BLOOD CANCER
Connect & Learn

The Future of Blood Cancer Care

Breakthroughs in treatment and patient-centered care – Dr. Berg
The intersection of medical innovation, mental health, and quality of life – Dr. Mayo

Our Experts

Dr. Tobias Berg

Dr. Tobias Berg is an Associate Professor, Department of Oncology at McMaster University, and a Hematologist at Hamilton Health Sciences, in Hamilton, Ontario.

Our Experts

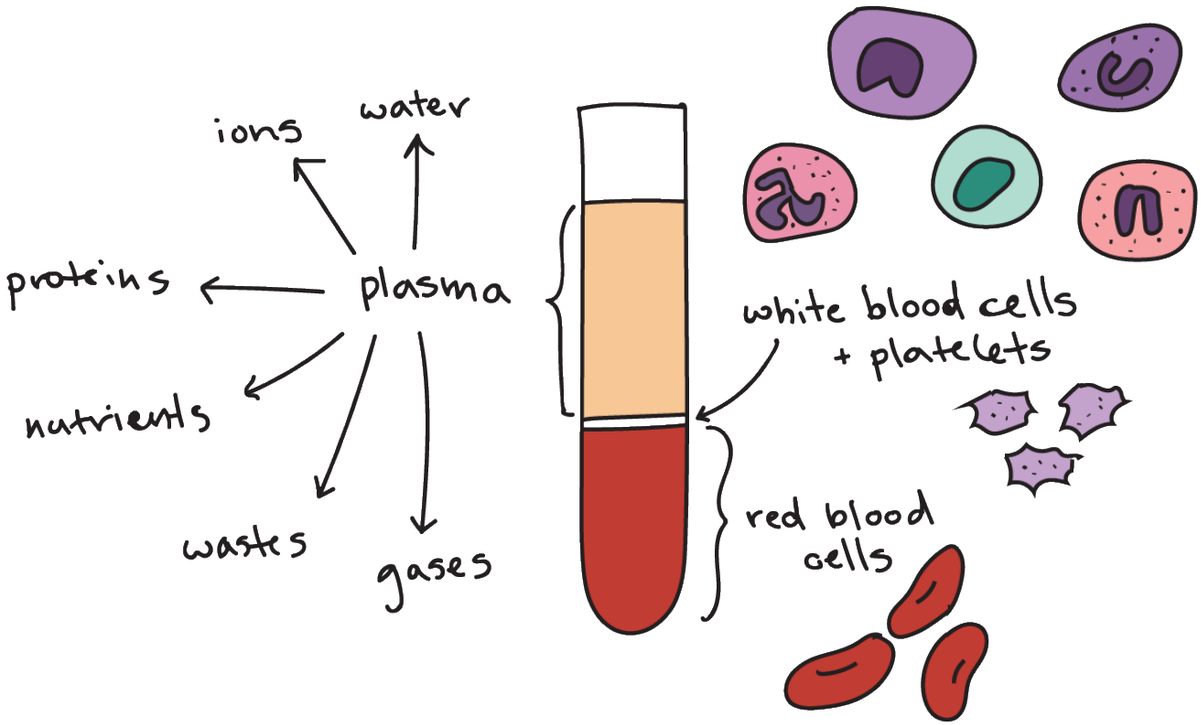
Dr. Samantha Mayo

Professor Samantha Mayo RN, PhD, FAAN is an Associate Professor in the Lawrence Bloomberg Faculty of Nursing, University of Toronto. She also holds the RBC Chair in Nursing Oncology, Research & Education at the Princess Margaret Cancer Centre, where she co-leads the Oncology Nursing Research Centre of Excellence.

Breakthroughs in treatment and patient-centered care

LEUKEMIA & LYMPHOMA SOCIETY OF CANADA®

What is our blood?



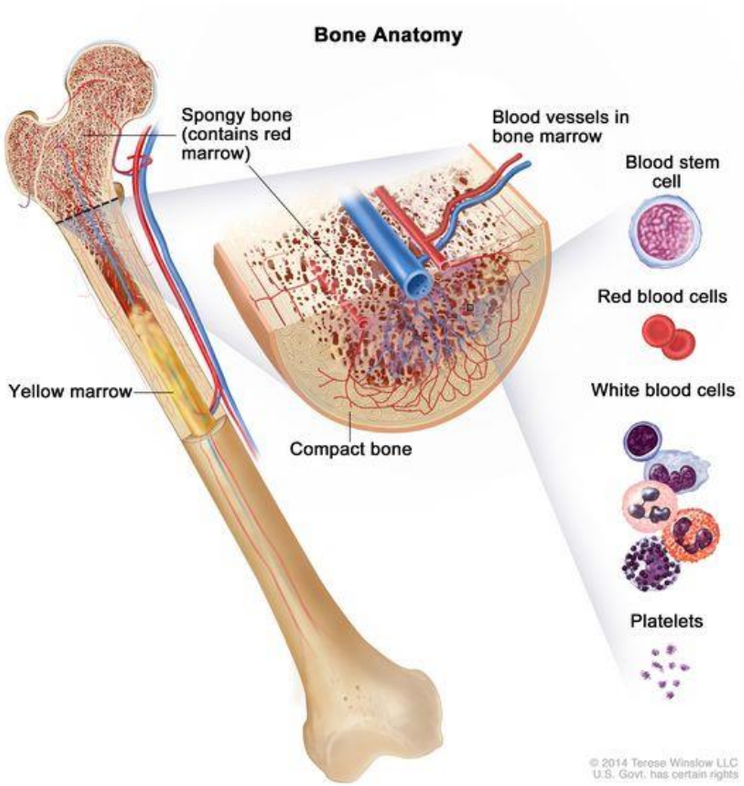
Immune System

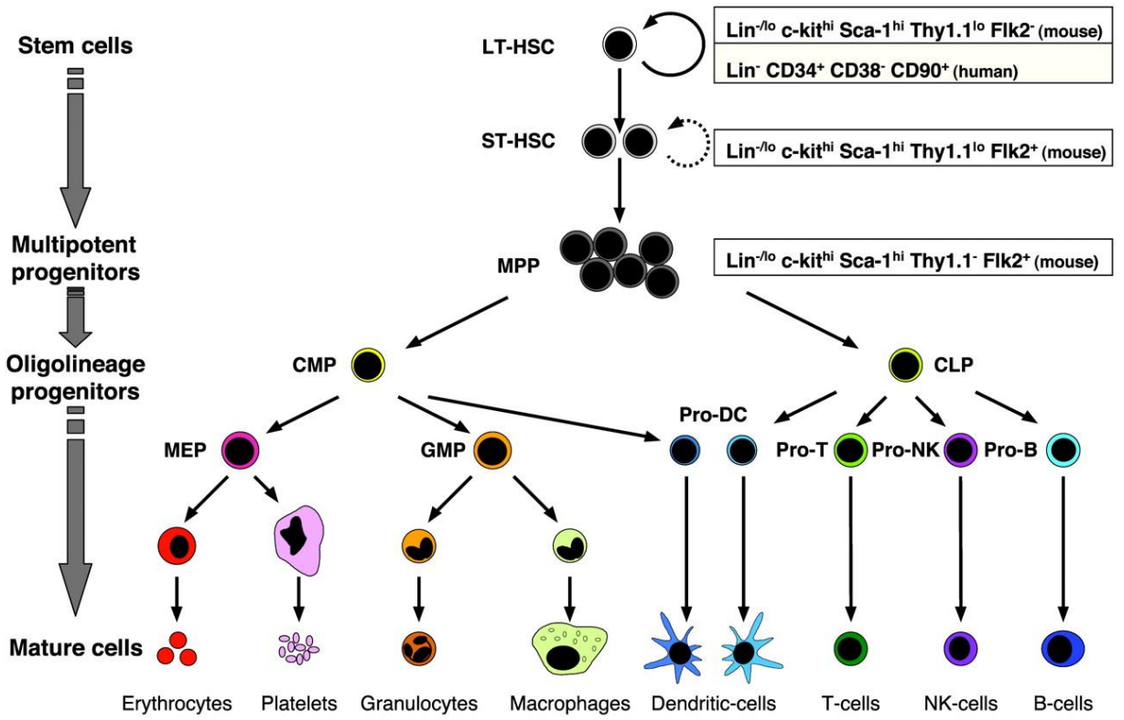
Coagulation

Oxygen transport

LEUKEMIA & LYMPHOMA SOCIETY OF CANADA

Cellular components of the blood are formed in the bone marrow



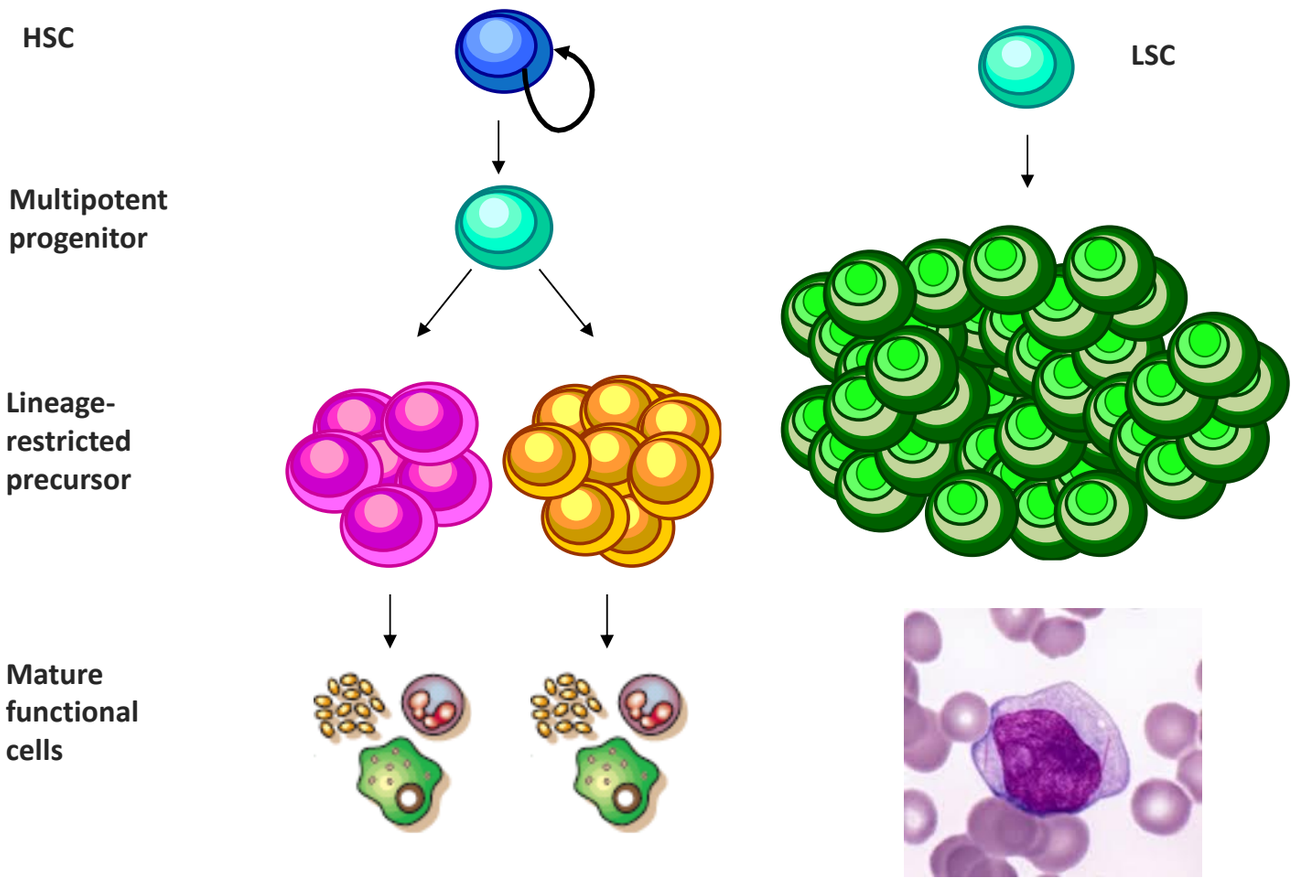


Passegué E. et.al. PNAS 2003;100:11842-11849

200,000,000,000 **red cells per day**
10,000,000,000 **white cells per day**
400,000,000,000 **platelets per day**

LEUKEMIA & LYMPHOMA SOCIETY OF CANADA

Acute Myeloid Leukemia



Most common acute leukemia in the adult population

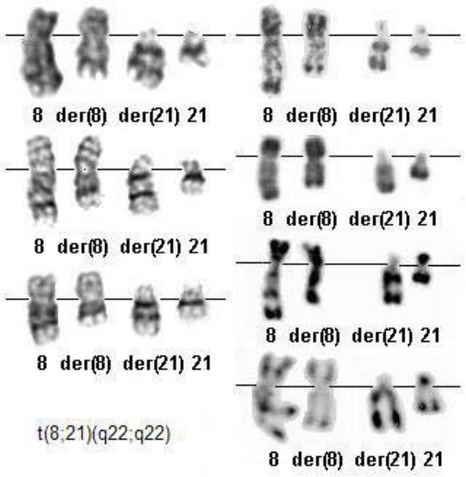
Median age about 68 years

Rare disease, but unfortunately very deadly: less than 30 % of patients survive long-term

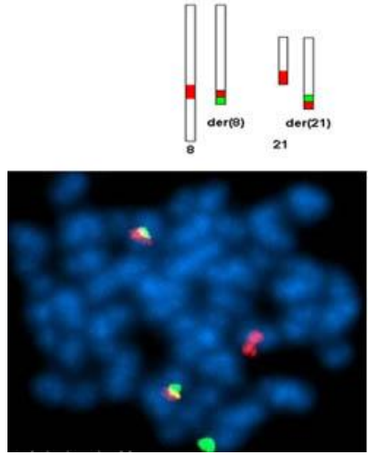
LEUKEMIA & LYMPHOMA SOCIETY OF CANADA

AML is not one disease

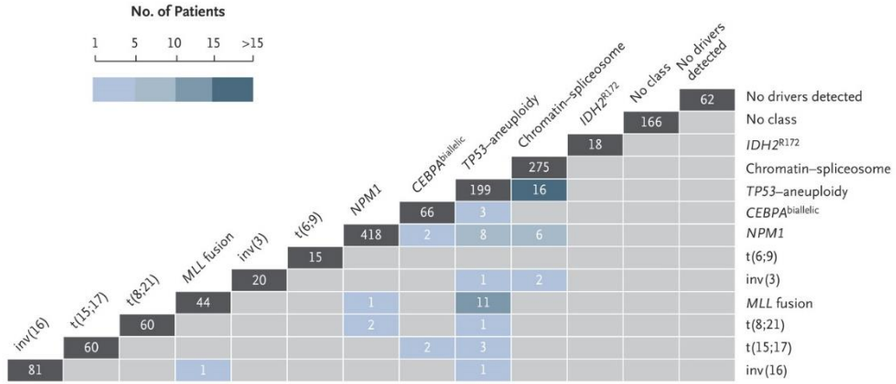
Cytogenetics



FISH

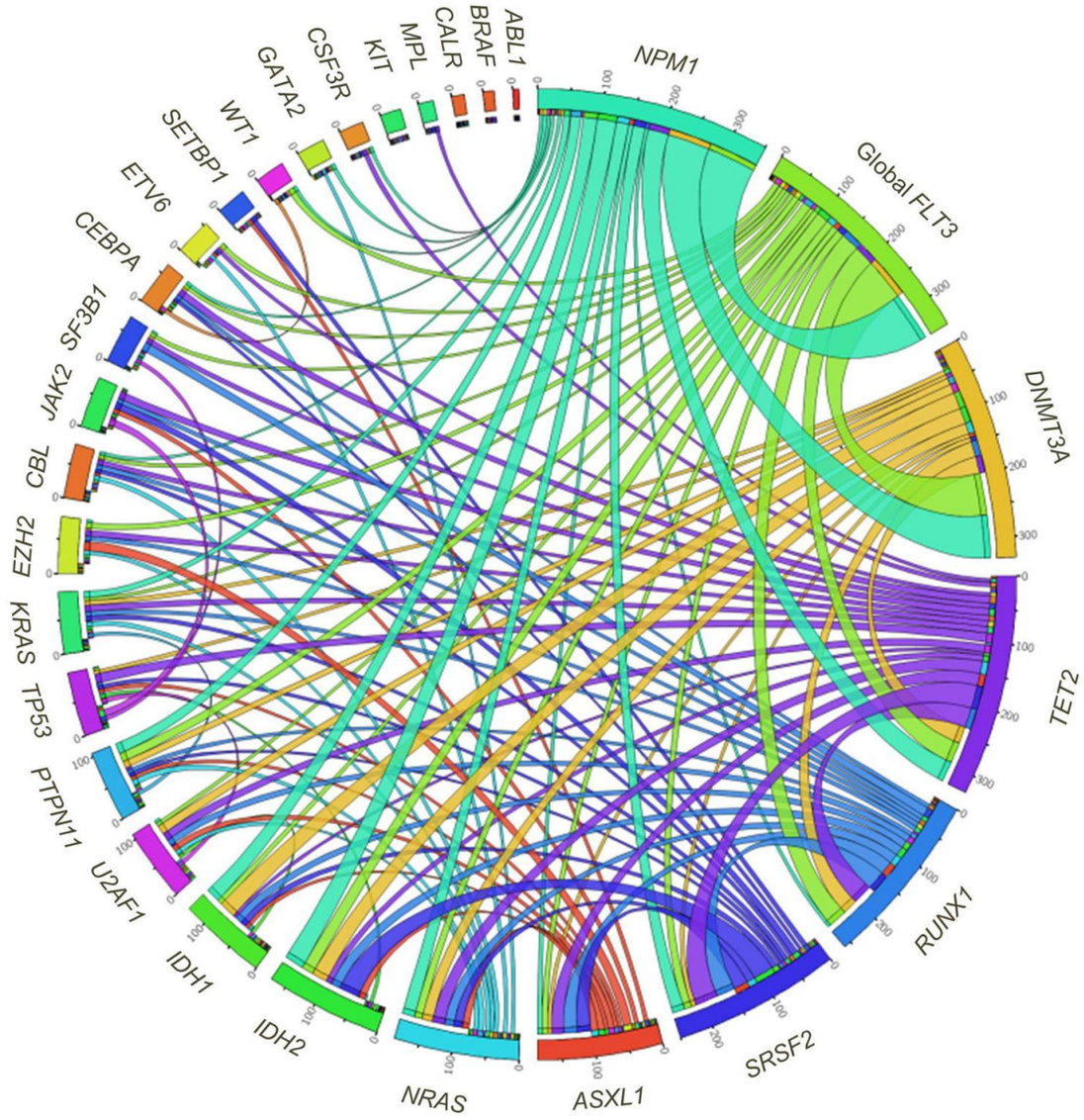


Molecular Diagnostics PCR NGS



LEUKEMIA & LYMPHOMA SOCIETY OF CANADA

Even one type of blood cancer is many different diseases

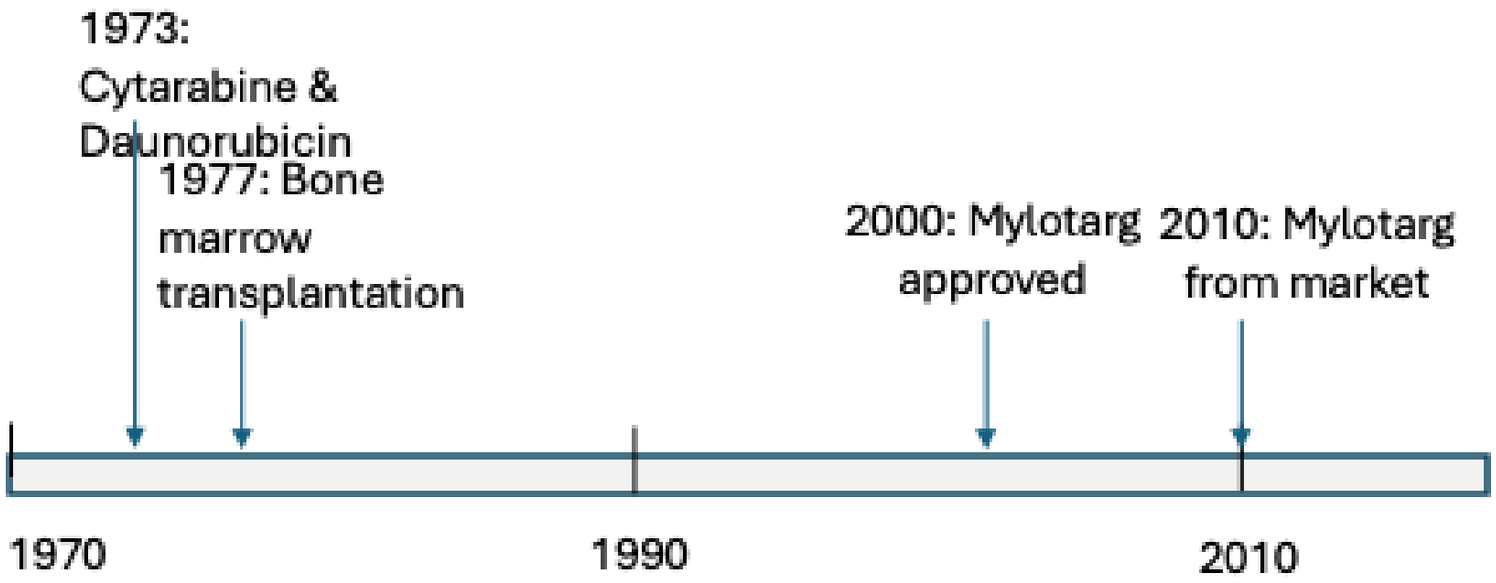


LEUKEMIA & LYMPHOMA SOCIETY OF CANADA®

For many years there has been only one treatment in AML

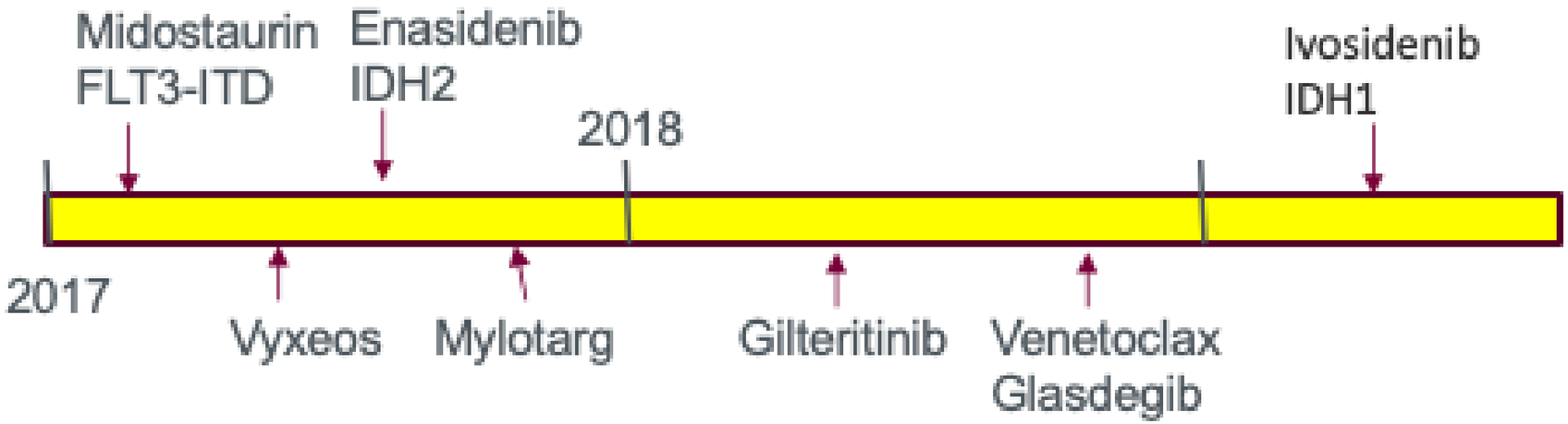
7 + 3

Cytarabine for 7 days
Daunorubicin for 3 days



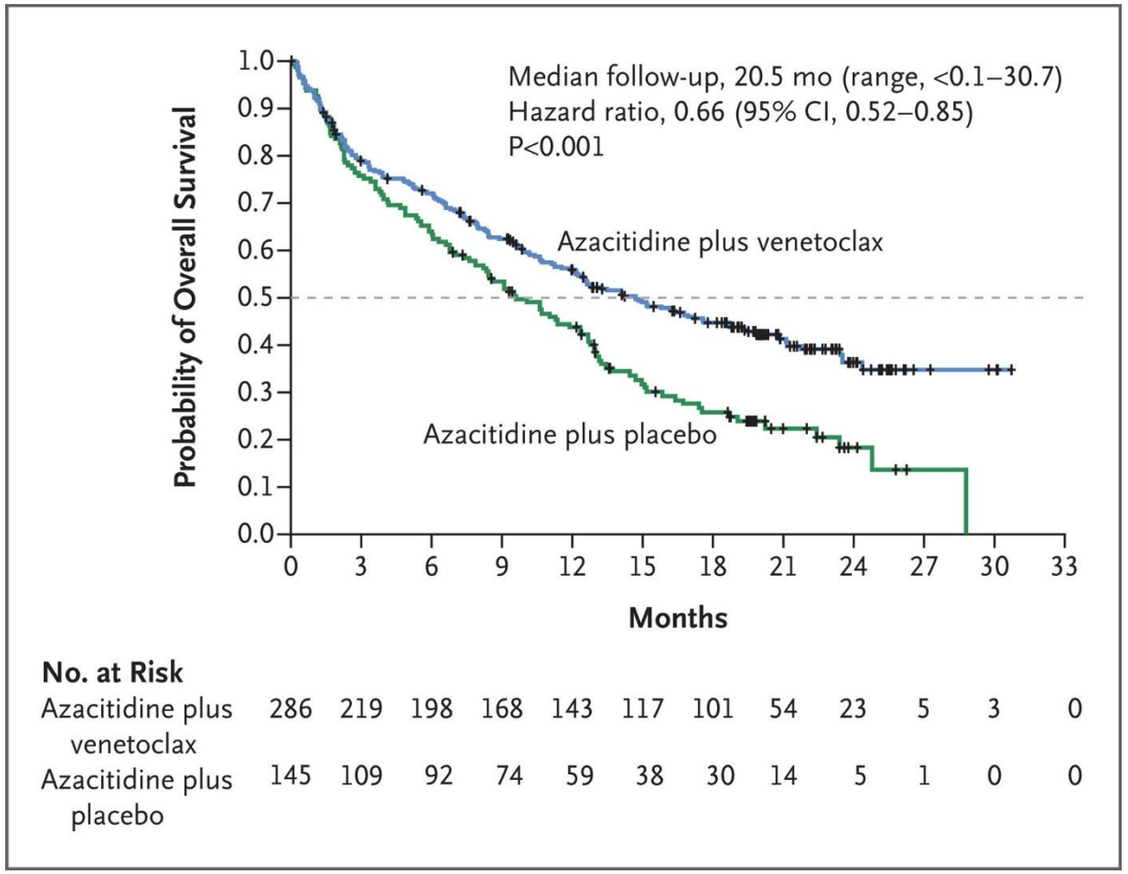
LEUKEMIA & LYMPHOMA SOCIETY OF CANADA

A stellar phase in AML



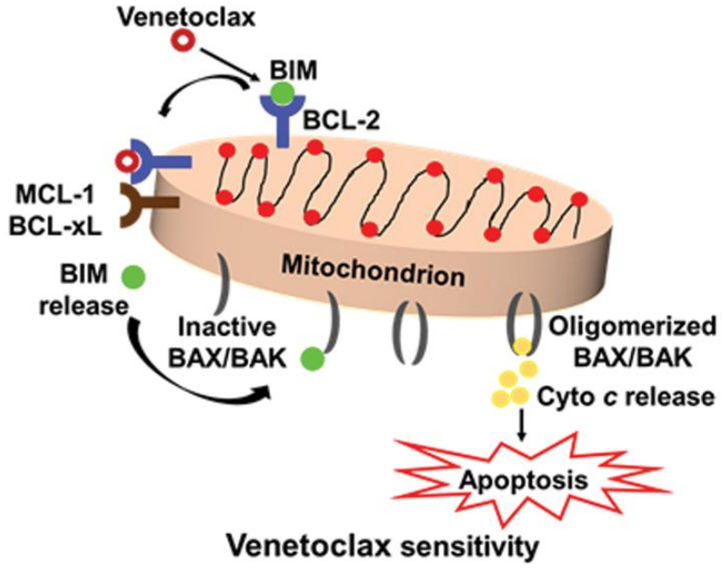
LEUKEMIA & LYMPHOMA SOCIETY OF CANADA

Targeted therapies improving the treatment



No. at Risk

Azacitidine plus venetoclax	286	219	198	168	143	117	101	54	23	5	3	0
Azacitidine plus placebo	145	109	92	74	59	38	30	14	5	1	0	0



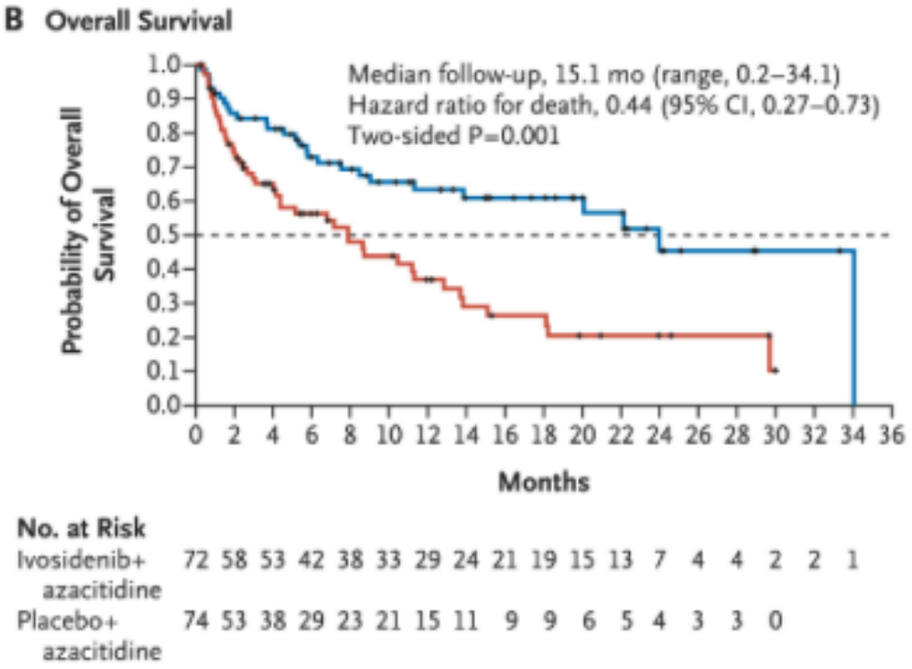
The NEW ENGLAND JOURNAL of MEDICINE

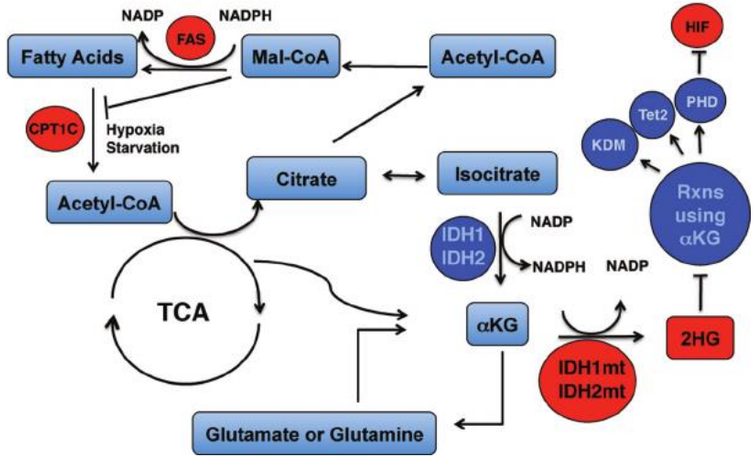
ESTABLISHED IN 1812 AUGUST 13, 2020 VOL. 383 NO. 7

Azacitidine and Venetoclax in Previously Untreated Acute Myeloid Leukemia

C.D. DiNardo, B.A. Jonas, V. Pullarkat, M.J. Thirman, J.S. Garcia, A.H. Wei, M. Konopleva, H. Döhner, A. Letai, P. Fenaux, E. Koller, V. Havelange, B. Leber, J. Esteve, J. Wang, V. Pejsa, R. Hájek, K. Porkka, Á. Illés, D. Lavie, R.M. Lemoli, K. Yamamoto, S.-S. Yoon, J.-H. Jang, S.-P. Yeh, M. Turgut, W.-J. Hong, Y. Zhou, J. Potluri, and K.W. Pratz

Targeted therapies improving the treatment





Cold Spring Harbor Symposia on Quantitative Biology 76:299-311

ORIGINAL ARTICLE

Ivosidenib and Azacitidine in *IDH1*-Mutated Acute Myeloid Leukemia

Pau Montesinos, M.D., Ph.D., Christian Recher, M.D., Ph.D., Susana Vives, M.D., Ewa Zarzycka, M.D., Jianxiang Wang, M.D., Giambattista Bertani, M.D., Michael Heuser, M.D., Rodrigo T. Calado, M.D., Ph.D., Andre C. Schuh, M.D., Su-Peng Yeh, M.D., Scott R. Daigle, M.S., Jianan Hui, Ph.D., Shuchi S. Pandya, M.D., Diego A. Gianolio, Ph.D., Stephane de Botton, M.D., Ph.D., and Hartmut Döhner, M.D.

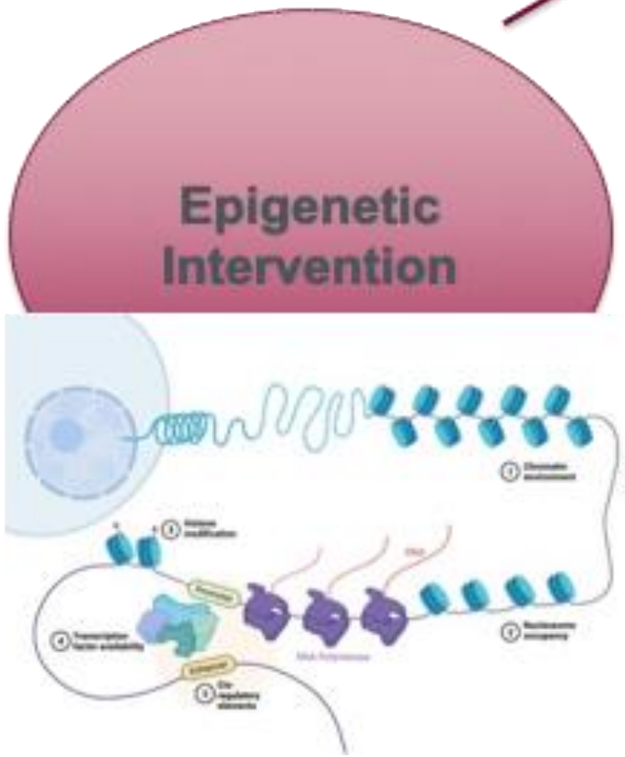
Our Research Approach

Primary Patient Material

Live Cell Banking for hematological malignancies HHS McMaster Cancer Research Stem Cell Bank

50 – 60 patients per year
Total > 100 AML samples

Functional human and murine model systems



In vitro Screening

Functional Metabolic Profiling

Multiomic Profiling

In vivo Modeling

LEUKEMIA & LYMPHOMA SOCIETY OF CANADA

67 year-old patient AML

Normal karyotype
NPM1 type A
FLT3-ITD+

- Induction with 7+3+ Midostaurin
- Disease persistence (PR)

- Received Azacitidine + Venetoclax
- CR with persistent MRD

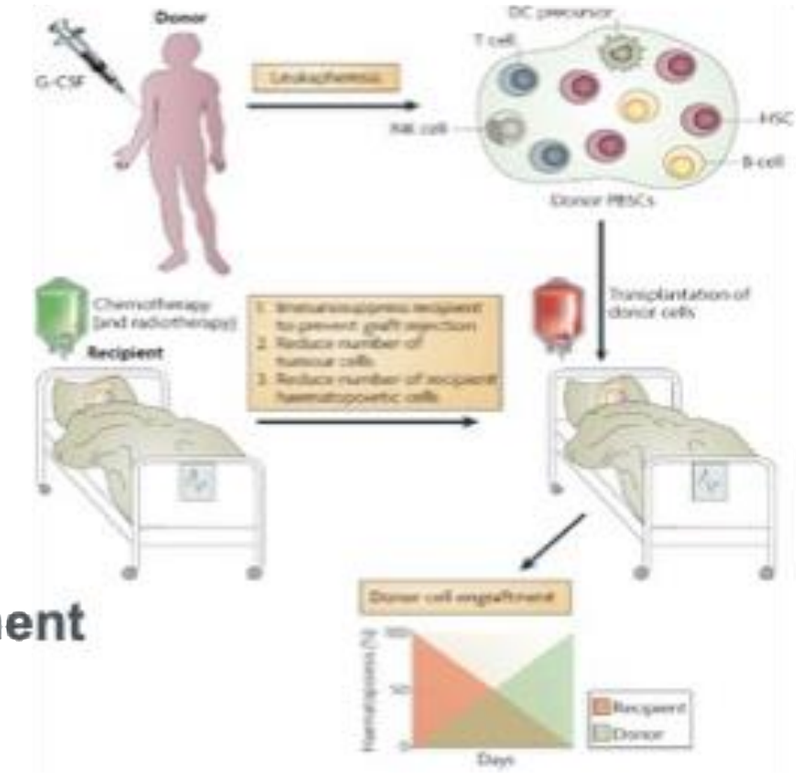
What should we do?

LEUKEMIA & LYMPHOMA SOCIETY OF CANADA

A cure for many...

Stem Cell Transplantation

Stem Cell Mobilization



Transplant
Stem Cells
Immune Cells

2-4 weeks wait until
new blood cells are made

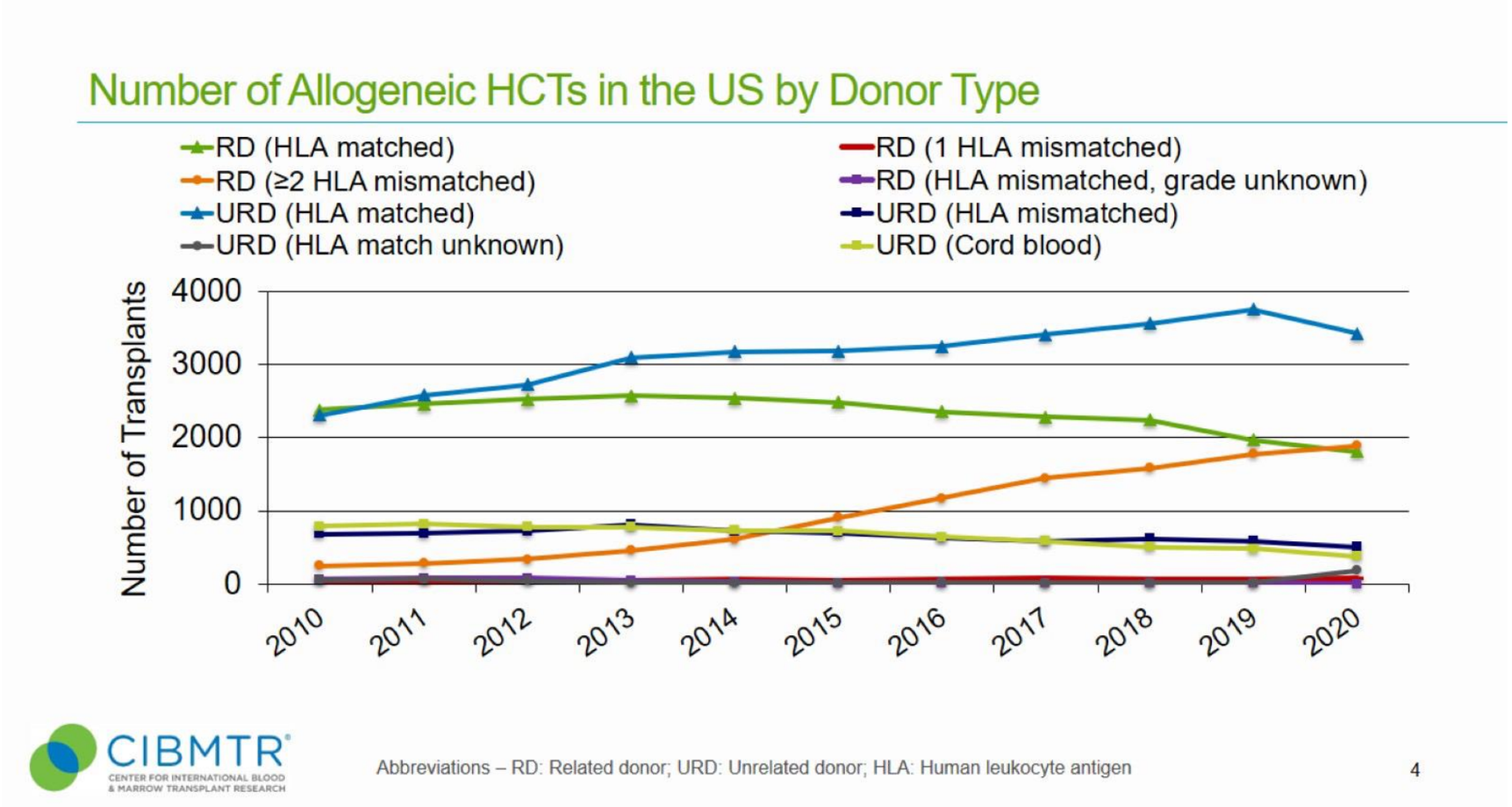
Most effective treatment for AML

Shlomchik – Nat Rev Immunol, 2007

LEUKEMIA & LYMPHOMA SOCIETY OF CANADA

Who can be a donor?

- Matched related donor = Siblings
- Matched unrelated donors
- Haploidentical donors = Other siblings, kids, parents



LEUKEMIA & LYMPHOMA SOCIETY OF CANADA®

Who can get a transplant?

https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.pinterest.com%2Fpin%2F403564816585708609%2F&psig=AOvVaw31eqDUUygfdg62pHDwtVdz&ust=1595642573587000&source=images&cd=vfe&ved=0CAMQjB1qFwoTCKisgInm5OoCFQAAAAAdAAAAABAD

No strict age limit…

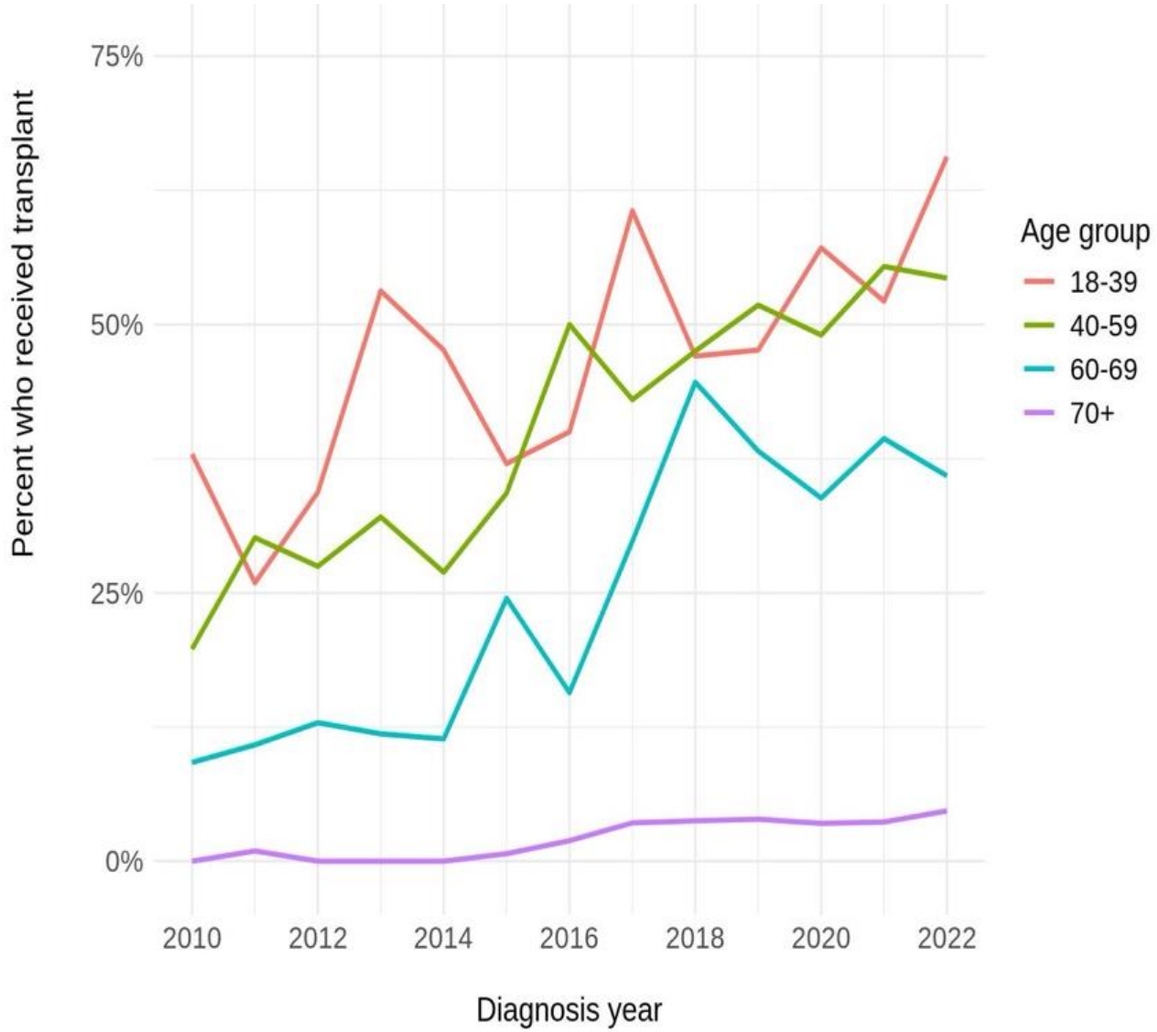
”Biological Age less than 75…”

Because: Comorbidities are important!

LEUKEMIA & LYMPHOMA SOCIETY OF CANADA®

How many patients with AML get a transplant?

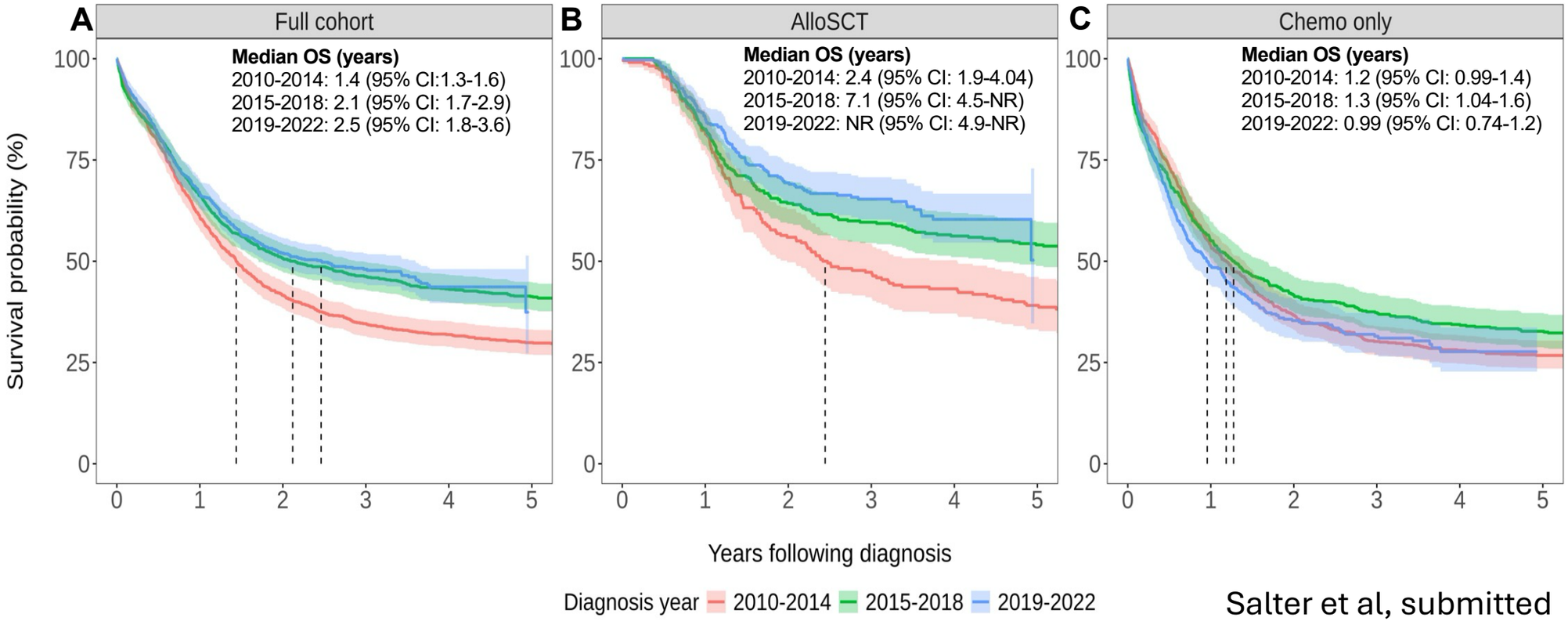
Laura Hillier, 2016
From CBC Global News



Salter et al, submitted

LEUKEMIA & LYMPHOMA SOCIETY OF CANADA

Transplant has become better over time



Salter et al, submitted

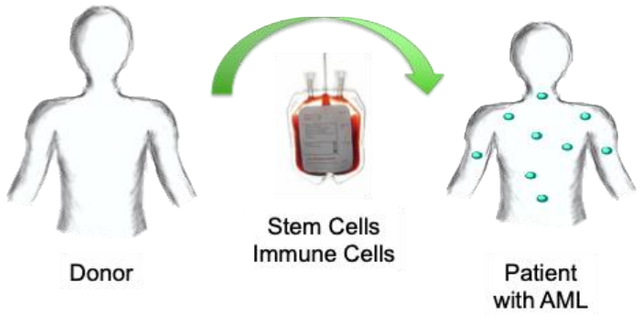
More and better matching donors

Better transplant protocols

Better supportive therapies

LEUKEMIA & LYMPHOMA SOCIETY OF CANADA

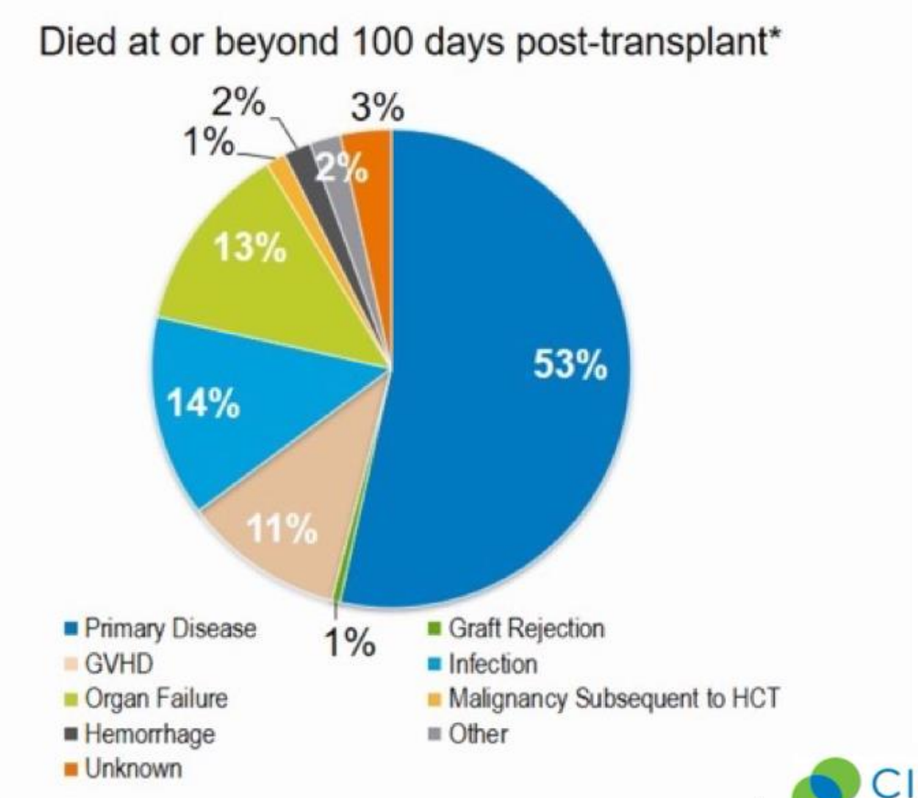
Problems after transplant



Problems after allogeneic stem cell transplantation

- Relapse
- GVHD

NEED:
Strategies that favor GVL over GVHD!

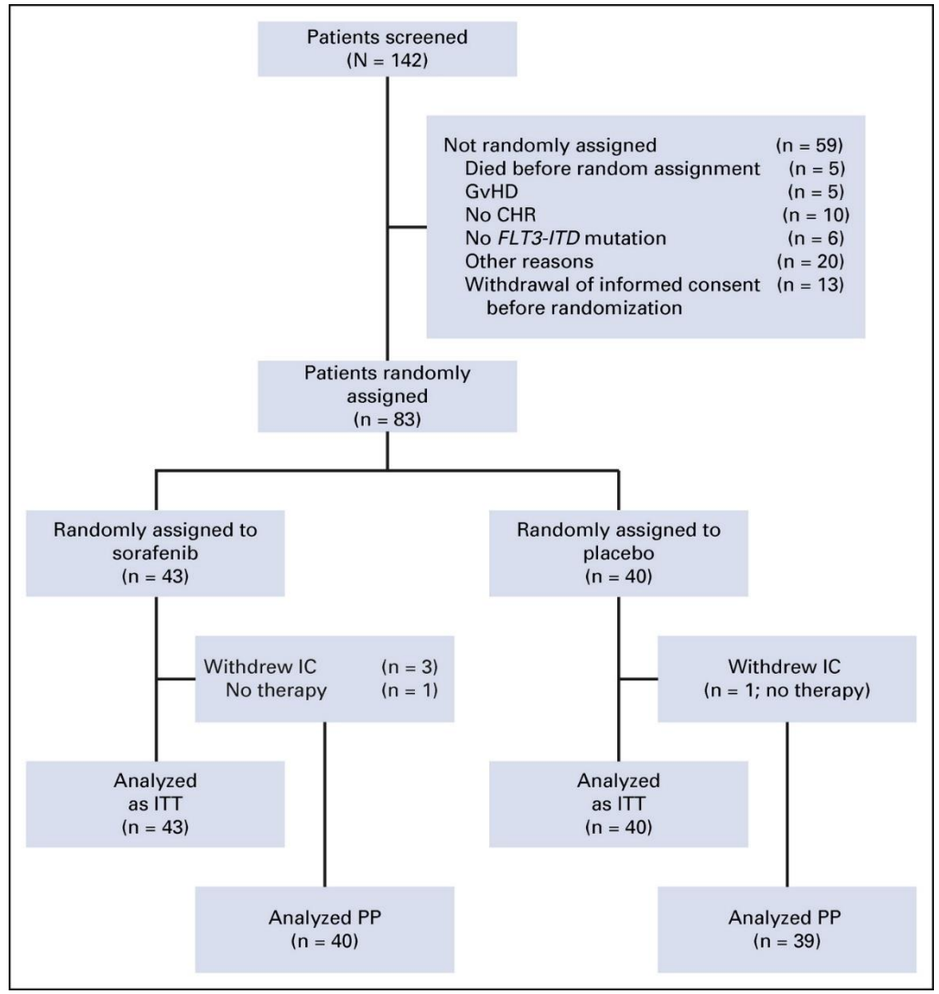


LEUKEMIA & LYMPHOMA SOCIETY OF CANADA

original reports

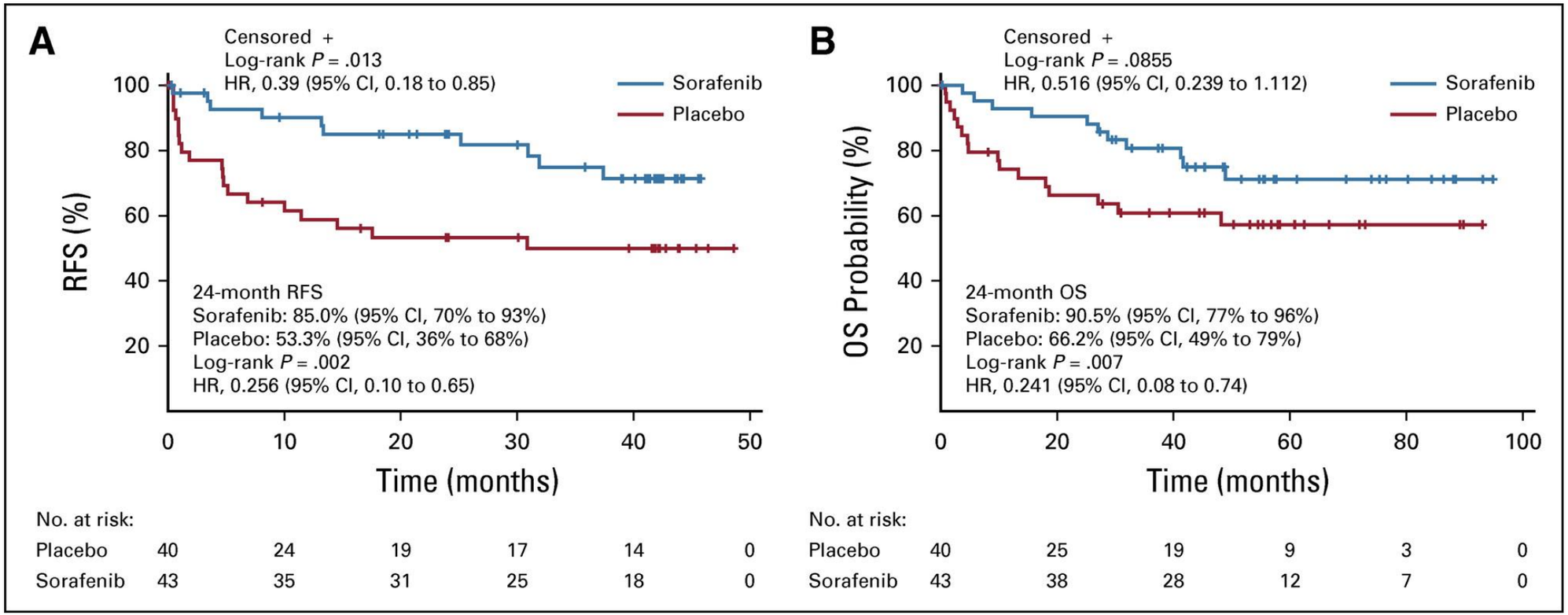
Sorafenib Maintenance After Allogeneic Hematopoietic Stem Cell Transplantation for Acute Myeloid Leukemia With *FLT3*–Internal Tandem Duplication Mutation (SORMAIN)

Andreas Burchert, MD[1]; Gesine Bug, MD[2]; Lea V. Fritz, MSc[1]; Jürgen Finke, MD[3]; Matthias Stelljes, MD[4]; Christoph Röllig, MD, MSc[5]; Ellen Wollmer, MD[1]; Ralph Wäsch, MD[3]; Martin Bornhäuser, MD[5]; Tobias Berg, MD[2]; Fabian Lang, MD[2]; Gerhard Ehninger, MD[5]; Hubert Serve, MD[2]; Robert Zeiser, MD[3]; Eva-Maria Wagner, MD[6]; Nicolaus Kröger, MD[7]; Christine Wolschke, MD[7]; Michael Schleuning, MD[8]; Katharina S. Götze, MD[9]; Christoph Schmid, MD[10]; Martina Crysandt, MD[11]; Eva Eßeling, MD[4]; Dominik Wolf, MD[12]; Ying Wang, MD[1]; Alexandra Böhm, MD[13]; Christian Thiede, MD[5]; Torsten Haferlach, MD[14]; Christian Michel, MD[1]; Wolfgang Bethge, MD[15]; Thomas Wündisch, MD[1]; Christian Brandts, MD[2]; Susanne Harnisch, DiplHumanbiol[16]; Michael Wittenberg, PhD[16]; Heinz-Gert Hoeffkes, MD[17]; Susanne Rospleszcz, PhD[18]; Alexander Burchardt, MD[19]; Andreas Neubauer, MD[1]; Markus Brugger, DiplHumanbiol, MSc[20]; Konstantin Strauch, PhD[20,21]; Carmen Schade-Brittinger[16]; and Stephan K. Metzelder, MD[1]



Burchert et al, 2020

LEUKEMIA & LYMPHOMA SOCIETY OF CANADA



Burchert et al, 2020

Patient was started on
Sorafenib Maintenance

Ongoing **molecular CR**

- Mild hypertension
- Hand-Foot syndrome

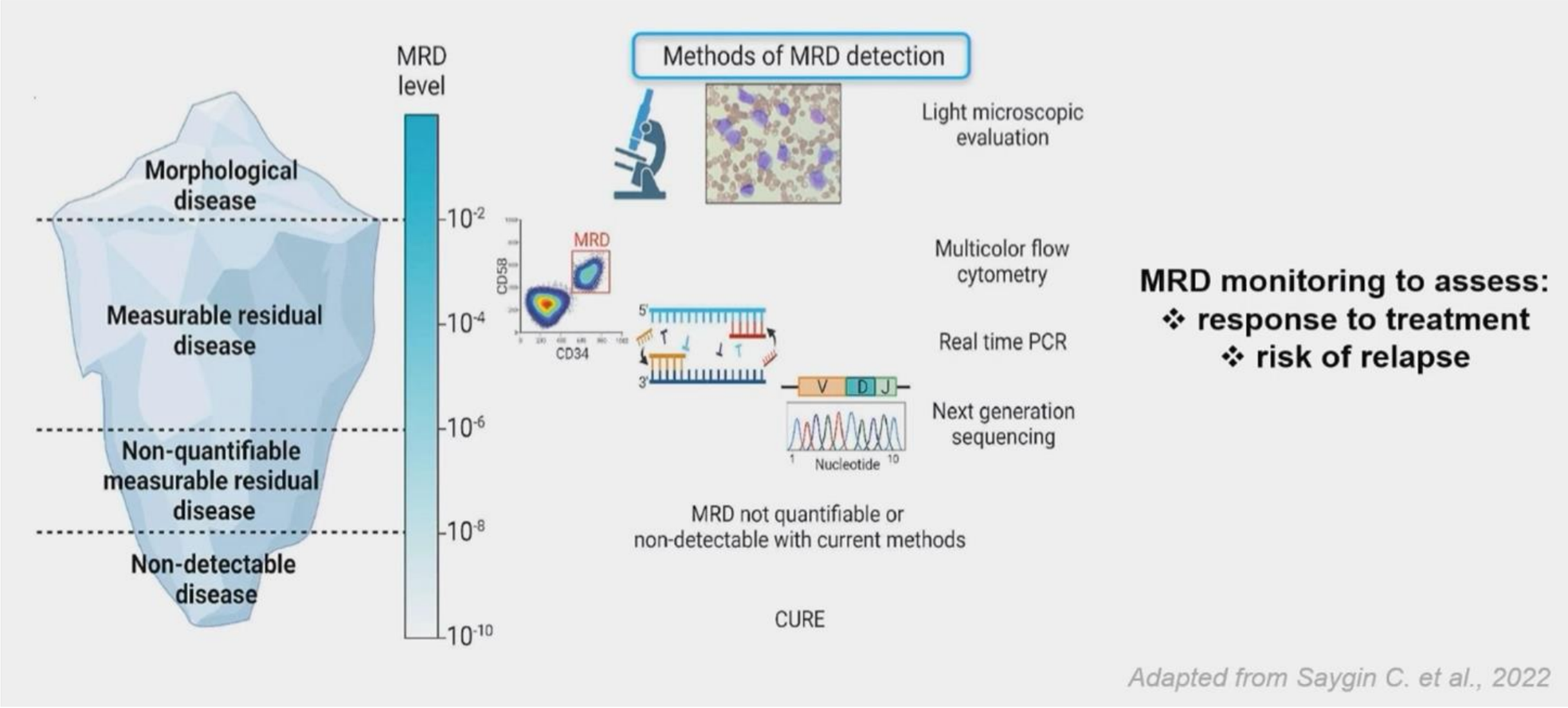
LEUKEMIA & LYMPHOMA SOCIETY OF CANADA

Can we find out early if something starts to go wrong?

LEUKEMIA & LYMPHOMA SOCIETY OF CANADA

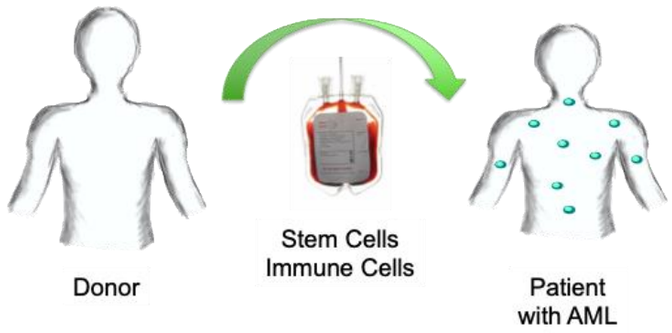
Can we find out early if something starts to go wrong?

MRD = ~~Minimal~~ Measurable Residual Disease



LEUKEMIA & LYMPHOMA SOCIETY OF CANADA

Can we find out early if something starts to go wrong?

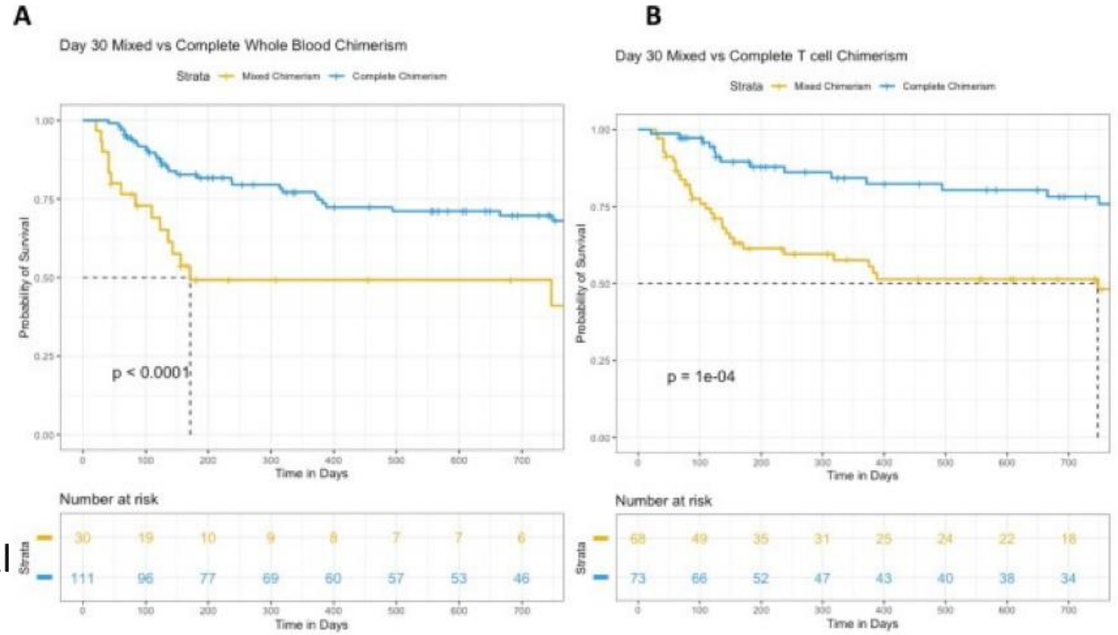


Chimerism Analysis:

- Investigate how many cells are derived from donor?
- Complete Chimerism: all cells from donor
- Mixed Chimerism: significant fraction of residual recipient cells

Early Mixed Donor Chimerism is a Strong Negative Prognostic Indicator in Allogeneic Stem Cell Transplant for AML and MDS

Michael Radford[1,*], Alejandro Garcia-Horton[1], Rohail Badami[2], Elaine Jin[3], Nida Usmani[4], Daria Grafodatskaya[5,6], Elizabeth McCready[5,6], Dina Khalaf[1], Irwin Walker[3], Brian Leber[3], Kylie Lepic[1], Gregory Pond[1,7], Tobias Berg[1,7,8]



LEUKEMIA & LYMPHOMA SOCIETY OF CANADA

What do we do if we find something?

"Ordering a diagnostic test is like picking your nose in public. You must first consider what you will do if you find something."

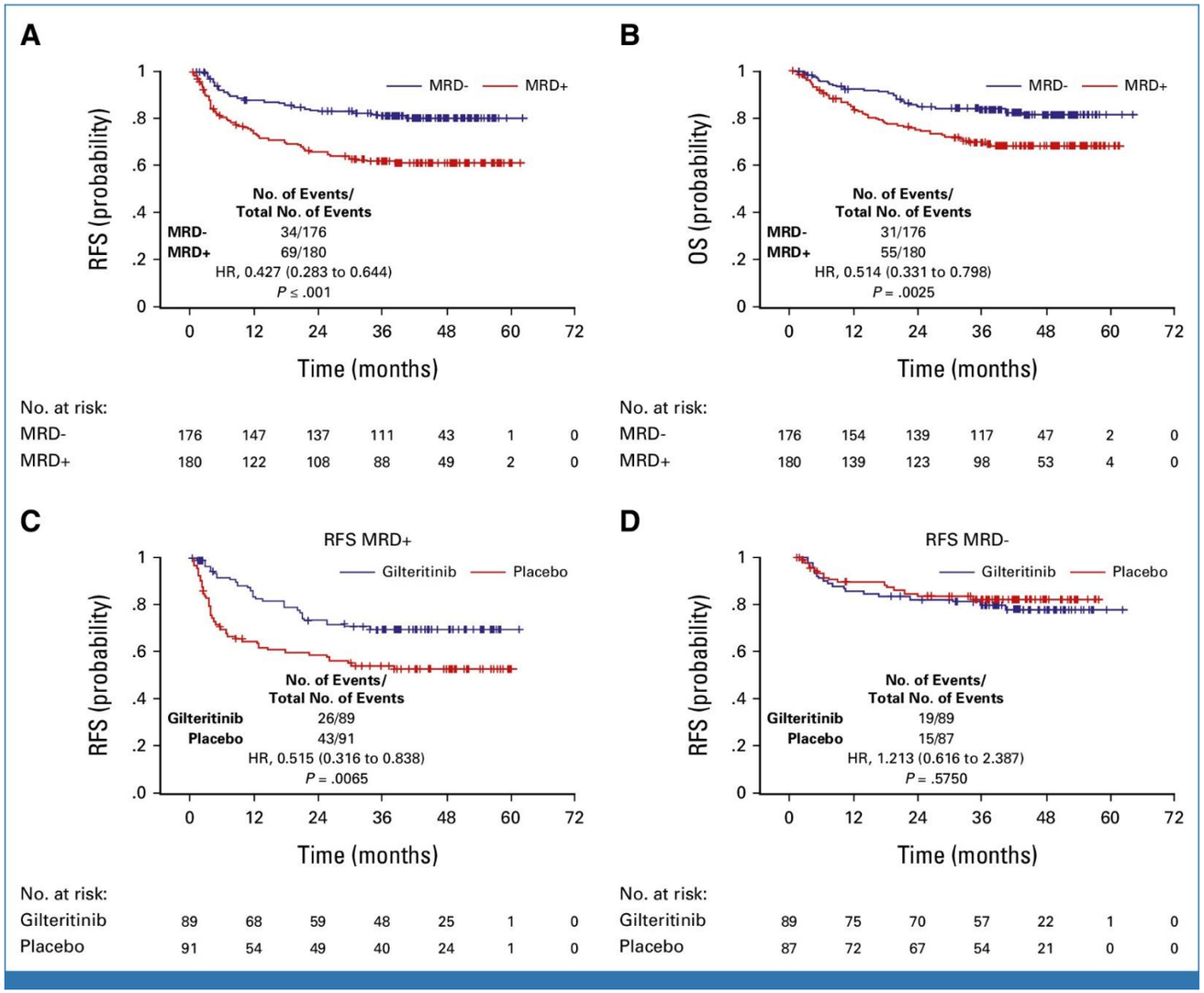
Catherine D. DeAngelis, MD, MPH
Pediatrician and Editor-in-chief of the *Journal of the American Medical Association* (JAMA)

From Wikipedia, the free encyclopedia

LEUKEMIA & LYMPHOMA SOCIETY OF CANADA

Maintenance treatment

Gilteritinib as Post Transplant Maintenance – BMT-CTN 1506 MORPHO Study



https://www.cambridgebutterfly.com/the-famous-blue-morpho/

Levis et al, 2024

LEUKEMIA & LYMPHOMA SOCIETY OF CANADA

Donor lymphocyte infusion

Donor

Immune Cells

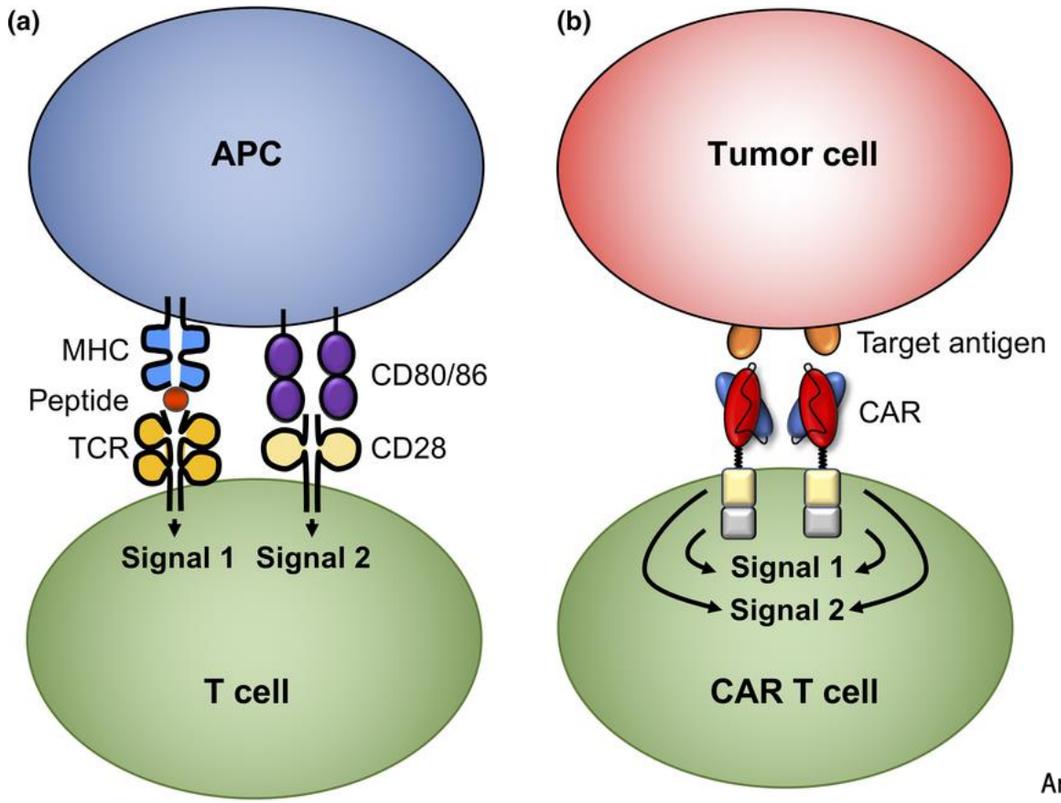
Patient with AML

LEUKEMIA & LYMPHOMA SOCIETY OF CANADA

Can we use immune cells without the risk for GVHD?

LEUKEMIA & LYMPHOMA SOCIETY OF CANADA®

CAR T has been made possible by a deep understanding of the immune system…

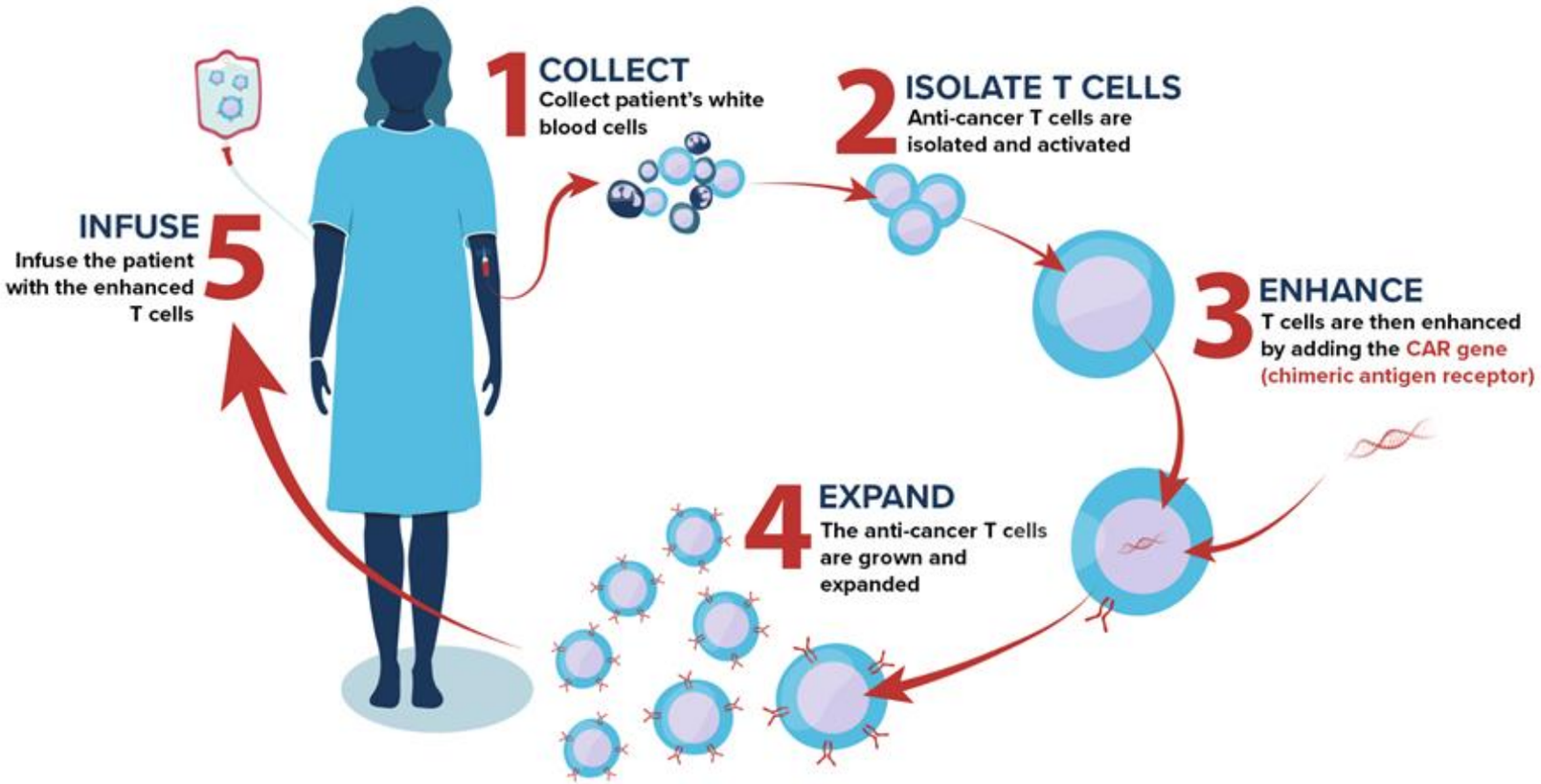


T cell receptor signaling

Archivum Immunologiae et Therapiae Experimentalis (2020) 68:34
https://doi.org/10.1007/s00005-020-00599-x

LEUKEMIA & LYMPHOMA SOCIETY OF CANADA

...and gene therapy



https://biocanrx.com/research/made-canada-car-t-platform

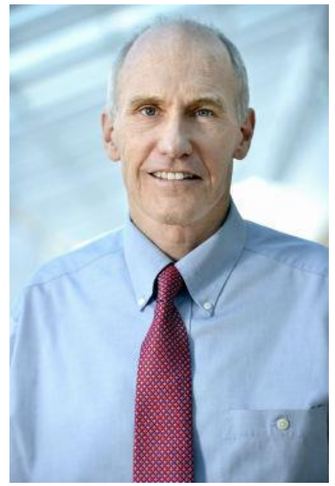
Remarkably successful…

Emily Whitehead was diagnosed with acute lymphoblastic leukemia (ALL) in May 2010 when she was five years old.

Incredibly, the T-cell therapy worked, and Emily has remained cancer-free.

https://emilywhiteheadfoundation.org/our-journey/

Carl June

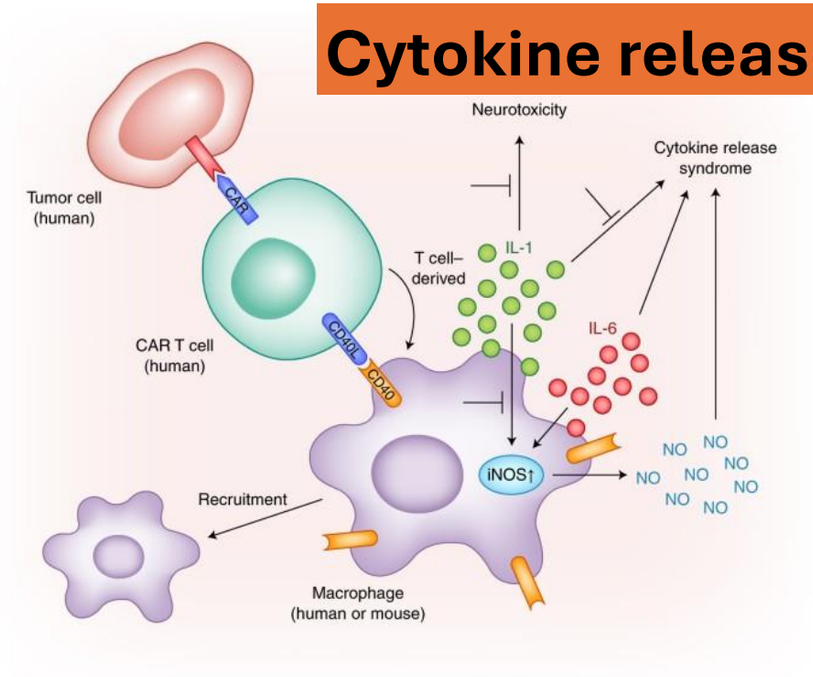


Stephan Grupp

LEUKEMIA & LYMPHOMA SOCIETY OF CANADA®

… but not free of side effects

Cytokine release syndrome



Nature Medicine volume 24, pages 705–706 (2018)

https://vimeo.com/54668275

LEUKEMIA & LYMPHOMA SOCIETY OF CANADA

Which diseases can we treat with CAR-T cell therapy

• B cell ALL	tisagenlecleucel	2018
• B cell lymphoma	axicabtagene ciloleucel	2019
• Multiple Myeloma	ciltacabtagene autoleucel	2024

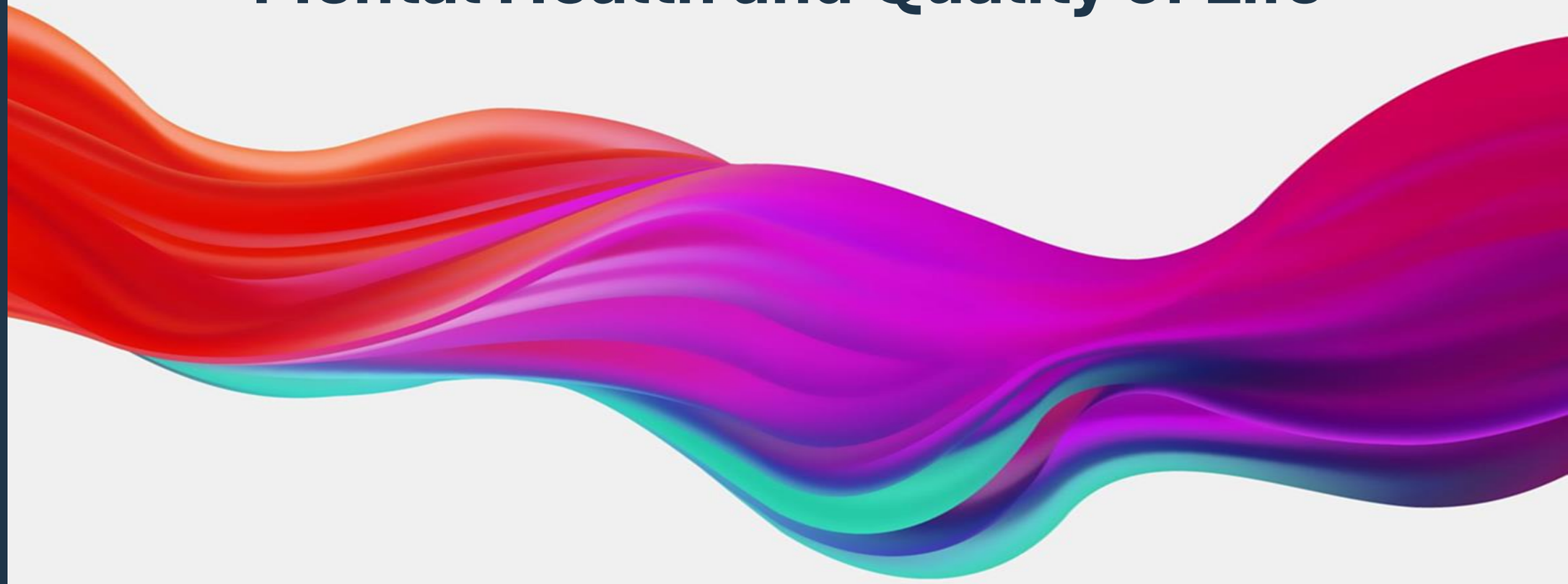
Maybe also AML? In the future …

LEUKEMIA & LYMPHOMA SOCIETY OF CANADA®

The future of blood cancer treatment is now

- Targeted therapies are selected based on genetic mutations and drug sensitivity testing
- Use of MRD testing to decide about treatment and employ intervening strategies
- Engineering of more and more sophisticated cellular therapies to improve outcomes of even very difficult-to-treat leukemias and lymphomas

The Intersection of Medical Innovation, Mental Health and Quality of Life



LEUKEMIA & LYMPHOMA SOCIETY OF CANADA®

Mental Health in the Era of Medical Innovation

LEUKEMIA & LYMPHOMA SOCIETY OF CANADA®

Quality of Life

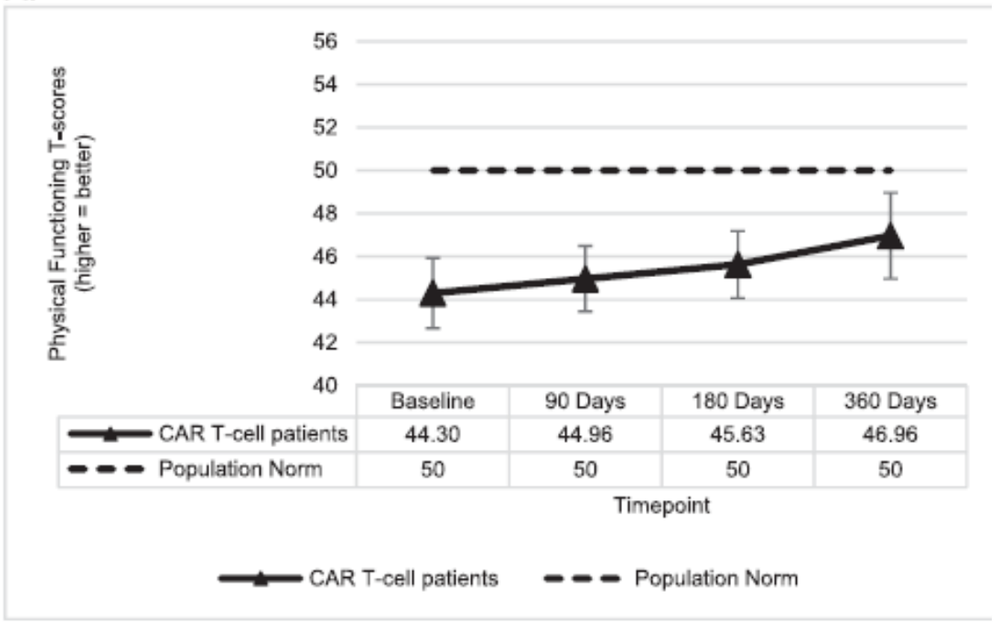
- QoL is more than “being alive” — it’s about how we live

- New therapies may reduce physical side effects — but can still have physical impacts, such as:
  - Disrupt sleep, appetite, concentration
  - Require long-term monitoring or lifestyle change

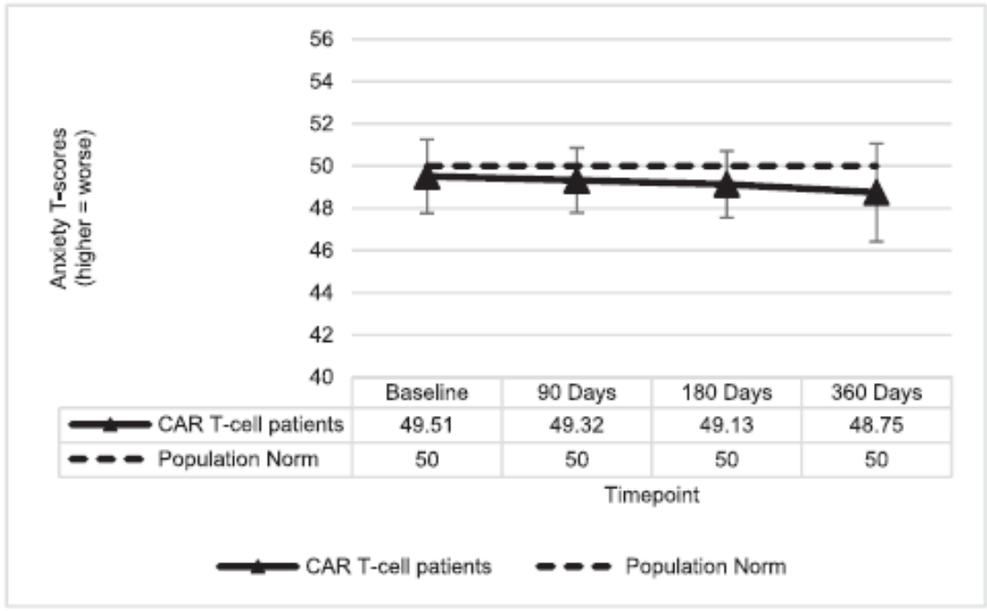
- Emotional and social dimensions of QoL:
  - Impact on work, identity, relationships, finances
  - Family caregiver stress

During the first year after CAR T-Cell therapy, Quality of Life improves or remains similar to pre-CAR T-Cell therapy levels

A.



D.



"Qualitative methods are needed to understand patient experience"

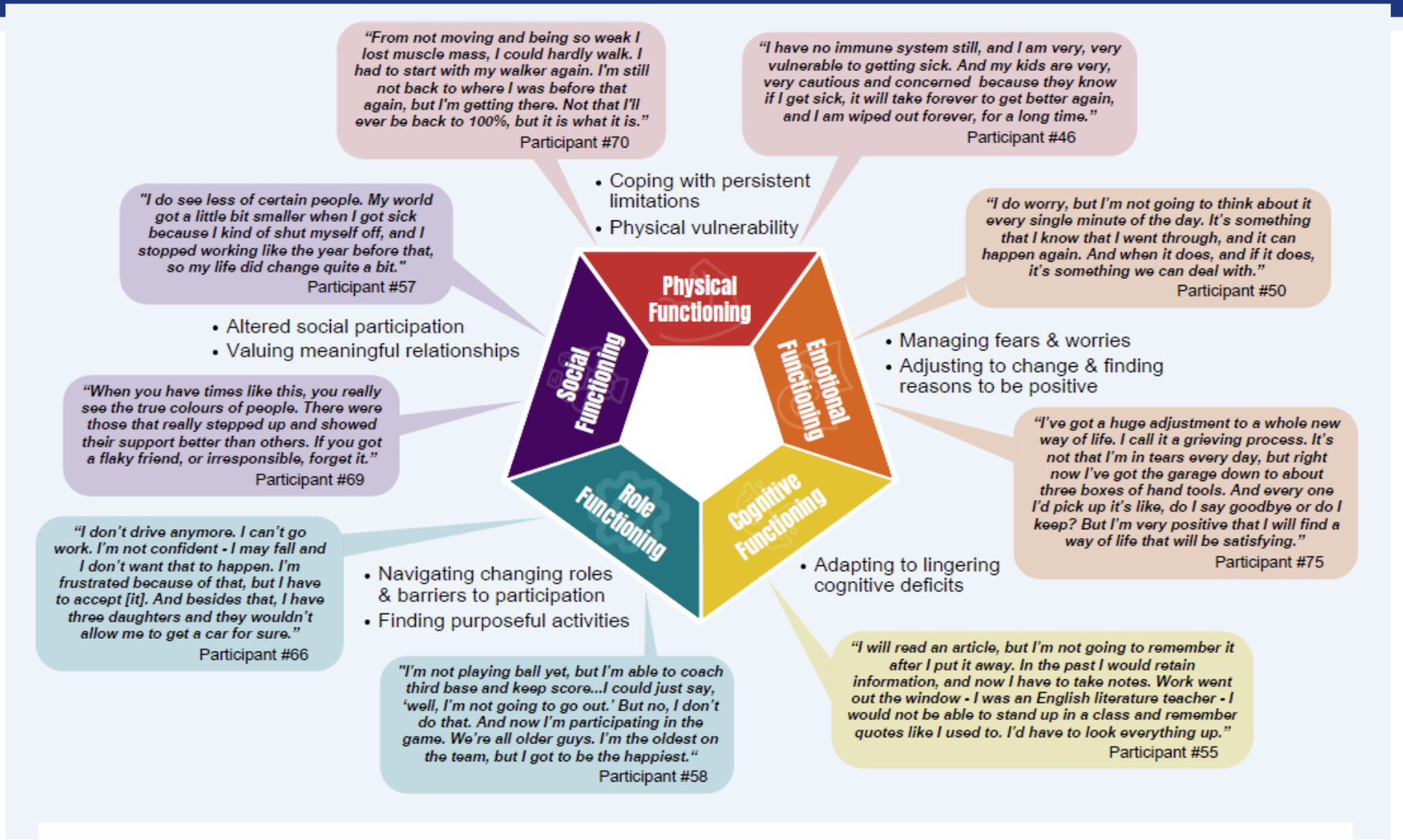
LEUKEMIA & LYMPHOMA SOCIETY OF CANADA

Hoogland, A. I., Barata, A., Li, X., Irizarry-Arroyo, N., Jain, M. D., ... Jim, H. S. L. (2024). Prospective Assessment of Quality of Life and Patient-Reported Toxicities Over the First Year After Chimeric Antigen Receptor T-Cell Therapy. *Transplantation and cellular therapy*, *30*(12), 1219.e1–1219.e11.

An Interpretive Description of Quality of Life After Treatment of Relapsed & Refractory B-Cell Lymphoma

Samantha Mayo[1,2] Jeus Cabaluna[3] Stacey Morrison[1] Shanelle Racine[1] Medha Surajpal[1] Anca Prica[1,2] John Kuruvilla[1,2]

1 Princess Margaret Cancer Centre, Toronto, Canada; 2 University of Toronto, Toronto, Canada; 3 University Health Network, Toronto, Canada

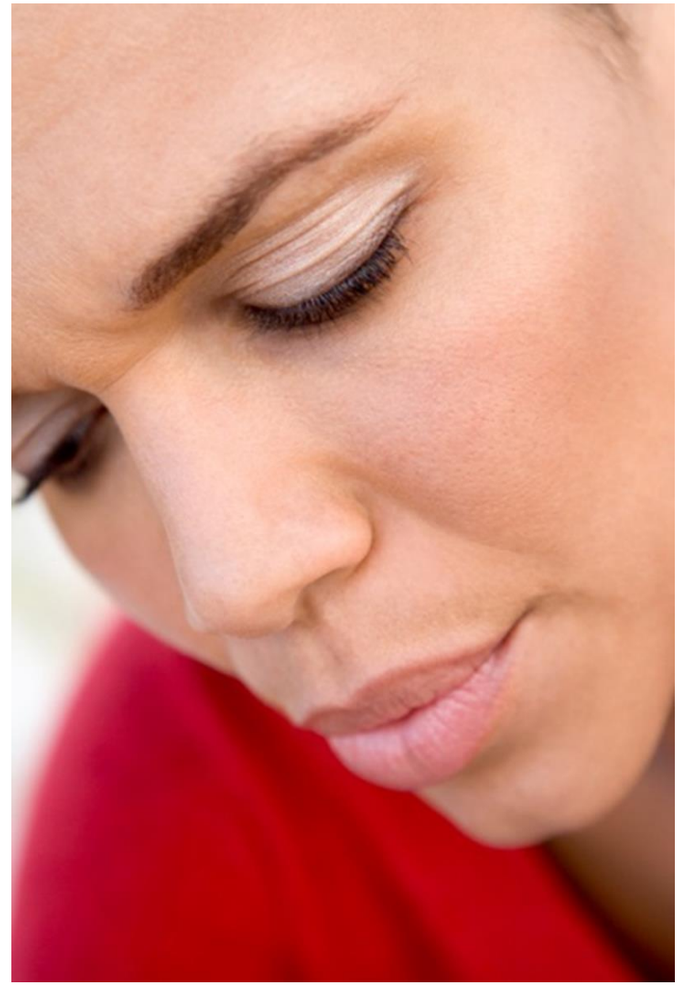


LEUKEMIA & LYMPHOMA SOCIETY OF CANADA

Mayo, S., Cabaluna, J., Morrison, S., Racine, S., Surajpal, M., Prica, A. & Kuruvilla, J. (2025). "An Interpretive Description of Quality of Life After Treatment of Relapsed and Refractory B-Cell Lymphoma" Poster presentation at the 2025 Canadian Association of Psychosocial Oncology Conference, Toronto, Canada. April 23-25, 2025.

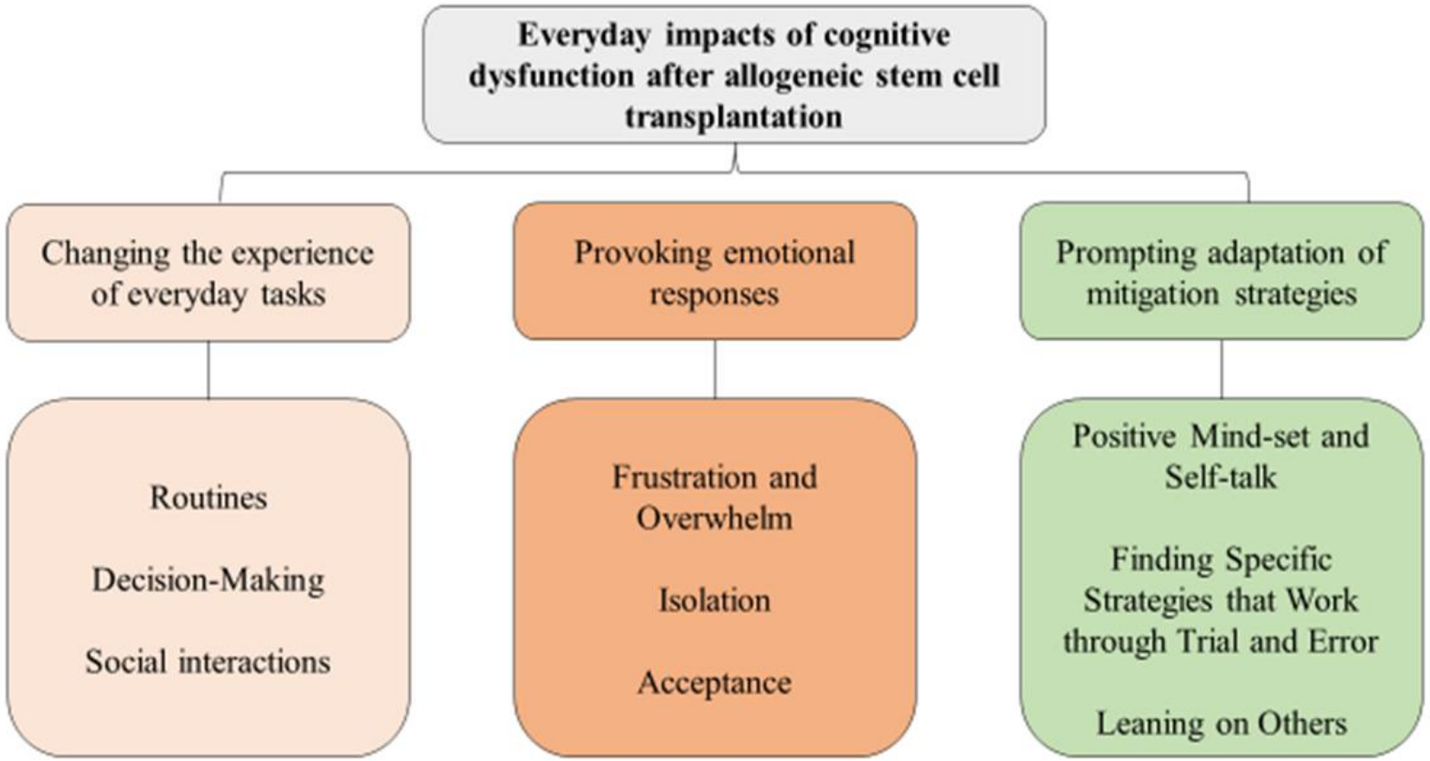
Cancer-Related Cognitive Impairment

- Decreased short-term memory
- Difficulty finding the right words
- Trouble paying attention or concentrating
- Feeling disorganized
- Taking longer to do tasks
- Feeling “foggy”



LEUKEMIA & LYMPHOMA SOCIETY OF CANADA

Everyday Impacts of Cognitive Difficulties



"The way I best described it was it's like a pencil. You can still write with a pencil, but it just wasn't quite as sharp. So, I was able to get the things done, but just not with the precision that I was used to." (ID:3)

LEUKEMIA & LYMPHOMA SOCIETY OF CANADA

Mayo, S. J., Wozniczka, I., Edwards, B., Rourke, S. B., Howell, D., Metcalfe, K. A., Taghavi Haghayegh, A., & Lipton, J. H. (2022). A Qualitative Study of the Everyday Impacts of Cognitive Difficulties After Stem Cell Transplantation. Oncology nursing forum, 49(4), 315–325.

Princess Margaret Cancer Centre
RESEARCH UHN

Neurocognitive outcomes after treatment with autologous stem cell transplantation or CAR-T cell therapy for relapsed or refractory b-cell lymphoma

S J Mayo[1], K Edelstein[1], L J Bernstein[1], S Morrison[1], S Racine[1], M Surajpal[1], A Haghayegh[1], E Atenafu[3], A Prica[2], and J Kuruvilla[2]
1 Department of Supportive Care, 2 Division of Medical Oncology & Hematology, 3 Department of Biostatistics
Princess Margaret Cancer Centre, University Health Network,Toronto, Canada

Table 1. Frequency of neurocognitive impairment

Neurocognitive Battery Test	n (%) Impaired
HVLT-R Trial 1	6 (9.8%)
HVLT-R Total Recall (Immediate)	15 (24.6%)
HVLT-R Delayed Recall	16 (26.2%)
HVLT-R Retention	6 (9.8%)
HVLT-R Recognition Discrimination Index	6 (9.8%)
Oral Trail-Making Test A	8 (13.1%)
Oral Trail-Making Test B	3 (5.4%)
COWAT	7 (11.5%)
Overall Impaired	**21 (34.4%)**

Table 2. Self-reported cognitive function

EORTC QLQ-C30 CF Score	
Mean ± SD	79.0 ± 22.1
Range	0 - 100
Clinically Important Score (≤ 75)	**31%**

Impairment rates across domains ranged from about 10% (attention span), 25% (verbal memory), 13% (processing speed), and 5% to 12% (executive functioning).

LEUKEMIA & LYMPHOMA SOCIETY OF CANADA

Mayo, S.J., Edelstein, K., Bernstein, L., Morrison, S., Racine, S., Surajpal, M., Taghavi Haghayegh, A., Atenafu, E. G., Prica, A., & Kuruvilla J. (2024). Neurocognitive outcomes after treatment with autologous stem cell transplantation or CAR-T cell therapy for relapsed or refractory B-cell lymphoma. Supportive Care in Cancer, 32 (Suppl 1): S194

Princess Margaret Cancer Centre
RESEARCH UHN

Neurocognitive outcomes after treatment with autologous stem cell transplantation or CAR-T cell therapy for relapsed or refractory b-cell lymphoma

S J Mayo[1], K Edelstein[1], L J Bernstein[1], S Morrison[1], S Racine[1], M Surajpal[1], A Haghayegh[1], E Atenafu[3], A Prica[2], and J Kuruvilla[2]
1 Department of Supportive Care, 2 Division of Medical Oncology & Hematology, 3 Department of Biostatistics
Princess Margaret Cancer Centre, University Health Network,Toronto, Canada

Table 1. Frequency of neurocognitive impairment

Neurocognitive Battery Test	n (%) Impaired
HVLT-R Trial 1	6 (9.8%)
HVLT-R Total Recall (Immediate)	15 (24.6%)
HVLT-R Delayed Recall	16 (26.2%)
HVLT-R Retention	6 (9.8%)
HVLT-R Recognition Discrimination Index	6 (9.8%)
Oral Trail-Making Test A	8 (13.1%)
Oral Trail-Making Test B	3 (5.4%)
COWAT	7 (11.5%)
Overall Impaired	**21 (34.4%)**

Table 2. Self-reported cognitive function

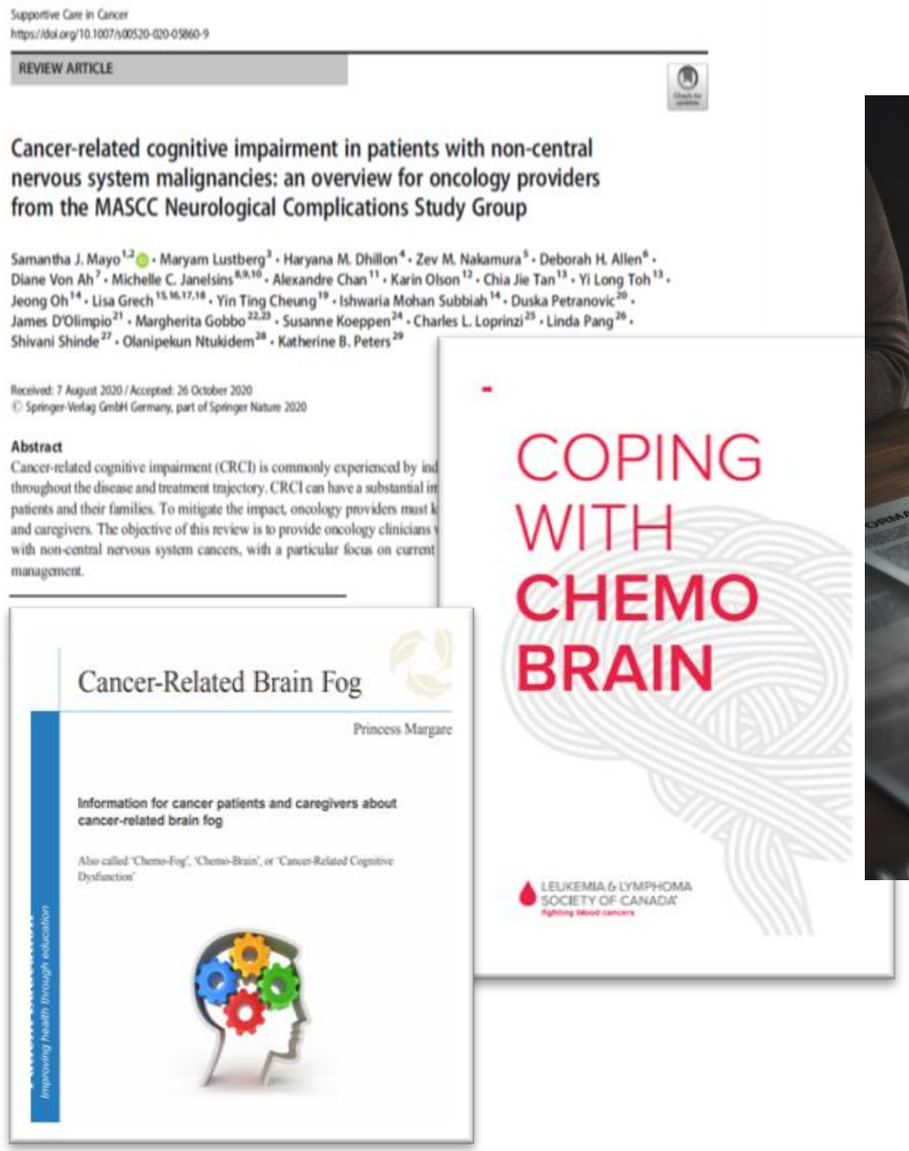
EORTC QLQ-C30 CF Score	
Mean ± SD	79.0 ± 22.1
Range	0 - 100
Clinically Important Score (≤ 75)	**31%**

Impairment rates across domains ranged from about 10% (attention span), 25% (verbal memory), 13% (processing speed), and 5% to 12% (executive functioning).

LEUKEMIA & LYMPHOMA SOCIETY OF CANADA

Mayo, S.J., Edelstein, K., Bernstein, L., Morrison, S., Racine, S., Surajpal, M., Taghavi Haghayegh, A., Atenafu, E. G., Prica, A., & Kuruvilla J. (2024). Neurocognitive outcomes after treatment with autologous stem cell transplantation or CAR-T cell therapy for relapsed or refractory B-cell lymphoma. Supportive Care in Cancer, 32 (Suppl 1): S194

Co-designing New Models of Care



Supportive Care in Cancer
https://doi.org/10.1007/s00520-020-05860-9

REVIEW ARTICLE

Cancer-related cognitive impairment in patients with non-central nervous system malignancies: an overview for oncology providers from the MASCC Neurological Complications Study Group

Samantha J. Mayo[1,2] · Maryam Lustberg[3] · Haryana M. Dhillon[4] · Zev M. Nakamura[5] · Deborah H. Allen[6] · Diane Von Ah[7] · Michelle C. Janelsins[8,9,10] · Alexandre Chan[11] · Karin Olson[12] · Chia Jie Tan[13] · Yi Long Toh[13] · Jeong Oh[14] · Lisa Grech[15,16,17,18] · Yin Ting Cheung[19] · Ishwaria Mohan Subbiah[14] · Duska Petranovic[20] · James D'Olimpio[21] · Margherita Gobbo[22,23] · Susanne Koeppen[24] · Charles L. Loprinzi[25] · Linda Pang[26] · Shivani Shinde[27] · Olanipekun Ntukidem[28] · Katherine B. Peters[29]

Received: 7 August 2020 / Accepted: 26 October 2020

Abstract
Cancer-related cognitive impairment (CRCI) is commonly experienced by ind
throughout the disease and treatment trajectory. CRCI can have a substantial im
patients and their families. To mitigate the impact, oncology providers must k
and caregivers. The objective of this review is to provide oncology clinicians v
with non-central nervous system cancers, with a particular focus on current
management.

COPING WITH CHEMO BRAIN

LEUKEMIA & LYMPHOMA SOCIETY OF CANADA
fighting blood cancers

Cancer-Related Brain Fog

Princess Margaret

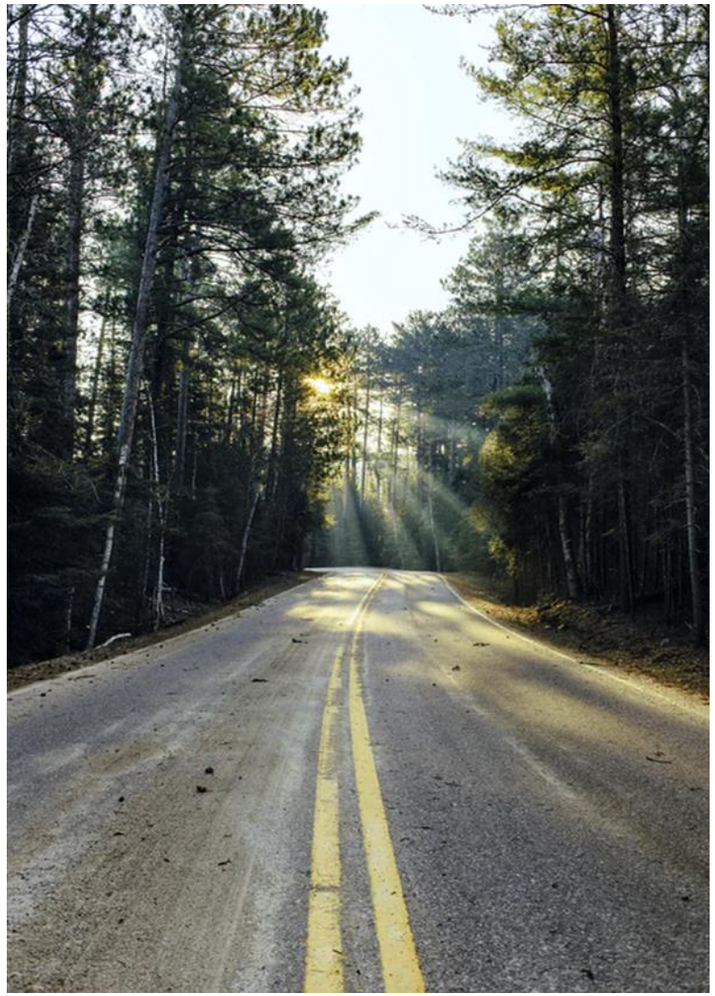
Information for cancer patients and caregivers about cancer-related brain fog

Also called 'Chemo-Fog', 'Chemo-Brain', or 'Cancer-Related Cognitive Dysfunction'

Improving Health Through Education

LEUKEMIA & LYMPHOMA SOCIETY OF CANADA

Understanding the patient and caregiver experience over time



Our current studies are examining the experience of people impacted by:

- Non-Hodgkin Lymphoma
- Relapsed Refractory B-Cell Lymphoma
- Relapsed Refractory Acute Leukemia
- Critical Illness and Hematological Malignancy
- Transplant as an Adolescent/Young Adult
- Caregiving in the setting of Blood Cancers

- Findings will support tailored and effective approaches for meeting their needs

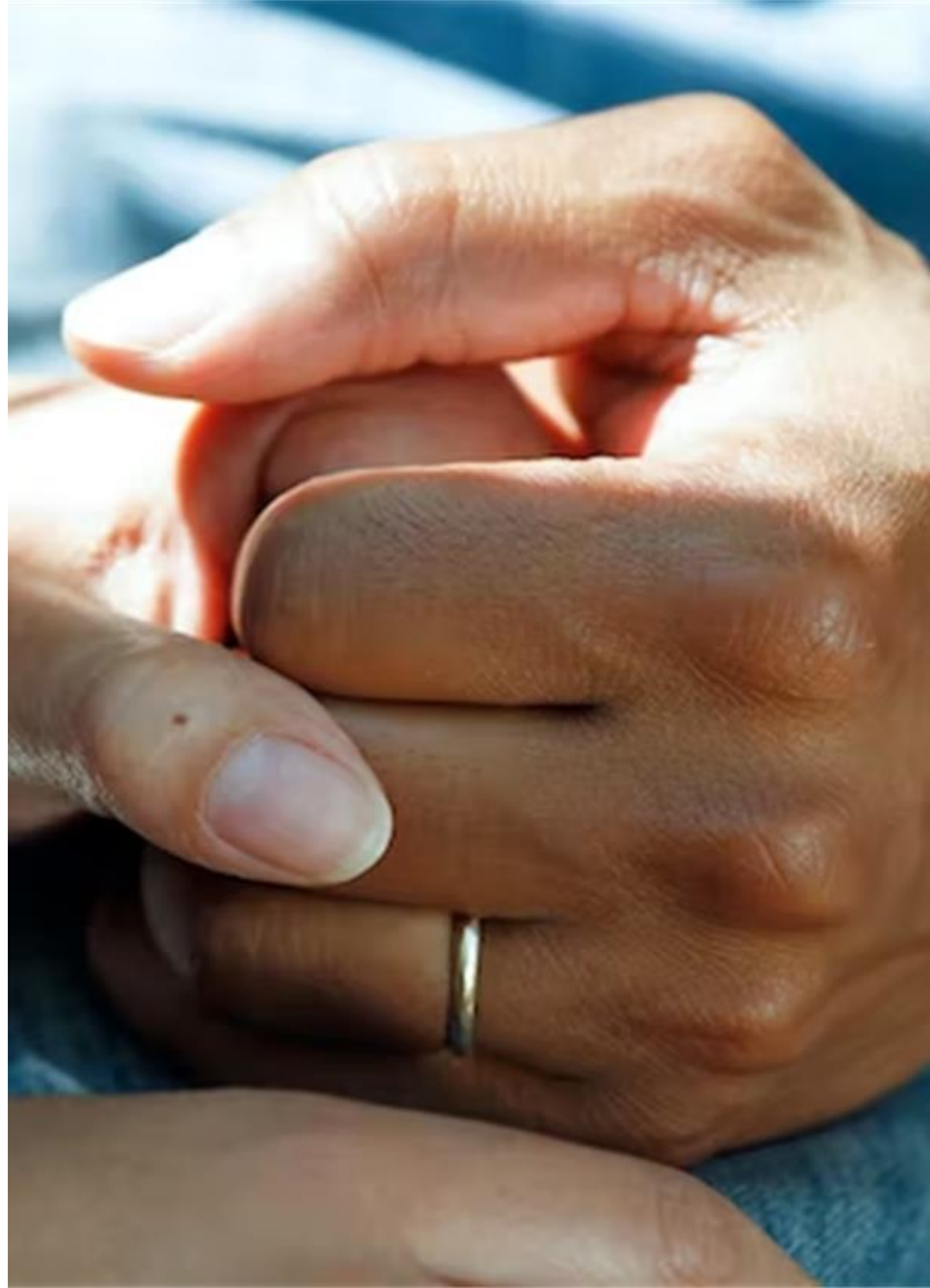
LEUKEMIA & LYMPHOMA SOCIETY OF CANADA

Goal: Support for the Whole Self

- Greater integration of psychosocial and supportive care into cancer care
- Better understanding of the impacts of new treatments on quality of life and how these impacts differ among people
- Health systems that advocate for equitable access to care, trials, and mental health resources

LEUKEMIA & LYMPHOMA SOCIETY OF CANADA®

Caregiver Well-being and Supports



LEUKEMIA & LYMPHOMA SOCIETY OF CANADA®

Closing thoughts

- Novel treatments may be associated with a range of psychosocial and functional challenges that may impact quality of life over the long-term.
- Quality of life may be optimized through tailored approaches to address factors that impact overall health and well-being.
- There is a need for real-world data to inform the design of health services that comprise the right interventions, provided at the right time, to the right people.