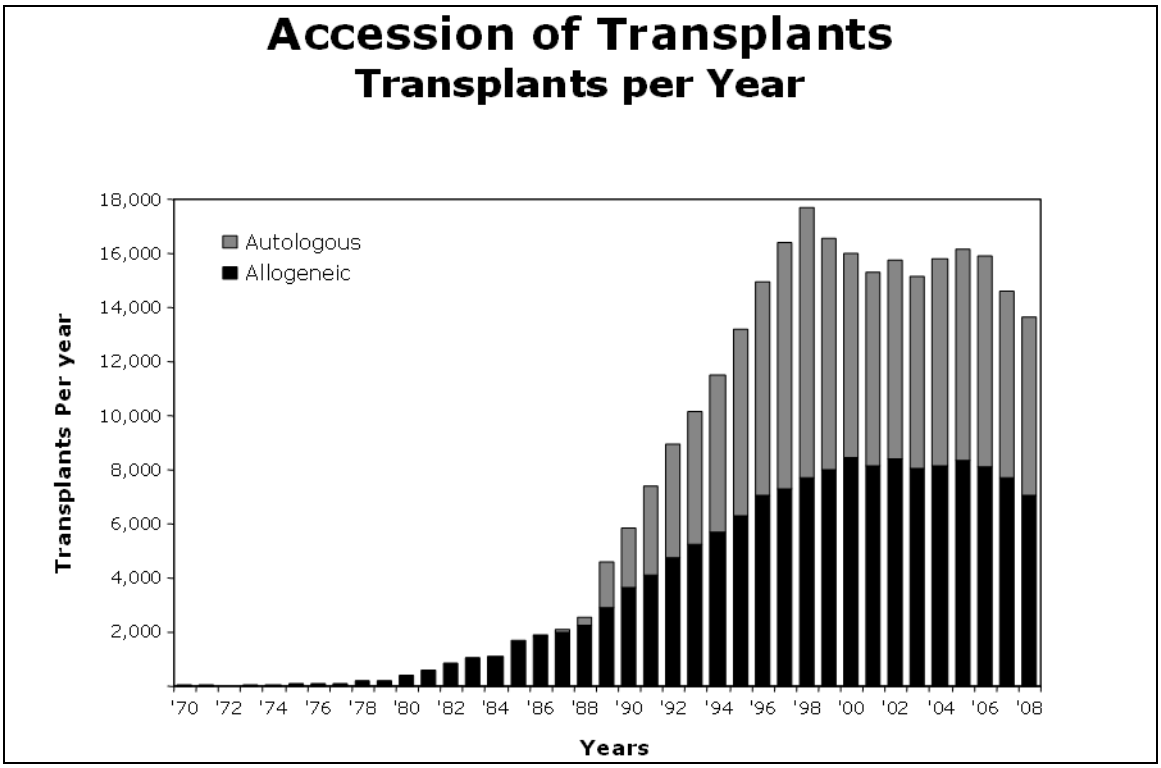

Figure 19. Number of transplants per year registered with the CIBMTR since it began collecting allogeneic transplant data in 1970

Figure 20 shows cumulative information on related donor transplants, autologous transplants, and unrelated donor transplants facilitated through NMDP since 1987.

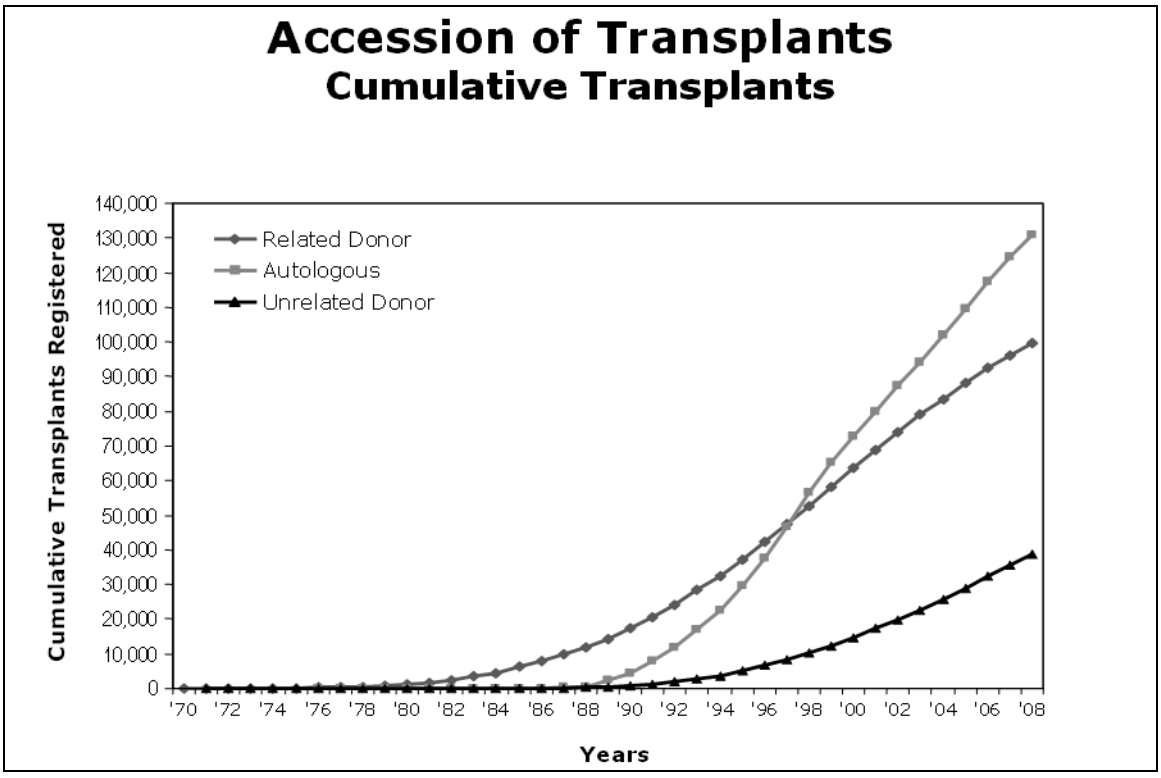

Figure 20. Cumulative totals for registered transplants

2.4.6.4 Overall Data Collection

The following tables summarize the distribution of HCT by disease for which data was collected and the quantity of data collected by CIBMTR. Along with Figures 19 and 20 in the previous section, they include information about allogeneic transplants since 1970 and autologous transplants done since 1989.

Table 9 shows the distribution of transplants worldwide by disease available in the CIBMTR Research Database.

Disease	2008-2009 Allogeneic[a]	2008-2009 Autologous	Cumulative Allogeneic	Cumulative Autologous
Acute lymphoblastic leukemia	3,293	32	27,059	1,549
Acute myelogenous leukemia	6,032	403	42,594	7,552
Chronic myelogenous leukemia	1,859	1	26,996	730
Chronic lymphocytic leukemia	650	10	3,067	607
Hodgkin disease	87	1,626	1,182	15,733
Non-Hodgkin lymphoma	1,446	3,795	10,650	37,565
Plasma cell disorders	165	6,150	3,100	34,791

[a] Includes allogeneic transplants [IBMTR] since 1970, allogeneic and autologous transplants [ABMTR] since 1989, NMDP since 1987; registration began in 1991 and comprehensive data collection in 1992; data for 1989-90 were collected retrospectively.

Disease	2008-2009 Allogeneic[a]	2008-2009 Autologous	Cumulative Allogeneic	Cumulative Autologous
Breast cancer	(12)	83	181	23,289
Neuroblastoma	9	418	183	3,411
Ovarian cancer	1	20	23	1,708
Melanoma	-	-	48	59
Lung cancer	-	5	10	231
Sarcoma (soft tissue, bone and other)	(1)	5	37	703
Ewing sarcoma	4	10	75	813
Wilm tumor	-	34	7	307
Myelodysplastic syndromes	2,170	7	12,871	251
Other leukemia	394	6	2,085	394
Medulloblastoma	-	138	5	826
Germ cell tumor	2	67	12	690
Brain tumors	(1)	80	4	1,184
Testicular cancer	1	122	9	1,410
Other malignancies[b]	26	198	1,085	1,498
Autoimmune diseases[c]	10	40	69	388
Severe aplastic anemia	1,461	2	10,143	17
Inherited erythrocyte abnormalities	29	(1)	4,865	4
SCID and other immunodeficiencies[d]	390	2	3,768	6
Inherited disorders of metabolism	218	-	1,884	4
Histiocytic disorders	181	1	818	8
Other non-malignancies	50	12	380	333
TOTAL	**18,464**	**13,266**	**153,210**	**136,061**

Table 9. Distribution of transplants worldwide by disease available in the CIBMTR Research Database through 2009 (Data continue to accrue in this reporting period)

Table 10 shows the number of transplants worldwide for which data were submitted to CIBMTR.

Type of Transplant	2008	2009	Life-to-Date*
Allogeneic	8,749	9,169	178,841
Autologous	7,836	8,501	149,759
TOTAL	**16,585**	**17,670**	**328,600**

Table 10. Number of transplants worldwide for which data were submitted to CIBMTR by year

b Includes retinoblastoma, head and neck tumors, mediastinal neoplasms, GI tract tumors, pancreatic cancer, hepatobiliary, kidney and urinary tract tumors, prostate cancer, cervical, uterine cancer, vaginal cancer and thymoma

c Includes multiple sclerosis (n=150), systemic sclerosis (n=91), systemic lupus erythematosis (n=75), rheumatoid arthritis (n=15), ITP (N=10), Crohn's disease (n=12) and other (n=104) in registration data

d SCID=Severe Combined Immune Deficiency

2.4.7 Data Quality

2.4.7.1 Program Description

CIBMTR does extensive internal quality checks for missing and inconsistent data. These checks have been incorporated into FormsNet2, CIBMTR's electronic data collection system, so that data can be verified at the time it is entered.

The separate NMDP and CIBMTR forms submission quality control plans and auditing programs are now integrated into a single Continuous Process Improvement (CPI) Program and Audit Program. The unified CPI program, targeted to begin in spring 2010, will monitor submission of forms for all types of transplants (related donor, unrelated donor and autologous) on a trimester basis. Centers are required to submit at least 90 percent error-free forms within a trimester.

CIBMTR and NMDP have had on-site auditing programs for their Research Centers since 1989 and 1998, respectively. These programs audited transplant centers on a 3-4 year cycle, comparing the data that had been submitted with the medical records. They require centers to have error rates of less than five percent. Centers that do not meet this standard must submit a plan for correction and be re-audited. More than 365 audits were performed by CIBMTR and NMDP since 2003, with an overall error rate of less than two percent.

The new unified Audit Program uses a four-year audit cycle, with centers randomly assigned to year 1, 2, 3, or 4 of the initial cycle. Up to 16 cases are audited at any given center. The audit concentrates on "critical" data; that is, data most likely to be included in a research study. These include, among other data, what disease the patient had, disease status (progression), conditioning regimen, date of transplant, and last contact date. Randomly selected "non-critical" data are also audited for each patient. Consecutive reporting and Institutional Review Board (IRB) oversight are also reviewed and documented.

2.4.7.2 Number of audits by year, 2008-09

Table 11 shows the number of audits by year from 2008 to 2009.

Year of Audit	Number of audits
2008	34
2009	31
Total	**65**

Table 11. Number of audits by year

2.4.8 Data Shared with Others

2.4.8.1 Data Available to the Public

A Web site is available at http://bloodcell.transplant.hrsa.gov/index.htm to provide general information about HCT, research data, and relevant published material to the public. It includes descriptions of CIBMTR research results in lay language and annual transplant center-specific outcomes reports (see Sections 2.1.2.4 and 2.4.9). The content is reviewed periodically by HRSA, NMDP, the CIBMTR Consumer Advocacy Committee, and transplant physicians to ensure that it is both accurate and understandable to a lay audience.

The site includes information about the uses and outcomes of HCT using data reported to the CIBMTR by participating transplant programs worldwide. This information is useful for understanding trends in the use of HCT based on diseases treated, donor type, graft sources, patient age, and transplant regimes. It is available to physicians, researchers, and the public in several formats, including a series of slide sets that can be printed or requested for

presentation. Early outcomes of HCT, such as description of outcomes of HCT, including 100 day, 1 year survival and general causes of death are also included in this series. Color summary slides may be viewed at http://www.cibmtr.org/ReferenceCenter/SlidesReports/SummarySlides/index.html. The slides are also reproduced in black and white in Appendix G.

2.4.8.2 Information Requests Fulfilled By Year

In addition to providing general information about HCT on a routine basis through publications and its Web sites, CIBMTR answers requests for customized information. The CIBMTR database is a valuable informational resource about HCT for researchers and non-research organizations. CIBMTR makes data about HCT available upon request to a large variety of public and private entities in a timely way. The distribution of requests is displayed in Table 12.

Type of Organization	Number of Information Requests in 2008	Number of Information Requests in 2009	Total Information Requests
Physician	454	557	1011
Pharmaceutical/Biotech Company	91	153	244
Patient or Relative	20	15	35
Patient Advocacy Group	20	57	77
Market Research Firm	15	19	34
Federal Government Agency	11	12	23
State Government Agency	1	2	3
Insurance Company	10	14	24
Medical Society	8	4	12
Student	13	13	26
News Media	10	5	15
Law Firm	1	1	2
Cord Blood Bank	2	3	5
TOTAL	**656**	**855**	**1511**

Table 12. Information requests fulfilled by year

While preserving the privacy and confidentiality of patients and donors, CIBMTR is and will remain committed to making data available to patients, physicians, transplant centers, other HCT-related organizations, and the public. This is also a requirement of the SCTOD contract. All electronic or paper requests for data must be made using a Data Request Form that outlines the Data Release Policy. The form lists what information must be submitted, including data required, requestor identification, and purpose of request. It can be found at http://www.cibmtr.org/Data/Request/CustomRequests/index.html. Simple questions (e.g. general information about Program activity or combined outcomes data for common HCT uses), can also be accessed via the http://bloodcell.transplant.hrsa.gov/index.htm Web site. Requests are answered on a first-come, first-served basis, usually within five business days of the request. Responses to these queries are generally reviewed by a physician scientist for accuracy and appropriateness before they are released.

2.4.8.3 CIBMTR Presentations and Publications

The observational data collected by the CIBMTR is used to inform patients and health care professionals through presentations at professional society meetings, and through publications in professional journals.

Information about CIBMTR accomplishments and data was given in formal presentations by CIBMTR faculty and others at national and international meetings in excess of 100 times per year in 2008 and 2009. These data were also used to promote the work of the CIBMTR at local and regional meeting presentations and for teaching purposes, enlarging the educational outreach of CIBMTR research within the transplant community, as well as creating awareness of CIBMTR and its activities with new and varied audiences. Scientific abstracts presented at the two largest HCT meetings in the United States in 2008 and 2009 are shown in Table 13.

Meeting	Number of Abstracts Presented in 2008	Number of Abstracts Presented in 2009
American Society of Hematology	24	20
BMT Tandem Meetings	6	12

Table 13. Presentations given at professional meetings by year

Publications from 2008 and 2009, which resulted from research conducted by the CIBMTR and NMDP using their observational databases and other resources, are summarized in Table 14 and listed in Appendix F.

Source of Publication	Number of Publications in 2008	Number of Publications in 2009	Total Number of Publications
CIBMTR Grand Total	60	45	105
CIBMTR Working Committee Publications	41	37	78
Bioinformatics	7	3	10
Biostatistics	11	3	14
Blood and Marrow Transplant Clinical Trials Network	1	1	2
Health Services Research	0	1	1

Table 14. CIBMTR publications by source

2.4.9 Transplant Center-specific Survival Rates

2.4.9.1 Program Summary

NMDP has been comparing transplant center outcomes for unrelated donor HCTs since 1994 (see Section 2.1.2.4). The Program now requires this from CIBMTR, but the current information includes only NMDP-facilitated unrelated donor transplants. Future analyses will also include related donor allogeneic transplants when enough patients have been reported to allow for valid statistical analysis of center outcomes (anticipated to occur in 2010). The current report gives one-year survival statistics for all U.S. transplant centers performing unrelated donor transplants, using a five-year rolling window. It compares observed and expected survival rates with a 95 percent confidence interval. Because centers vary considerably in the risk level of the cases they treat, a statistical model has been developed to adjust for several risk factors known or suspected to influence outcomes.

The method of risk adjustment uses a model for one-year survival probability based on patient risk factors. It computes the risk-adjusted one-year survival rate for each center as if the patients had been transplanted at a “generic” center, and then compares the actual survival rate at that center with the predicted survival rate to assess the center’s performance compared to

the overall network. Reports are submitted to HRSA each year and published online at http://bloodcell.transplant.hrsa.gov/RESEARCH/Transplant_Data/US_Tx_Data/index.html.

2.4.9.2 Future Center-specific Outcomes Reports

With the Stem Cell Therapeutic and Research Act of 2005, the requirement to report outcomes of HCT by transplant center was broadened to include all allogeneic (related and unrelated) HCTs in the United States. During this initial transition phase of the C.W. Bill Young Cell Transplantation Program, CIBMTR is working with NMDP, ASBMT, FACT, transplant centers, and HRSA to review the current approach to center-specific outcomes reporting and to make recommendations for future reports.

Participants in meetings on center-specific outcomes reports have developed recommendations for new approaches to future HCT center outcomes reports that are scientifically valid, equitable, free from bias, useful to the HCT community for improving quality, and informative for the public. A review of these recommendations is planned for late 2010. Since collection of outcomes data for related-donor recipients in the United States was voluntary until the end of 2007, it is anticipated that the first center outcomes report to include related-donor HCT recipients will be produced in 2010.

2.4.10 Quality of Life Studies

CIBMTR has conducted a large observational Quality of Life (QOL) study on HCT recipients. Based on Program requirements, it will perform additional QOL studies for a limited number of patients. A pilot study, using paper-based questionnaires is anticipated to begin in 2010. Future plans include use of a Computer-Assisted Telephone Interview system, which will centralize data collection.

Collection of high-quality QOL information requires the use of many resources, and is complicated by several issues:

- QOL data must be collected prior to a transplant as well as after, in order to compare changes in status.
- Many of the current means of collecting QOL information rely on physicians' observations rather than the patient's own perceptions.
- A variety of post-HCT issues must be measured that go beyond mere health status.
- Collection of this type of patient data often requires additional Institutional Review Board approvals at each participating institution, since it may expose patients to psychological distress.
- There is no recognized model for collecting this type of long-term, complex data in such a large population.
- Local expertise is often needed for approaching and interviewing patients.

QOL data collection requires careful thought to devise studies that will collect high-quality data. CIBMTR has consulted with recognized experts in measurement of QOL in HCT recipients to develop its plan and to address the complexities of this type of research. The new CIBMTR study will use QOL surveys that place the least possible burden on patients and transplant centers, but are able to define meaningful differences in QOL.

In the future, CIBMTR may solicit research proposals from other experts to study QOL in specific patient groups, study specific QOL questions across patient groups, or to focus on centers that are willing to perform studies to evaluate QOL in HCT recipients at their center. CIBMTR is committed to advancing knowledge in this important and understudied area.

2.4.11 Other Therapeutic Applications

Another requirement of the SCTOD contract is for CIBMTR to maintain a system for collecting and analyzing transplant outcomes information when cells derived from bone marrow, peripheral blood or umbilical cord blood are used for clinical applications other than HCT (e.g. for cardiac or central nervous system regeneration). Key data to be collected and potential data sources (i.e., blood banks and collection centers, cord blood banks, processing centers, clinical centers, FDA) have been identified. CIBMTR will be assisted in this undertaking by the Steering Committee for the Specialized Centers for Cell-Based Therapy (SCCT) and The EMMES Corporation. The EMMES Corporation is the data coordinating center for both SCCT and the Production Assistance for Cellular Therapies (PACT) group. Innovative approaches to data collection are needed to identify clinical centers that are involved in this new area of research and to identify NIH-funded projects that use this technique.

2.4.12 Research Repository

Since 1988, NMDP has maintained a Research Repository (the Repository) for collecting blood specimens from unrelated pairs of adult donors and recipients of hematopoietic stem cells that were facilitated by NMDP. The Repository collects, processes and stores pre-HCT blood samples for DNA-based analyses.

In 2006, NMDP began collecting samples from NMDP-facilitated cord blood transplants. The cord blood research sample inventory has grown rapidly, adding 1623 samples in 2008 and 2009, and contained more than 2,600 samples by the end of 2009, as shown in Table 15.

Sample Type	2008 Total	2009 Total	Total 2008-09
Donor	3,411	3,835	7,246
Recipient	3,160	3,535	6,695
Cord	700	923	1,623
All samples	7,271	8,293	15,564
Donor/Recipient Pairs	1,761	2,257	4,018

Table 15. Unrelated donor transplant research samples collected by calendar year

In 2007, NMDP and CIBMTR established a related donor-recipient sample repository. Because patients inherit the genetic material that determines HLA type from their parents, having pairs of samples from related donors and recipients will make it easier for researchers to conduct certain types of studies because the samples will have the same HLA types. Sample collection for related donor-recipient pairs began in December 2007 when FormsNet2 was released. Table 16 shows related donor transplant research samples collected by calendar year.

Sample Type	Number of Samples Collected in 2008	Number of Samples Collected in 2009	Total Samples Collected 2008-09
Donor	175	235	410
Recipient	171	262	433
Cord	0	0	0
All samples	346	497	843
Donor/Recipient Pairs	158	214	372

Table 16. Related donor transplant research samples collected by calendar year

The Repository provides research samples for use in studies approved through CIBMTR research programs as well as to participant transplant centers for clinical follow-up. Since it began, the Repository has distributed nearly 134,000 unrelated donor-recipient samples to

investigators worldwide to support research. The knowledge gained from research using these unique and precious repository samples could make allogeneic HCT a viable treatment option for more patients.

Section 3: Appendices

List of Appendices

Appendix A: Glossary of Terms

Glossary Term	Definition
allele	One member of a pair or series of different forms of a gene. There are two or more alleles at a given location on a chromosome. Each allele is characterized by a slightly different nucleotide sequence. Alleles can only be identified through molecular (DNA) typing.
allogeneic	A form of bone marrow or peripheral blood stem cell transplant in which a patient receives cells collected from a sibling, other related donor or an unrelated donor.
anemia	A condition in which the number of red cells or the amount of hemoglobin in the blood is abnormally low. Anemia is not a disease; it is a symptom of various underlying diseases.
apheresis	A technique for separating blood into its components. An apheresis machine draws blood from a vein in a donor's arm, collects the desired blood product (such as peripheral blood stem cells), and returns the remaining blood components to the donor.
aplastic anemia	A disorder of the bone marrow that causes deficient production of all types of blood cells.
autologous	A form of transplantation in which marrow or peripheral blood stem cells (PBSCs) are collected from a patient, cryopreserved, and then returned to the same patient after he/she has undergone myeloablative (conditioning) therapy. In a process called purging, the autologous marrow is treated to try to remove cancer cells.
BMT	Bone marrow transplant or bone marrow transplantation. (See also HCT.)
conditioning	Treatment with high-dose chemotherapy, and sometimes high-dose radiation therapy, to prepare a patient for hematopoietic stem cell transplantation (HCT). (See also reduced-intensity conditioning and myeloablative therapy.)
cord blood or cord blood unit (CBU)	An alternate source of hematopoietic stem cells that can be used to reconstitute the immune system of a recipient. Cord blood is collected from the placenta and umbilical cord soon after birth and then cryopreserved until needed by a patient.
CT	*Confirmatory typing*. A step in the NMDP donor search process where an NMDP transplant center tests a blood sample from a potential donor or cord blood unit to confirm that the donor has a similar HLA tissue type and is compatible with the patient.
donor	An individual who has actually donated hematopoietic cells to a patient. In contrast, volunteer donor, potential donor and potential volunteer donor are used interchangeably to refer to individuals listed on the NMDP Registry.
DR typing	HLA typing to determine the HLA-DR locus in the blood of a volunteer donor or patient. HLA-DR typing is almost exclusively performed by DNA-based HLA typing (see separate entry).
engraftment	The process in which transplanted hematopoietic stem cells begin to grow in the bone marrow of the recipient and to produce new white blood cells, red blood cells and platelets.
event-free survival	The period of time following a transplant in which no major complications such as disease relapse or death occur.

Glossary Term	Definition
formal search	The point in the NMDP donor search process where more specific information is requested about individual volunteer donors, who have been identified as potential HLA matches with a patient.
graft	Tissue taken from one person (donor) and transferred to another person (recipient). Also, tissue taken from one part of a person's body and transferred to another part of that same person's body.
GVHD	*Graft-versus-host disease*. A common complication of hematopoietic stem cell transplantation whereby the recipient's body triggers the immune defenses of the transplanted hematopoietic stem cells. These cells then attack the recipient's body. GVHD, which can range from mild to life-threatening, usually involves the skin or internal organs.
haplotype	Set of closely linked genes that tends to be inherited together as a unit; a combination of alleles at multiple locations that are transmitted together on the same chromosome.
HCT	*Hematopoietic stem cell transplant.* The transplantation of blood-forming cells derived from the bone marrow, peripheral blood or cord blood.
hematopoietic	Pertaining to the production and development of blood cells. The leukemias are hematopoietic diseases.
hematopoietic cells	Cells in the marrow, umbilical cord and peripheral blood that are capable of developing into all three types of blood cells: white blood cells, red blood cells and platelets. Cord blood transplants, bone marrow transplants and peripheral blood stem cell transplants all provide the hematopoietic stem cells needed to rejuvenate a transplant recipient's immune system.
histo-compatibility	Refers to the degree of HLA (tissue) matching between two individuals. Cells from highly histocompatible individuals can survive in each other's bodies without triggering an immune response.
HLA	*Human leukocyte antigens*. Proteins (markers) on the surface of most of the body's cells that allow the immune system to distinguish between the body's cells and foreign cells. In hematopoietic stem cell transplantation, three or more HLA markers (HLA-A, HLA-B and HLA-DR) are matched between donors and recipients to reduce the chance of triggering an immune system response.
HLA typing	The process of determining an individual's HLA tissue type. In hematopoietic stem cell transplantation, volunteer donors and potential recipients are HLA typed at three locations (A, B, and DR) on the gene that determine the most important of an individual's tissue type characteristics.
leukemia	Any of the chronic or acute malignant diseases characterized by unrestrained growth of leukocytes (white blood cells).
locus	The locus is the position of a gene on a chromosome. There are three locations typically used for tissue typing in hematopoietic stem cell transplants: A, B, and DR on the major histocompatibility complex on chromosome 6.
lymphoma	Cancer of the lymphatic system, which includes the bone marrow, spleen, thymus, lymph nodes and the network of vessels that carry fluid and infection-fighting cells. Included in this disease category are Hodgkin Disease and Non-Hodgkin Lymphoma.
malignant	Characterized by unrestrained growth; cancerous.

Glossary Term	Definition
multiple myeloma	Cancer of the bone marrow, that leads to overproduction of plasma cells. Characterized by the formation of multiple tumor masses in the bone and bone marrow. More common in males than in females.
myeloablative therapy	Treatment with high-dose chemotherapy and high-dose radiation that irreversibly damages the bone marrow cell function of the recipient and prepares them for hematopoietic stem cell transplantation (*HCT*).
neuroblastoma	A cancer that forms in the nerve tissue. Usually starts in the adrenal glands, may also start in neck, chest or spinal cord. Often begins in early childhood.
non-malignant	Not cancerous.
PBSC	*Peripheral blood stem cells*. Hematopoietic cells present in the circulating (peripheral) bloodstream. To collect sufficient PBSCs for a transplant, a growth factor medication is used to cause hematopoietic stem cells to leave the marrow and enter the bloodstream.
preliminary search	A free search of the NMDP donor and cord blood registries for potential HLA-matched volunteer donors.
radiation therapy	Treatment with high-energy X-rays to kill cancer cells. Also called radiotherapy.
reduced-intensity	Pre-transplant chemotherapy and/or radiation therapy that uses lower doses than standard conditioning regimens. Reduced-intensity conditioning regimens focus less on myeloablation and more on immune system suppression in the recipient to permit donor cells to engraft. (See *myeloablative therapy*)
relapse	A recurrence of an illness after a period of remission.
remission	A period of time where the disease is inactive in a patient with a chronic illness.
search process	The process of comparing a patient's HLA antigens to those of the volunteer bone marrow and peripheral blood stem cell donors and cord blood units listed on the NMDP Registry, and testing potentially matched donors to identify the best one for the patient.
summary report	A summary of the results of a preliminary search. A summary report shows the number of potential donors that matched with the patient and their degree of match with the patient. Summary reports also show matching cord blood units (CBUs).
survival	A primary measure of the level of success of a medical procedure. In evaluating bone marrow or other hematopoietic stem cell transplants, survival is expressed as a percentage of recipients surviving after a specified period of time. (See also *Event-free survival*.)
tissue typing	See HLA typing.

Appendix B: U.S. Centers reporting data to NMDP and CIBMTR Sorted by State

Transplant Center Name	City	State	Transplants Performed
University of Alabama Birmingham	Birmingham	AL	Allo / Auto
University of Arkansas for Medical Sciences	Little Rock	AR	Allo only
City of Hope Samaritan	Phoenix	AZ	Allo / Auto
Mayo Clinic	Phoenix	AZ	Allo / Auto
University of Arizona Health Sciences Center	Tucson	AZ	Allo / Auto
Alta Bates Medical Center	Berkeley	CA	Allo / Auto
City of Hope National Medical Center	Duarte	CA	Allo / Auto
University of California-San Diego	La Jolla	CA	Allo / Auto
Scripps Clinic Research Foundation	La Jolla	CA	Allo / Auto
Loma Linda University Medical Center	Loma Linda	CA	Allo / Auto
University of Southern California	Los Angeles	CA	Auto only
Cedars Sinai Medical Center	Los Angeles	CA	Allo only
Children's Hospital of Los Angeles	Los Angeles	CA	Allo / Auto
University of California (UCLA) Adults	Los Angeles	CA	Allo only
Children's Hospital of Oakland	Oakland	CA	Allo / Auto
St Joseph's Hospital Irvine	Orange	CA	Auto only
Children's Hospital of Orange County	Orange	CA	Allo / Auto
University of California Irvine Medical Center	Orange	CA	Allo / Auto
Sutter Cancer Center	Sacramento	CA	Allo / Auto
University of California-Davis Cancer Center	Sacramento	CA	Allo / Auto
Rady Children's Hospital San Diego	San Diego	CA	Allo / Auto
University of California - San Francisco	San Francisco	CA	Allo / Auto
University of California	San Francisco	CA	Allo / Auto
Stanford University Medical Center	Stanford	CA	Allo / Auto
The Children's Hospital of Denver	Aurora	CO	Allo / Auto
University of Colorado Hospital	Aurora	CO	Allo / Auto
Rocky Mountain Cancer Center	Denver	CO	Allo / Auto
Yale New Haven Hospital	New Haven	CT	Allo / Auto
George Washington University Medical Center	Washington	DC	Allo / Auto
Georgetown University Hospital	Washington	DC	Allo / Auto
Children's National Medical Center	Washington	DC	Allo / Auto
Christiana Care Health System	Newark	DE	Allo / Auto
Medical Oncology Hematology Consultants, PA	Newark	DE	Allo / Auto
Alfred I Dupont Hospital for Children	Wilmington	DE	Allo / Auto
South Florida Bone Marrow Stem Cell Transplant Institute	Boynton Beach	FL	Auto only
Shands Hospital	Gainesville	FL	Allo / Auto
Mayo Clinic Jacksonville	Jacksonville	FL	Allo / Auto

Transplant Center Name	City	State	Transplants Performed
Nemours Children's Clinic	Jacksonville	FL	Allo / Auto
University of Miami - Peds	Miami	FL	Allo / Auto
Miami Children's Hospital	Miami	FL	Allo / Auto
University of Miami - Adults	Miami	FL	Allo / Auto
Florida Hospital Cancer Institute	Orlando	FL	Allo / Auto
Memorial Cancer Institute	Pembroke Pines	FL	Auto only
All Children's Hospital	St. Petersburg	FL	Allo / Auto
H Lee Moffitt Cancer Center	Tampa	FL	Allo / Auto
Palm Beach Cancer Institute	West Palm Beach	FL	Auto only
Children's Healthcare of Atlanta at Egleston	Atlanta	GA	Allo / Auto
The Blood and Marrow Transplant Group of GA	Atlanta	GA	Allo / Auto
Emory University	Atlanta	GA	Allo / Auto
Medical College Of Georgia	Augusta	GA	Allo / Auto
Hawaii Medical Center	Honolulu	HI	Allo / Auto
University of Iowa Hospital & Clinics	Iowa City	IA	Allo / Auto
St Luke's Boise Regional Medical Center	Boise	ID	Allo / Auto
Children's Memorial Hosp	Chicago	IL	Allo / Auto
University of Illinois at Chicago Medical Center	Chicago	IL	Allo / Auto
Northwestern Memorial Hospital	Chicago	IL	Allo / Auto
Rush University Medical Center	Chicago	IL	Allo / Auto
Northwestern Memorial Hospital	Chicago	IL	Allo only
University of Chicago Medical Center	Chicago	IL	Allo / Auto
Loyola University Medical Center	Maywood	IL	Allo / Auto
Lutheran General Hospital	Park Ridge	IL	Allo / Auto
Methodist Medical Center Peoria	Peoria	IL	Auto only
Cancer Treatment Centers of America - Midwest	Zion	IL	Allo / Auto
St Francis Hospital	Beech Grove	IN	Allo / Auto
Central Indiana Cancer Centers	Indianapolis	IN	Auto only
Riley Hospital for Children	Indianapolis	IN	Allo / Auto
St Vincent Hospital Indianapolis	Indianapolis	IN	Auto only
University of Kansas Medical Center	Kansas City	KS	Allo / Auto
Via Christi Health System	Wichita	KS	Allo / Auto
University of Kentucky Medical Center	Lexington	KY	Allo / Auto
James Graham Brown Cancer Center	Louisville	KY	Allo / Auto
Louisiana State University Children's Hospital	New Orleans	LA	Allo / Auto
Tulane University Medical Center	New Orleans	LA	Allo / Auto
Louisiana State University Health Sciences Center	Shreveport	LA	Allo / Auto
Beth Israel Deaconess Medical Center	Boston	MA	Allo / Auto
Dana Farber Cancer Institute - Adults	Boston	MA	Allo / Auto
Tufts New England Medical Center	Boston	MA	Allo / Auto

Transplant Center Name	City	State	Transplants Performed
Massachusetts General Hospital	Boston	MA	Allo / Auto
Dana Farber Cancer Institute - Peds	Boston	MA	Allo / Auto
Lahey Clinic Medical Center Sophia Gordon Cancer Center	Burlington	MA	Auto only
University of Massachusetts Medical Center	Worcester	MA	Allo / Auto
University of Maryland School of Medicine	Baltimore	MD	Allo / Auto
Johns Hopkins Oncology Center	Baltimore	MD	Allo / Auto
National Institute Of Health	Bethesda	MD	Allo only
National Institutes of Allergy & Infectious Disease	Bethesda	MD	Allo / Auto
National Cancer Institute	Bethesda	MD	Allo / Auto
National Heart Lung & Blood Institute	Bethesda	MD	Allo only
NIH - Matched Unrelated Donor Program	Bethesda	MD	Allo only
University of Michigan Cancer Center	Ann Arbor	MI	Allo / Auto
Henry Ford Hospital	Detroit	MI	Allo / Auto
Wayne State University Hospital	Detroit	MI	Allo / Auto
Children's Hospital of Michigan	Detroit	MI	Allo / Auto
Helen DeVos Children's Hospital	Grand Rapids	MI	Allo / Auto
Abbott Northwest Hospital	Minneapolis	MN	Auto only
Children's Hospital and Clinics of Minnesota	Minneapolis	MN	Auto only
University of Minnesota Medical Center	Minneapolis	MN	Allo / Auto
Mayo Clinic Rochester	Rochester	MN	Allo / Auto
University of Kansas Medical Center	Kansas City	MO	Allo / Auto
Children's Mercy Hospital	Kansas City	MO	Allo / Auto
Cardinal Glennon Children's Hospital	St. Louis	MO	Allo / Auto
Washington University School Of Medicine	St. Louis	MO	Allo / Auto
St Louis University Medical Center	St. Louis	MO	Allo / Auto
St Louis Children's Hospital	St. Louis	MO	Allo / Auto
University of Mississippi Medical Center - Jackson	Jackson	MS	Allo / Auto
Billings Clinic Hospital	Billings	MT	Auto only
Montana Cancer Center	Missoula	MT	Auto only
University of North Carolina at Chapel Hill	Chapel Hill	NC	Allo / Auto
Levine Children's Hospital	Charlotte	NC	Allo / Auto
Duke University, Immunology/BMT, peds	Durham	NC	Allo only
Duke University	Durham	NC	Allo / Auto
Duke University - Adults	Durham	NC	Allo / Auto
Wake Forest University Baptist Medical Center	Winston-Salem	NC	Allo / Auto
Alegent Health - Immanual Medical Center	Omaha	NE	Allo / Auto
University of Nebraska Medical Center	Omaha	NE	Allo / Auto
Dartmouth-Hitchcock Medical Center	Lebanon	NH	Allo / Auto
Hackensack University Medical Center	Hackensack	NJ	Allo / Auto
Cancer Institute of New Jersey	New Brunswick	NJ	Allo / Auto

Transplant Center Name	City	State	Transplants Performed
University of New Mexico Cancer Center	Albuquerque	NM	Allo / Auto
Our Lady Of Mercy Medical Center	Bronx	NY	Auto only
Montefiore Medical Center	Bronx	NY	Allo / Auto
Roswell Park Cancer Institute	Buffalo	NY	Allo / Auto
Arlin Cancer Institute	Hawthorne	NY	Allo / Auto
North Shore University Hospital	Manhasset	NY	Allo / Auto
Schneider Children's Hospital	New Hyde Park	NY	Allo / Auto
St Vincent's Hospital Manhattan	New York	NY	Auto only
New York Presbyterian Hospital	New York	NY	Allo / Auto
Morgan Stanley Children's Hospital of New York	New York	NY	Allo / Auto
Memorial Sloan-Kettering Cancer Center	New York	NY	Allo only
Mt Sinai Hospital	New York	NY	Allo / Auto
Columbia University	New York	NY	Allo / Auto
University of Rochester Medical Center	Rochester	NY	Allo / Auto
Stony Brook University Medical Center	Stony Brook	NY	Auto only
State University of NY Upstate Medical University	Syracuse	NY	Allo / Auto
Akron Children's Hospital	Akron	OH	Allo / Auto
Jewish Hospital Cincinnati	Cincinnati	OH	Allo / Auto
Cincinnati Children's Hospital	Cincinnati	OH	Allo / Auto
Cleveland Clinic	Cleveland	OH	Allo / Auto
Ireland Cancer Center, Univ. Hospitals Case Medical Ctr	Cleveland	OH	Allo / Auto
Nationwide Children's Hospital	Columbus	OH	Allo / Auto
The Ohio State University Medical Center	Columbus	OH	Allo / Auto
Miami Valley Hospital	Dayton	OH	Auto only
Oklahoma University Medical Center	Oklahoma City	OK	Allo / Auto
Cancer Care Assoc Oklahoma City	Oklahoma City	OK	Allo / Auto
St Francis Hospital	Tulsa	OK	Auto only
Cancer Care Associates	Tulsa	OK	Allo / Auto
Providence Portland Medical Center	Portland	OR	Auto only
Legacy Good Samaritan Hospital	Portland	OR	Auto only
Oregon Health & Science University -Adult	Portland	OR	Allo / Auto
Oregon Health & Science University -Pediatrics	Portland	OR	Allo / Auto
Geisinger Medical Center	Danville	PA	Allo / Auto
Penn State Milton S Hershey Medical Center	Hershey	PA	Allo / Auto
St Christopher's Hospital for Children	Philadelphia	PA	Allo / Auto
Fox Chase-Temple BMT Program	Philadelphia	PA	Allo / Auto
Thomas Jefferson University	Philadelphia	PA	Allo / Auto
Hospital of the University of Pennsylvania	Philadelphia	PA	Allo / Auto
Hahnemann University Hospitals	Philadelphia	PA	Allo / Auto
Philadelphia Children's Hospital	Philadelphia	PA	Allo / Auto

Transplant Center Name	City	State	Transplants Performed
University of Pittsburgh Medical Center	Pittsburgh	PA	Allo / Auto
The Western Pennsylvania Hospital	Pittsburgh	PA	Allo / Auto
Children's Hospital of Pittsburgh	Pittsburgh	PA	Allo / Auto
Guthrie Health Systems	Sayre	PA	Auto only
Roger Williams Medical Center	Providence	RI	Allo / Auto
Charleston Hematology Oncology	Charleston	SC	Allo / Auto
Medical University of South Carolina	Charleston	SC	Allo / Auto
Cancer Centers of the Carolinas	Greenville	SC	Allo / Auto
Avera McKennan Transplant Institute	Sioux Falls	SD	Allo / Auto
Thompson Cancer Survival Center	Knoxville	TN	Auto only
Baptist Centers for Cancer Care	Memphis	TN	Auto only
University of Tennessee	Memphis	TN	Allo / Auto
St Jude Children's Research Hospital	Memphis	TN	Allo only
Sarah Cannon BMT Program	Nashville	TN	Allo / Auto
Vanderbilt University Veterans Center	Nashville	TN	Allo / Auto
Vanderbilt University	Nashville	TN	Allo / Auto
Texas Oncology	Amarillo	TX	Allo / Auto
Arlington Cancer Center	Arlington	TX	Auto only
Christus Spohn Cancer Center	Corpus Christi	TX	Auto only
Children's Medical Center - Dallas	Dallas	TX	Allo / Auto
Medical City Dallas	Dallas	TX	Allo / Auto
University of Texas Southwestern Medical Center at Dallas	Dallas	TX	Allo / Auto
Baylor University Medical Center	Dallas	TX	Allo / Auto
Cook Children's Medical Center	Fort Worth	TX	Allo / Auto
Baylor College of Medicine	Houston	TX	Allo / Auto
MD Anderson Cancer Center	Houston	TX	Allo only
Wilford Hall Medical Center	Lackland AFB	TX	Allo / Auto
Covenant Health Systems-Joe Arrington Cancer Research and Treatment Center	Lubbock	TX	Allo / Auto
Texas Tech University Health Sciences Center-Southwest Cancer Center	Lubbock	TX	Allo / Auto
Texas Transplant Institute	San Antonio	TX	Allo / Auto
University of Texas Health Science Center	San Antonio	TX	Allo / Auto
Scott & White Clinic & Hospitals	Temple	TX	Auto only
Latter Day Saints Hospital	Salt Lake City	UT	Allo / Auto
University of Utah Medical Center	Salt Lake City	UT	Allo / Auto
University of Utah, BMT Program	Salt Lake City	UT	Allo / Auto
Fairfax-Northern Virginia Hospital	Fairfax	VA	Allo / Auto
Virginia Oncology Associates	Norfolk	VA	Auto only
Virginia Commonwealth University	Richmond	VA	Allo / Auto

Transplant Center Name	City	State	Transplants Performed
University of Vermont Cancer Center	Burlington	VT	Auto only
Fred Hutchinson Cancer Center	Seattle	WA	Allo / Auto
VA Puget Sound Healthcare System	Seattle	WA	Allo only
University of Wisconsin Hospital and Clinics	Madison	WI	Allo / Auto
Marshfield Clinic	Marshfield	WI	Allo / Auto
Aurora St Luke's Medical Center	Milwaukee	WI	Auto only
Froedtert Memorial Lutheran Hospital Cancer Center	Milwaukee	WI	Allo / Auto
Children's Hospital of Wisconsin	Milwaukee	WI	Allo / Auto
West Virginia University Hospital	Morgantown	WV	Allo / Auto

Appendix C: Non-U.S. centers reporting data to NMDP and CIBMTR:Sorted by Country

Transplant Center Name	City	Country	Transplants Performed
Hospital De Pediatria	Buenos Aires	Argentina	Allo only
Hospital Jose De San Martin	Buenos Aires	Argentina	Allo / Auto
Alexander Fleming Institute	Buenos Aires	Argentina	Allo / Auto
Fundaleu-Angelica Ocampo	Buenos Aires	Argentina	Allo / Auto
Hospital Priv De Onc-Buenos Aries	Buenos Aires	Argentina	Allo / Auto
Hospital De Ninas La Plata	Buenos Aires	Argentina	Allo / Auto
Hospital Universitario Austral	Buenos Aires	Argentina	Allo / Auto
Hospital Priv Cordoba	Cordoba	Argentina	Allo / Auto
Sanatorio Allende	Cordoba	Argentina	Allo / Auto
Hanson Center Cancer Research	Adelaide	Australia	Allo only
Box Hill Hospital	Box Hill	Australia	Auto only
Royal Price Alfred Hospital	Camperdown	Australia	Allo / Auto
St Vincent's Hospital	Darlinghurst	Australia	Allo only
Royal Brisbane & Women's Hospital	Herston	Australia	Allo / Auto
Royal Brisbane Hospital	Herston	Australia	Allo / Auto
Alfred Hospital	Melbourne	Australia	Allo / Auto
Royal Children's Hospital	Parkville	Australia	Allo only
Royal Perth Hospital	Perth	Australia	Allo only
Princess Margaret Hospital	Perth	Australia	Allo only
Sydney Children's Hospital	Randwick	Australia	Allo only
Royal Melbourne Hospital	Victoria	Australia	Allo only
Calvary Mater Newcastle Hospital	Waratah	Australia	Allo / Auto
Westmead Hospital	Westmead	Australia	Allo only
Children's Hospital at Westmead	Westmead	Australia	Allo only
University of Graz	Graz	Austria	Allo only
Ludwig Blotzmann Institute	Vienna	Austria	Auto only
Medical University of Vienna	Vienna	Austria	Allo only
Hospital Az Sint-Jan	Brugge	Belgium	Allo only
Children's University Hospital	Bruxelles	Belgium	Allo / Auto
Cliniques Universitaires St-Luc	Bruxelles	Belgium	Allo only
University Hospital Antwerp	Edegem	Belgium	Allo only
University Hospital Gasthuisberg	Leuven	Belgium	Allo only
University De Liege	Liege	Belgium	Allo only
Hospital De Barretos	Barretos	Brazil	Allo only
Universidade Fedearl de Mina Gerasis	Belo Horizonte	Brazil	Allo / Auto
University Estadual De Campinas	Campinas	Brazil	Allo / Auto
Hospital De Clinicas Curitiba	Curitiba	Brazil	Allo / Auto

Transplant Center Name	City	Country	Transplants Performed
Hospital Amaral Carvalho	Jau	Brazil	Allo / Auto
Hospital De Clin De Porto Alegre	Porto Alegre	Brazil	Allo / Auto
Hospital De Porto Alegre	Porto Alegre	Brazil	Allo / Auto
Real Hospital Portugues	Recife	Brazil	Allo / Auto
Centro de Transplante de Medula Ossea	Recife Pernambu	Brazil	Allo / Auto
Universidade de Sao Paulo	Ribeirao Preto	Brazil	Allo / Auto
Instituto Nacional de Cancer	Rio de Janeiro	Brazil	Allo / Auto
University Federal Rio De Janeiro	Rio de Janeiro	Brazil	Allo / Auto
Santa Casa Medical School-Sao Paulo	Sao Paolo	Brazil	Allo only
De Sao Jose De Campos	Sao Paolo	Brazil	Auto only
Instituto da Crianca-Universidade de Sao Paulo	Sao Paolo	Brazil	Allo / Auto
Instituto De Oncologia Pediatrica	Sao Paolo	Brazil	Allo / Auto
Albert Einstein Hospital	Sao Paolo	Brazil	Allo / Auto
Universidad do Sao Paulo	Sao Paolo	Brazil	Allo / Auto
Hospital Sirio Libanes	Sao Paolo	Brazil	Allo / Auto
Tom Baker Cancer Center	Calgary	Canada	Allo / Auto
Alberta Children's Hospital	Calgary	Canada	Allo / Auto
Queen Elizabeth II Health Sciences Center	Halifax	Canada	Allo / Auto
Hamilton Henderson Science Corporation	Hamilton	Canada	Allo / Auto
Kingston General Hospital	Kingston	Canada	Auto only
London Health Science Center	London	Canada	Allo / Auto
Montreal Children's Hospital	Montreal	Canada	Allo / Auto
Mcgill University Health Center	Montreal	Canada	Allo / Auto
Maisonneuve-Rosemont Hospital	Montreal	Canada	Allo only
Centre Hospitalier	Montreal	Canada	Allo / Auto
Ottawa General Hospital	Ottawa	Canada	Auto only
Hotel-Dieu De Quebec	Quebec	Canada	Allo / Auto
CHA-Enfant-Jesus Hospital	Quebec City	Canada	Allo / Auto
St John's Health Sciences Center	St. John's	Canada	Auto only
RCP-Sudbury Regional Hospital	Sudbury	Canada	Auto only
Princess Margaret Hospital	Toronto	Canada	Auto only
Princess Margaret Hospital	Toronto	Canada	Allo only
British Columbia Children's Hospital	Vancouver	Canada	Allo / Auto
Cancer Care Manitoba	Winnipeg	Canada	Allo / Auto
Clinica Santa Maria	Providencia	Chile	Allo / Auto
Peking University People's Hospital	Beijing	China	Allo only
Guangzhou First Municipal People's Hospital	Guangzhou	China	Allo / Auto
The First Affiliated Hospital	HangZhou	China	Allo / Auto
Instituto de Transplante de Medula Osea de la Costa Caribe	Barranquilla	Colombia	Allo / Auto
Fundacion HOMI Hospital de la Misericordia	Bogota	Colombia	Allo / Auto

Transplant Center Name	City	Country	Transplants Performed
Instituto de Cancerologia	Medellin	Colombia	Allo / Auto
Hospital Pable Tobon Uribe	Medellin	Colombia	Allo / Auto
Hospital Mexico	San Jose	Costa Rica	Allo only
Charles University Hospital	Pilsen	Czech Republic	Allo / Auto
Institute of Hem-Blood Transfusion	Praha	Czech Republic	Allo only
Teaching Hospital Motol	Praha	Czech Republic	Allo only
Rigshospitalet-Copenhagen	Copenhagen	Denmark	Allo only
NCI Cairo University	Cairo	Egypt	Allo only
Helsinki University Central Hospital	Helsinki	Finland	Allo only
Turku University	Turku	Finland	Allo only
Centre Hospitalier Regional University D'Angers	Angers	France	Allo only
Hopital Jean Minjoz	Besancon	France	Allo only
Hospital A Michallon, CHU de Grenoble	Grenoble	France	Allo only
Hopital Claude Huriez, Lille	Lille	France	Allo only
Hospital Edouard Herriot	Lyon	France	Allo only
Hopital Debrousse	Lyon	France	Allo / Auto
Institute Paoli Calmettes	Marseille	France	Allo only
Hotel Dieu	Paris	France	Allo only
Hopital Robert Debre	Paris	France	Allo only
Hospital Saint Louis	Paris	France	Allo only
Hospital Jean Bernard	Poitiers	France	Allo only
University Hospital Charite - Virchow	Berlin	Germany	Allo / Auto
University Hospital Charite Kinderklinik - Virchow	Berlin	Germany	Allo only
Universitaetsklinikum Carl Gustav Carus	Dresden	Germany	Allo / Auto
Heinrich-Heine University	Dusseldorf	Germany	Allo only
University Hospital of Essen	Essen	Germany	Allo / Auto
University Children's Hospital Frankfurt	Frankfurt	Germany	Allo / Auto
Frieburg University Medical Center	Freiburg	Germany	Allo only
Ernst Moritz Arndt Universitat, Greifswald	Greifswald	Germany	Allo only
Martin-Luther-University Halle-Wittenberg	Halle	Germany	Allo only
Universitaets Klinikum Hamburg	Hamburg	Germany	Allo only
Medical School Of Hannover	Hannover	Germany	Allo only
University of Heidelberg	Heidelberg	Germany	Allo only
Clinic for Bone Marrow Transplantation	Idar-Oberstein	Germany	Allo / Auto
Christian Albrechts University	Kiel	Germany	Allo / Auto
Leipzig University Bone Marrow Transplant	Leipzig	Germany	Allo only
University Hospital Mainz	Mainz	Germany	Allo / Auto
University of Munich	Munich	Germany	Allo only

Transplant Center Name	City	Country	Transplants Performed
Klinikum der Universitaet Regensburg	Regensburg	Germany	Allo only
Universitats Klinikum Tubingen	Tubingen	Germany	Allo only
Universitats-Kinderlinik Tubingen	Tubingen	Germany	Allo only
Universitat Ulm - adults	Ulm	Germany	Allo only
Universitat Ulm - peds	Ulm	Germany	Allo only
Deutsche Klinik fr Diagnostik	Wiesbaden	Germany	Allo only
University Hospital of Patras, Patras University Medical Ctr	Rio Patras	Greece	Allo / Auto
University of Hong Kong	Hong Kong	Hong Kong	Allo / Auto
Chinese University of Hong Kong	Shatin	Hong Kong	Allo only
Gujrat Cancer & Research Institute	Ahmedabad	India	Allo / Auto
Sir Ganga Ram Hospital	Dehli	India	Allo / Auto
Christian Medical College, Ludhiana	Ludhiana	India	Allo / Auto
Tata Memorial Hospital	Mumbai	India	Allo only
All India Institute of Medical Science	New Delhi	India	Allo only
Institute Rotary Cancer Hospital	New Delhi	India	Allo / Auto
Christian Medical College Hospital	Vellore	India	Allo only
Shariati General Hospital	Tehran	Iran	Allo / Auto
St James Hospital	Dublin	Ireland	Allo only
Rambam Medical Center,	Haifa	Israel	Allo / Auto
Haddasah University Hospital	Jerusalem	Israel	Allo only
Schneider Children's Medical Center	Petach Tikva	Israel	Allo only
Chaim Sheba Medical Center	Tel-Hashomer	Israel	Allo / Auto
Chaim Sheba Medical Center	Tel-Hashomer	Israel	Allo only
Instituto di Ematologia e Oncologia Medica Seragnoli	Bologna	Italy	Allo only
University Bologna-Pediatrics	Bologna	Italy	Allo / Auto
Spedali Civili di Brescia	Brescia	Italy	Allo / Auto
Ospedale Ferrarotto	Catania	Italy	Allo only
Universita di Firenze	Firenze	Italy	Allo / Auto
Ospedale Civile-Pesaro	Pesaro	Italy	Allo / Auto
Ospedale Civile	Pescara	Italy	Allo only
University La Sapienza	Rome	Italy	Allo only
Universita Cattolica Sacro Cuore	Rome	Italy	Allo / Auto
St Eugenio Hospital	Rome	Italy	Allo only
Ospedale Molinette	Torino	Italy	Allo only
Udine University Hospital	Udine	Italy	Allo only
Kyushu University Hospital	Fukuoka	Japan	Allo / Auto
Tokai University Hospital	Isehara	Japan	Allo only
Hyogo College of Medicine	Nishinomiya	Japan	Allo / Auto
Osaka City University	Osaka	Japan	Allo only

Transplant Center Name	City	Country	Transplants Performed
Jichi Medical School	Tochigi	Japan	Allo / Auto
National Cancer Center Hospital	Tokyo	Japan	Allo only
The Catholic University of Korea	Seoul	Korea (South)	Allo / Auto
Asan Medical Center	Seoul	Korea (South)	Allo only
Samsung Medical Center	Seoul	Korea (South)	Allo only
Hamid Al-Essa Multi-Organ Transplant Center	Safat	Kuwait	Auto only
American University of Beirut	Beirut	Lebanon	Auto only
University of Malaya Medical Center	Kuala Lumpur	Malaysia	Allo only
The American British Cowdrey Medical Center	Mexico City	Mexico	Allo / Auto
Institute Nacional de Pediatria	Coyoacan	Mexico	Allo / Auto
Hospital Angeles de las Lomas	Huixquilucan	Mexico	Allo / Auto
Hospital Especialidades Centro Medico	Mexico D.F.	Mexico	Allo / Auto
Hospital San Jose-Tec De Monterrey	Monterrey	Mexico	Allo / Auto
Hospital Universitario	Monterrey	Mexico	Allo / Auto
Centro de Hematologia y Medicina Interna. Clinica Ruiz de Puebla	Puebla	Mexico	Allo / Auto
Academic Medical Center	Amsterdam	Netherlands	Allo / Auto
Leiden University Medical Center	Leiden	Netherlands	Allo only
Academic Hospital Maastricht	Maastricht	Netherlands	Allo only
University Hospital of Nijmegen	Nijmegen	Netherlands	Allo only
Dr Daniel Den Hoed Cancer Center	Rotterdam	Netherlands	Allo only
Auckland City Hospital	Auckland	New Zealand	Allo only
Starship Children's Hospital	Auckland	New Zealand	Allo only
Christchurch Hospital	Christchurch	New Zealand	Allo only
Wellington Blood and Cancer Centre	Wellington	New Zealand	Allo only
Rikshospital	Oslo	Norway	Allo only
Aga Khan University Hospital	Karachi	Pakistan	Allo / Auto
Hill Park Hospital National Institute of Blood Diseases & Bone Marrow Transplantation	Karachi	Pakistan	Allo only
Hospital Rebagliati	Lima	Peru	Allo / Auto
Silesian Medical Academy	Katowice	Poland	Allo only
Poznan University of Medical Sciences	Poznan	Poland	Allo only
K Marcinkowski University of Medical Science	Poznan	Poland	Allo only
Medical University of Warsaw	Warsaw	Poland	Allo only

Transplant Center Name	City	Country	Transplants Performed
Lower-Silesian Center for Cellular Transplantation and National Bone Marrow Donor Registry	Wroclaw	Poland	Allo only
Institute Portugues de Oncologia - Lisbon	Lisbon	Portugal	Allo only
Russian Central Children's Hospital	Moscow	Russian Fed.	Allo only
Dr. Soliman Fakeeh Hospital	Jeddah	Saudi Arabia	Allo / Auto
Riyadh Military Hospital (RKH)	Riyadh	Saudi Arabia	Allo only
King Faisal Specialist Hospital & Research Center	Riyadh	Saudi Arabia	Allo only
King Faisal Specialist Hospital-Pediatrics	Riyadh	Saudi Arabia	Allo only
National University Hospital	Singapore	Singapore	Allo / Auto
Singapore General Hospital	Singapore	Singapore	Allo only
National University Hospital, Singapore	Singapore	Singapore	Allo only
Slovak Medical University	Bratislava	Slovak Republic	Allo only
Constantiaberg Medi-Clinic	Cape Town	South Africa	Allo / Auto
University of Cape Town Leukemia Center	Cape Town	South Africa	Allo only
University of Witwatersrand	Parktown	South Africa	Allo / Auto
University Barcelona	Barcelona	Spain	Allo only
Hospital Infantil Vall d'Hebron	Barcelona	Spain	Allo / Auto
Institut Catala d'Oncologia-IDIBELL	Barcelona	Spain	Allo / Auto
Hospital Santa Creui Sant Pau	Barcelona	Spain	Allo / Auto
Hospital Puerta Hierro	Madrid	Spain	Allo only
Hospital Infantil Universitario Nino Jesus	Madrid	Spain	Allo only
Gregorio Mara$on University General Hospital	Madrid	Spain	Allo / Auto
Hospital Infantil La Paz	Madrid	Spain	Allo / Auto
Son Dureta Hospital	Palma Mallorca	Spain	Allo only
Hospital Universitario La Fe	Valencia	Spain	Allo only
Sahlgrenska University Hospital	Goteborg	Sweden	Allo only
Lund University Hospital	Lund	Sweden	Allo only
Karolinska University Hospital	Stockholm	Sweden	Allo only
University Hospital - Uppsala	Uppsala	Sweden	Allo only
Basel Kantonsspital	Basel	Switzerland	Allo only
Geneva University Hospital	Geneva	Switzerland	Allo only
University Hospital-Zurich	Zurich	Switzerland	Allo only
Taipei Veterans General Hospital	Taipei	Taiwan	Allo only
Chang Gung Children's Hospital	Taoyuan	Taiwan	Allo / Auto
Ankara University Faculty of Medicine	Ankara	Turkey	Allo only
Hacettepe University	Ankara	Turkey	Allo / Auto

Transplant Center Name	City	Country	Transplants Performed
Gulhane Military Medical Academy	Ankara	Turkey	Allo / Auto
Istanbul Medical Faculty Bone Marrow Bank	Istanbul	Turkey	Allo / Auto
Yeditepe University Hospital	Istanbul	Turkey	Allo / Auto
University of Erciyes Medical School	Kayseri	Turkey	Allo / Auto
Birmingham Heartlands Hospital	Birmingham	UK	Allo only
Birmingham Children's Hospital	Birmingham	UK	Allo only
Queen Elizabeth Hospital-Birmingham	Birmingham	UK	Allo only
Bristol Children's Hospital	Bristol	UK	Allo only
Addenbrooke's NHS Trust	Cambridge	UK	Allo only
Western General Hospitals NHS Trust	Edinburgh	UK	Allo only
Beatson West of Scotland Cancer Centre	Glasgow	UK	Allo only
Royal Hospital for Sick Children	Glasgow	UK	Allo only
St James University Hospital	Leeds	UK	Allo only
London Clinic	London	UK	Allo only
Royal Free Hospital	London	UK	Allo only
Imperial College School of Medicine	London	UK	Allo only
Great Ormond Street Hospital	London	UK	Allo only
St George's Hospital	London	UK	Allo only
Imperial College- St Mary's Hosptial	London	UK	Allo only
Royal Victorian Hospital-Newcastle	Newcastle	UK	Allo only
ABM University, NHS Trust, Swansea	Swansea	UK	Auto only
British Hospital	Montevideo	Uruguay	Allo / Auto
Centro IMPASA de Trasplante de Medula Ossea	Montevideo	Uruguay	Allo / Auto
Unidad de Transplante de Medula Osea Pediatrica	Montevideo	Uruguay	Allo / Auto
Hospital de Clinicas Caracas	Caracas	Venezuela	Allo / Auto
Ciudad Hospitalaraia Dr Enrique Tejera	Valencia	Venezuela	Allo / Auto

Appendix D: Related Web Links

Transplant Resources (http://bloodcell.transplant.hrsa.gov/TRANSPLANT/index.html)
Understanding Transplant as a Treatment Option (http://bloodcell.transplant.hrsa.gov/TRANSPLANT/Understanding_Tx/index.html)
Planning for a Bone Marrow Transplant (http://bloodcell.transplant.hrsa.gov/TRANSPLANT/Planning/index.html)
Searching for a Marrow Donor or Cord Blood Unit (http://bloodcell.transplant.hrsa.gov/TRANSPLANT/Searching/index.html)
Patient Support Resources (http://bloodcell.transplant.hrsa.gov/TRANSPLANT/Patient_Support/index.html)
Physician Resources (http://bloodcell.transplant.hrsa.gov/TRANSPLANT/Physician_Resources/index.html)
Donor Information (http://bloodcell.transplant.hrsa.gov/DONOR/index.html)
The Need for More Marrow Donors http://bloodcell.transplant.hrsa.gov/DONOR/Need_for_Donors/index.html)
Joining the Registry (http://bloodcell.transplant.hrsa.gov/DONOR/Joining/index.html)
Donating Marrow (http://bloodcell.transplant.hrsa.gov/DONOR/Donating/index.html)
Cord Blood Information (http://bloodcell.transplant.hrsa.gov/CORD/index.html)
The Need for More Cord Blood Donations (http://bloodcell.transplant.hrsa.gov/CORD/The_Need/index.html)
Options for Umbilical Cord Blood Banking and Donation (http://bloodcell.transplant.hrsa.gov/CORD/Options/index.html)
Research, Data, and Outcomes (http://bloodcell.transplant.hrsa.gov/RESEARCH/index.html)
Transplant Outcomes and Data (http://bloodcell.transplant.hrsa.gov/RESEARCH/Transplant_Data/index.html)
Donor Registry Data (http://bloodcell.transplant.hrsa.gov/RESEARCH/Registry_Data/index.html)
Biennial Report (http://bloodcell.transplant.hrsa.gov/RESEARCH/Biennial_Report/index.html)
Cord Blood Units for Research (http://bloodcell.transplant.hrsa.gov/RESEARCH/CBU_for_Research/index.html)
About the Program (http://bloodcell.transplant.hrsa.gov/ABOUT/index.html)
Advisory Council on Blood Stem Cell Transplantation (http://bloodcell.transplant.hrsa.gov/ABOUT/Advisory_Council/index.html)
Legislation and Contracts (http://bloodcell.transplant.hrsa.gov/ABOUT/Legislation_and_Contracts/index.html)
Program Contractors (http://bloodcell.transplant.hrsa.gov/ABOUT/Contractors/index.html)
Program Assessments (http://bloodcell.transplant.hrsa.gov/ABOUT/Program_Assessments/index.html)
Radiation Injury Treatment Network (http://bloodcell.transplant.hrsa.gov/ABOUT/RITN/index.html)
Current Use and Outcomes of HCT (http://www.cibmtr.org/SERVICES/Observational_Research/Summary_Slides/index.html)
Information Request Form (http://www.cibmtr.org/ReferenceCenter/SlidesReports/SummarySlides/pages/index.aspx)
U.S. Transplant Data: outcomes (http://bloodcell.transplant.hrsa.gov/RESEARCH/Transplant_Data/US_Tx_Data/index.html)

Appendix E: Map of Worldwide Transplant Centers Providing Data to NMDP and CIBMTR

Appendix F: CIBMTR Publications

2008 CIBMTR Publications

Lee SJ, Kamani N, Confer DL. Principles and tools for selection of umbilical cord blood and unrelated adult donor grafts. Biol Blood Marrow Transplant 14:112-119, 2008

Kamani N, Spellman S, Hurley CK, Barker JN, Smith FO, Oudshoorn M, Bray R, Smith A, Williams TM, Logan B, Eapen M, Anasetti C, Setterholm M, Confer DL. State of the art review: HLA matching and outcome of unrelated donor umbilical cord blood transplants. Biol Blood Marrow Transplant 14:1-6, 2008

Schlenk RF, Pasquini MC, Pérez WS, Zhang M-J, Krauter J, Antin JH, Bashey A, Bolwell BJ, Büchner T, Cahn J-Y, Cairo MS, Copelan EA, Cutler CS, Döhner H, Gale RP, Ilhan O, Lazarus HM, Liesveld JL, Litzow MR, Marks DI, Maziarz RT, McCarthy PL, Nimer SD, Sierra J, Tallman MS, Weisdorf DJ, Horowitz MM, Arnold Ganser A. HLA-identical sibling allogeneic transplants versus chemotherapy in acute myelogenous leukemia with t(8;21) in first complete remission: collaborative study between the German AML Intergroup and CIBMTR. Biol Blood Marrow Transplant 14:187-196, 2008

Hari P, Carreras J, Zhang MJ, Gale RP, Bolwell BJ, Bredeson CN, Burns LJ, Cairo M, Freytes CO, Goldstein SC, Hale GA, Inwards DJ, LeMaistre CF, Maharaj D, Marks DI, Schouten HC, Slavin S, Vose JM, Lazarus HM, van Besien K. Allogeneic transplants in follicular lymphoma: higher risk of disease progression after reduced-intensity compared to myeloablative conditioning. Biol Blood Marrow Transplant 14:236-245, 2008

Eapen M, Zhang MJ, Devidas M, Raetz E, Barredo JC, Ritchey AK, Godder K, Grupp S, Lewis VA, Malloy K, Carroll WL, Davies SM, Camitta BM. Outcomes after HLA-matched sibling transplantation or chemotherapy in children with acute lymphoblastic leukemia in a second remission after an isolated central nervous system relapse: a collaborative study of the Children's Oncology Group and the Center for International Blood and Marrow Transplant Research. Leukemia 22:281-286, 2008

Hou L, Steiner NK, Chen M, Belle I, Kubit AL, Ng J, Hurley CK. Limited allelic diversity of stimulatory two-domain killer cell immunoglobulin-like receptors. Hum Immunol 69:174–178, 2008

Scheike TH, Zhang MJ, Gerds TA. Predicting cumulative incidence probability by direct binomial regression. Biometrika 95:205-220, 2008

Nietfeld JJ, Pasquini MC, Logan BR, Verter F, Horowitz MM. Lifetime probabilities of hematopoietic stem cell transplantation in the US: implications for umbilical cord blood storage. Biol Blood Marrow Transplant 14:316-322, 2008

Ueno NT, Rizzo JD, Demirer T, Cheng YC, Hegenbart U, Zhang MJ, Bregni M, Carella A, Blaise D, Bashey A, Bitran JD, Bolwell BJ, Elfenbein GJ, MD, Fields KK, Freytes CO, Gale RP, Lazarus HM, Champlin RE, Stiff PJ, Niederwieser D. Allogeneic hematopoietic cell transplantation for metastatic breast cancer. Bone Marrow Transplant 41:537-545, 2008

Klein JP, Gerster M, Andersen, PK, Tarima S, Perme MP. SAS and R functions to compute pseudo-values for censored data regression. Comput Methods Programs Biomed 89:289-300, 2008

Howard DH, Meltzer D, Kollman C, Maiers M, Logan B, Gragert L, Setterholm M, Horowitz MM. Use of cost-effectiveness analysis to determine inventory size for a national cord blood bank. Med Decis Making 28:243-253., 2008

Williams TM, Winden T, Setterholm M, Vierra-Green CA, Spellman S, Flesch S, Awdeh Z, Baxter-Lowe LA, Begovich AB, Fernandez-Vina M, Hegland J, Hurley CK, Johnson D, Noreen H, Salazar M, Schmeckpeper B, Yunis EJ. Strategies and technical challenges in allele level Class II typing in 2578 bone marrow transplantation donor-recipient pairs. Hum Immunol 69:227–234, 2008

Bishop MR, Logan BR, Gandham S, Bolwell BJ, Cahn J-Y, Lazarus HM, Litzow MR, Marks DI, Wiernik PH, McCarthy PL, Russell JA, Miller C, Sierra J, Milone G, Keating A, Loberiza, FR, Jr, Giralt SA, Horowitz MM, Weisdorf DJ. Long-term outcomes of adults with acute lymphoblastic leukemia after autologous or unrelated donor bone marrow transplantation: a comparative analysis by the National Marrow Donor Program and Center for International Blood and Marrow Transplant Research. Bone Marrow Transplant 41:635-642, 2008

Perez-Albuerne ED, Eapen M, Klein JP, Gross TG, Lipton JM, Baker KS, Woolfrey AE, Kamani NR. Outcome of unrelated donor stem cell transplantation for children with severe Aplastic anemia. Br J Haematol 141:216-223., 2008

Belle I, Hou L, Chen M, Steiner NK, Ng J, Hurley CK. Investigation of killer cell immunoglobulin-like receptor gene diversity in KIR3DL1 and KIR3DS1 in a transplant population. Tissue Antigens 71:434–439, 2008

Gardner SL, Carreras J, Boudreau C, Camitta BM, Adams RH, Chen AR, Davies SM, Edwards JR, Grovas AC, Hale GA, Lazarus HM, Arora M, Stiff PJ, Eapen M. Myeloablative therapy with autologous stem cell rescue for patients with Ewing sarcoma. Bone Marrow Transplant 41:867-872, 2008

Lee SJ, Joffe S, Artz AS, Champlin RE, Davies SM, Jagasia M, Kernan NA, Loberiza Jr. FR, Soiffer RJ, Eapen M. Individual physician practice variation in hematopoietic cell transplantation. J Clin Oncol 26:2162–2170, 2008

Mulrooney TJ, Hou L, Steiner NK, Chen M, Belle I, Ng J, Hurley CK. Promoter variants of KIR2DL5 add to diversity and may impact gene expression. Immunogenetics 60:287–294, 2008

Weinstock DM, Case Jr. C, Bader JL, Chao NJ, Coleman CN, Hatchett RJ, Weisdorf DJ, Confer DL. Radiological and nuclear events: contingency planning for hematologist/oncologists. Blood 111:5440–5445, 2008

Weinstock DM, Case, Jr. C, Confer DL. Response: radiologic and nuclear events. Blood 111:5758–5759, 2008

Nietfeld JJ, Pasquini MC, Logan BR, Verter F, Horowitz MM. On the probability of using cord blood. Biol Blood Marrow Transplant 14:724-725, 2008

Marks DI, Pérez WS, He W, Zhang M-J, Bishop MR, Bolwell BJ, Bredeson CN, Copelan EA, Gale RP, Gupta V, Hale GA, Isola LM, Jakubowsi AA, Keating A, Klumpp TR, Lazarus HM, Liesveld JL, Maziarz RT, McCarthy PL, Sabloff M, Schiller G, Sierra J, Tallman MS, Waller EK, Wiernik PH, Weisdorf DJ. Unrelated donor transplants in adults with Philadelphia-negative acute lymphoblastic leukemia in first complete remission. Blood 112:426-434, 2008

Weisdorf D, Spellman S, Haagenson M, Horowitz M, Lee S, Anasetti C, Setterholm M, Drexler R, Maiers M, King R, Confer D, Klein J. Classification of HLA-matching for retrospective analysis of unrelated donor transplantation: revised definitions to predict survival. Biol Blood Marrow Transplant 14:748-758, 2008

Confer D, Robinett P The US National Marrow Donor Program role in unrelated donor hematopoietic cell transplantation. Bone Marrow Transplant 42:S3-S5, 2008

Smith SM, van Besien K, Carreras J, Bashey A, Cairo MS, Freytes CO, Gale RP, Hale GA, Hayes-Lattin B, Holmberg LA, Keating A, Maziarz RT, McCarthy PL, Navarro WH, Pavlovsky S, Schouten HC, Seftel M, Wiernik PH, Vose JM, Lazarus, HM, Hari P. Second autologous stem cell transplantation for relapsed lymphoma after a prior autologous transplant Biol Blood Marrow Transplant 14:904-912, 2008

Horowitz MM. The role of registries in facilitating clinical research in BMT: examples from the Center for International Blood and Marrow Transplant Research. Bone Marrow Transplant 42:S1-S2, 2008

Baker KS, Filipovich AH, Gross TG, Grossman WJ, Hale GA, Hayashi RJ, Kamani NR, Kurian S, Kapoor N Ringdén O, Eapen M. Unrelated donor hematopoietic cell transplantation for hemaophagocytic lymphohistiocytosis. Bone Marrow Transplant 42:175-180, 2008

Levine JE, Barrett AJ, Zhang M-J, Pulsipher MA, Bunin N, Fort J, Loberiza FR, Porter D, Giralt S, Drobyski W, Ringdén O, Horowitz MM, Collins R. Donor leukocyte infusions to treat hematologic malignancy relapse following allogeneic stem cell transplantation in a pediatric population. Bone Marrow Transplant 42:201-205, 2008

Ballen KK, King RJ, Chitphakdithai P, Bolan Jr. CD, Agura E, Hartzman RJ, Kernan NA The National Marrow Donor Program 20 years of unrelated donor hematopoietic cell transplantation. Blood Marrow Transplant 14:2–7, 2008

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MacMillan ML, Davies SM, Nelson GO, Chitphakdithai P, Confer DL, King RJ, Kernan NA Twenty years of unrelated donor bone marrow transplantation for pediatric acute leukemia facilitated by the National Marrow Donor Program. Biol Blood Marrow Transplant14:16–22, 2008

Miller JP, Perry EH, Price TH, Bolan Jr. CD, Karanes C, Boyd TM, Chitphakdithai P, King RJ. Recovery and safety profiles of marrow and PBSC donors: experience of the National Marrow Donor Program. Biol Blood Marrow Transplant 14:29–36, 2008

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Bredeson CN, Zhang MJ, Agovi MA, Bacigalupo A, Bahlis NJ, Ballen K, Brown C, Chaudhry MA, Horowitz MM, Kurian S, Quinlan D, Muehlenbien CE, Russell JA, Savoie L, Rizzo JD, Stewart DA. Outcomes following HCT using Fludarabine, Busulfan and Thymoglobulin: A matched comparison to allogeneic transplants conditioned with Busulfan and Cyclophosphamide. Biol Blood Marrow Transplant 14:993-1003, 2008

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Karanes C, Nelson GO, Chitphakdithai P, Agura E, Ballen KK, Bolan CD, Porter DL, Uberti JP, King RJ, Confer DL Twenty years of unrelated donor hematopoietic cell transplantation for adult recipients facilitated by the National Marrow Donor Program. Biol Blood Marrow Transplant 14:8–15, 2008

Bashey A, Pérez WS, Zhang M-J, Anderson KC, Ballen K, Berenson JR, Fonseca R, Freytes CO , Gale RP, Gibson J, Giralt SA, Kyle RA, Lazarus HM, Maharaj D, McCarthy PL, Milone GA, Nimer S, Pavlovsky S, Reece DE, Schiller G, Vesole DH, Hari P. Comparison of twin and autologous transplants for multiple myeloma Biol Blood Marrow Transplant 14:1118-1124, 2008

Kumar S, Pérez WS, Zhang M-J, Ballen K, Bashey A, Bik To L, Bredeson CN, Cairo MS, Elfenbein GJ, Freytes CO, Gale RP, Gibson J, Kyle RA, Lacy MQ, Lazarus HM, McCarthy PL, Milone GA, Moreb JA, Pavlovsky S, Reece DE, Vesole DH, Wiernik PH, Hari P. Comparable outcomes in non-secretory and secretory multiple myeloma after autologous stem cell transplantation. Biol Blood Marrow Transplant 14:1134-1140, 2008

Pasquini R, Carreras, J, Pasquini MC, Camitta BM, Fasth AL, Hale GA, Harris RE, Marsh JC, Robinson AJ, Zhang M-J, Eapen M, Wagner JE. HLA-matched sibling hematopoietic stem cell transplantation for Fanconi anemia: comparison of irradiation and nonirradiation containing conditioning regimens. Biol Blood Marrow Transplant 14:1141-1147, 2008

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Dehn J, Arora M, Spellman S, Setterholm M, Horowitz M, Confer D, Weisdorf D. Unrelated donor hematopoietic cell transplantation: factors associated with a better HLA match. Biol Blood Marrow Transplant 14:1334-1340, 2008

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Aljurf MD, Zaidi SZ, El Solh H, Hussain F, Ghavamzadeh A, Mahmoud HK, Shamsi T, Ben Othman T, Sarhan MM, Dennison D, Ibrahim A, Benchekroun S, Chaudhri N, Labar B, Horowitz M, Niederwieser D, Gratwohl A. Special issues related to hematopoietic SCT in the Eastern Mediterranean region and the first regional activity report. Bone Marrow Transplant 43:1-12, 2009

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Gale RP, Eapen M, Logan B, Zhang MJ, Lazarus HM. Are there roles for observational database studies and structured quantification of expert opinion to answer therapy controversies in transplants? Bone Marrow Transplant 43:435-446, 2009

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Appendix G: CIBMTR Summary Slides

Current Uses and Outcomes of Hematopoietic Stem Cell Transplantation 2009: Summary Slides

INTRODUCTION: The Summary Slides are an annual report on data submitted to the CIBMTR. The first half focuses on trends in the use of hematopoietic cell transplantation (HCT) according to donor type, graft sources, patient age and transplant regimes. Early outcomes such as mortality rates at day 100 post HCT and causes of death are also included in this series. Graphs with total transplant numbers (slides 7 & 8) are estimates based on data reported to the CIBMTR adjusted according to transplant type. These adjustment factors are derived from comparisons with other national and international databases.

- Acute myeloid leukemia (AML), acute lymphocytic leukemia (ALL), and chronic myelogenous leukemia (CML) are classified as early (first complete remission [CR1] or first chronic phase [CP1]), intermediate (second or subsequent CR or CP or accelerated phase [AP]), and advanced (primary induction failure, active disease, or blastic phase) disease.
- Myelodysplastic syndrome (MDS) is divided into early (refractory anemia [RA] or refractory anemia with ringed sideroblasts [RARS]), and advanced (refractory anemia with excess of blasts [RAEB] or chronic myelomonocytic leukemia [CMML]) disease.
- Lymphoma is classified according to sensitivity to prior chemotherapy (chemosensitive or chemoresistant).

The classification of conditioning regimen intensities is based on the agents, doses and schedules used. Several classifications are available, and for this report we used a composite classification. Cases defined as reduced-intensity by the transplant center were classified as such. Cases without such information and with available data on chemotherapy agents, radiation and doses were classified according to the CIBMTR operational definition of conditioning regimen intensity:

- Myeloablative conditioning regimen: regimens with total body irradiation doses of ≥500 cGY, single fractionated doses of ≥800 cGY, busulfan doses of >9mg/kg, or melphalan doses of >150 mg/m2 given as single agents or in combination with other drugs.
- Reduced-intensity conditioning regimen: regimens with lower doses of total body irradiation, fractionated radiation therapy, busulfan, and melphalan than those used to define a myeloablative conditioning regimen (above).

The second half of the CIBMTR summary slides describes the probabilities of survival in patients with diseases most commonly treated with HCT. The data were derived from patients transplanted between 1998 and 2007 and reported to CIBMTR. Survival curves are stratified by several factors: recipient age, donor type (i.e. autologous, human leukocyte antigen [HLA]-identical sibling, or matched-unrelated donor transplant), time from diagnosis to HCT, disease status or chemosensitivity at time of transplantation, and conditioning regimen intensity. However, all comparisons are univariate and do not adjust for other potentially important factors that may impact overall survival. Consequently, differences in outcomes between curves should be interpreted cautiously.

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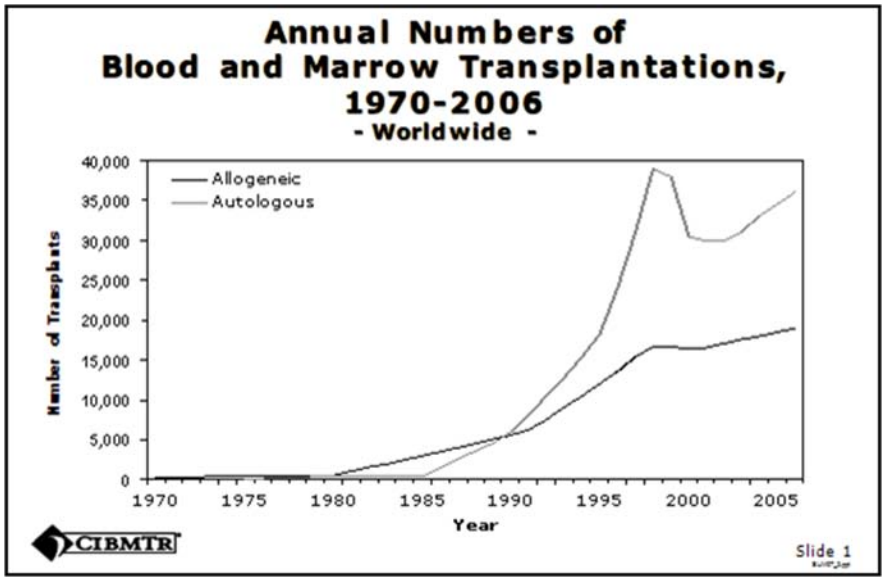
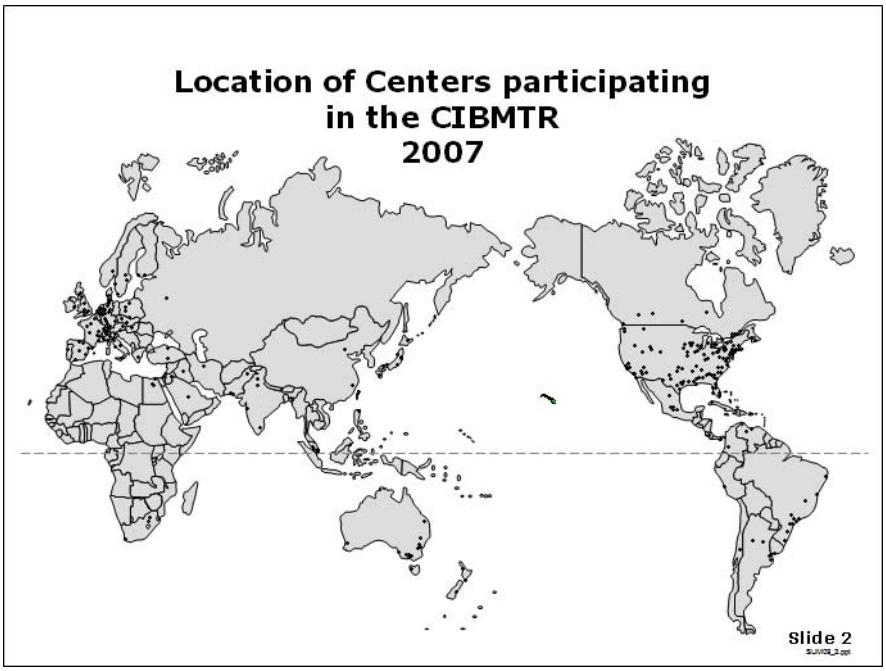
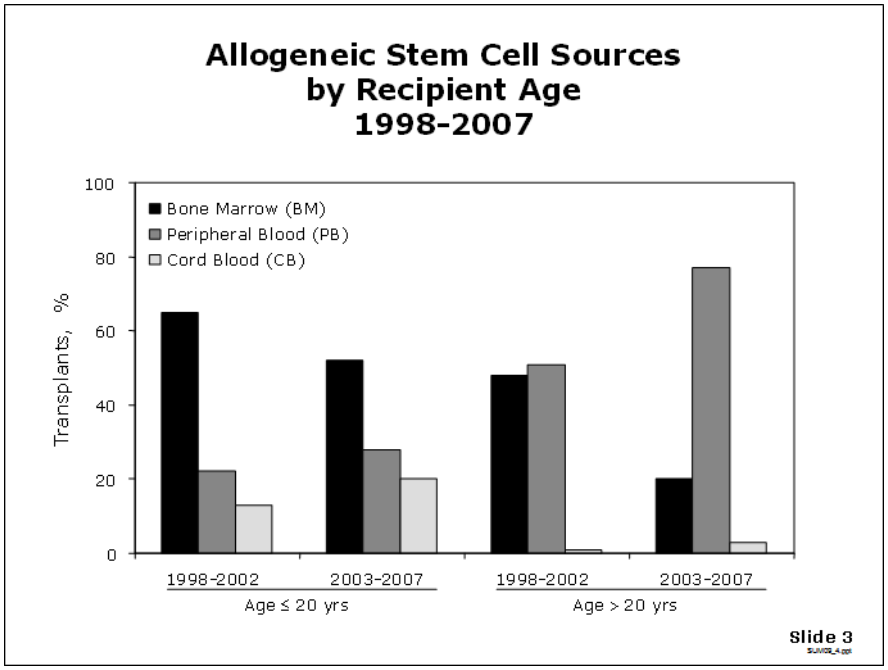


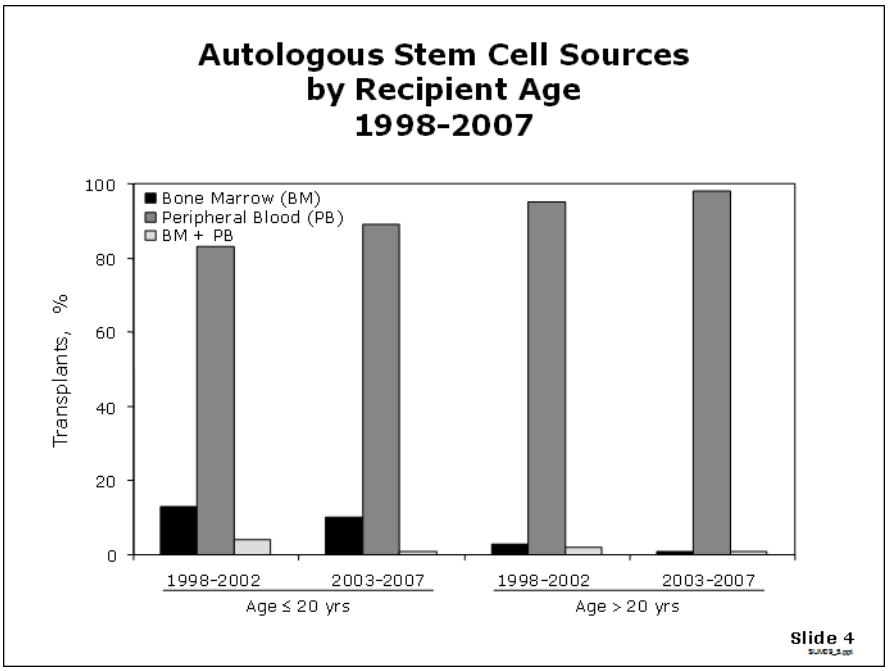
Slide 1: There are an estimated 50,000-60,000 hematopoietic stem cell transplants (HCTs) done every year worldwide. This slide shows several of the notable events in the field over the past decade. They include the initial enthusiasm and later disappointment about the use of autologous transplants for breast cancer, the availability of targeted non-transplant therapy for chronic myelogenous leukemia (a leading use for allogeneic HCT), and the increasing use of autologous and allogeneic HCT in older patients.



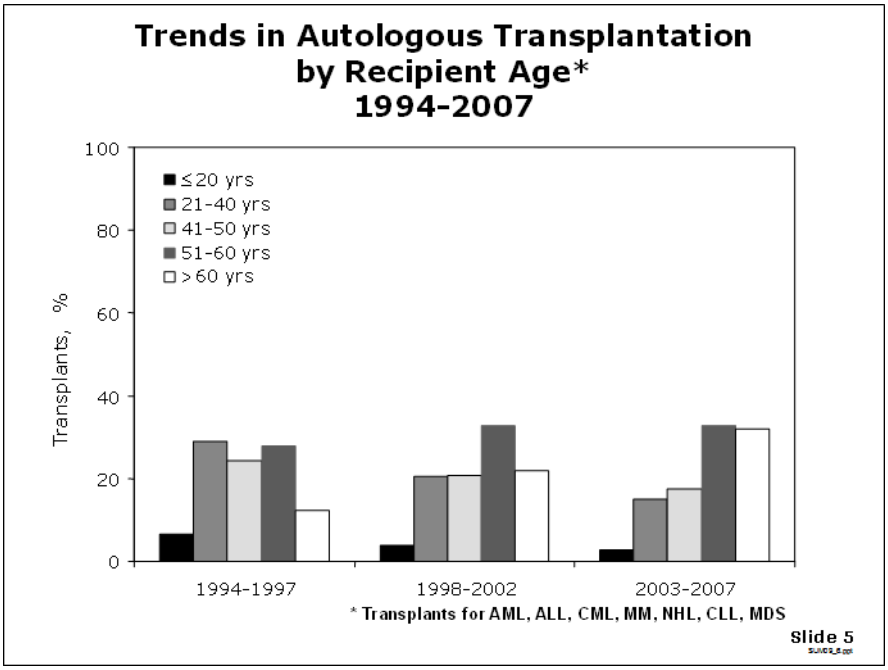
Slide 2: The CIBMTR database includes data reported by more than 500 centers in 54 countries worldwide.



Slide 3: Bone marrow is the primary graft source for transplantation in children, though the use of peripheral blood and umbilical cord blood grafts is increasing. During the period 2003 to 2007, peripheral blood grafts accounted for 28%, and cord blood accounted for 20% of allotransplants in patients younger than 20 years of age. Among adults older than 20 years, peripheral blood is the most common source of allogeneic grafts.



Slide 4: Mobilized peripheral blood progenitor cells are currently the main graft source for autologous HCT, accounting for greater than 90% of transplants in children. The practice of combining bone marrow with peripheral blood stem cells in patients unable to mobilize optimal cell doses has decreased in both adults and children (1%). Better mobilization regimens and patient selection may account for this trend.



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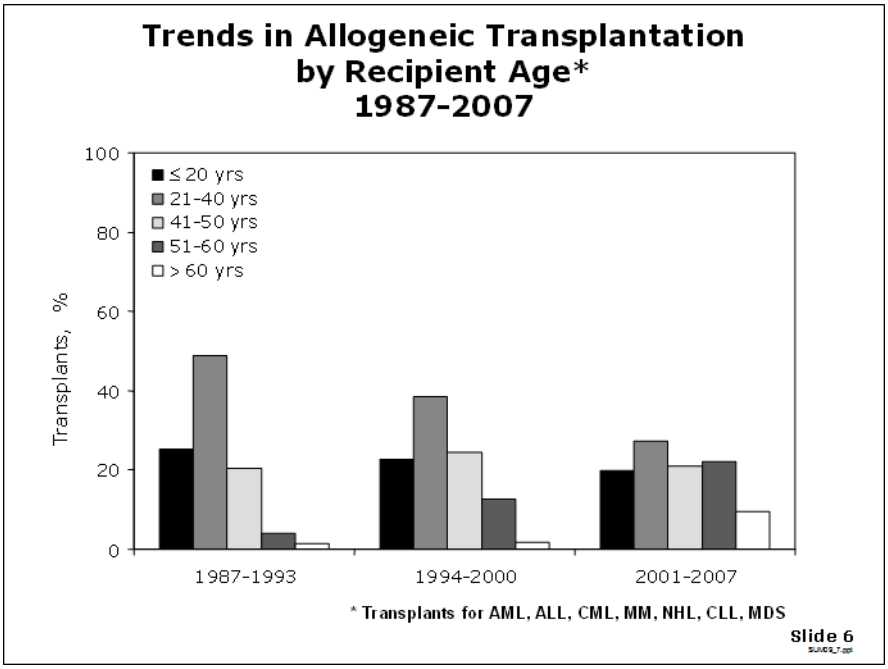
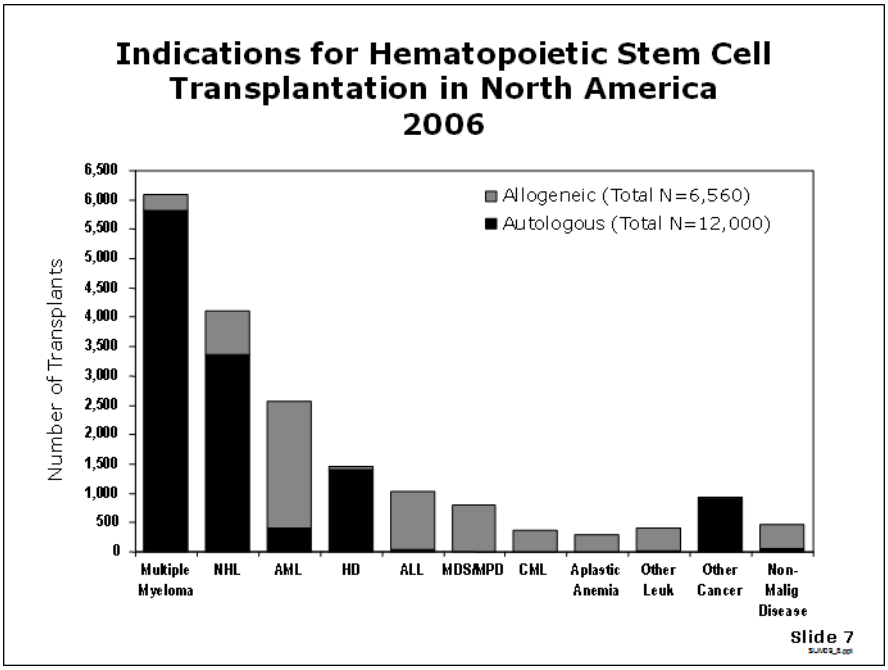
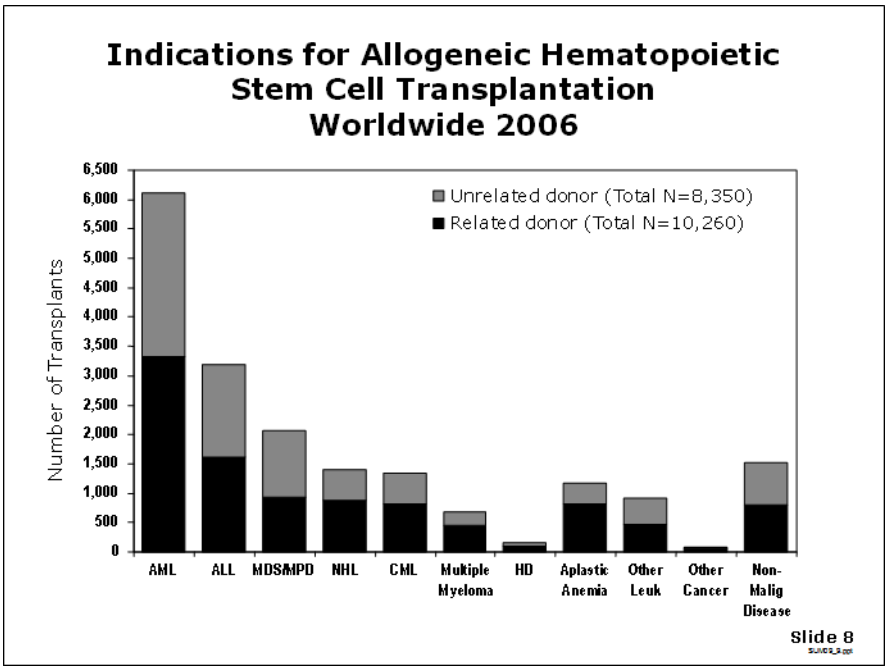


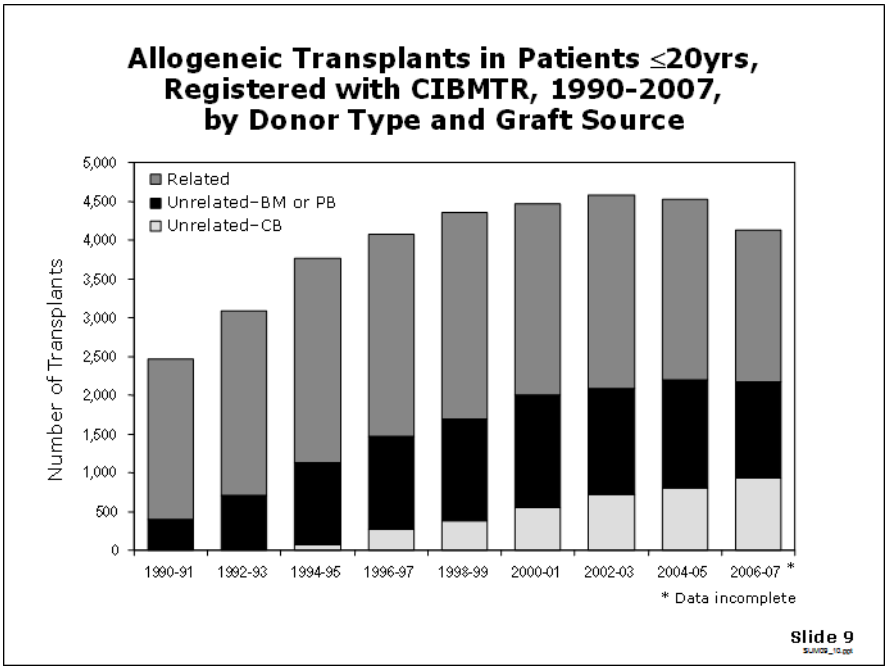
Slides 5 & 6: The numbers of autologous and allogeneic HCTs for treatment of the most common malignant disease indications in patients older than 60 continue to increase. Thirty-two percent of autologous transplant recipients and 10% of allogeneic transplant recipients in 2003-2007 were older than 60 years of age. The majority of autologous transplant recipients (65%) are older than 50 years in this later period.



Slide 7: The most common disease indications for HCT in North America in 2006 were multiple myeloma and lymphoma, accounting for 63% of all HCTs. Multiple myeloma was the most common indication for autologous transplantation and acute myeloid leukemia was the most common indication for allogeneic transplantation.



Slide 8: Approximately 45% of all allogeneic transplants performed worldwide are from unrelated donors. Use of alternative donors depends on the disease indication, recipient's age, and lack of a related donor. Patients with acute leukemias and myelodysplasias most commonly receive unrelated allogeneic transplants. The proportion of unrelated transplants performed in acute leukemias and myelodysplasia are 47% and 55% respectively.



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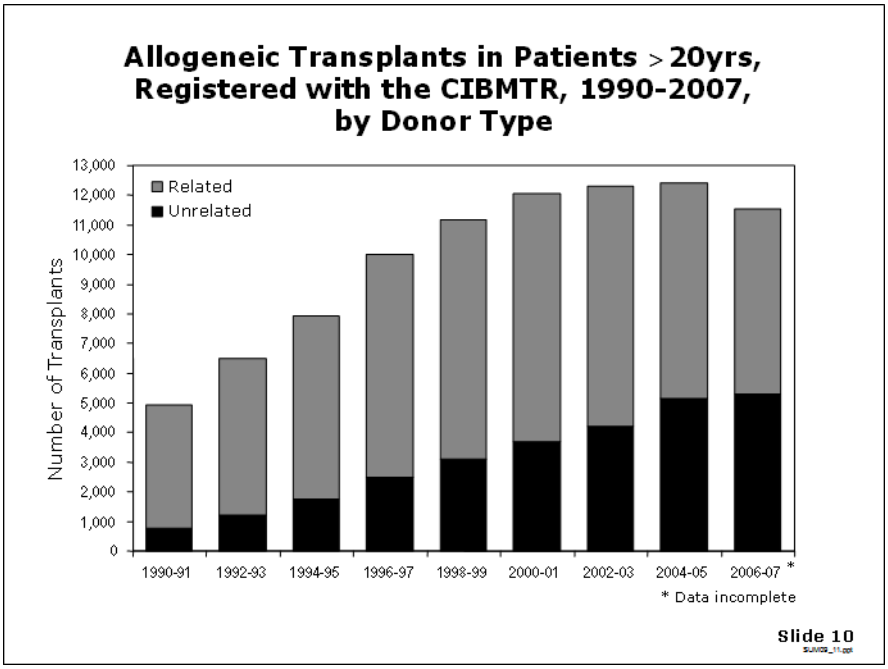
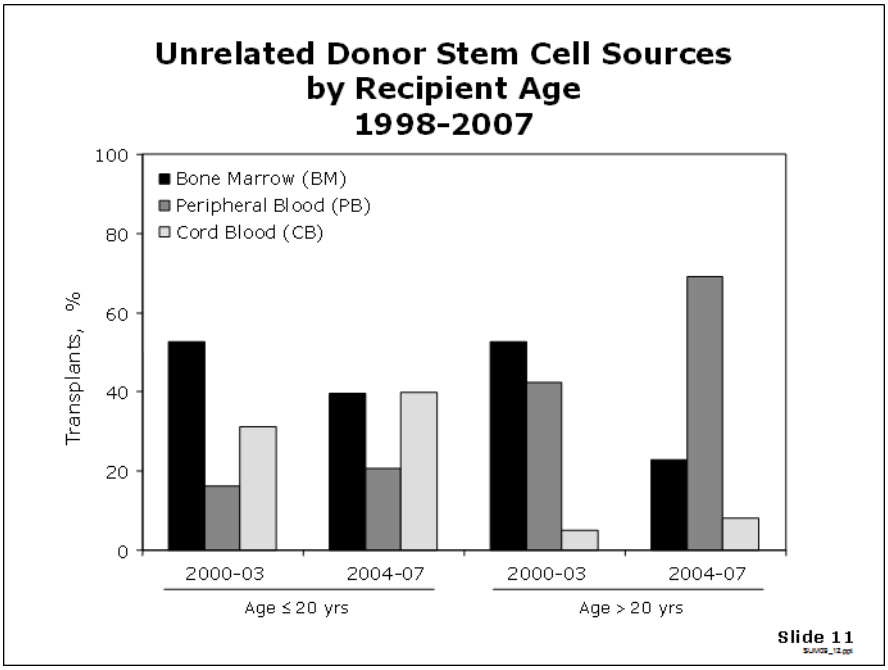
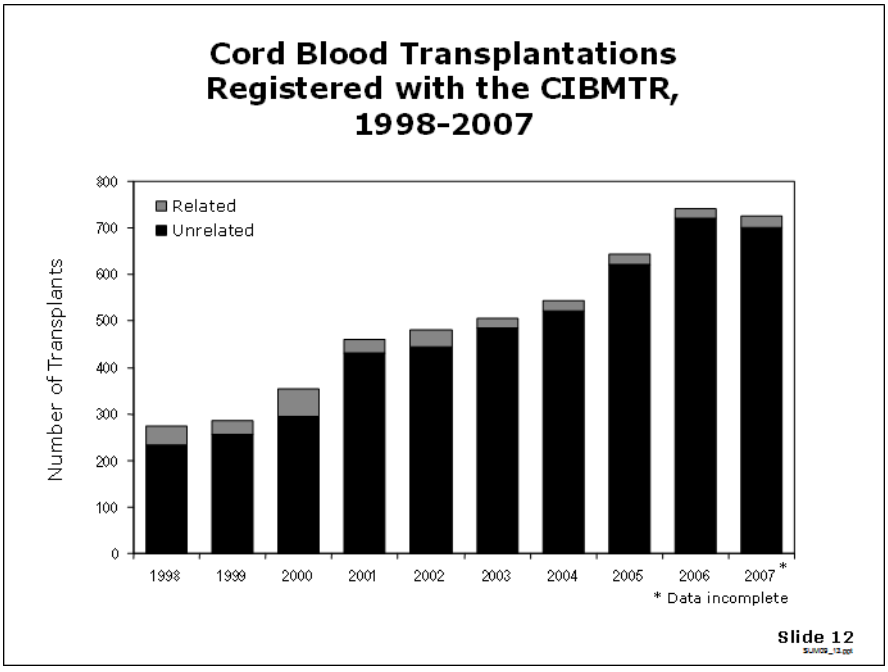


Slides 9 & 10: The proportion of transplants from unrelated donors is steadily increasing for both children and adults. For patients younger than 20, the proportion of unrelated transplants is 53%, with 23% utilizing cord blood as the graft source in 2006-2007. The same general trend is observed in patients older than 20 as well, with 46% of patients receiving unrelated donor transplants. Studies demonstrating similar outcomes between unrelated and related donor transplants, the increased availability of unrelated donors, and the increase in use of cord blood for the pediatric population are all responsible for this increase.

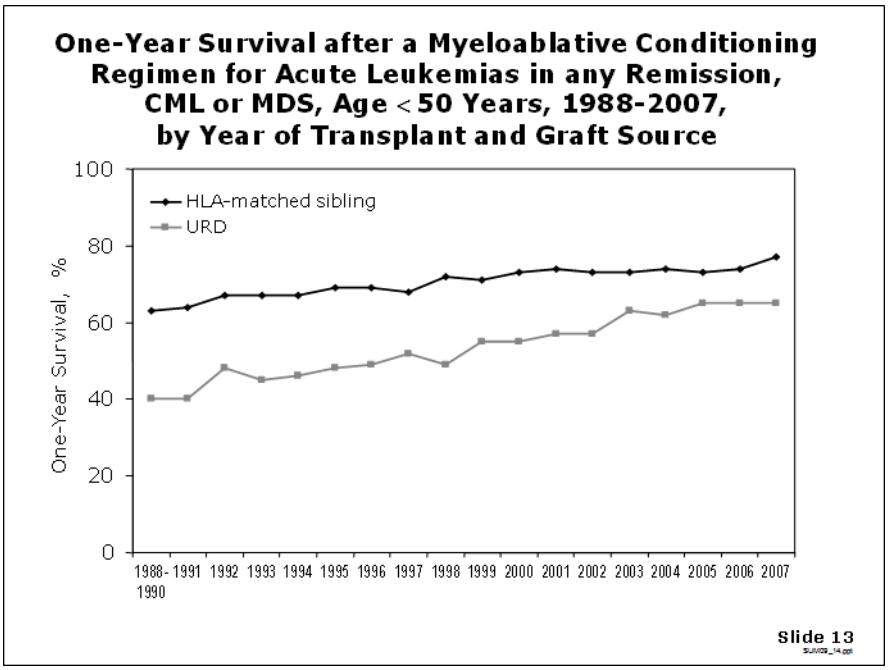


Slide 11: Graft selection for unrelated donor transplantation has shifted from bone marrow to other sources of hematopoietic cells. Among patients younger than 20 years, marrow was used for 40% of unrelated donor transplants in 2004-2007, compared to 53% in 2000-2003. Among patients older than 20 years, marrow accounted for 23% of unrelated donor transplants in 2004-2007, compared to 53% in 2000-2003. The use of cord blood, however, has increased only modestly in patients older than 20 years, reaching just 7%. Limited numbers of cells in single cord blood units is the main barrier for widespread use of this graft source in adults. Similar to related donor allogeneic transplantation, peripheral blood stem cells are the most common graft source for unrelated HCT in adults

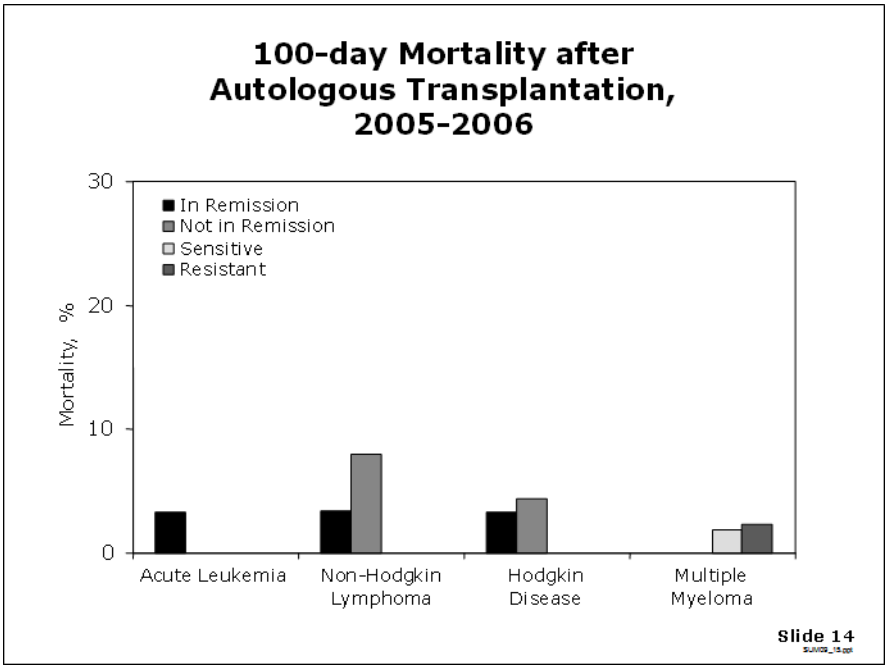


Slide 12: The past 10 years have seen a steady increase in the number of cord blood banks and consequently, in the number of umbilical cord blood transplants. Although cord blood is most frequently

an unrelated donor graft source, there are consistent small numbers of related donor cord blood transplants performed every year.

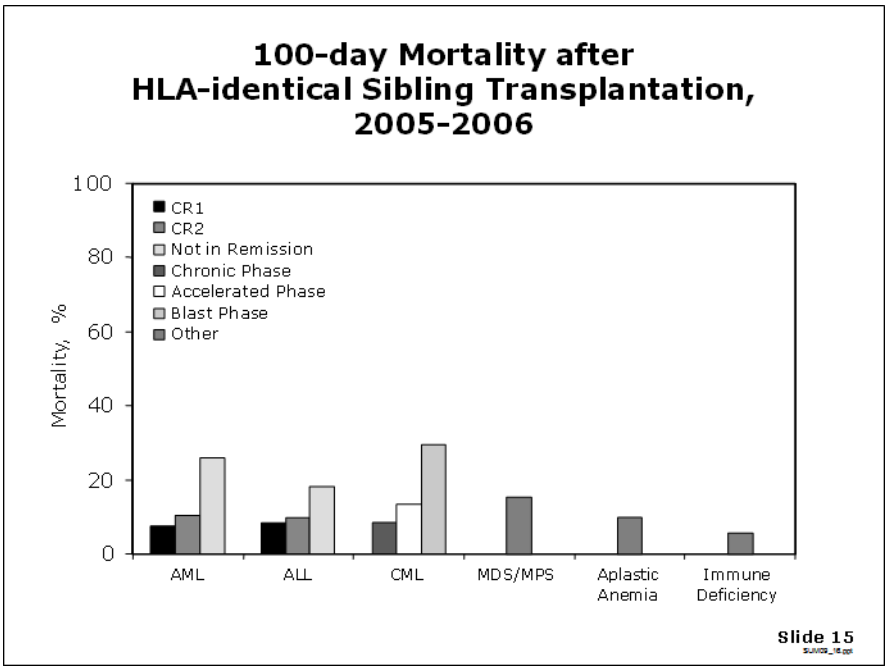


Slides 13: One-year survival rates after transplant have generally improved in the last two decades. Outcomes of unrelated donor transplants are approaching those observed with related donors. Improvements in HLA-matching techniques, with consequently better donor selection, better overall patient selection for transplantation, and improvements in supportive care are the likely explanation for this trend.



Slide 14: The 100-day mortality rate is often cited to reflect the toxicity of the transplantation process. Hundred-day mortality rates are much lower after an autologous than after an allogeneic transplant. The

primary disease and disease status at the time of transplantation also significantly affect early post-transplant mortality.



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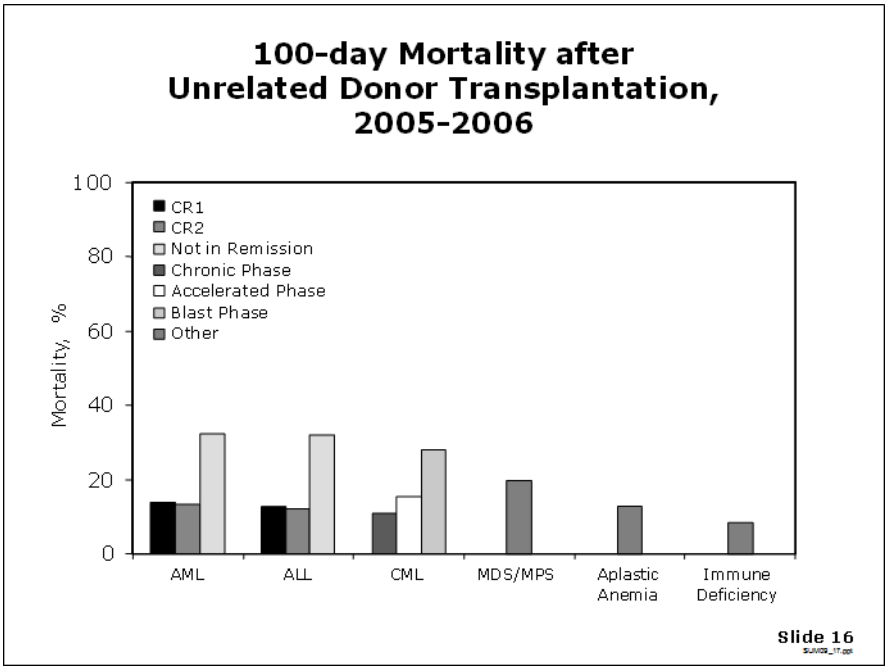

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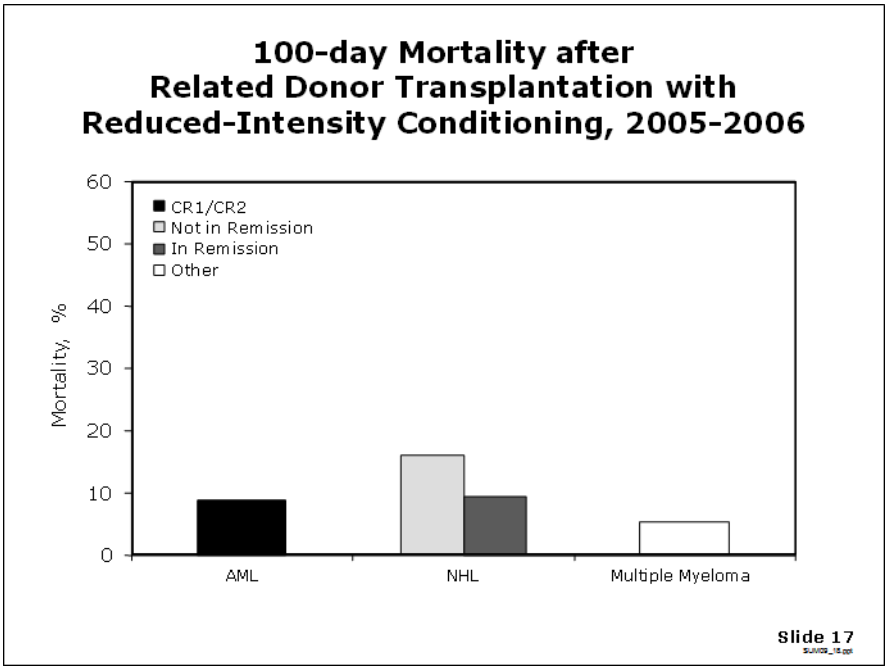
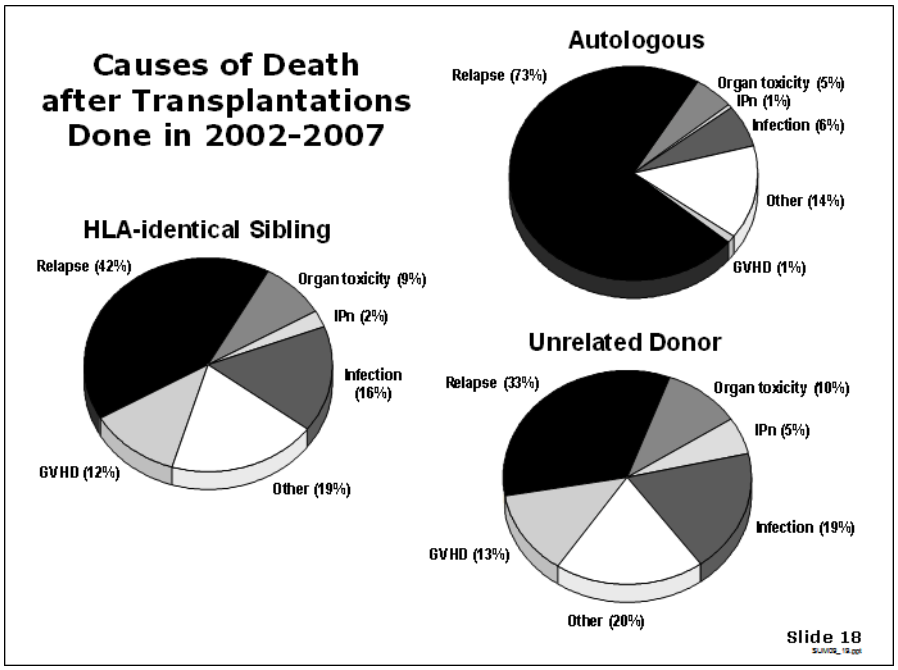
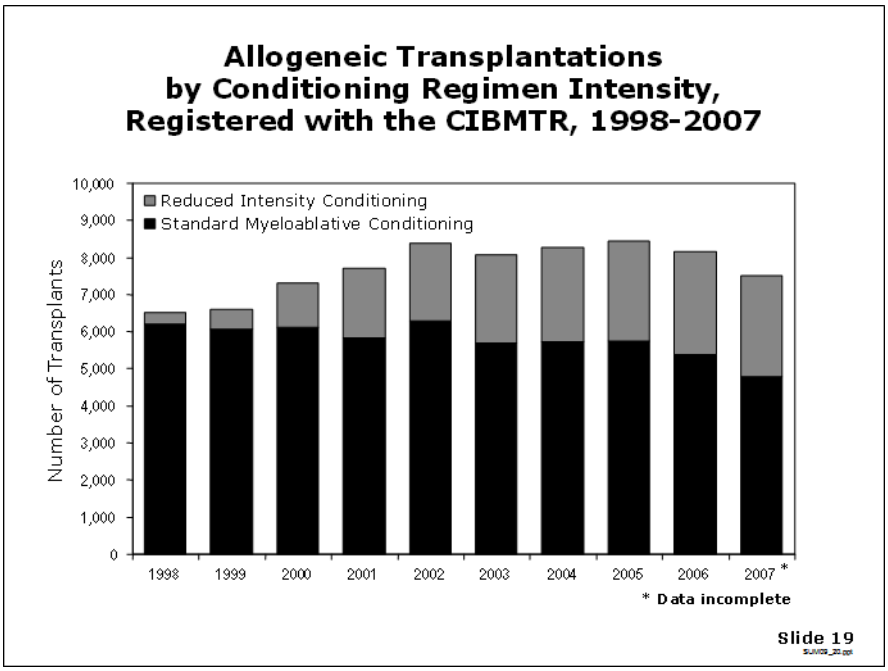


Slides 15 to 17: The effect of disease stage is more apparent for allogeneic transplants. For instance, patients receiving HLA-identical sibling transplants for acute myeloid leukemia in remission have a 100-day mortality rate of 7 to 10% compared to 26% for patients with active leukemia at time of transplantation. Early mortality after an unrelated donor transplant is higher than after an HLA-identical sibling transplant, but this also depends on the disease and disease stage. The causes of death in the first 100 days post-transplant relate mainly to the primary disease, graft-versus-host disease, infection and end-organ damage. Early mortality in patients receiving allogeneic transplants after reduced-intensity conditioning is generally lower. However, patients with active disease have 100-day mortality rates approaching those observed with more intensive conditioning because of high rates of recurrent malignancy.



Slide 18: Relapse is the single most common cause of death after all transplant types, accounting for 73% of deaths after autologous HCT. Graft-versus-host disease (GVHD), interstitial pneumonitis (IPn) and infection are the major causes of death after allogeneic HCT.



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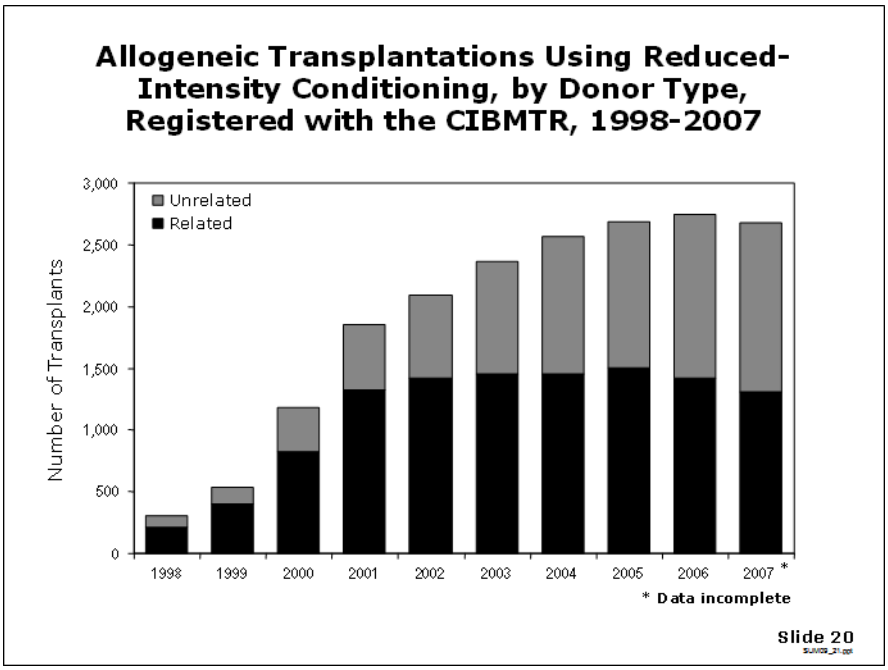

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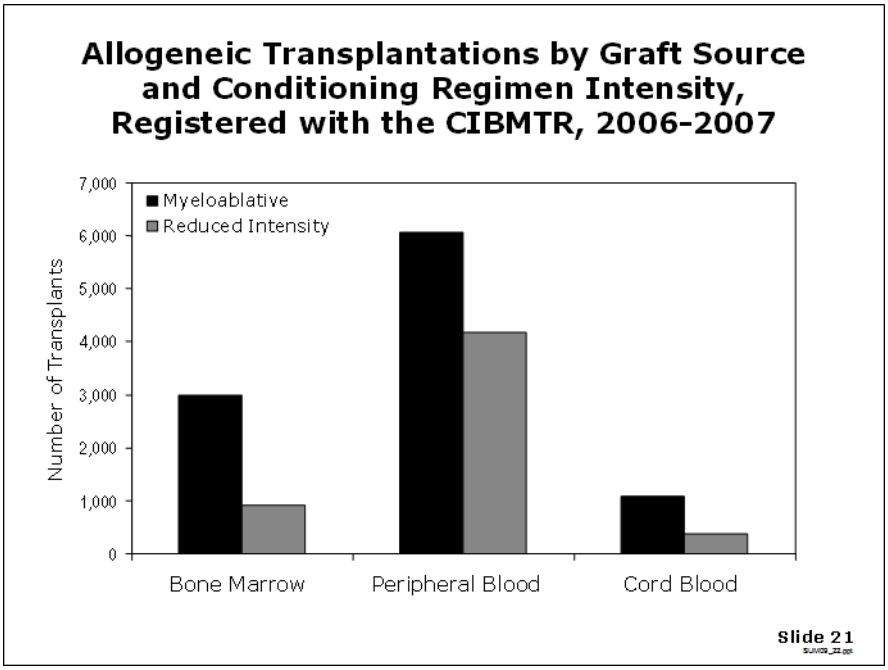

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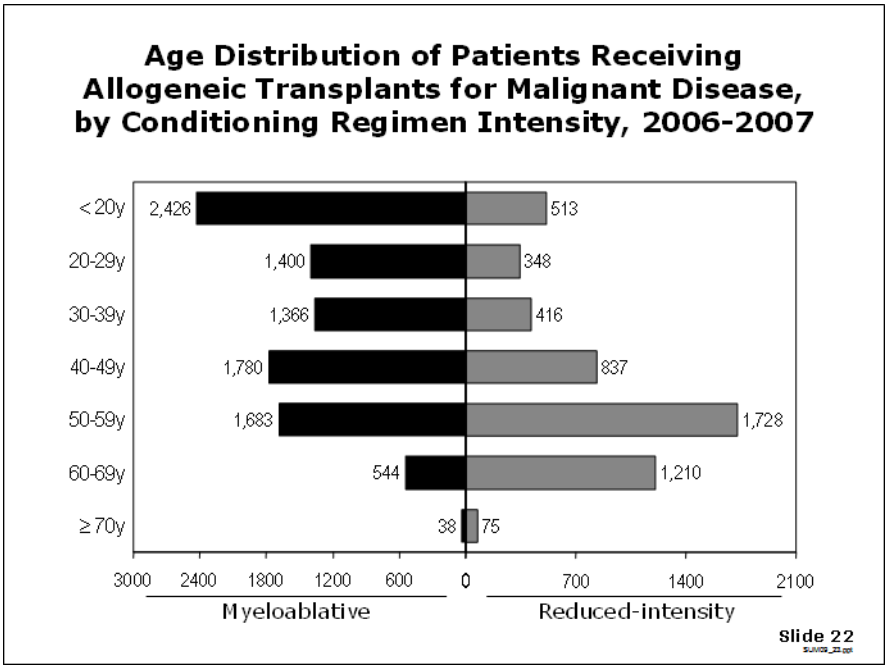
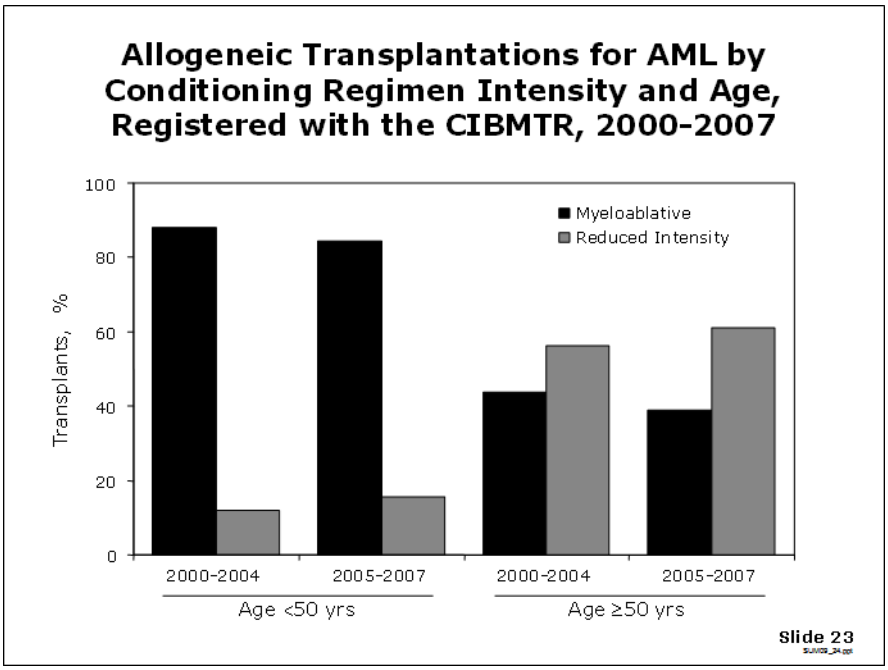
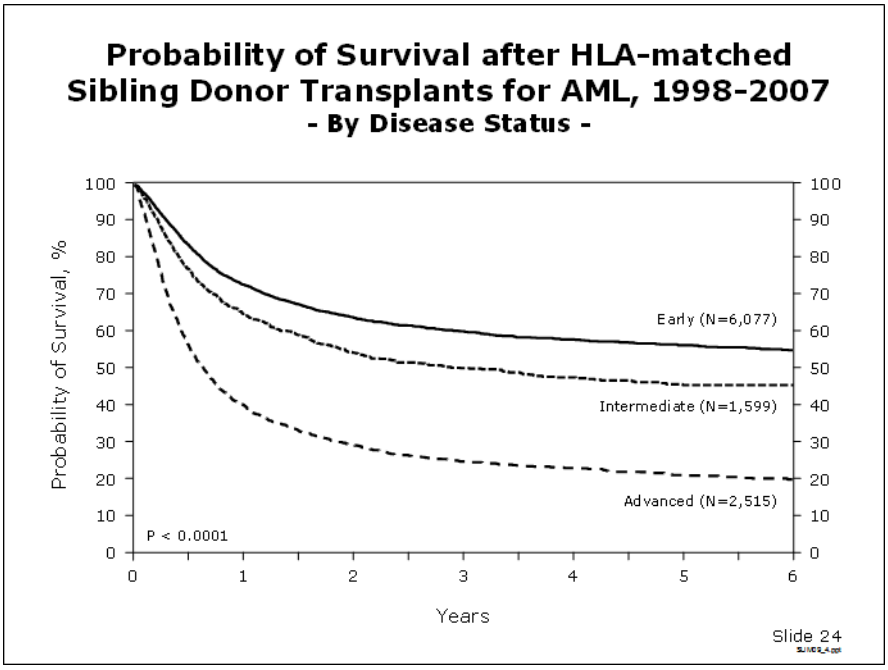


Slides 19 to 22: The numbers of allogeneic transplants performed with reduced-intensity conditioning have steadily increased since 1998, accounting for more than a third of transplants in the later periods. Unrelated donor transplants with reduced-intensity conditioning follow the same trends observed with transplants with myeloablative conditioning, with a slight majority of unrelated over sibling donor transplants. Mobilized peripheral blood is the most common graft source for transplants with reduced-intensity conditioning. The age distribution according to conditioning regimen intensity demonstrates the preferential use of conditioning regimens with lower intensity in patients older than 50 years. Sixty percent of reduced-intensity conditioning recipients are within this age group, compared to fewer than 25% of those receiving standard high-intensity regimens. Patients younger than 50 years who are ineligible to

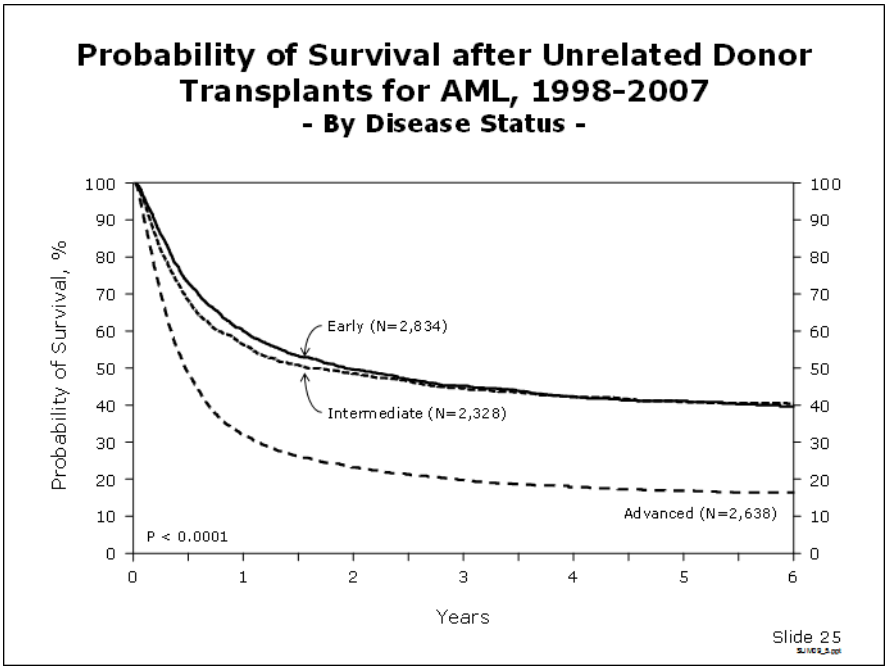
receive myeloablative conditioning because of co-morbidities may undergo an allogeneic transplant with reduced-intensity conditioning.



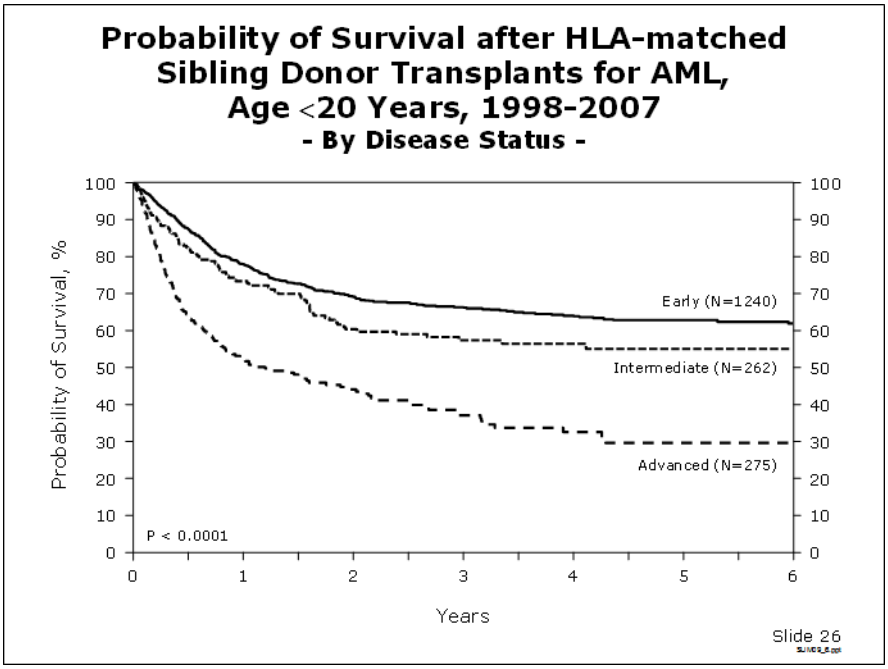
Slide 23: Acute myeloid leukemia (AML) is the most common indication for reduced-intensity conditioning allogeneic transplant, and the proportion of these transplants compared to myeloablative regimens is increasing in older patients. Fifty-three percent of patients 50 years and older received an allotransplant with reduced-intensity conditioning in 2005-2007. In younger patients, standard myeloablative intensity regimens remain the most common.



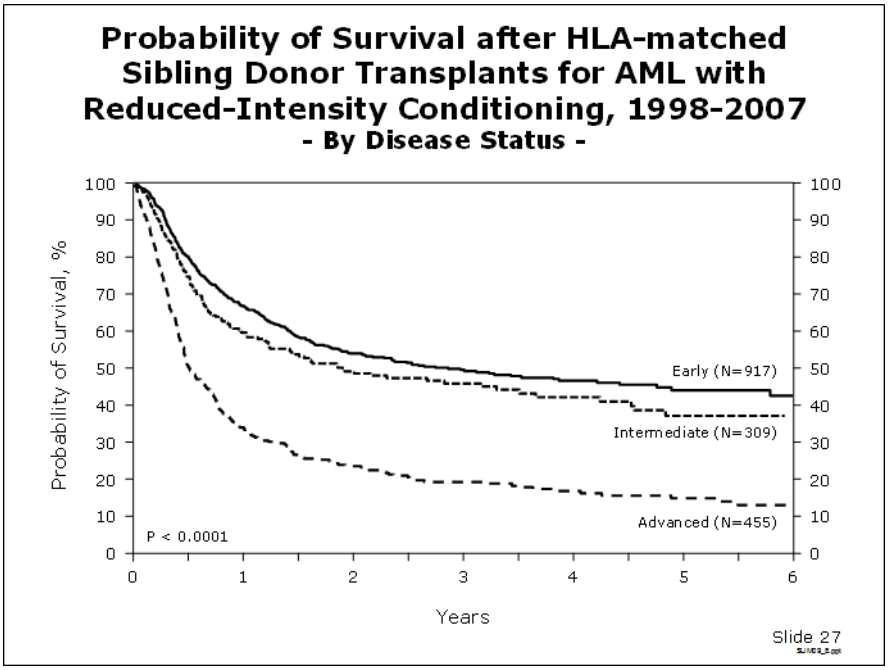
Slide 24



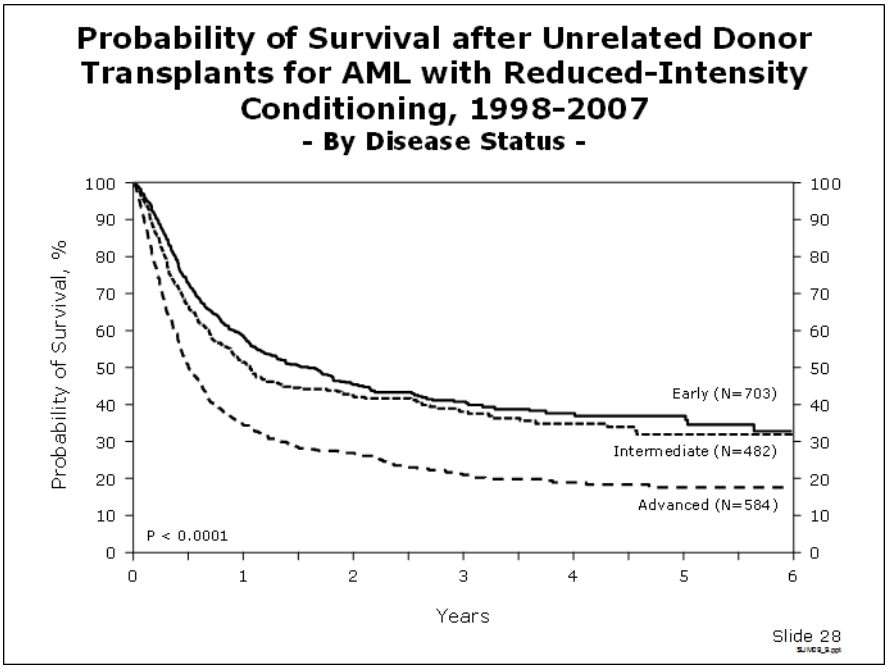
Slides 24 and 25: The CIBMTR has data for 17,991 patients receiving HLA-matched sibling (n=10,191) or unrelated donor (n=7,800) HCT for AML between 1998 and 2007. Disease status at the time of HCT and donor type are the major predictors of post-transplant survival. The 3-year probabilities of survival after HLA-matched sibling HCT in this cohort are 60% ± 1%, 50% ± 1%, and 25% ± 1% for patients with early, intermediate, and advanced disease, respectively. The probabilities of survival after unrelated donor HCT are 45% ± 1% for patients with early and intermediate disease and 20% ± 1% for patients with advanced disease.



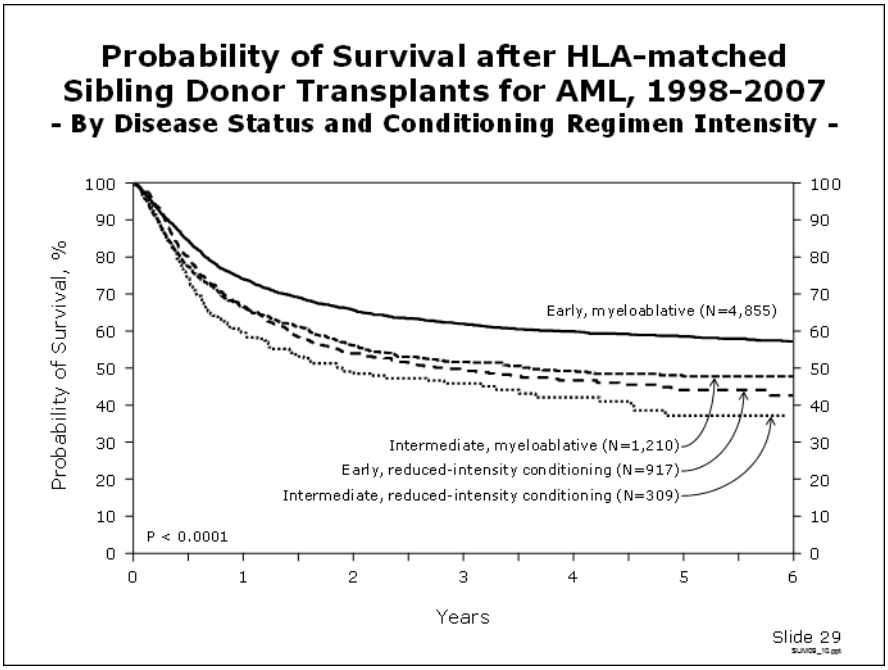
Slide 26: Among AML patients younger than 20 years, the 3-year probabilities of survival following HCT for patients with early, intermediate, and advanced disease are 66% ± 2%, 58% ± 4%, and 37% ± 3%, respectively.



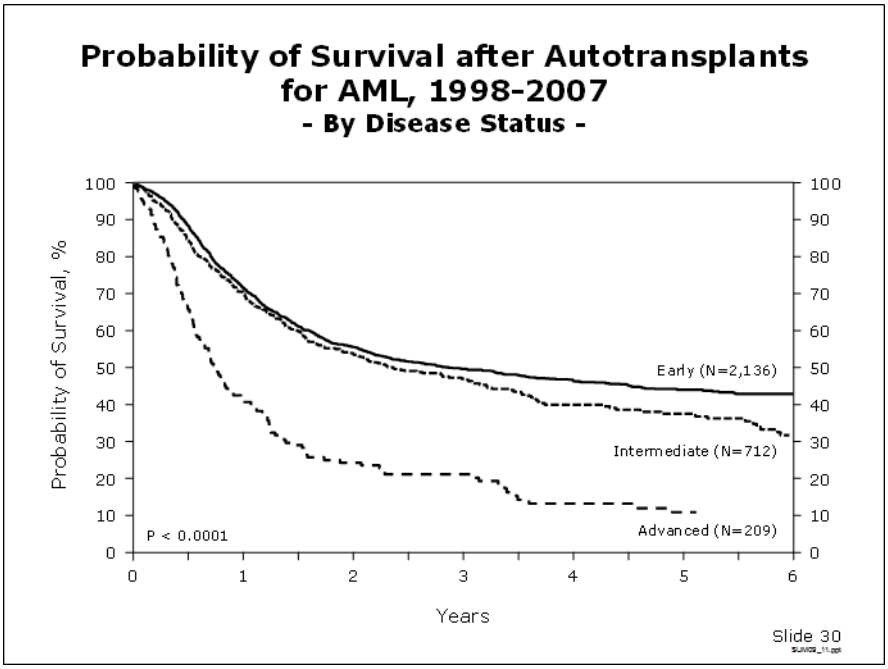
Slide 27



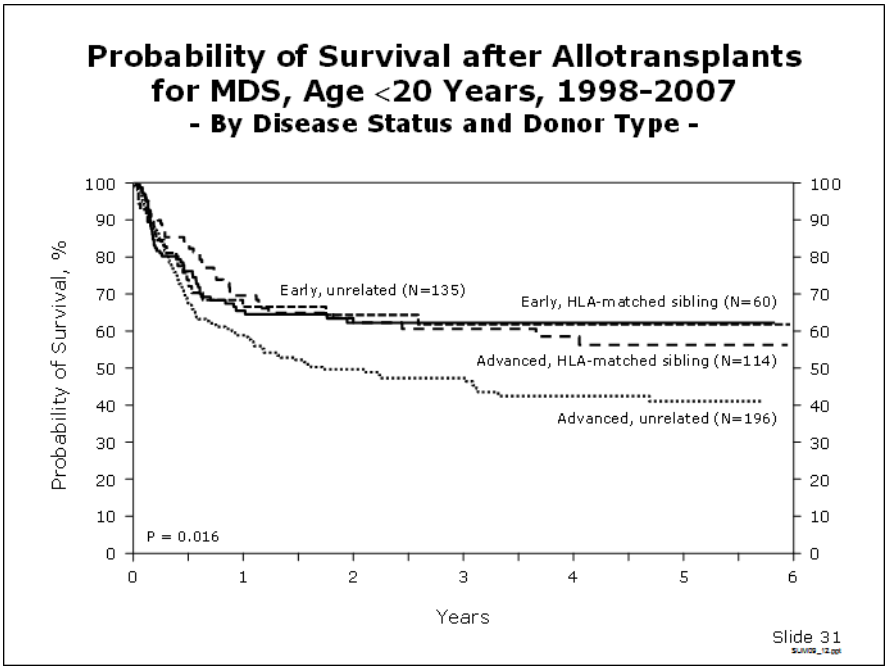
Slides 27 and 28: The 3-year probabilities of survival for the 1,681 patients with AML who received transplantation with reduced-intensity conditioning regimen from an HLA-matched sibling donor are 50% ± 2%, 46% ± 3%, and 19% ± 2% for patients with early, intermediate, and advanced disease, respectively. The probabilities of survival for the 1,769 recipients of unrelated donor allogeneic transplants are 41% ± 2%, 38% ± 3% and 21% ± 2% for patients with early, intermediate and advanced disease.



Slide 29: Reduced-intensity conditioning regimens are frequently used in patients older than 50 years of age or with comorbidities at time of transplant. Among AML patients who received an HLA-matched sibling HCT, the 3-year probabilities of survival for patients with early and intermediate disease who received a reduced-intensity conditioning regimen were 50% ± 2% and 46% ± 3%, respectively. Among patients who received a myeloablative conditioning regimen, the probability of survival was 62% ± 1% in patients transplanted in CR1 and 52% ± 2% for those transplanted in subsequent remission. Differences in age and other comorbidities were not adjusted in the groups analyzed in this slide.



Slide 30: The CIBMTR has data for 3,057 autotransplants performed for AML between 1998 and 2007. The 3-year probabilities of survival for patients with early, intermediate and advanced AML were 50% ± 1%, 47% ± 2% and 21% ± 3%, respectively.



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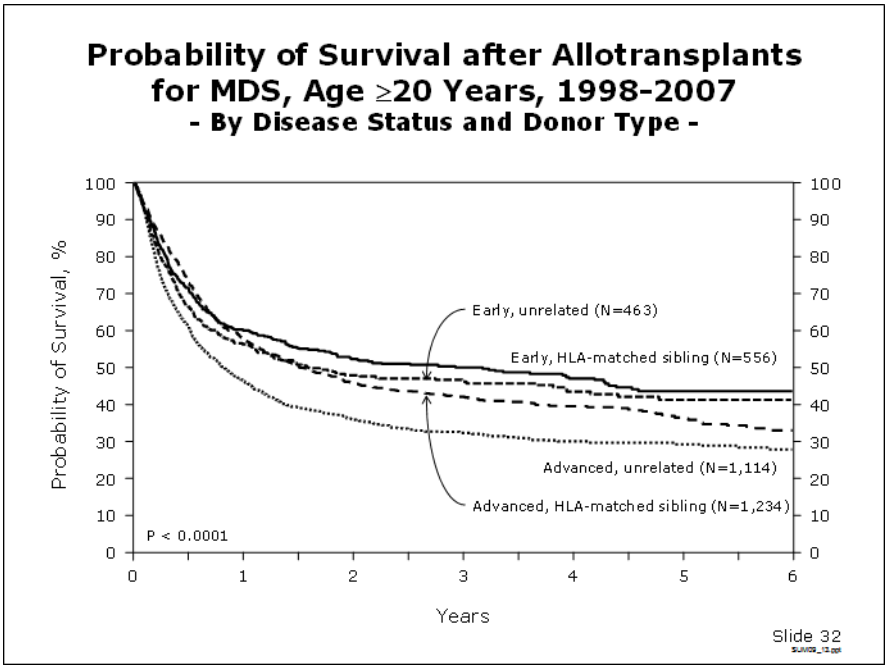
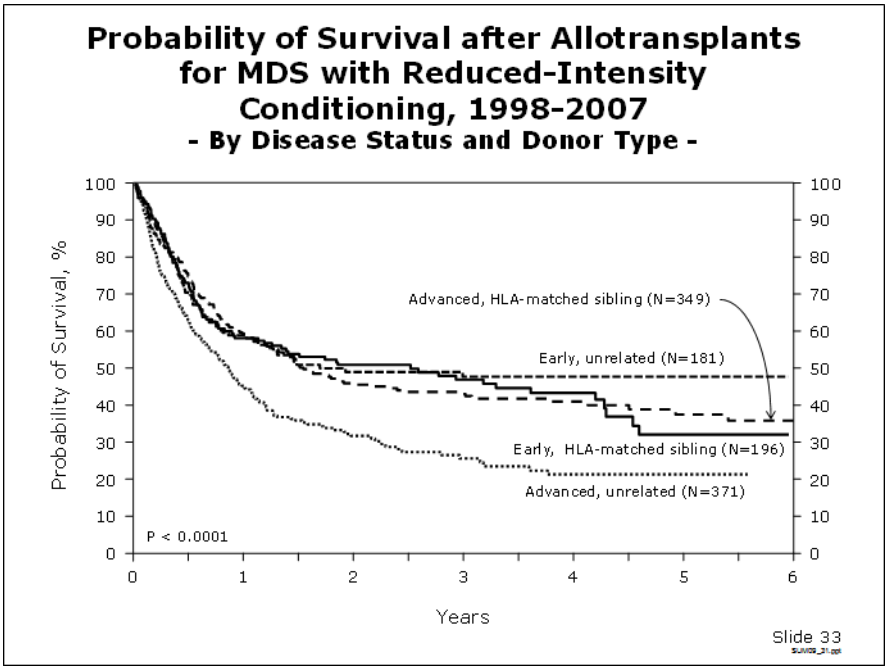
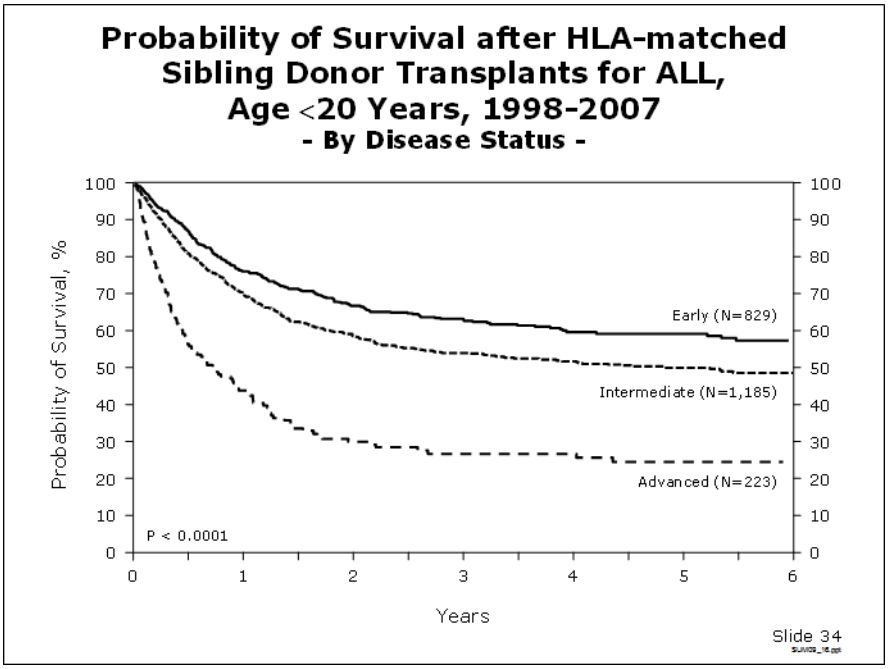


Slides 31 and 32: Allogeneic HCT is a potentially curative treatment for MDS. Outcomes differ according to the recipient's age, donor type, and disease status at transplant. Among 174 recipients of HLA-matched allogeneic HCT younger than 20 years of age, the 3-year probabilities of survival were 62% ± 6% and 61% ± 5% for patients with early and advanced disease, respectively. The corresponding probabilities of survival in the 331 recipients receiving an unrelated donor HCT were 62% ± 4% and 47% ± 4%. Among the 1,790 patients ≥20 years receiving HLA-matched sibling HCT, the 3-year probabilities of survival were 50% ± 2% and 42% ± 2% for early and advanced MDS, respectively. The corresponding probabilities in the 1,577 older patients receiving unrelated donor HCT were 46% ± 3% and 32% ± 2%.



Slide 33: The median age of patients with MDS at diagnosis is 70 years, limiting the use of myeloablative conditioning regimens for most patients with this disease. Reduced-intensity conditioning regimens are increasingly used for allogeneic transplantation in MDS. Among 1,097 patients who underwent reduced-intensity conditioning allogeneic transplantation for MDS from 2998 to 2007, the 3-year survival probabilities for recipients of HLA-matched donor grafts (N=455) were 47% ± 4% and 43% ± 3% HCT for early and advanced MDS, respectively. Corresponding probabilities for recipients of unrelated donor transplants (N=552) were 48% ± 4% and 26% ± 3%.



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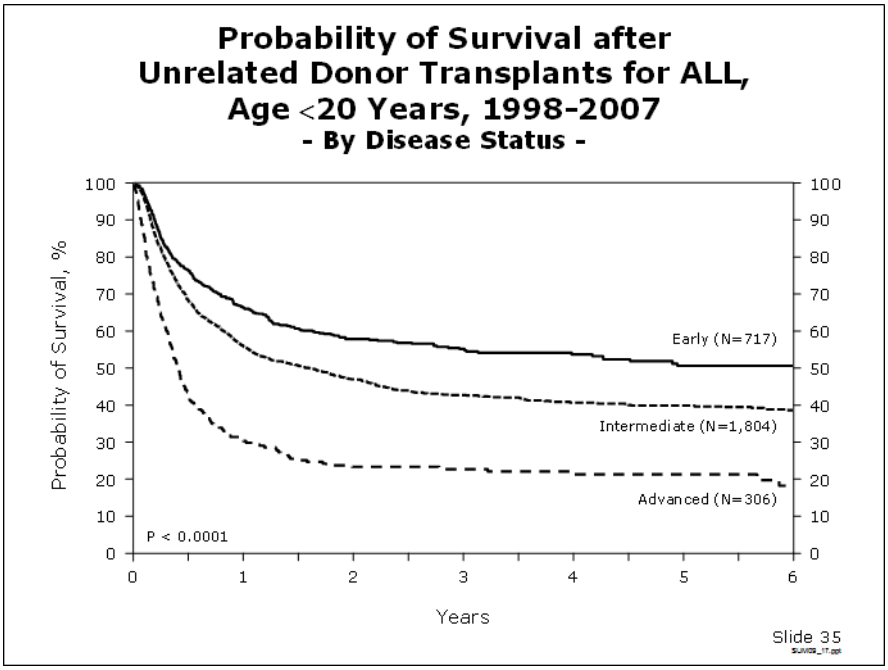
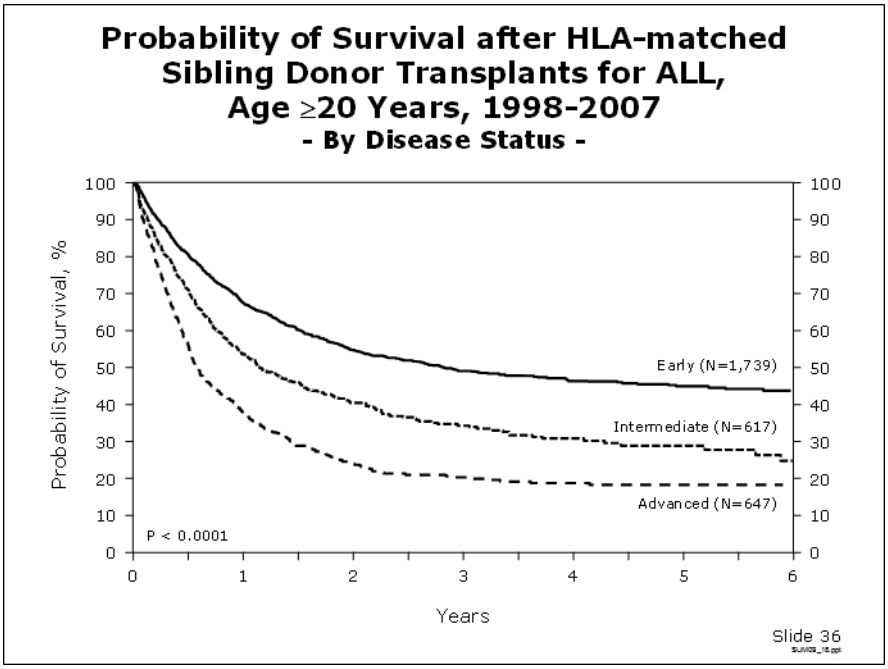


Slides 34 and 35: Among young patients with ALL, for whom chemotherapy has a high success rate, allogeneic transplantation is generally reserved for patients with high-risk disease (i.e. high leukocyte count at diagnosis and presence of poor-risk cytogenetic markers), who fail to achieve remission, or who relapse after chemotherapy. Among the 2,237 patients younger than 20 years of age receiving HLA-matched sibling HCT, the 3-year probabilities of survival were 63% ± 2%, 54% ± 2 %, and 27% ± 4% for patients with early, intermediate, and advanced disease, respectively. The corresponding probabilities of survival among the 2,827 recipients of unrelated donor HCT were 55% ± 2%, 43% ± 1%, and 23% ± 3%.



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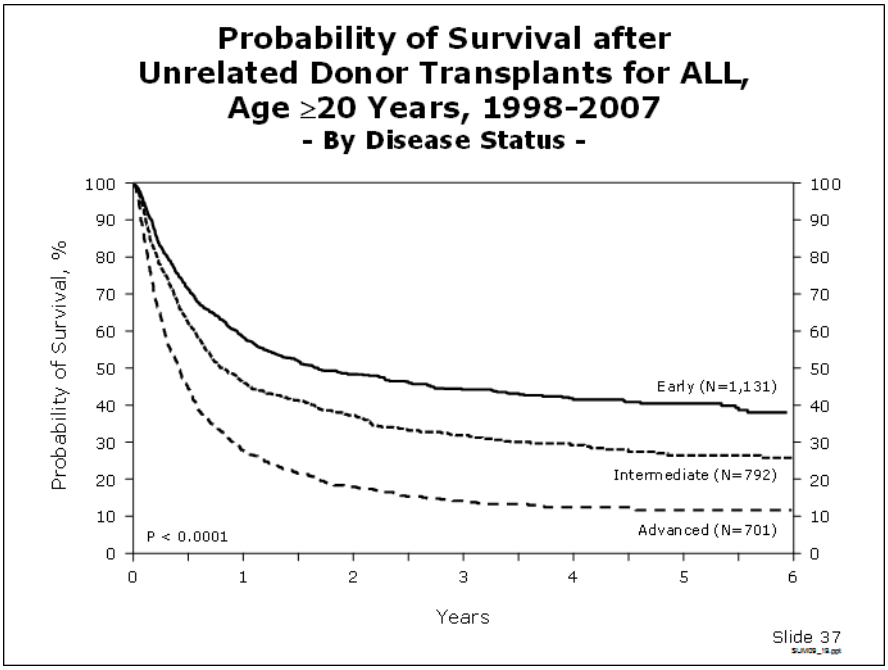
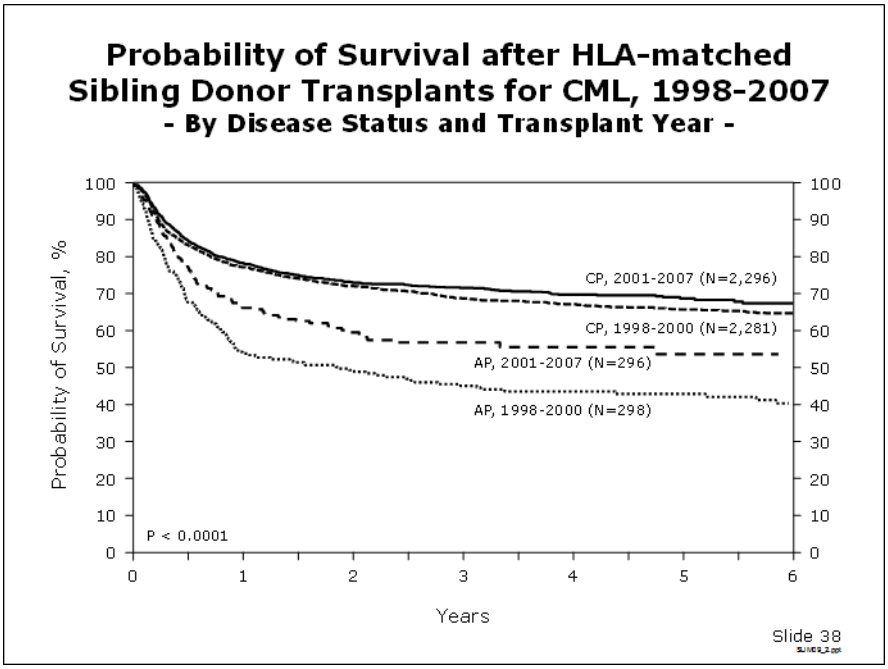
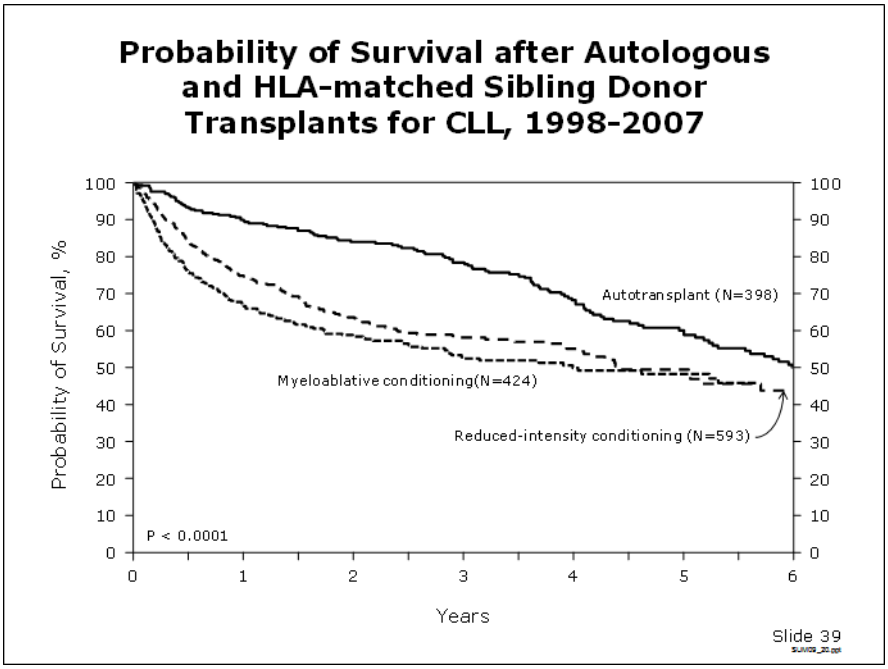


Slides 36 and 37: Older age at disease onset is a high-risk feature in ALL. Consequently, a larger proportion of ALL patients 20 years of age or older undergo allogeneic HCT for early disease. Among 3,003 patients ≥20 years of age receiving HLA-matched sibling HCT, the 3-year survival probabilities were 49% ± 1%, 34% ± 2%, and 20% ± 2% for patients with early, intermediate, and advanced disease, respectively. Corresponding probabilities among the 2,624 recipients of unrelated donor HCT were 44% ± 2%, 32% ± 2%, and 14% ± 2%.

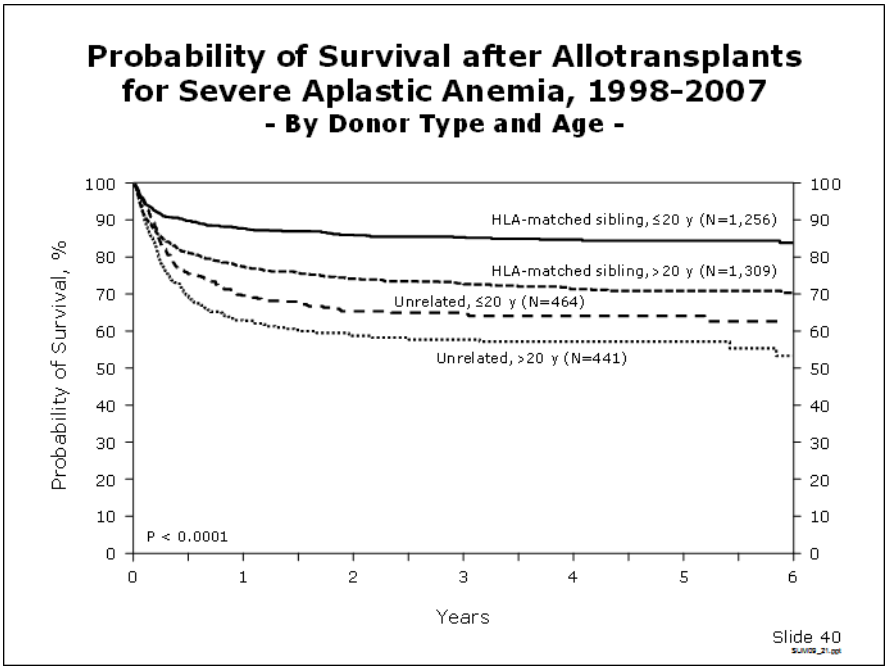


Slide 38: Annual numbers of patients undergoing allogeneic transplantation for the most common disease indications have changed over the past decade. While allogeneic transplantation for AML and ALL have steadily increased, allogeneic transplantation for CML has decreased. Tyrosine kinase inhibitors are currently the first treatment option for patients with newly-diagnosed CML and allogeneic

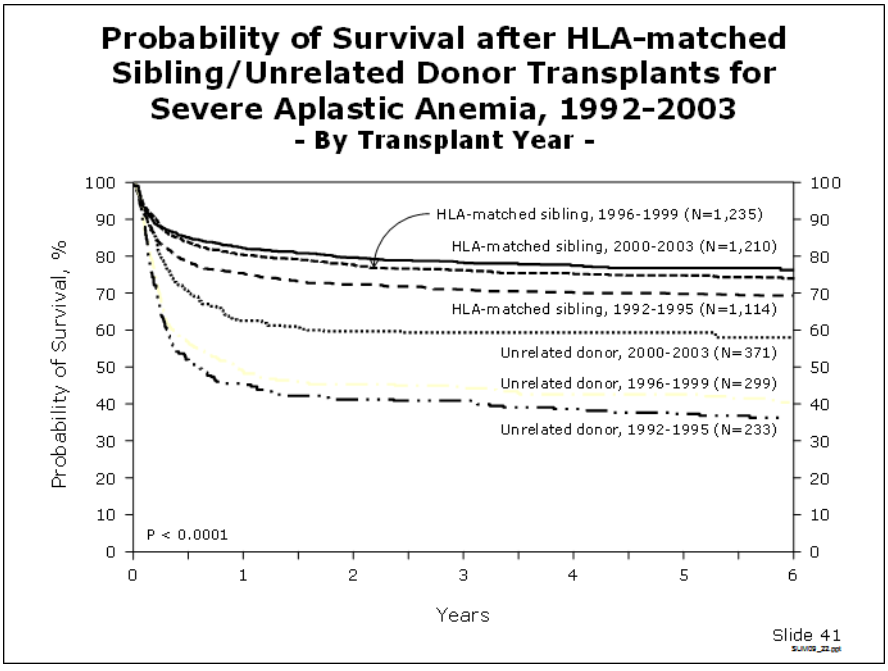
transplantation is reserved for patients who fail such therapy. The CIBMTR has data for 5,171 HLA-matched sibling donor allogeneic transplants for CML patients in CP (n=2,440) and in AP (n=2,731) between 1998 and 2007. Among patients in CP, the 3-year probability of survival were 69% ± 1% and 72% ± 1% for transplants in performed in the periods 1998 to 2000 and 2001 to 2007, respectively. Corresponding 3-year survival probabilities for patients in AP were 45% ± 3% and 57% ± 3%.



Slide 39: Both autologous and allogeneic HCT are treatment options for CLL patients who fail standard chemotherapy or have high-risk features (e.g. cytogenetic abnormalities). The use of reduced-intensity conditioning regimens for allogeneic HCT continues to increase in this population. Among the 1,415 patients who underwent HCT for CLL, the 3-year probabilities of survival were 78% ± 2% after autologous transplants, 53% ± 3% after HLA-matched sibling HCT with a myeloablative conditioning regimen, and 58% ± 3% after HLA-matched sibling HCT with a reduced-intensity conditioning regimen.

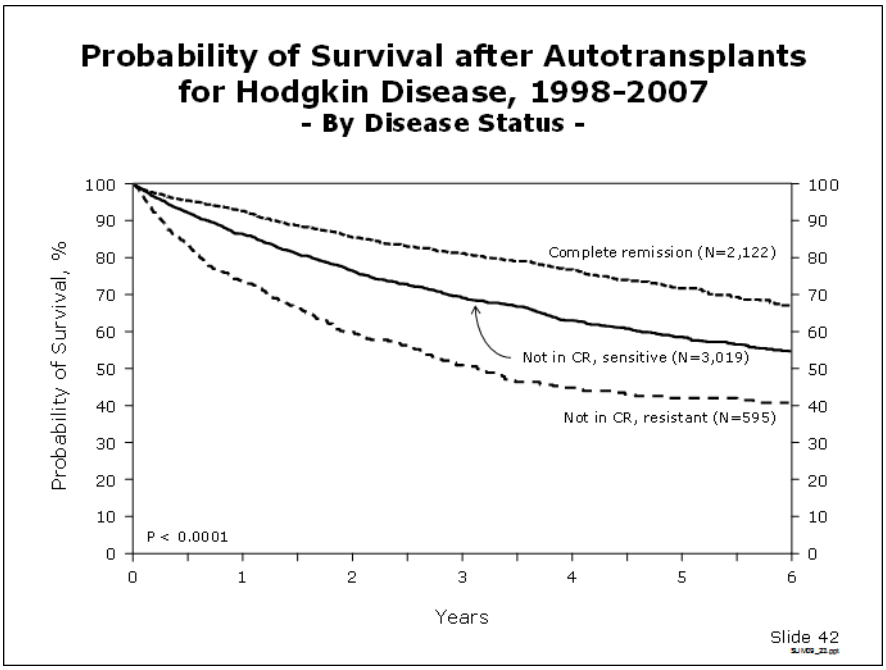


Slide 40: Allogeneic HCT is the treatment of choice for young patients with severe aplastic anemia and an HLA-matched sibling donor available. Among the 2,565 patients receiving HLA-matched HCT for severe aplastic anemia between 1998 and 2007, the 3-year probabilities of survival were 86% ±1% for those younger than 20 years and 73% ± 1% for those 20 years of age or older. Among the 905 recipients of unrelated donor HCT, the corresponding probabilities of survival were 65% ± 2% and 58% ± 3%.

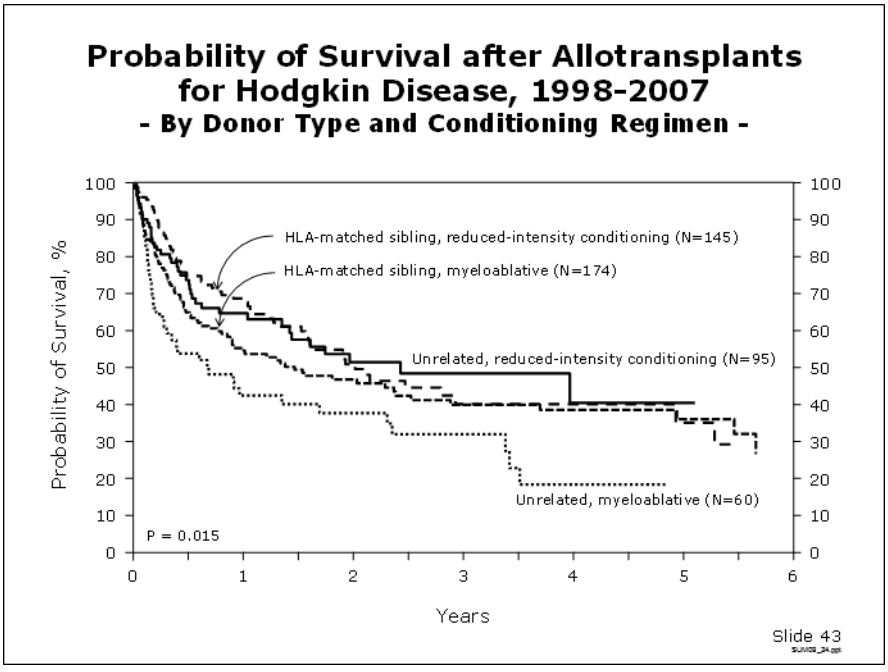


Slide 41: Survival probabilities for recipients of allogeneic HCT for SAA improved between 1992 and 2003. Among recipients of HLA-matched sibling donor grafts, the 3-year survival probabilities were 71% ± 1%, 76% ± 1%, and 79% ± 1% in transplants performed in the periods from 1992 to 1995, 1996 to 1999, and 2000 to 2003, respectively. Corresponding probabilities for recipients of unrelated donor transplants

were 41% ± 3%, 45% ± 3%, and 60% ± 3%. Better patient and donor selections, and improvements in supportive care contributed to improvements in survival outcomes in this population.

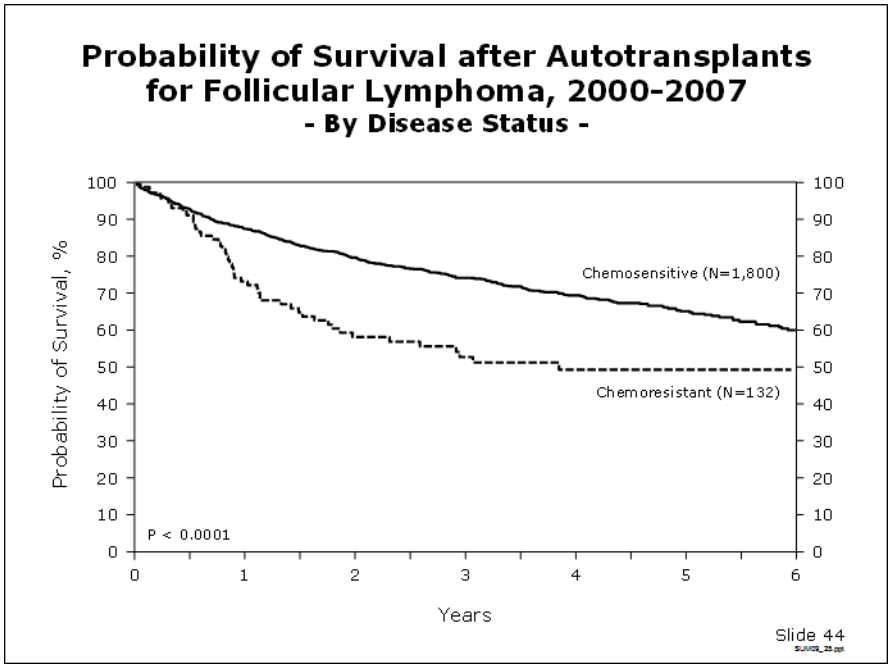


Slide 42: Transplantation for Hodgkin Disease (HD) is indicated in patients who have failed initial chemotherapy or radiation therapy. Survival after HCT for HD depends on disease response to previous salvage therapy. Among the 5,736 patients receiving autologous transplants for HD between 1998 and 2007, the 3-year probabilities of survival were 81% ± 1%, 69% ± 1%, and 51% ± 2% for patients in complete remission, in partial remission, and with chemoresistant disease, respectively.

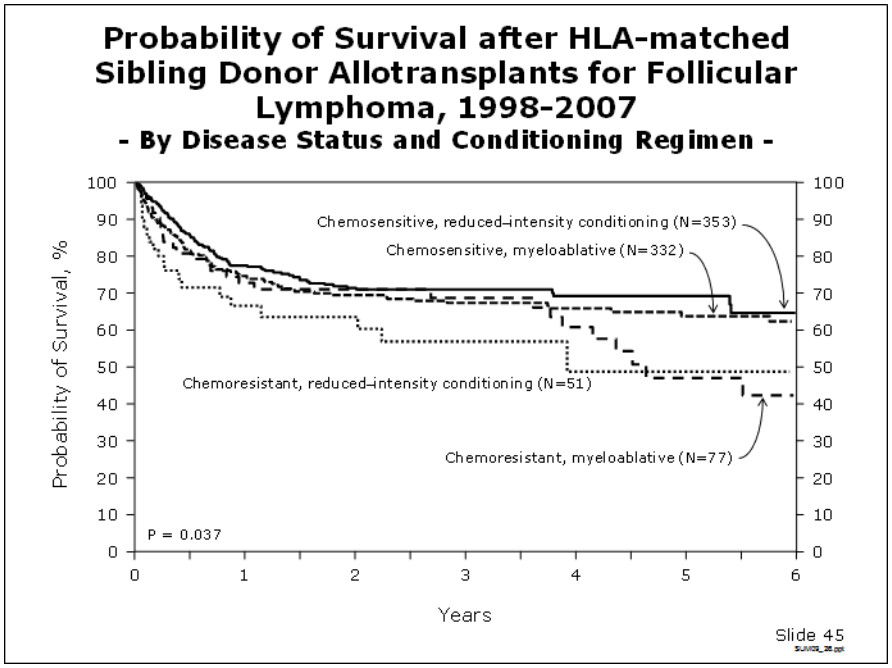


Slide 43: Allogeneic HCT for HD is generally performed in patients who experience disease relapse after receiving multiple lines of therapy or who have refractory disease and an available HLA-matched donor.

The use of reduced-intensity conditioning regimens in these heavily pretreated patients allows for a graft-versus-lymphoma effect with less regimen-related toxicity. Among 297 patients receiving HLA-matched HCT for HD between 1998 and 2006, the 3-year probabilities of survival were 39% ± 5% with myeloablative conditioning regimens and 38% ± 5% with reduced-intensity conditioning regimens. The corresponding probabilities of survival in the 138 recipients of unrelated donor HCT were 35% ± 7% and 46% ± 8%.

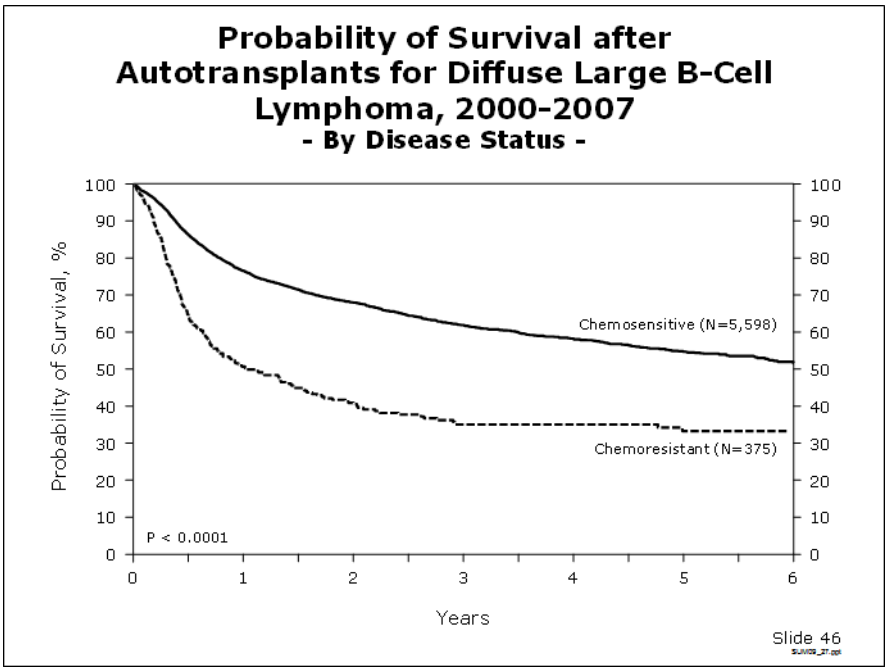


Slide 44

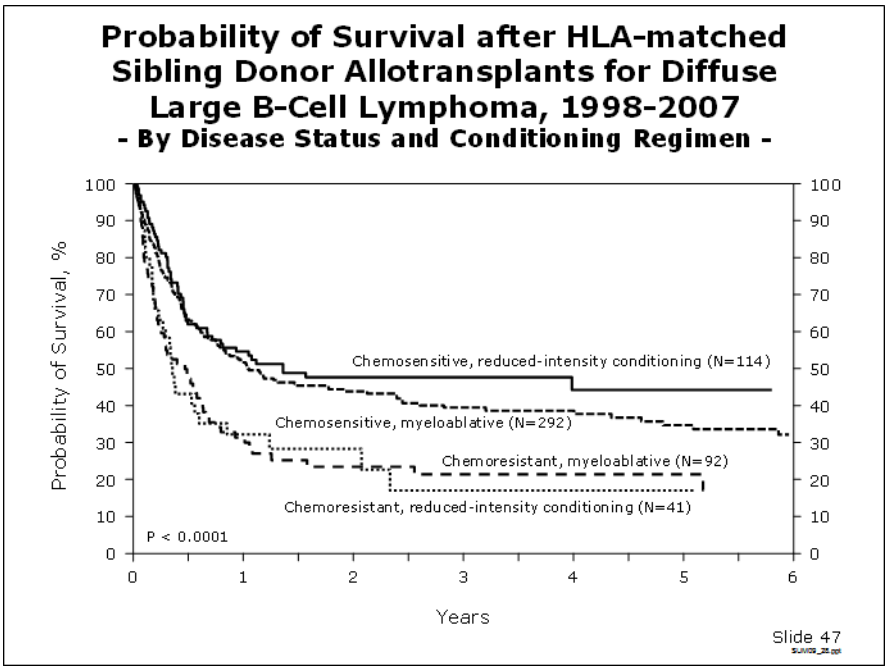


Slides 44 and 45: Transplantation for follicular lymphoma is generally reserved for patients with recurrent or aggressive disease. Autologous transplantation is the most common transplant approach in this

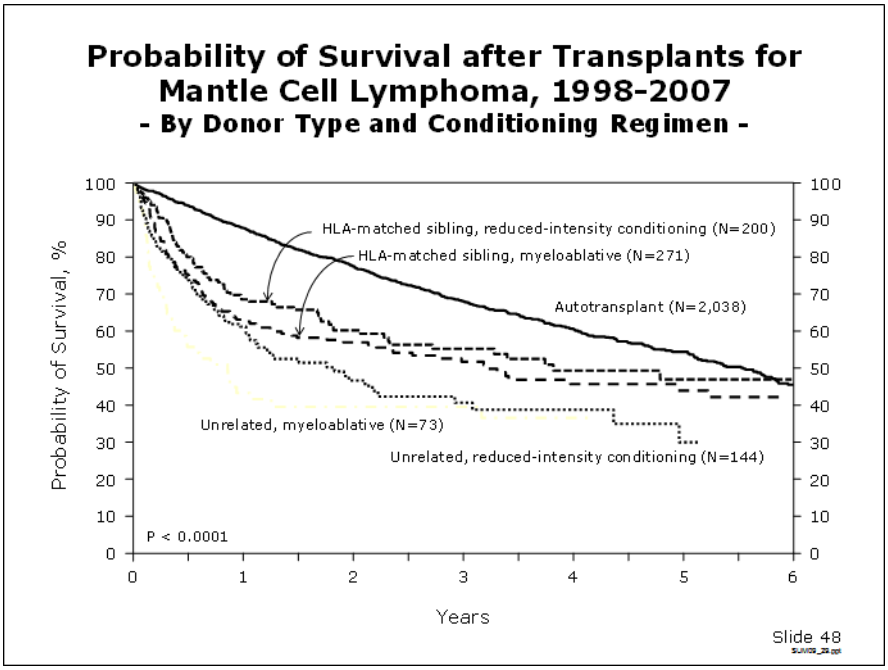
disease. Among the 1,932 patients receiving an autologous transplant for follicular lymphoma between 2000 and 2007, most had chemosensitive disease. The 3-year probabilities of survival were 75% ± 1% and 53% ± 5% for patients with chemosensitive and chemoresistant disease, respectively. Similar to CLL and HD, the use of reduced-intensity conditioning regimens is increasing for patients with follicular lymphoma. Among 813 patients with follicular lymphoma undergoing HLA-matched sibling donor allogeneic HCT between 1998 and 2007, the 3-year probabilities of survival for patients with chemosensitive disease (N=685) were 68% ± 3% and 71% ± 3% for those receiving myeloablative and reduced intensive conditioning regimens, respectively. Corresponding probabilities in the 128 patients with chemoresistant follicular lymphoma were 69% ± 6% and 57% ± 8%.



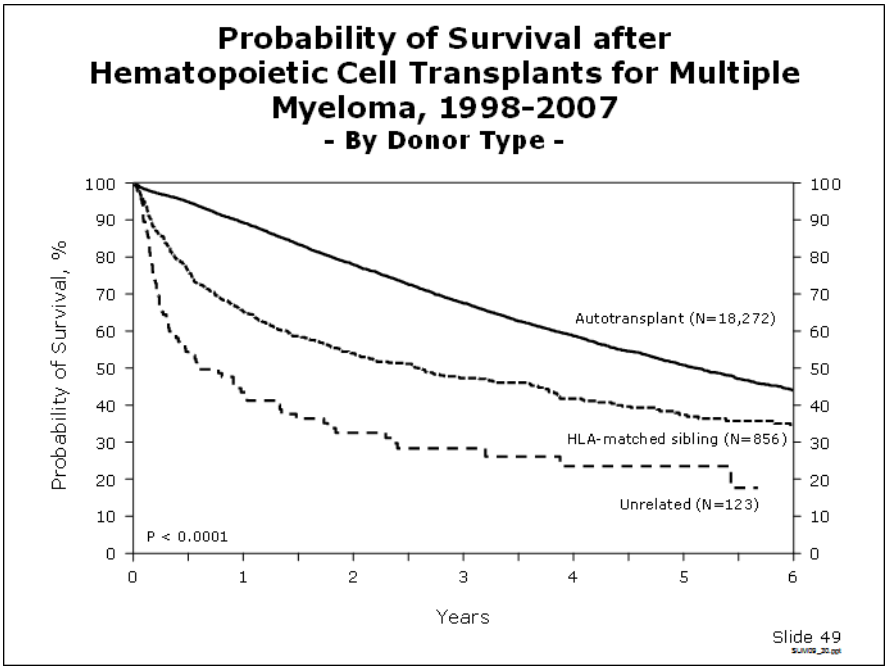
Slide 46



Slides 46 and 47: Autologous transplants are an accepted treatment indication for diffuse large B-cell lymphoma and, similar to follicular lymphoma, most autologous transplants are performed in patients with chemosensitive disease. Among the 5,973 patients who received an autologous transplant for diffuse large B-cell lymphoma between 2000 and 2007, the 3-year probabilities of survival were 62% ± 1% and 35% ± 3% for patients with chemosensitive and chemoresistant disease, respectively. Allogeneic HCT for treatment of diffuse large B-cell lymphoma is performed less frequently than for follicular lymphoma and is generally used only in patients with aggressive disease that has been resistant to previous therapies, including autologous transplants. Among the 539 patients who underwent an HLA-matched sibling HCT for diffuse large B cell lymphoma from 1998 to 2007, the 3-year probabilities of survival for patients with chemosensitive disease (N=406) were 39% ± 3% and 48% ± 5% for patients receiving myeloablative and reduced-intensity conditioning regimens, respectively. The corresponding probabilities in the 133 patients with chemoresistant diffuse large B-cell lymphoma were 21% ± 5% and 17% ± 8%.



Slide 48: The optimal timing of HCT for mantle cell lymphoma is not yet well defined. As with other mature B cell lymphoproliferative disorders, autologous transplantation is the most common transplant approach. Among the 2,038 patients who received an autotransplant for mantle cell lymphoma between 1998 and 2007, the 3-year probability of survival was 68% ± 1%. Among 688 patients who underwent an allogeneic transplantation for mantle cell lymphoma during the same period, the 3-year probabilities of survival for HLA-matched sibling donor transplants (N=471) were 52% ± 4% and 55% ± 4% for patients receiving myeloablative and reduced-intensity conditioning regimens, respectively. Corresponding probabilities for unrelated donor transplantation (N=217) were 40% ± 6% and 41% ± 5%.



Slide 49: Multiple myeloma is the most common indication for autologous HCT. Among 18,161 patients who received a single autotransplant for multiple myeloma between 1998 and 2007, the 3-year probability of survival was 68% ± 1%. Allogeneic transplantation for multiple myeloma is reserved for patients with high risk disease, and the majority of them are performed after an autologous HCT with reduced-intensity or nonmyeloablative conditioning regimens. Among the 979 patients who received an allogeneic HCT from 1998 to 2007, the 3-year probabilities of survival was 47% ± 2% for the 851 recipients of HLA-matched sibling donor grafts and 28% ± 5% for the 120 recipients of unrelated donor grafts.