



Use of NMP in DCD Liver Transplant: Balancing Utility and Costs

TODAY'S SPEAKER



Amit Mathur

Surgical Director of Liver Transplant



Tuesday, July 18, 2023 2:00pm – 3:00pm ET



Kristina Wheeler
Program Consultant



Need Assistance?

Contact Us via Zoom Chat, or
info@organdonationalliance.org
786-866-8730

Meet Our Moderator



Candy Wells BSN, MM

Director, Organ Utilization



Meet Our Speaker



Amit Mathur

MD, MS, FACS

Surgical Director of Liver Transplant

MAYO
CLINIC





Use of Normothermic Mechanical Perfusion in DCD Liver Transplant: Balancing Utility and Costs

Amit K. Mathur, MD MS FACS
Professor of Surgery, Division of Transplant Surgery
Surgical Director, Liver Transplantation
Director, Transplant Quality and Compliance
Associate Medical Director, Contracting and Payer Relations (Transplant)
Mayo Clinic in Arizona

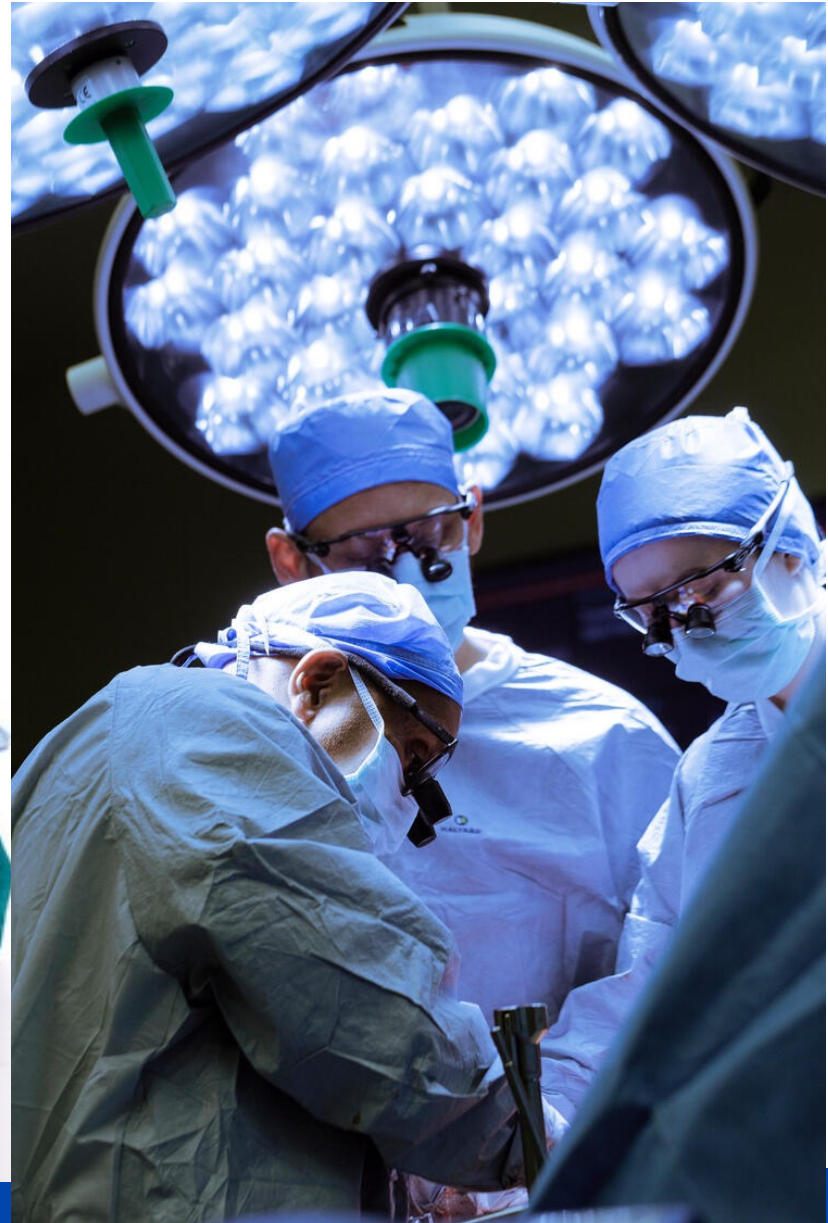
The Organ Donation and Transplant Alliance Conversation Series
July 18, 2023

Amit K. Mathur, MD MS
Professor of Surgery
Mayo Clinic, Phoenix, Arizona

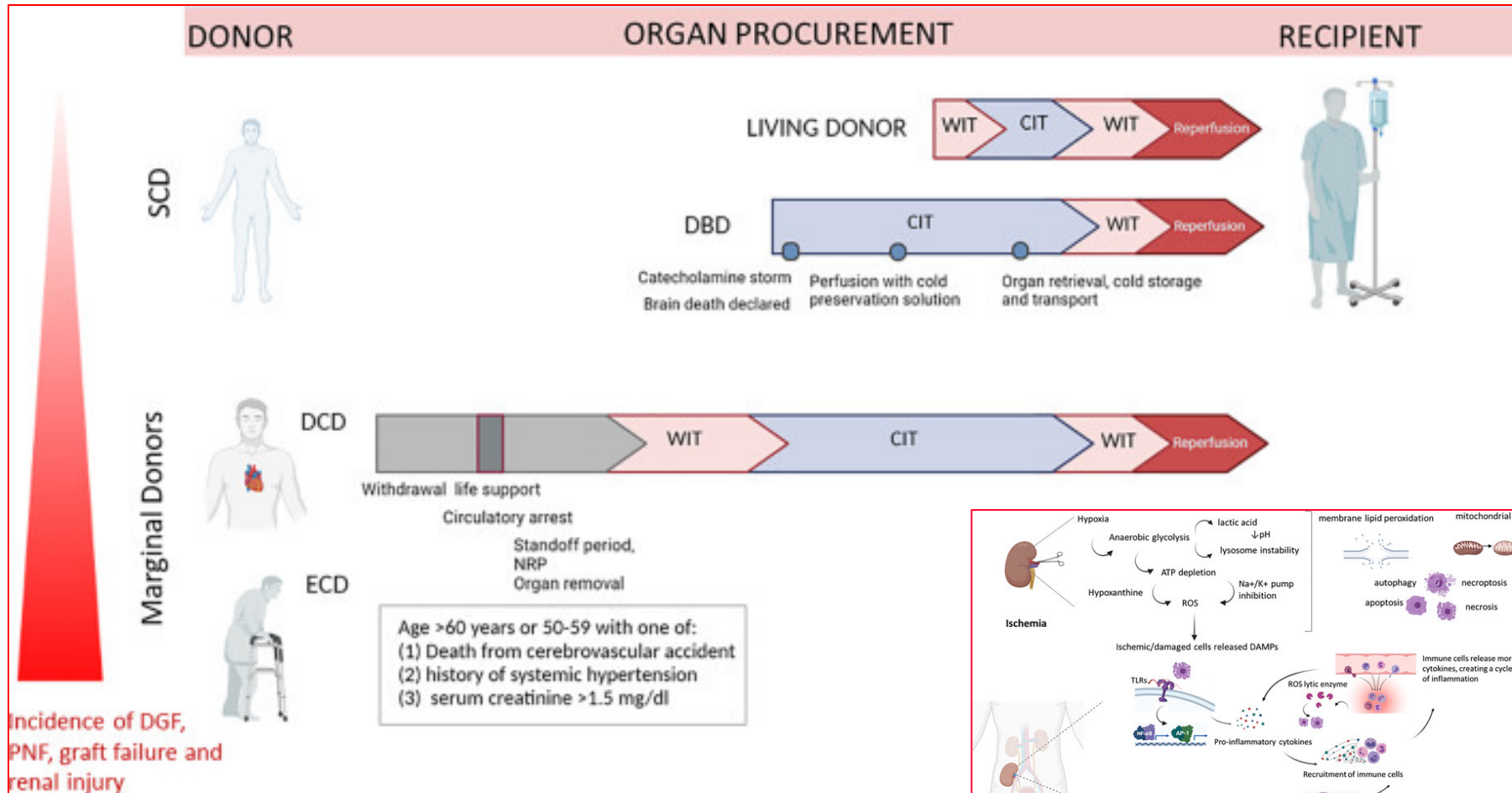
I have no financial relationships with commercial interests to disclose
I am a current member of UNOS MPSC, program team member of the National Living Donor Assistance Center

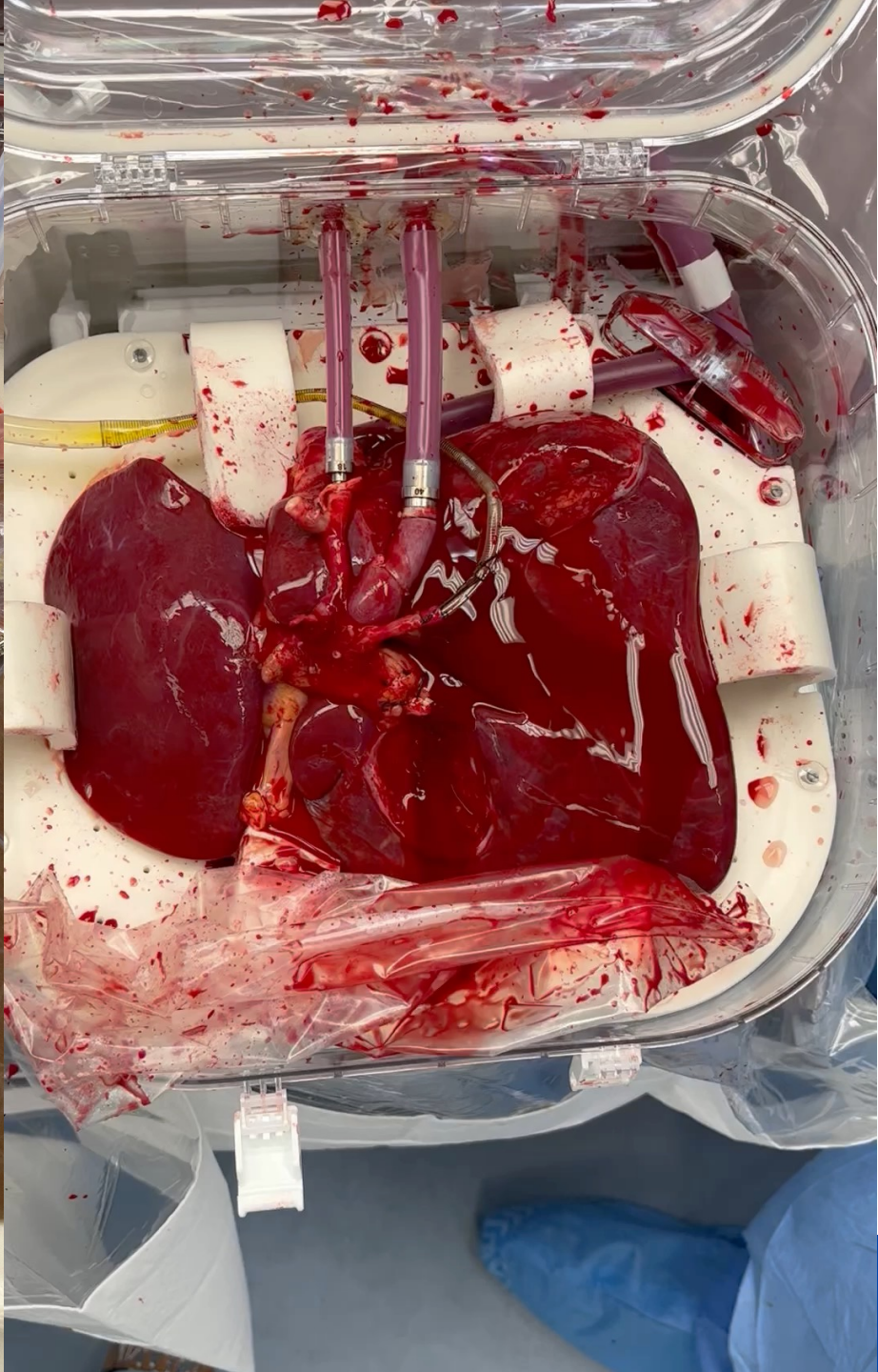
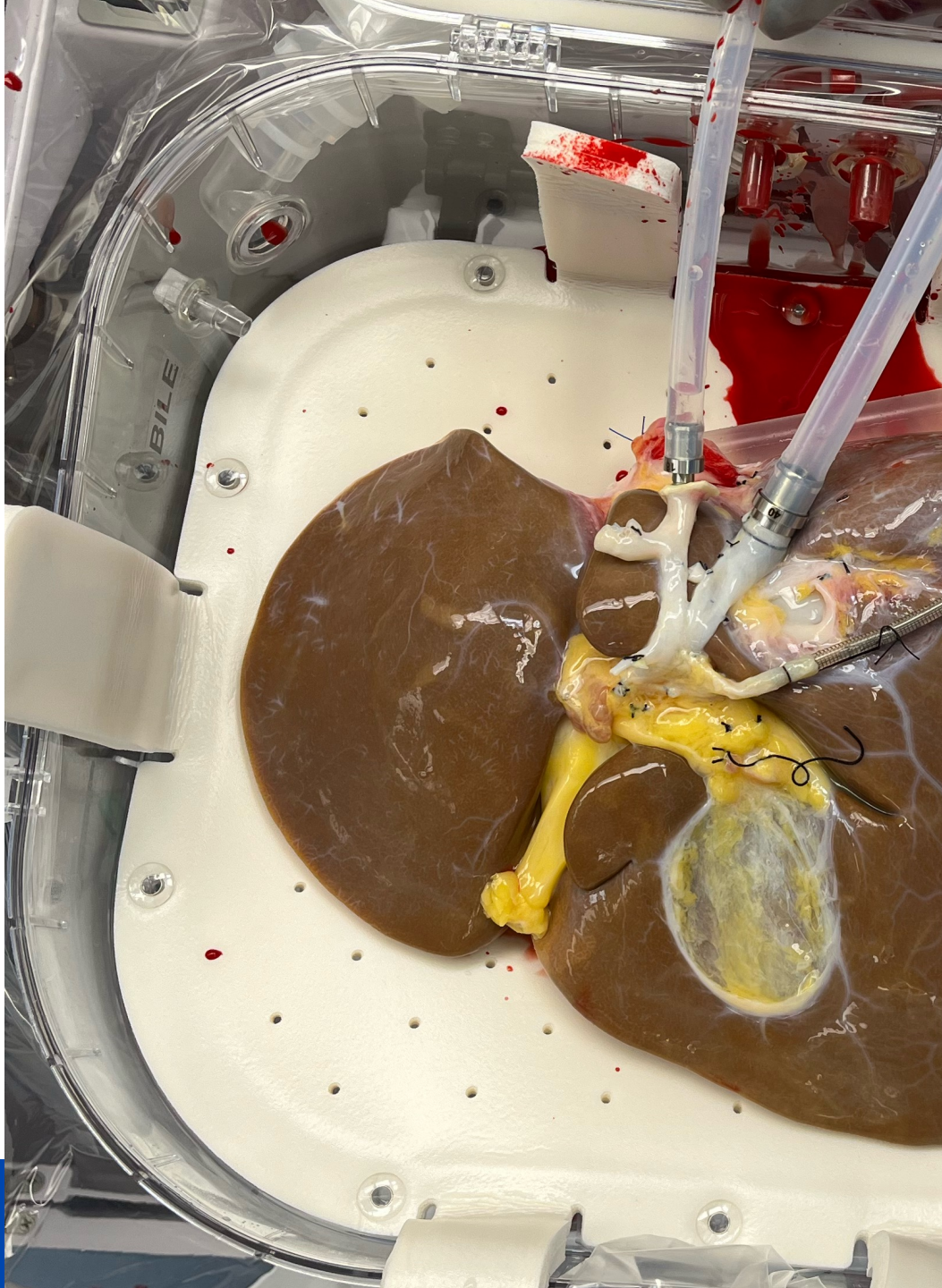
AND

My presentation **may** include discussion of off-label or investigational use of NMP



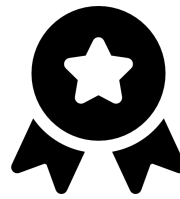
The Necessary Evil: Organ Injury from Ischemia and Reperfusion in Clinical Transplantation







Waiting List Size



Quality Rankings



Organ Availability/
Geography



Wait-list mortality

Drivers of
Program
Innovation



Program culture &
expertise



Program Competition



Risk appetite



Finances

Perfusion Strategy Design Questions

Do programs need multiple perfusion modalities?

Best organ perfusion program design?

How can we treat organs using organ perfusion to improve function?

How do we change our work models to reflect new perfusion tech?

Cost-effectiveness of perfusion?

What is the best modality to perfuse deceased donor organs?

What is the best approach to perfuse organs?

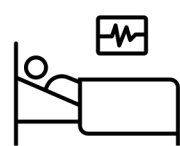
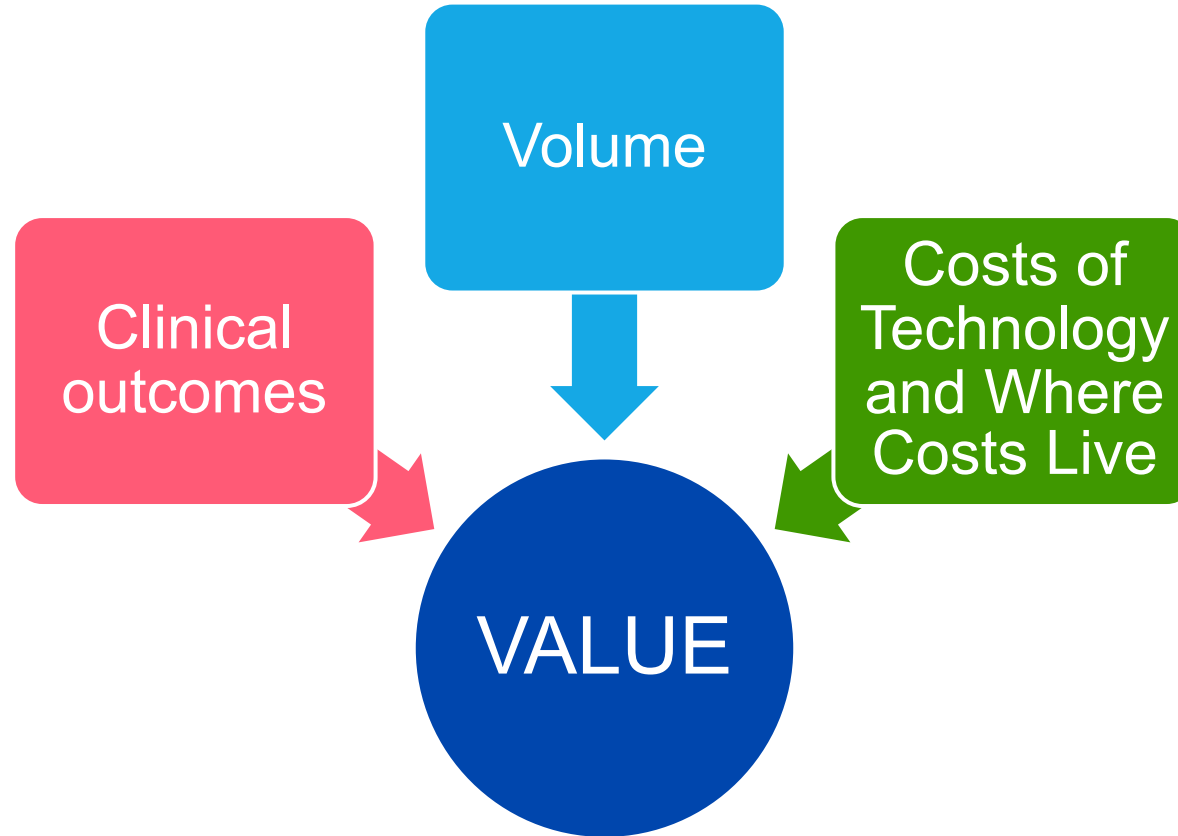
Immediate NMP at donor hospital?

Can perfusion increase access to transplant for low status patients?

Where should perfusion technology live? Transplant center, OPO, third party?

Cost reimbursement for perfusion? How do we measure *value* with organ perfusion?

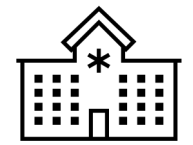
Making it Make Sense— Some Points to Consider in Balancing Utility and Costs of NMP in DCD LT



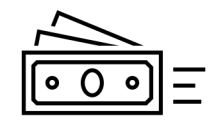
Patient



Doctor



Hospital

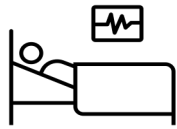


Payer



Regulator

Understanding Value of NMP in Liver Transplant



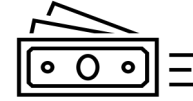
Patient



Doctor



Hospital



Payer



Regulator

Pre-Transplant Care

- Decompensated cirrhosis
- MELD > 30 = \$23,000 / month (2013)
- MELD Increase ~ Mortality Risk
- MELD Trajectory varies for each patient
- MMAT ~ 28-35 (OPTN 2023)

Post-Transplant Care

- Graft Survival with suboptimal organs
- Patient Survival with or without Retransplant
- Ischemic cholangiopathy = High use of endoscopy, radiology, hospital admissions, non-ideal PROs
- Management of complications often outside of transplant contract
- 50% risk of retransplant (new OACs and DRGs)

Transplant Care

- DCD and suboptimal donor liver incidence is increasing
- Utilization of suboptimal organs in higher complexity recipients
- Lower rates of EAD ~ less transfusion, mechanical vent days, dialysis
- Lower LOS and Readmissions

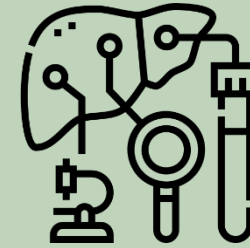
Where Do Liver Transplant Outcomes Need Improvement: Program and



Waiting for
Transplant



Offer
Acceptance

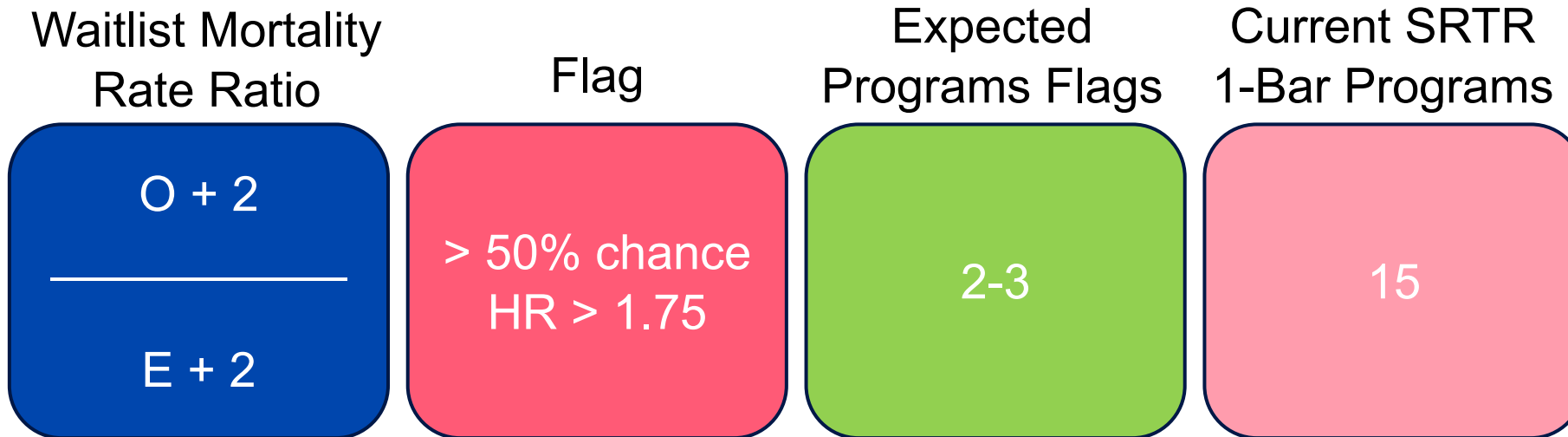


Operative
Course and
Post-
Transplant

Waiting List Mortality for Liver Transplant Centers by SRTR Rating

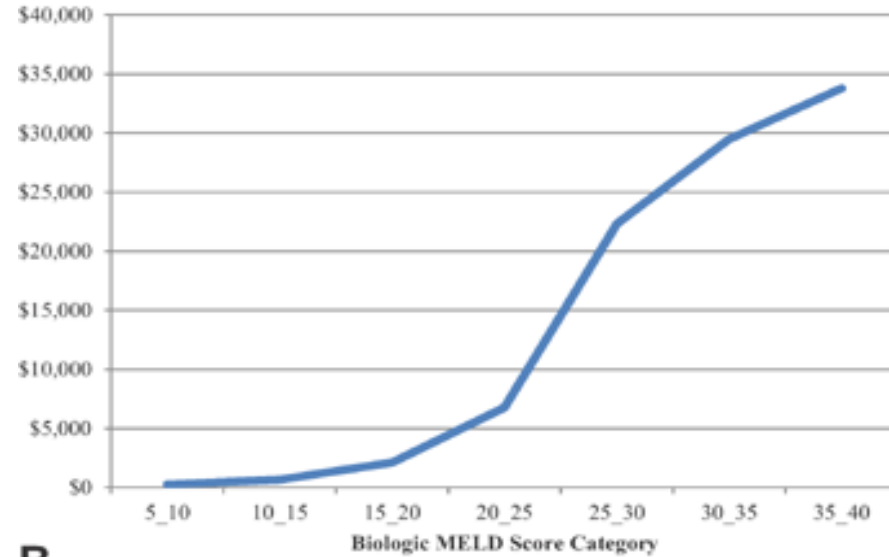
					
Survival On the Waitlist (Deaths Per 100 years of waiting)	20.1	15.6	12.7	11	7.5
Getting A Deceased Donor Transplant Faster (Transplants Per 100 years of waiting)	25.1	49.1	73.7	112.8	162.4
1-Year liver Survival (% with functioning transplant at 1 year)	87	89	92	93	95

OPTN Flagging Criteria for Waiting List Mortality



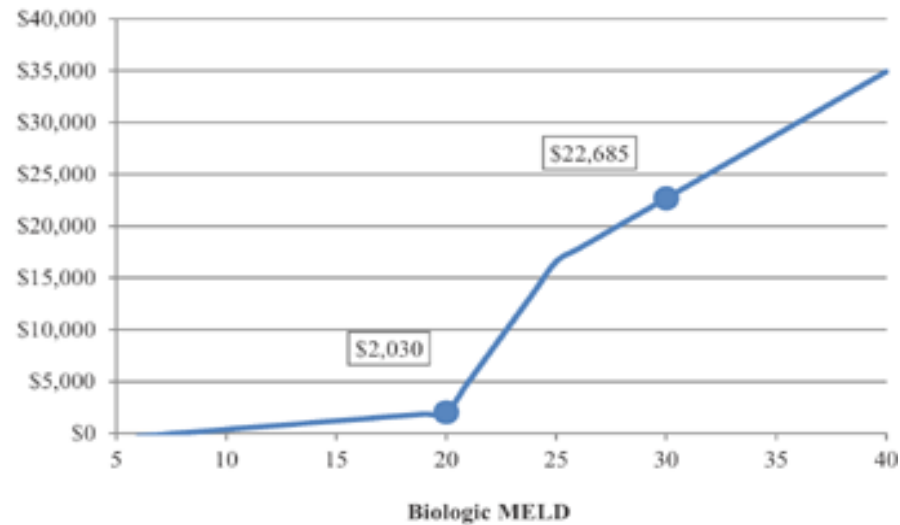
The Costs of Waiting for Liver Transplant: Important for all Stakeholders

A



Unadjusted Monthly
Costs

B



Risk-adjusted Monthly
Costs

Waitlist Outcomes

- Waiting List Mortality Remains Significant
- Many centers are not doing well with managing liver transplant waiting list patients
- Centers have much to lose on poor performance
- High health care expenditures for patients awaiting transplant for monthly costs of care
- Waitlist care is likely to be very low value care because of poor survival and high cost.
- Earlier Liver Transplant reduces the risk of patient death and poor center outcomes with waitlist mortality

Offer Acceptance Metrics: Under the Microscope

OPTN Flagging for Offer Acceptance Ratio < 0.3

Figure B10. Offer acceptance: Overall

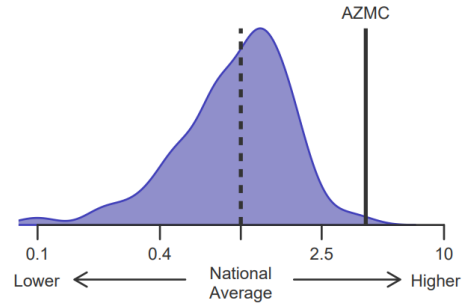


Figure B11. Offer acceptance: PHS increased infectious risk

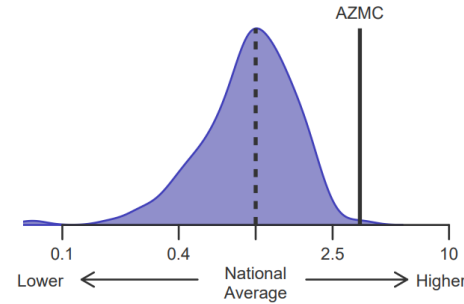


Figure B12. Offer acceptance: DCD Donor

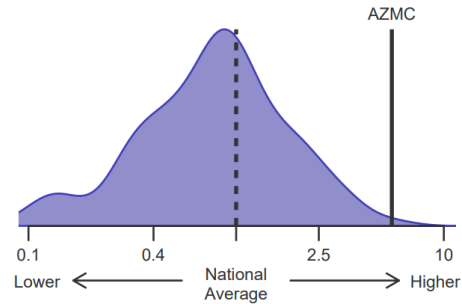


Figure B13. Offer acceptance: HCV+ Donor

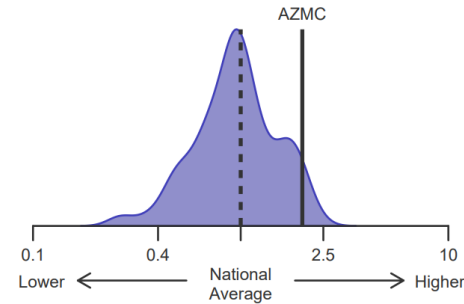


Figure B14. Offer acceptance: Offer number > 50

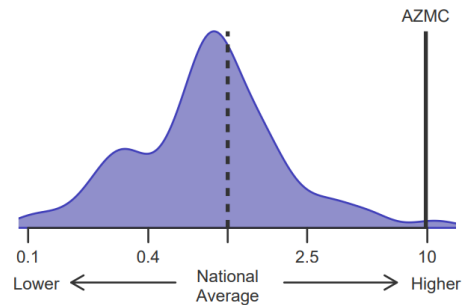
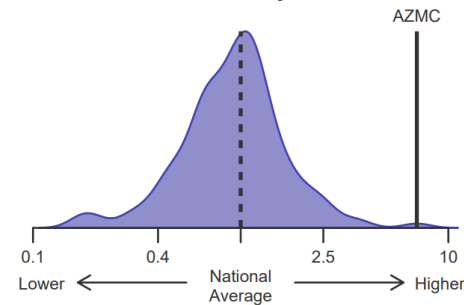
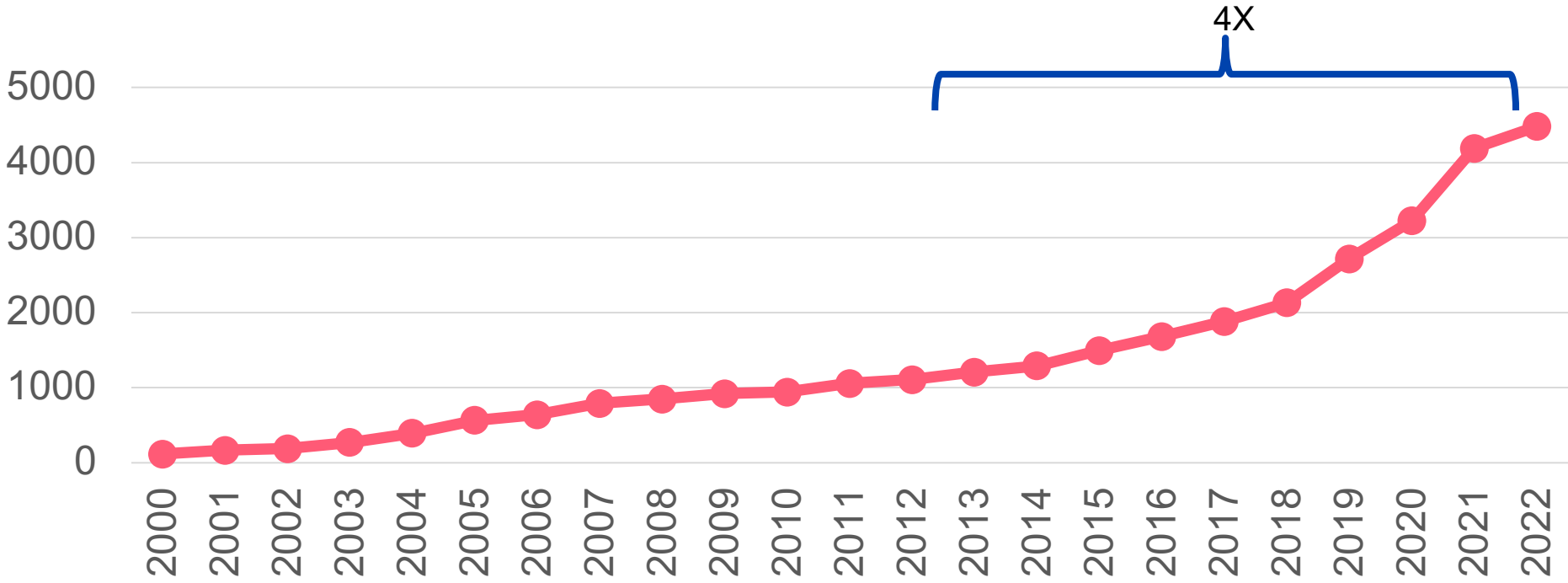


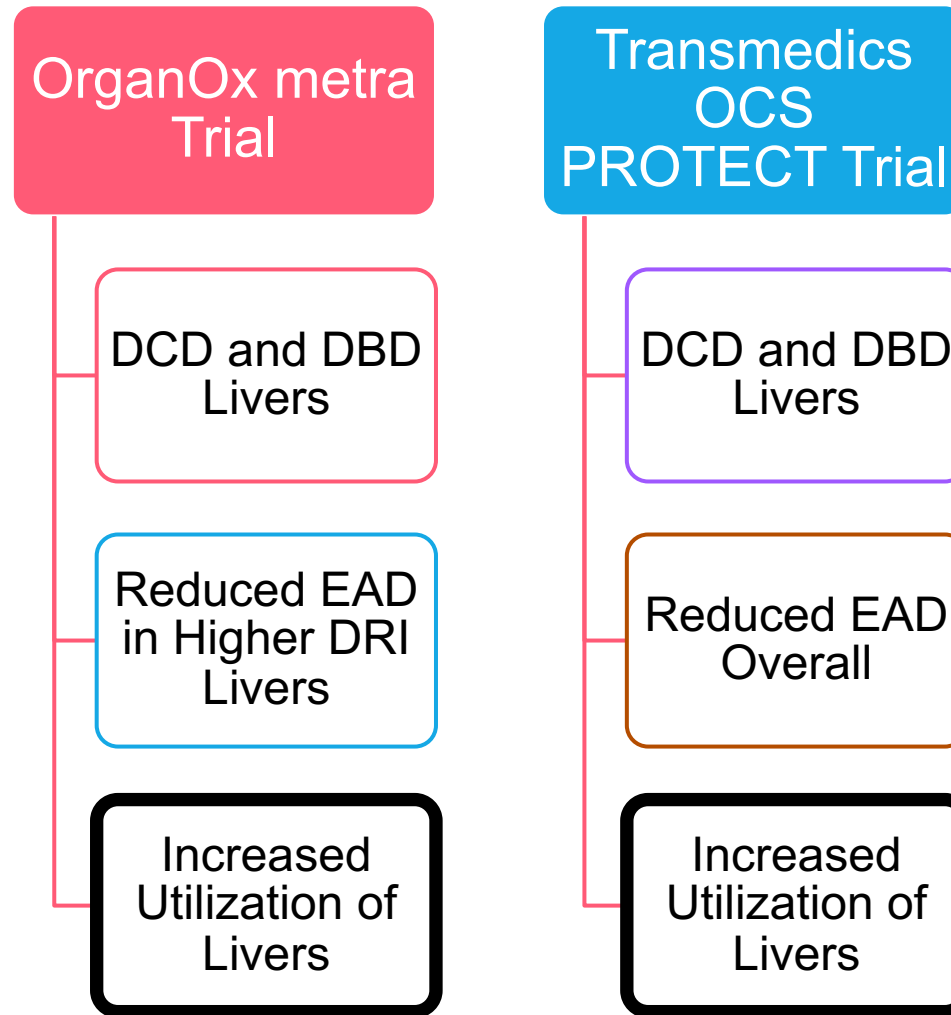
Figure B15. Offer acceptance: Donor more than 500 miles away



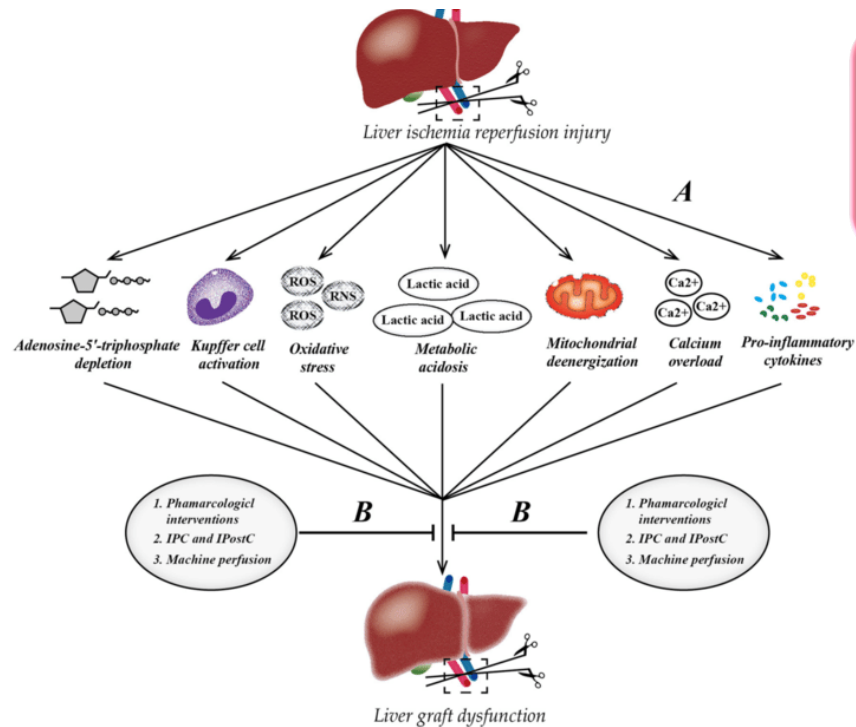
DCD Organ Donation: The Fastest Growing Category of Donation



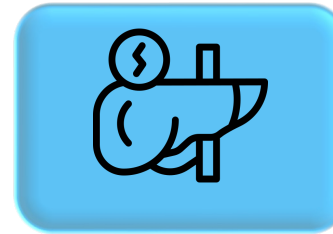
Offer Acceptance: Liver Transplant Volume and NMP



Liver Cellular Physiology Improves with Clinical Perfusion



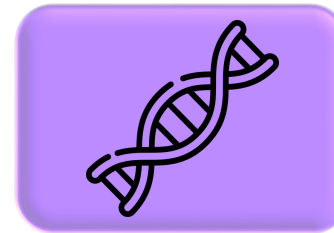
Mitochondrial Function & ATP Production



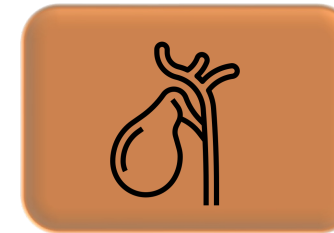
Reduction in hepatocellular injury & acidosis



Less free radical proliferation



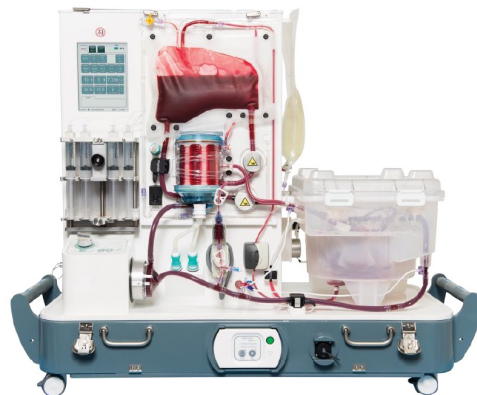
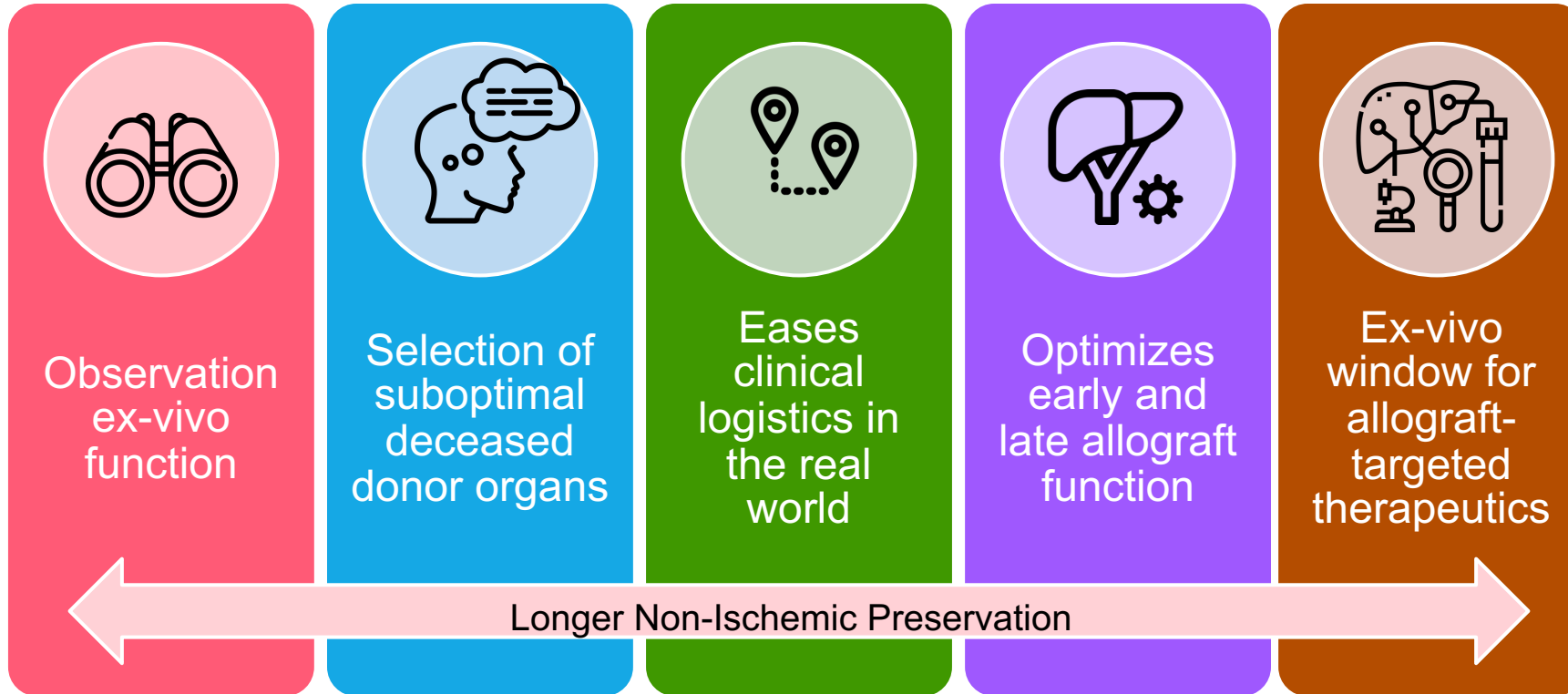
Upregulation of anti-inflammatory genes



Biliary epithelial regeneration

Mao 2022 Frontiers in Medicine

Use of NMP for DCD LT = Benefits in the Transplant Phase

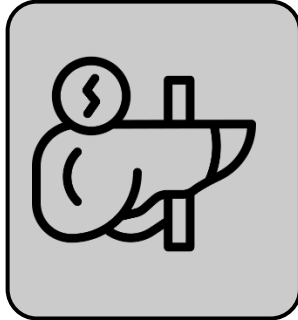


OrganOx *metra*

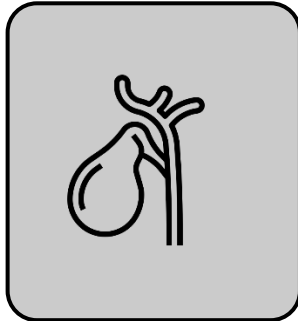


Transmedics Liver OCS

Post-Transplant Outcomes: Two Major Programmatic Challenges



Early Allograft Dysfunction



Ischemic Cholangiopathy



Michelle C. Nguyen, MD MPH
Assistant Professor of Surgery
Mayo Clinic

Normothermic Machine Perfusion of the Liver: Clinical Outcomes and Hospital Resource Utilization

Michelle C Nguyen¹, Bashar A. Aqel², Chi Zhang¹, Peter Frasco³, Winston R. Hewitt¹, Jack Harbell¹, Caroline Jadowiec¹, Nitin N. Katariya¹, Andrew Singer¹, Adyr Moss¹, Kunam S Reddy¹, Amit K. Mathur¹

(1) Department of Surgery, Division of Transplant Surgery, Mayo Clinic Arizona

(3) Department of Internal Medicine, Division of Gastroenterology & Hepatology, Mayo Clinic Arizona

(4) Department of Anesthesiology, Mayo Clinic Arizona

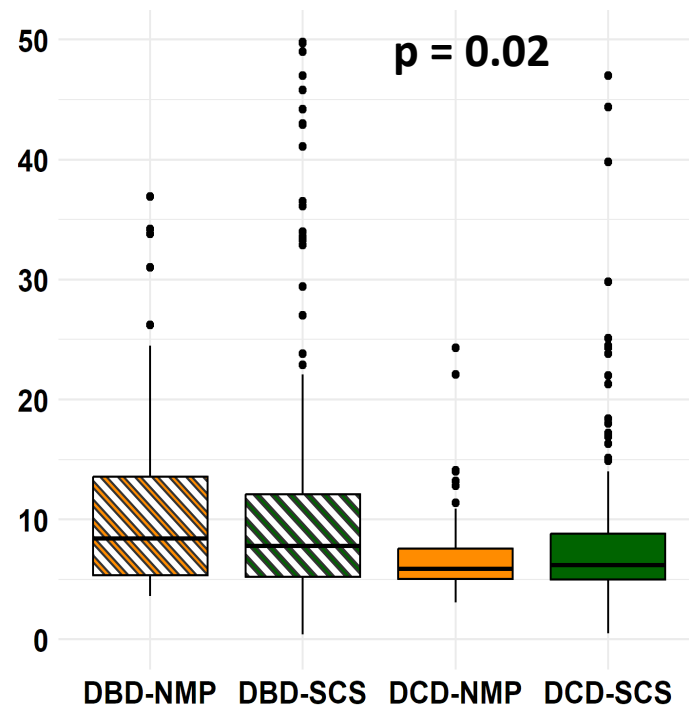
ATC 2023, June 4, 2023

Normothermic Machine Perfusion of the Liver: Clinical Outcomes and Hospital Resource Utilization

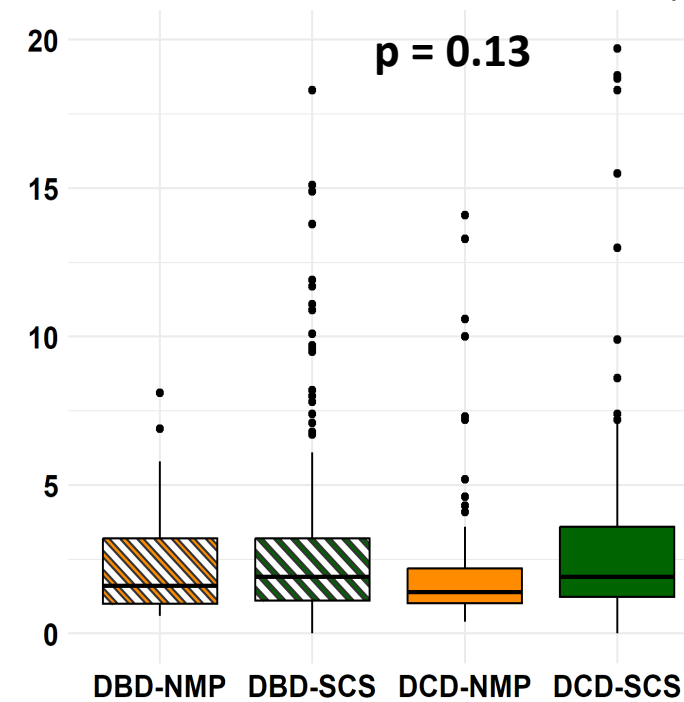


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Assistant Professor of Surgery
Mayo Clinic

Total Hospital LOS



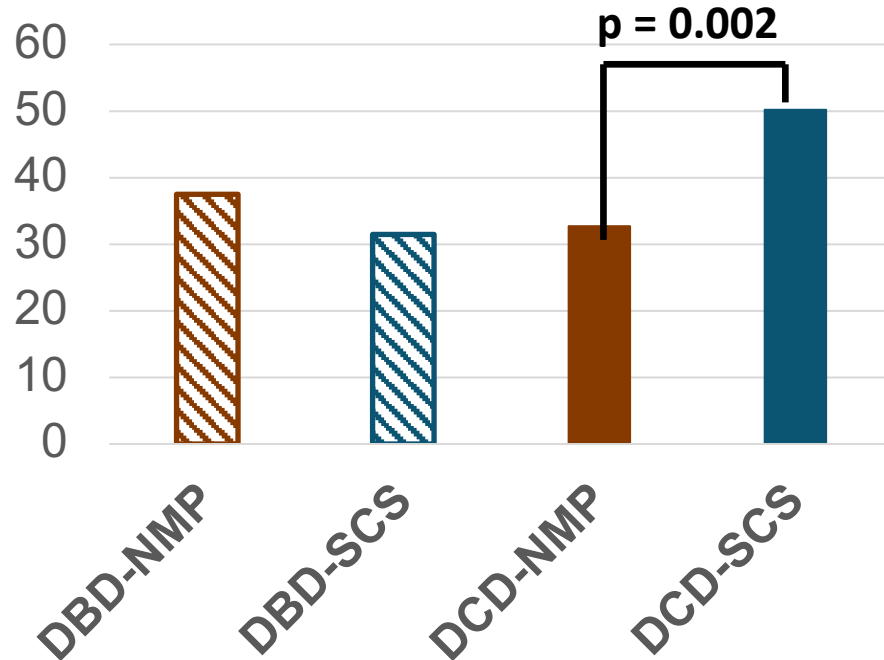
Total ICU LOS



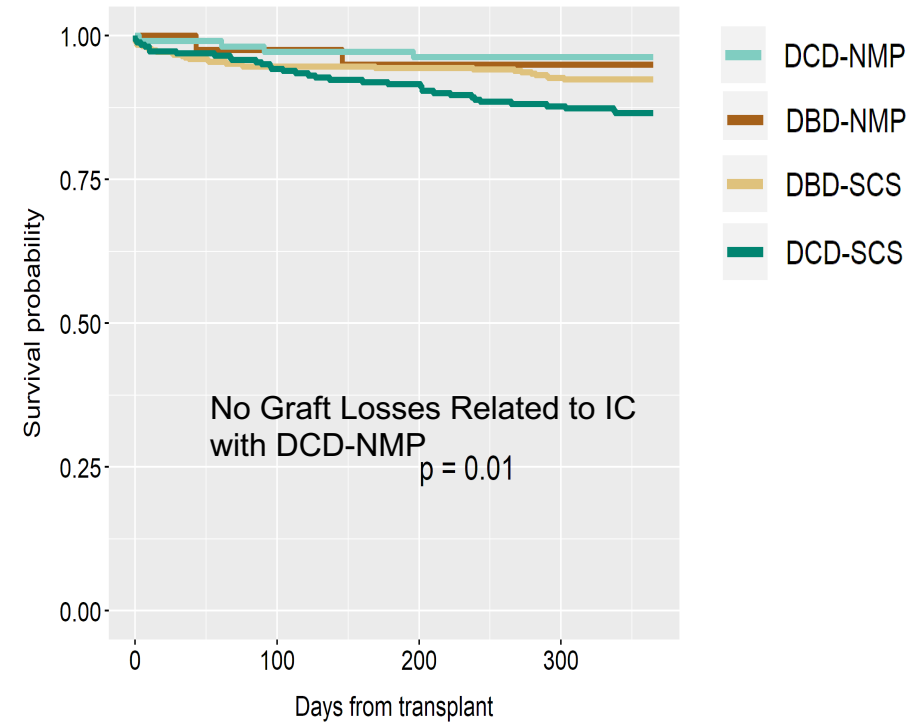
Normothermic Machine Perfusion of the Liver: Clinical Outcomes and Hospital Resource Utilization



Early Allograft Dysfunction



Graft Survival

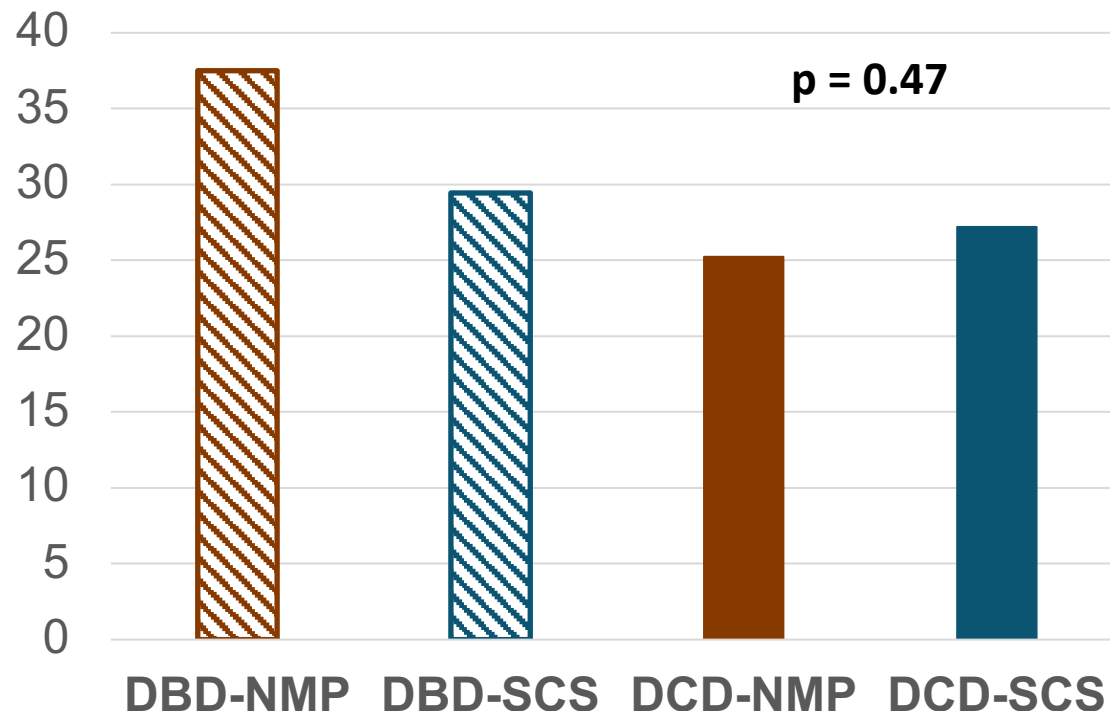


Normothermic Machine Perfusion of the Liver: Clinical Outcomes and Hospital Resource Utilization

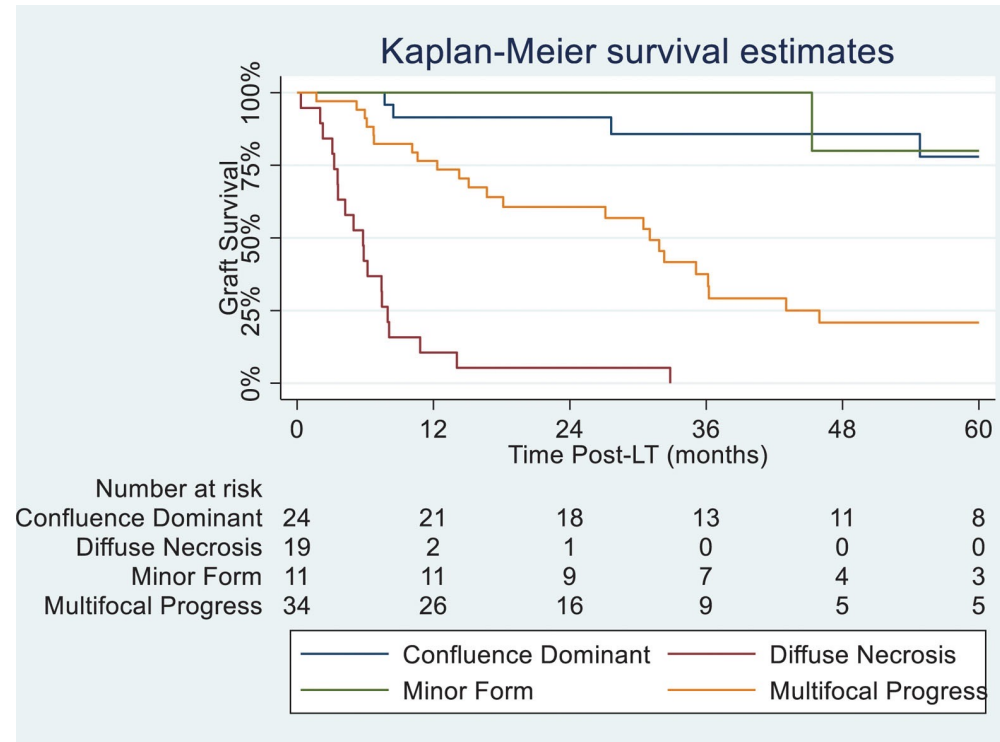
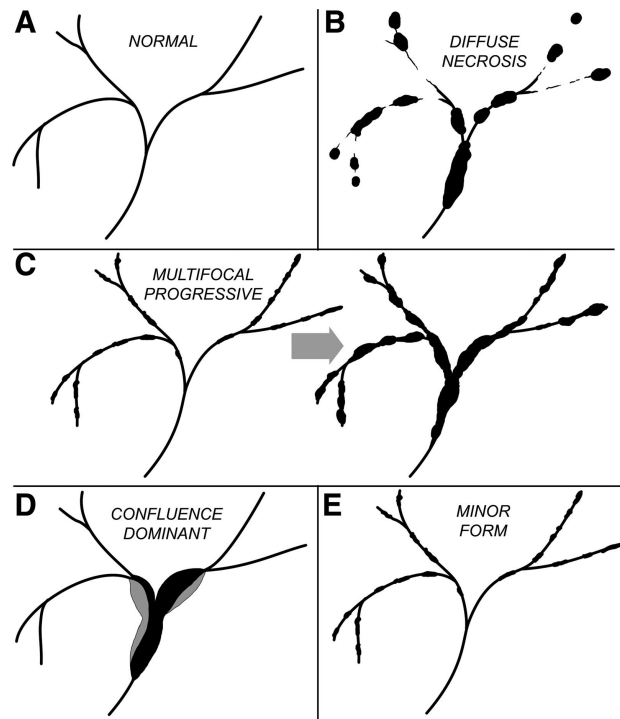


Michelle C. Nguyen, MD MPH
Assistant Professor of
Surgery
Mayo Clinic

30-Day Readmission



Ischemic Cholangiopathy Phenotypes and Their Outcomes



- Affects ~10-20% of DCD LT with Cold Storage

From Croome KP et. al, *Transplantation* 2021

Normothermic Mechanical Perfusion (NMP) significantly reduces the risk of ischemic cholangiopathy in recipients of donation after cardiac death (DCD) Liver Transplants

Bashar A. Aqel, Michelle Nguyen, Kunam S Reddy, Adyr Moss, Winston R. Hewitt, Jack Harbell, Caroline Jadowiec, Nitin N. Katariya, Andrew Singer, Efren Luque-Villa, and Amit K. Mathur

	NMP (107)	SCS (199)	Total (306)	p-value**
Biliary injury (n=77)	22 (20.2%)	55 (27.6%)	77 (25.0%)	0.15
Anastomotic	19 (86.4%)	9 (16.4%)	28 (36.4%)	<0.001
Ischemic cholangiopathy (IC)	3 (13.6%)	46 (83.6%)	49 (63.6%)	
Graft lost due IC	0	14 (30%)	14 (28.5%)	<0.01
Biliary anastomosis				0.23
Choledochoduodenostomy	2 (9.1%)	3 (5.5%)	5 (6.5%)	
Duct-Duct	19 (86.4%)	52 (94.5%)	71 (92.2%)	
Roux-en-Y	1 (4.5%)	0 (0.0%)	1 (1.3%)	
Ischemic cholangiopathy – type (among those with ischemic cholangiopathy, n=49)				
Bilateral multifocal/ multifocal progressive	0 (0.0%)	13 (27.7%)	13 (26.5%)	
Confluence dominant	2 (67%)	25 (53.2%)	26 (53.1%)	
Diffuse Necrosis	0 (0.0%)	2 (4.3%)	2 (4.1%)	
Minor Form	1 (23%)	7 (14.9%)	8 (16.3%)	

*Median (IQR) for continuous variables; n (%) for categorical variables

** Wilcoxon rank sum test for continuous variables; Chi-squared test for categorical variables

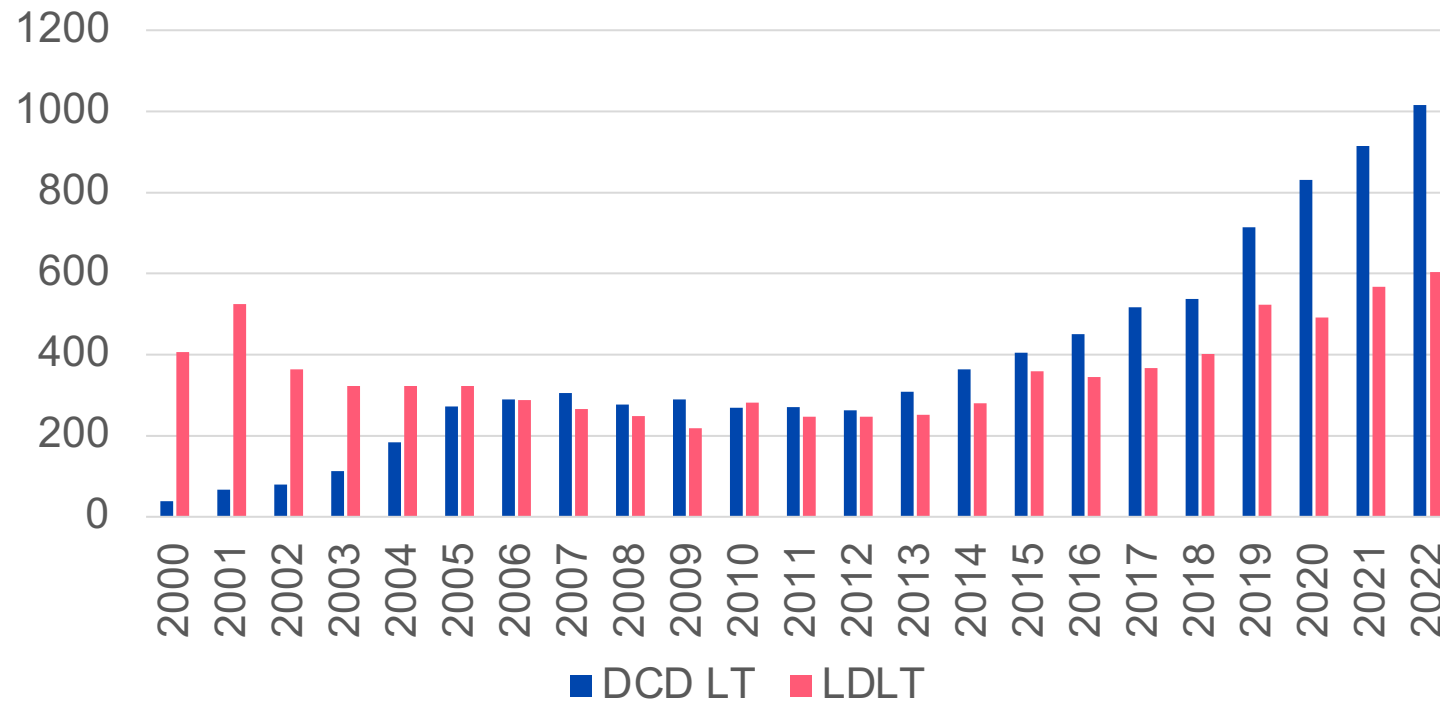


Bashar Aqel, MD
Professor of Medicine
Director, Transplant Center
Mayo Clinic Arizona

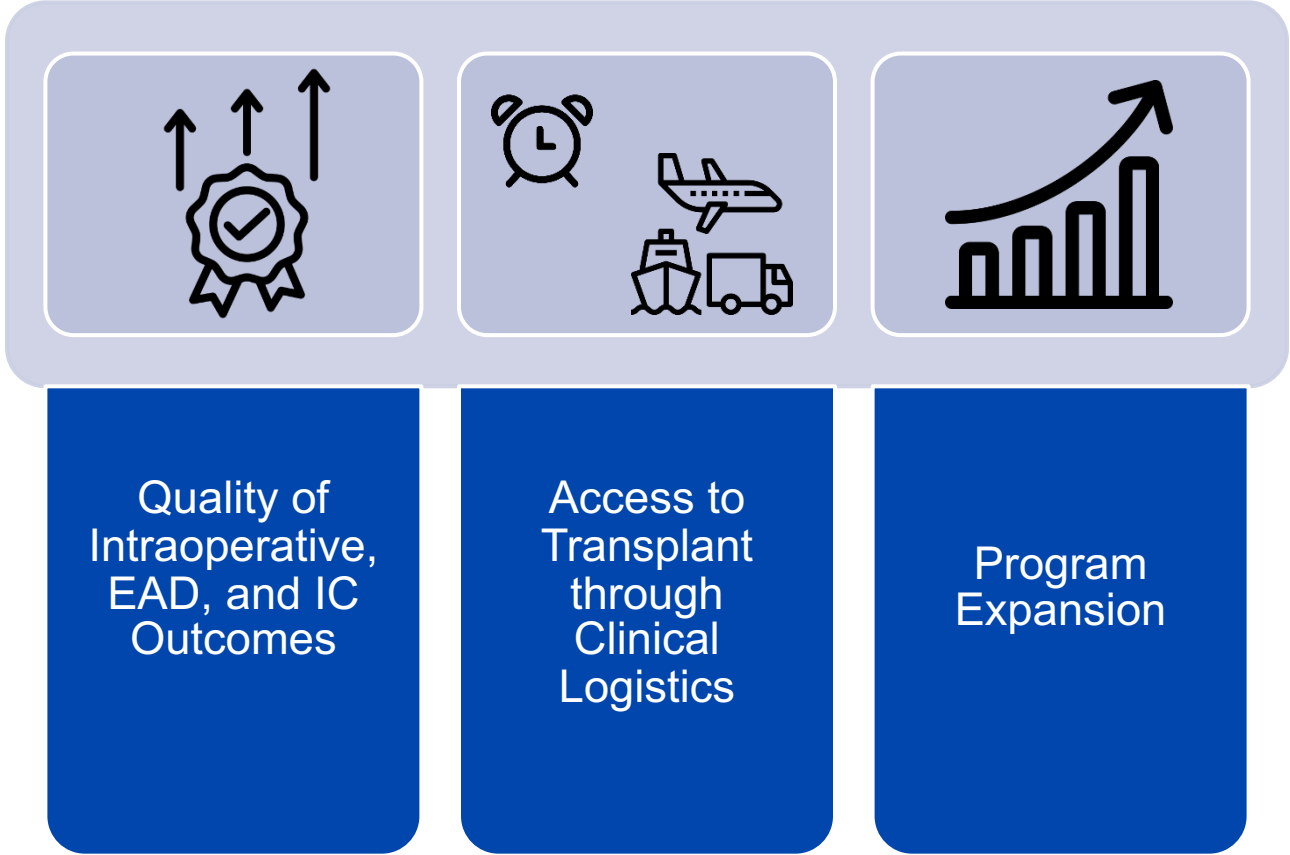
ATC 2023, June 5, 2023

Balancing Utility and Costs: Implications for Program Volume

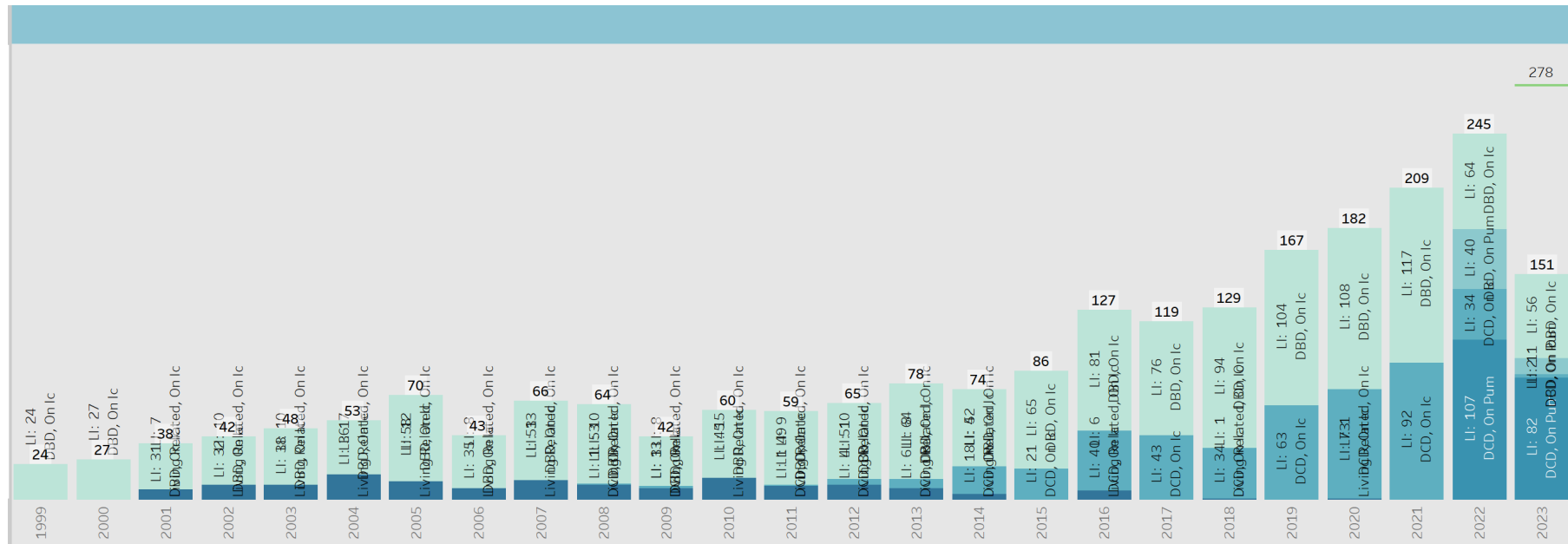
Volume of DCD and LDLT in the US, 2000-2022



Our Goal was to Improve



Mayo Clinic in Arizona is One of Largest Adult Liver Transplant Programs in the United States



Mayo Clinic in Arizona Liver Transplant Activity, January 2022 - Current



Liver Transplants

Select Transplant Year
Multiple values

Surgery Ty., All

Donor Type
All

Definitions:
NMP = Normothermic Mechanical Perfusion (received on pump)

SCS = Static Cold Storage (received on ice)

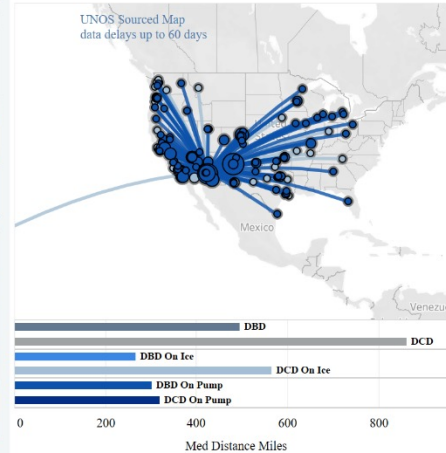
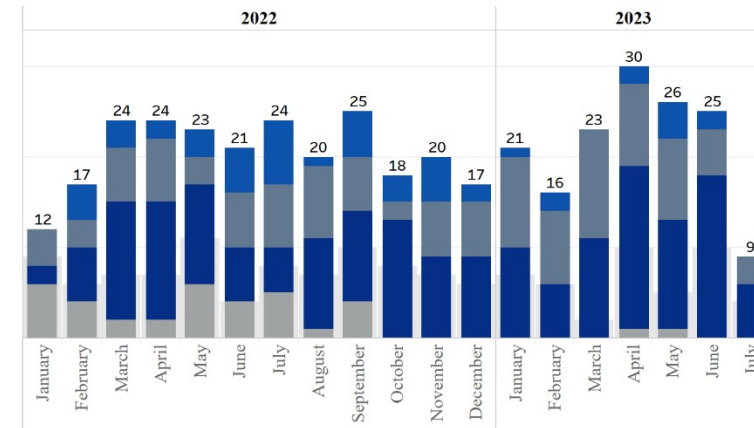
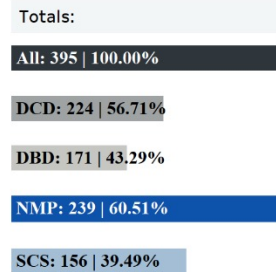
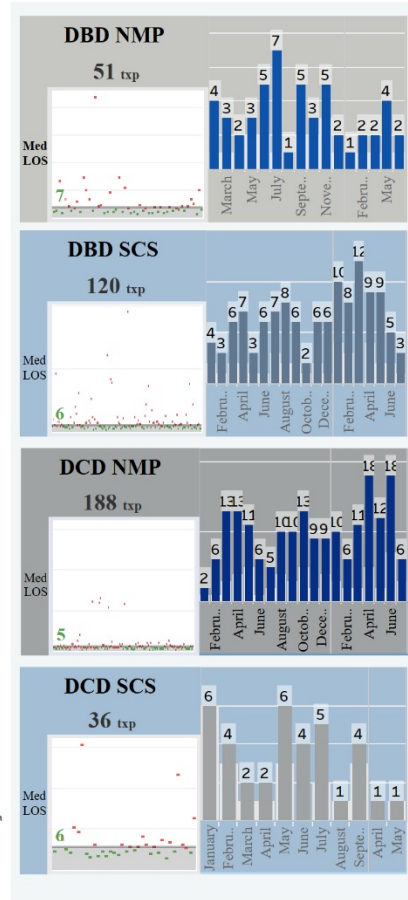
DCD = Donation after Cardiac Death

DBD = Donation after Brain Death

Data Source: EPIC (CLARITY)

Created by: Katey Harris, Data Analyst

Last Updated: 7/16/2023 9:45:34 AM
** expect data to be 1 day behind live data



	Grand Total	DBD		DCD	
		NMP	SCS	NMP	SCS
Liver Transplants Performed	395	51	120	188	36
% of Total Liver Transplants Performed	100%	13%	30%	48%	9%
Median Preservation Time (hours)	9.6	12.0	5.5	13.9	6.5
Median Total OR Time (minutes)	264	286	289	254	286
Median Total Hospital Transfusions (units)	16	17	21	14	22
Median LOS (LT to disch) (days)	6	7	6	5	6
IP Readmits 0-30 days	160	25	50	68	17
% of Total LT w/ IP Readmits 0-30 days	40.5%	49.0%	41.7%	36.2%	47.2%
Early Allograft Dysfunction	134	18	36	59	21
% of Total LT w/ Early Allograft Dysfunct..	33.9%	35.3%	30.0%	31.4%	58.3%
Graft Survival	375	49	115	183	28
% of Total LT Graft Survival	94.9%	96.1%	95.8%	97.3%	77.8%

Costs of Technology and Where Costs Live

Cost and Reimbursement Essentials

Contribution Margin = Net Revenue – Costs (Costs = Fixed and Variable Direct Costs)

- Contribution margin can be calculated for each case, in aggregate, or entire service line for a time period
- Understanding how LT affects contribution margin is critical
- Understanding your organizations financial metrics and cost structure is key

Cost and Reimbursement Reality: Costs of Liver Transplantation Are Going Up

- Organ distribution policies = broader sharing = more travel, flying, jet fuel, time
- Jet Costs
 - Sensitive to OPO and center contracts
 - Not unusual to see large 5-digit invoices
- Liver Perfusion Costs
 - \$20,000 - \$90,000++ per episode

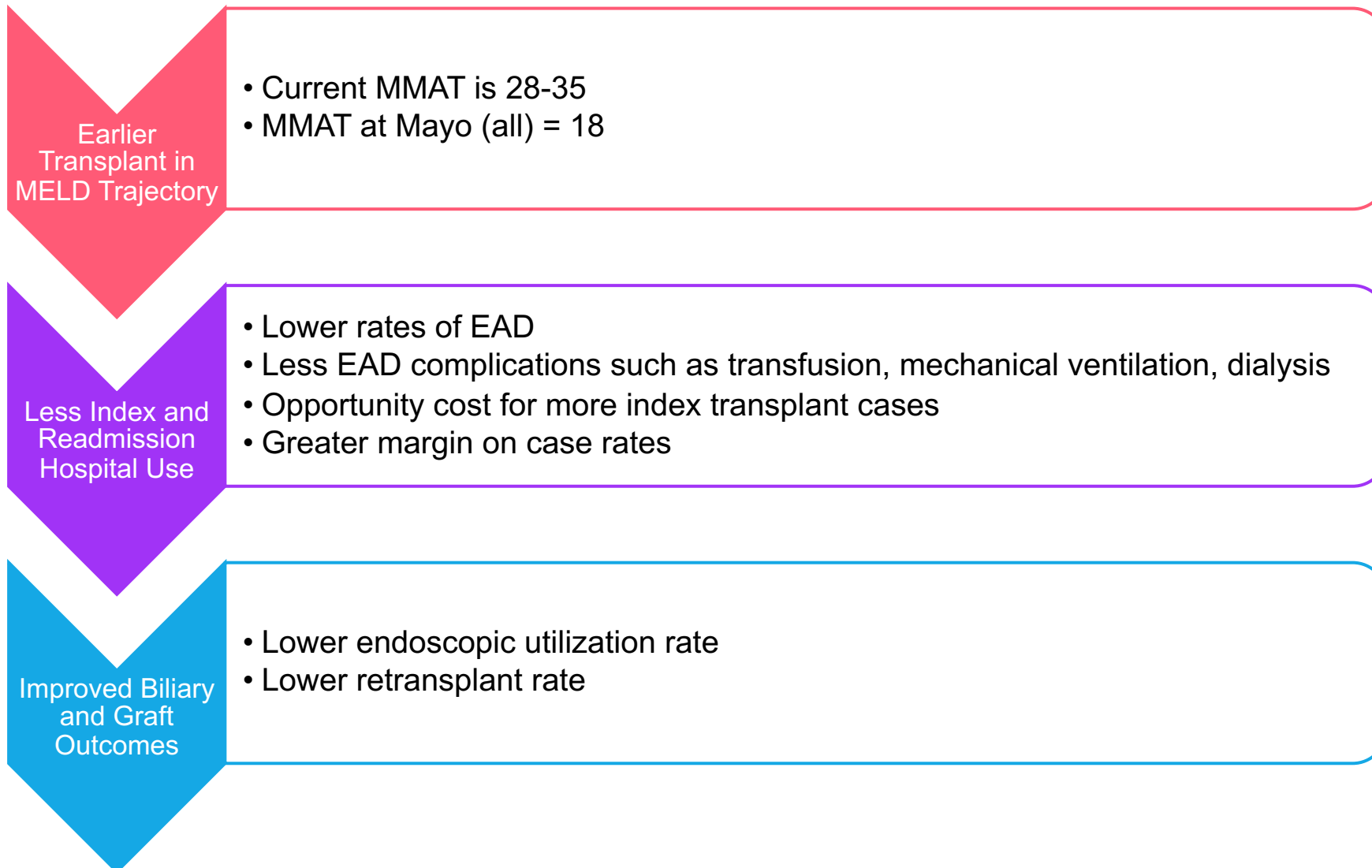
Reimbursement for Perfusion Expenses

- CMS Final Rule 2021
 - Codification of costs of acquiring renal and non-renal organs
 - Included multiple types of expenses
 - “Organ preservation and perfusion costs...”
- Medicare Cost Report expense
 - Medicare percentage impacts reimbursement
 - Lag time before reimbursement occurs

Reimbursement Structure

- Organ perfusion costs are allowable as a part of organ acquisition charges
- Commercial contracts for transplant
 - Driven by specialty networks
 - Payer relationships are critical for all transplant hospitals
 - OAC Reimbursement structure in agreements vary
 - OAC alterations have to account for totality and scope of payer agreement and are strategic for both hospitals and payers (case rate, outlier payment structure)
 - Interaction with hospital contracting team and hospital financial leadership is important
- Clinical leadership is needed to help explain clinical value to changes in financial agreements, i.e., payers want to know why is this change in cost important to their beneficiaries

NMP in DCD LT and Value



Summary

- Balancing utility and costs in the NMP era for liver transplant is a new challenge
- Requires a broad view of the patient journey to see the aggregate value to stakeholders
- Stakeholders retain individual benefits and value with perfusion
- Partnering with hospital executive, financial, and contracting leadership as well as payers is a key component to make this successful
- The transplant landscape is rapidly changing and new challenges in implementing new technologies abound

A Special Thanks to Our Speaker



Amit Mathur

MD, MS, FACS

Surgical Director of Liver Transplant

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THE Alliance

| Conversation Series