

PC4 

PAC3



## *The Great Divide:*

**Extended CICU LOS** vs.  
**Early Transition to ACCU Care**  
*for Post-Norwood Recovery*

# Moderators



Jay Duncan, MD  
Cook Children's Medical Center



Amy Lay, MD  
Lurie Children's Hospital



Jeremy Affolter, MD  
Children's Mercy Hospital



Josh Wolovits, MD  
Children's Medical Center Dallas



Tarif Choudhury, MD  
CUIMC/New York-Presbyterian



Mary Olive, MD  
CS Mott Children's Hospital



Ilana Schwartz, MD  
CS Mott Children's Hospital

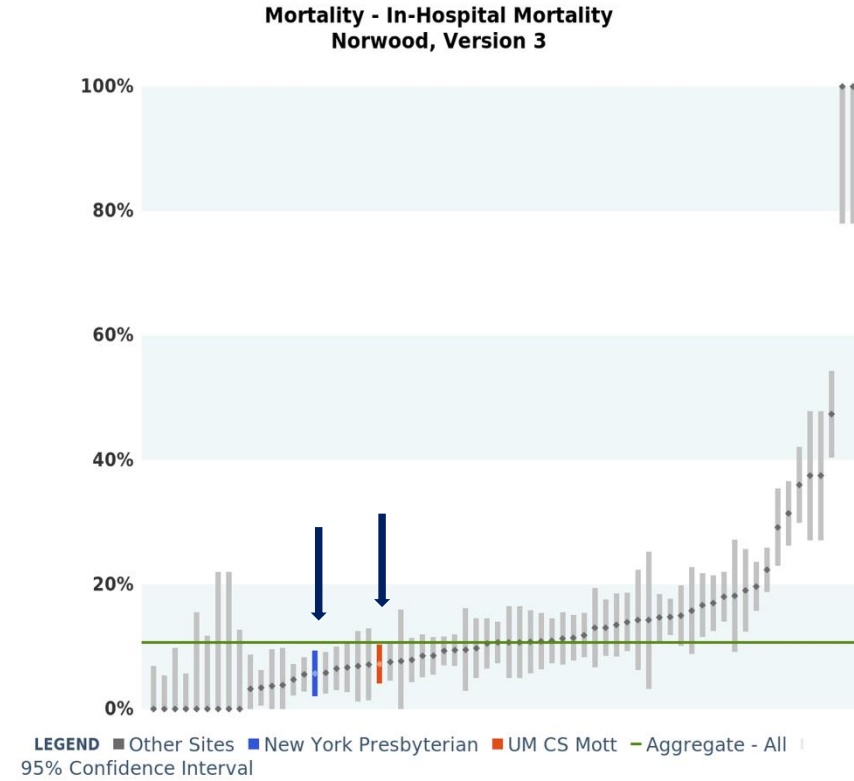
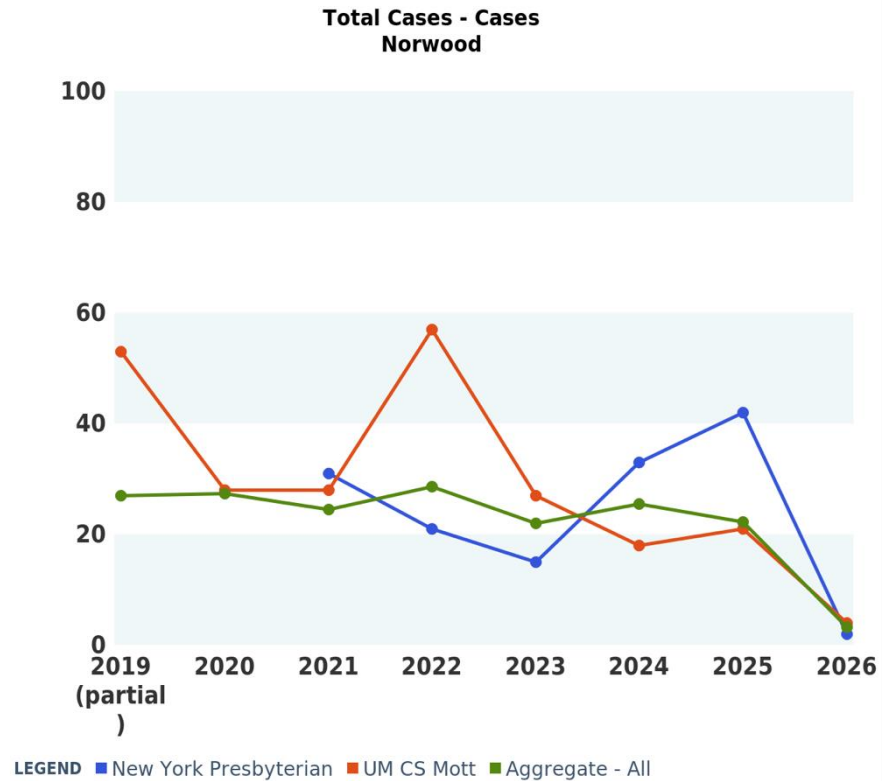


Anne Ferris, MD  
CUIMC/New York-Presbyterian

# Objectives

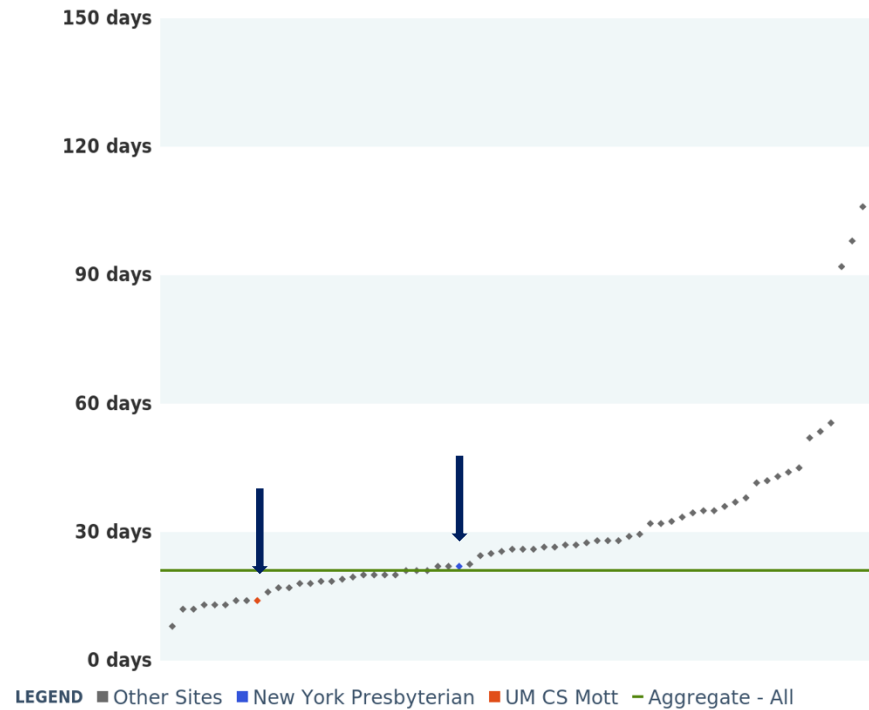
- **Analyze institutional variations** in postoperative care strategies among centers with low mortality and similar hospital stays.
- **Understand** the advantages and disadvantages of extended cardiac ICU care versus early transition to acute care for patients following Norwood operations.
- **Evaluate the impact** of ICU length of stay on clinical outcomes, resource utilization, and family experience.
- **Identify key factors** influencing decisions about ICU versus acute care management, including patient complexity, staffing models, and institutional resources.

# Background

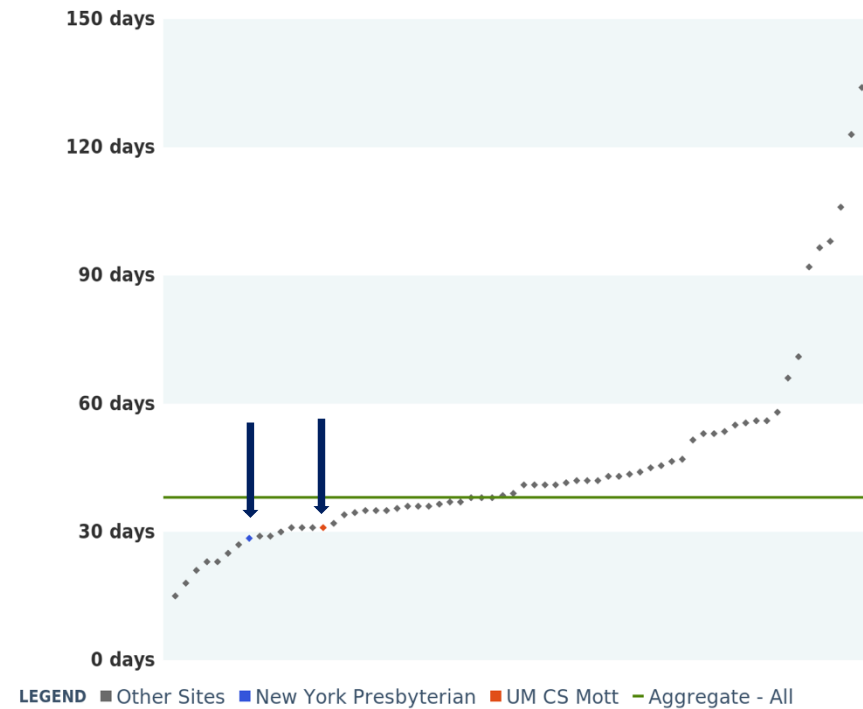


# Background

Resource Utilization (Medians) - Postop CICU LOS  
Norwood, Version 3



Resource Utilization (Medians) - Hospital LOS  
Norwood, Version 3



# Direct Discharge from the CICU After Norwood Pro Position: HLHS Infants Should Be Discharged Directly from the Cardiac ICU

Tarif A. Choudhury, MD  
Assistant Professor of Pediatrics  
Columbia University School of Medicine  
Divisions of Pediatric Critical Care Medicine and Pediatric Cardiology  
Morgan Stanley Children's Hospital of New York

# Objectives



**Describe why this debate is important- a tale of two populations and two places**

difference between normal (intended) physiology and HLHS physiology

impact of handoffs

difference between ICU and wards



**Describe what is our why at Columbia**



**Describe how we achieve this at Columbia**

Our CICU Model

- Who
- What
- When
- Where
- Why
- How



**Review Columbia outcomes**



**Acknowledge pitfalls/describe potential measures worth reviewing**



**Summary**



**Considerations for ward transfer**

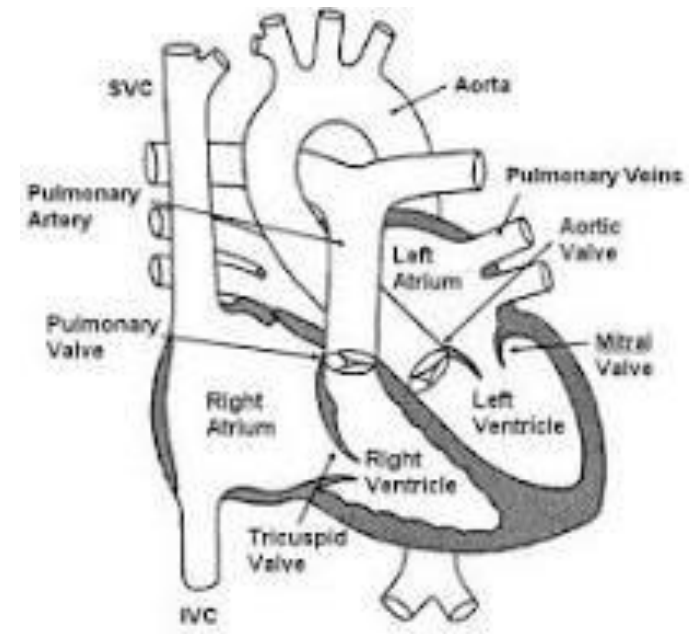
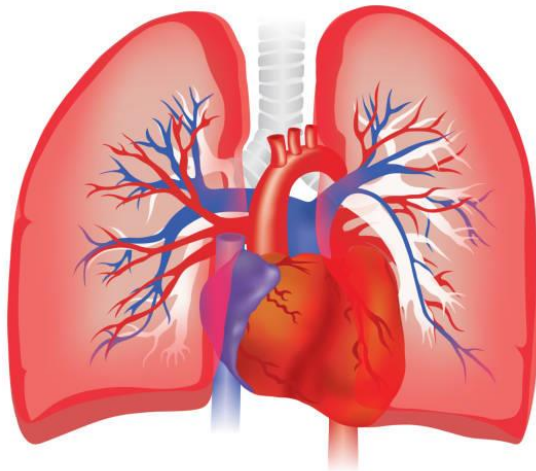
# My World View: A Deviation From Normal Demands Triaging Up



- What is important to highlight in this debate?
- Expected natural physiology is different from HLHS physiology
- CICU therapies and surveillance is different from ward therapies and surveillance

## Why this Debate is Important Normal Physiology is *Relatively* More Simple

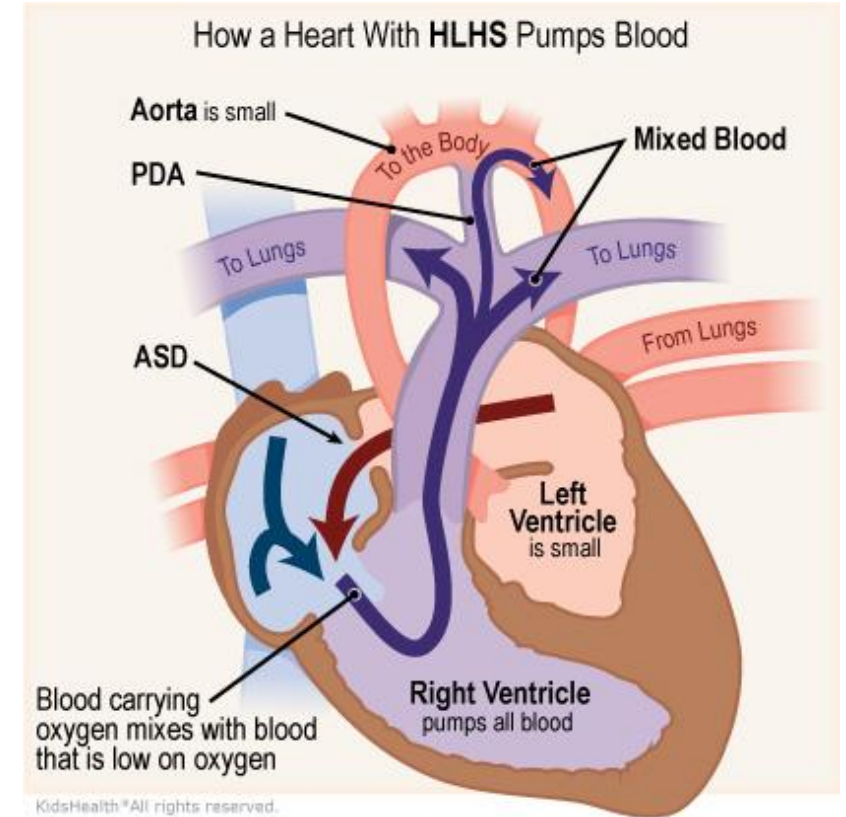
- Negative pressure breathing to be applied to in-series cardiovascular circulation that includes a subpulmonary ventricle WITHOUT admixture of deoxygenated and oxygenated blood



# Why this Debate is Important

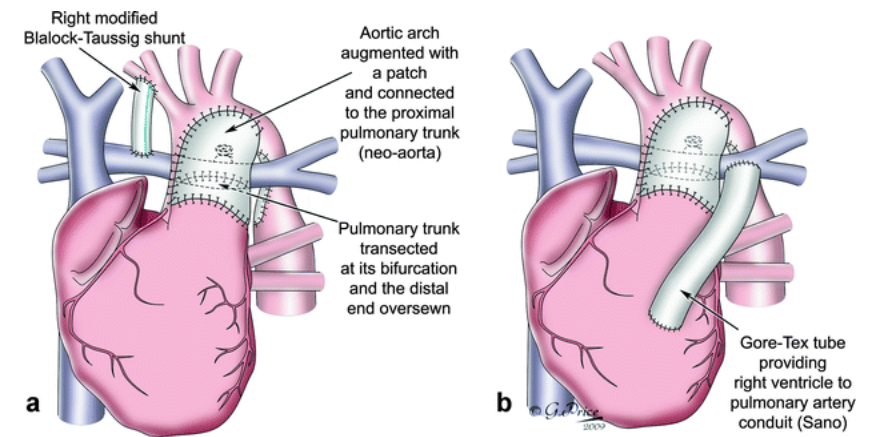
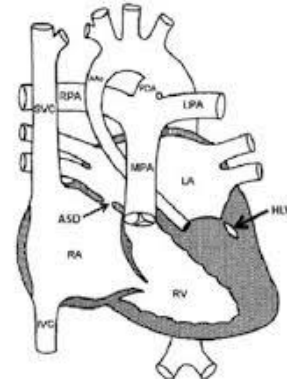
## Because HLHS Post Natal Physiology is More Complex

- Physiology highlighted by complete mixing in a single ventricle f/b output to pulmonary AND systemic circulation (parallel circulation)
- Pre-op/post natal goals for the neonate:
  - Sustain adequate systemic blood flow
    - PGE1
    - Maintain ventricular performance and oxygen carrying capacity
  - Ensure adequate mixing; consider atrial septectomy
  - Surveillance for adequate (as opposed to supranormal) pulmonary blood flow
    - Goal SpO2 80-85%; Manipulation of PVR/SVR if indicated.



Why this Debate is Important-  
Because HLHS Post Op Norwood Physiology Complexity  
May Not be Appropriate for the Wards?

- Create a systemic output/maintain systemic perfusion by DKS and arch reconstruction
- Maintains balanced pulmonary blood flow by BTS or Sano
- Maintains mixing by atrial septectomy
- At risk for
  - residual arch obstruction,
  - DKS obstruction
  - AVVR/semilunar valve regurgitation
  - ventricular dysfunction
  - BTS occlusion/BTS narrowing/Sano narrowing
  - branch PA stenosis
  - restrictive atrial septum



Sridharan et al (2010). In: *Cardiovascular MRI in Congenital Heart Disease*. Springer 2010

# What is Expected with a Ward Transfer (in Comparison to ICU Admission)?

Domain	NCICU	Ward
Nurse: Patient ratio	higher	lower
Monitoring intensity	Continuous expert interpretation	Often less
Staff expertise	Cardiac icu trained	Often less
Culture of vigilance	High	variable
room	Single possible vs double	Can be up to 4/room

# Argument 1: Specialized surveillance preservation is important throughout hospital stay

- Subtle desaturation trends may precede collapse
  - Feeding fatigue signals hemodynamic compromise
  - Weight trajectory requires expert interpretation
  - NCICU teams uniquely calibrated to detect early decline

# Argument 2: High-risk populations benefit from minimized transitions

- Handoffs are known sources of medical error
  - ICU-to-ward transfers associated with risk of medical errors +/- adverse events (*Mueller SK et al. J Hosp Med 2012*)
  - Information degradation occurs with transitions (*Starmer AJ et al. Pediatrics 2014*)
  - Norwood infants have little tolerance for delay in recognition

\*\*\*Norwood physiology is fragile — and transitions are where fragility is exposed\*\*\*

# What Is Our Why at Columbia (and Therefore How Our Mission Drives Disposition)?



- Optimize care for infants with HLHS with significant comorbidities
  - prematurity/LBW
  - extracardiac comorbidities
- Optimize Norwood outcomes (in HLHS infants with and without significant comorbidities)
  - survival (S1P to BDG)
  - mitigate residual lesion burden
  - optimize NDV outcomes
  - Optimize survival to BDG, Fontan, and beyond

# How do we Achieve Our Why at Columbia?

## Who are the People Caring for our NCICU Patients?

- The people
  - 4 surgeons- 2-3 with significant/evolving neonatal surgical interest
  - 4 NCICU attendings with advanced training who round with fetal cardiologists
  - 3 NICU attendings who round with double boarded cardiac intensivists
  - NICU and cardiology fellow



# How do we Achieve Our Why at Columbia? **Who** are the People Caring for our NCICU Patients?

- Front line
  - No residents, only APPs
- NCICU nurses with specific expertise in neonatal cardiovascular physiology
- NCICU RTs
- NCICU nutritionists
- NCICU OT/PT
- NCICU social worker
- NCICU pharmacist
- NICU palliative care

# Argument 3: The ICU environment is best suited for intensive caregiver training

- Parents must master pulse oximetry, daily weights, feeding and medication administration
  - Recognizing red-flag symptoms is critical
  - Standardized discharge bundles improve outcomes; 15% interstage mortality to 0% in intervention group (*Ghanayem NS et al. J Thorac Cardiovasc Surg 2003*)
    - Easier to do with a favorable nurse/multidisciplinary team to patient ratio
  - Education quality outweighs location (large centers vs small centers) convenience (*Anderson JB et al. J Pediatr 2010*)
    - Easier to find time to educate in NCICU with a favorable nurse/multidisciplinary team to patient ratio

# Argument 4: Cardiac ward shouldn't be used to “prove stability”

- Ward often used to 'prove stability'
  - True physiologic stability should allow ICU discharge
  - If unstable, transfer increases risk
  - Ward should not be a testing ground for fragile physiology

# How do we Achieve Our Why at Columbia? **Where** at Columbia are our Infants Cared for?

- 17 bed NCICU
- Separate wing of the 9<sup>th</sup> floor in “north building” on the same floor as PCICU which is in the “tower building”
- Transitional nursery location in “tower building”
- OR in “central building” building
- Cath lab on 3<sup>rd</sup> floor of “tower building”



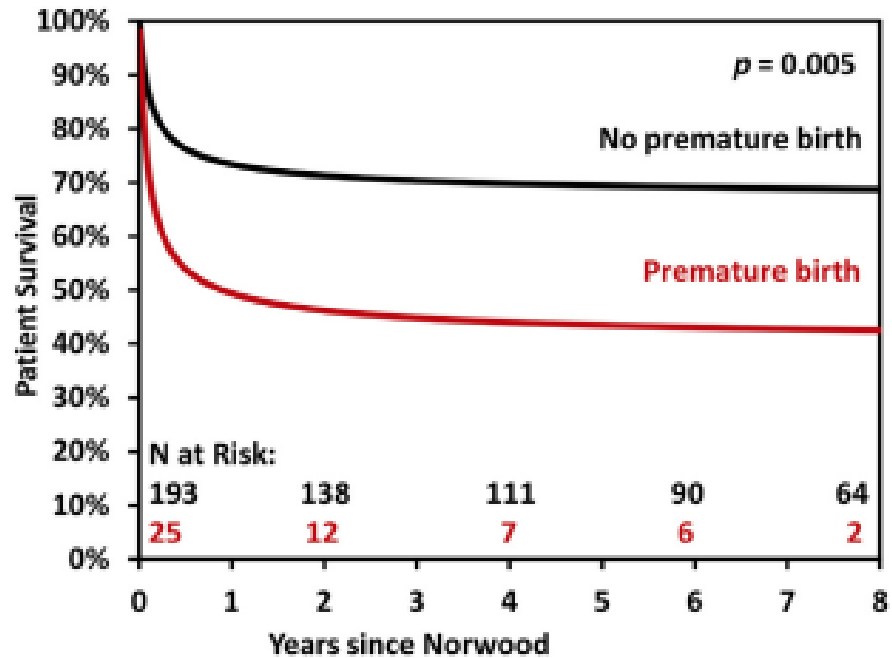
# How do we Achieve Our Why at Columbia?

## What is the Population we care in our NCICU?

- Neonates and premies with CHD +/- extracardiac comorbidities
- Central and peripheral VA ECMO
- VV ECMO
- What we don't care for:
  - No BDG
  - No CVVH
  - No VAD patients

## Argument 5

Prematurity has ongoing impact later throughout hospital course therefore remain in unit with prematurity expertise



Early gestational age >> LBW at birth are independent factors for worse outcomes

Fig 8. Parametric model for survival after Norwood operation stratified by premature birth equal or less than 36 weeks' gestation.

Al Soufi et al Ann Thor Surg 2015

# How do we Achieve Our Why at Columbia?

## **When** do we care for these infants in our NCICU?

- Immediately after birth admitted to the NCICU and admitted through discharge\*
- \*NICU and NCICU surges may demand transfer of infants from the NCICU to the wards\*

# Argument 6: Standardization improves outcomes

- High-performing SV programs emphasize protocolization
  - Interstage monitoring programs reduce mortality
  - Direct ICU admission to discharge reduces pathway variability
  - Reliability is a safety strategy

# How do we Achieve Our Why at Columbia?

## How is Care Delivered to Our Infants with HLHS Pre and Post Norwood?

- **Pre-op**
  - surveillance for **“high-risk” factors** = consideration for flow restrictors and PGE x 2-4 wks. (*LaSala et al, JTCVS Open 2025*)
  - Maintain on PGE 0.005 to 0.01
  - **Feeds PO** (as opposed to NGT) but **no more than 50cc/kg/day**
  - UVC placed
  - **OR by day 3-4** (*LaSala et al, JTCVS Open 2025*)
  - **Usually valved Sano**
- **Intra-op-** atrial septectomy, DKS, valved Sano, arch reconstruction using ACP>DHCA
  - **Nasal intubation** (associated with less sedation and better oral feeding add ref)
  - Chest usually closed
  - RA lines placed
  - **Usually 5mm(valved) Sano with goretex base dunked into RV with 3 rings anastomosed with femoral 8-10 mm vein graft (of varying lengths)** (*Beqaj et al 2024*)
- **Post Op**
  - If chest left open, usually closed within 48 hours
  - Common vasoactive cocktail= epi gtt +/- milrinone, ?hydrocortisone +/- vasopressin gtt>>>>dig when taking PO/NGT
  - Sedation with fent, precede gtt
  - Extubate within 48 hours, usually to HFNC/CPAP>>>>bubble CPAP (NIV NAVA for those with poor respiratory mechanics)
  - PO/NGT/NDT feeds increased by ~20/kg/day and wean TPN
  - Weekly echos thereafter

# HLHS Proposed High Risk Pre-Op Risk Stratification at Columbia

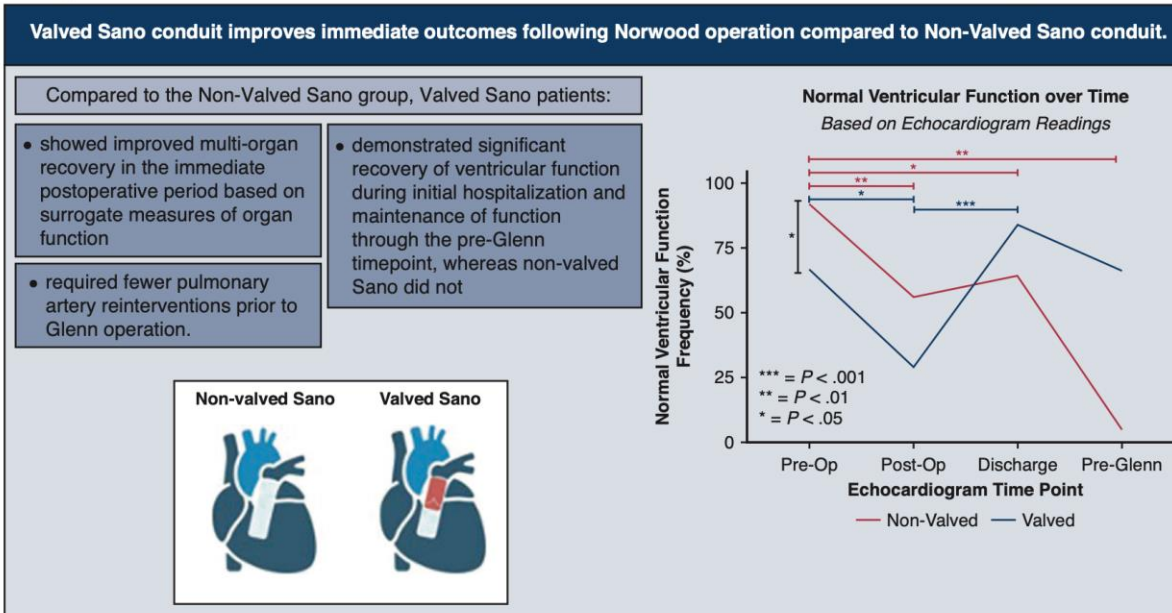
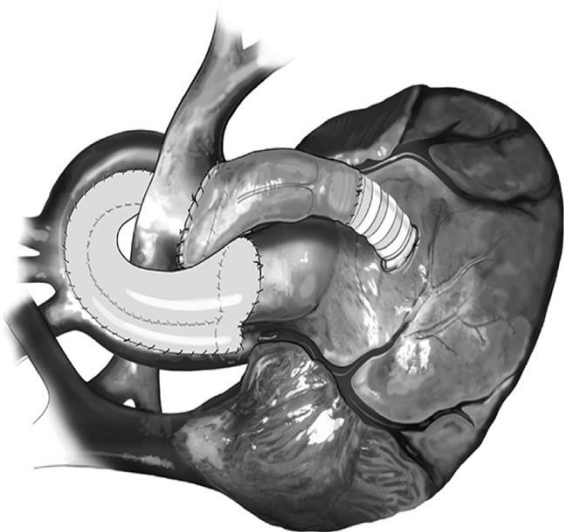
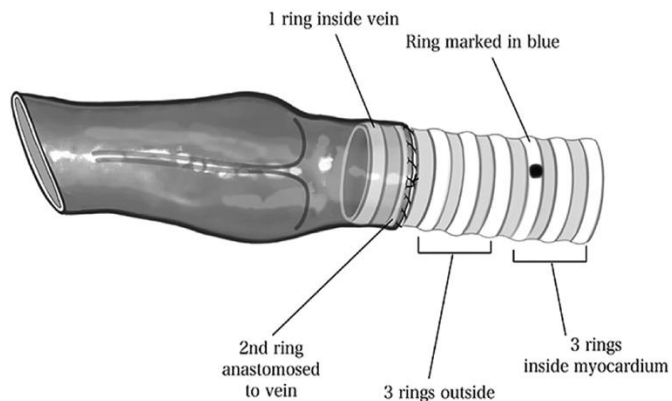


<b>Table 1: Final Risk Categories</b>		
<b>Standard Risk</b> Gestational age 38-41 weeks Birth weight > 2.5 kg No or trivial TR No extracardiac anomalies	<b>Intermediate Risk</b> Gestational age 35-37 weeks Birth weight 2.0-2.5 kg Mild or mild-to-moderate TR Major extracardiac anomalies Female sex Age greater than 7 days at stage 1	<b>High Risk</b> Gestational age < 35 weeks Birth weight < 2.0 kg Moderate or greater TR TAPVR (except intracardiac)
<b>Original Risk Categories</b>		
<b>Standard Risk</b> Gestational age 38-41 weeks Birth weight > 2.5 kg No or trivial TR Mild or less RV dysfunction No genetic anomalies No extracardiac dysfunction or anomalies	<b>Intermediate Risk</b> Gestational age 35-37 weeks Birth weight 2.0-2.5 kg Mild or mild-to-moderate TR Moderate RV dysfunction Abnormal ventricular myocardium Mitral stenosis / aortic atresia Presence of genetic anomalies Presence of extracardiac anomalies Preoperative mechanical ventilation	<b>High Risk</b> <b>Cardiac</b> Moderate or greater TR Severe RV dysfunction Intact or highly restrictive atrial septum TAPVR (except intracardiac) Pre-operative mechanical ventilation or inotropic support due to <u>overcirculation</u> <b>Extracardiac</b> Gestational age < 35 weeks Birth weight < 2.0 kg Late presentation to care Organ dysfunction/dysgenesis Major genetic anomalies Major extracardiac anomalies

- Major extracardiac malformations
- CDH
  - Scimitar syndrome
  - TEF
  - Lung hypoplasia +/- tracheal stenosis
  - Congenital chyloous effusion

LaSala et al. JTCVS Open November 2025

# The Columbia Valved Sano- Good for Branch PA Growth and Ventricular Function



- 50 patients b/t 2019=2022
  - 4% in hospital mortality
  - 5 (10%) required ECMO
- Reintervention for residual lesions
- 8/50 (16%) reintervention rate
  - Sano
  - Branch PAs
  - TV

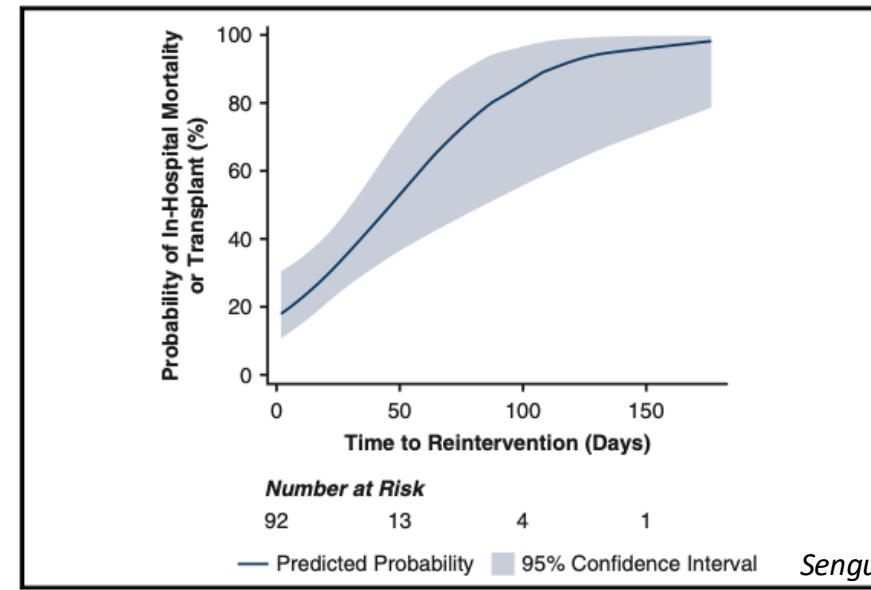
Beqaj et al JTCVS 2024

## Argument 7:

Residual lesions dealt with later in hospital course (and therefore potentially on ward) is already associated with increased mortality

- BCH reviewed 500 Norwood patients between 1997 and 2017 to examine impact of time to intervention of residual lesions
- 92 (18%) with reintervention during same hospitalization
- Outcome= death/transplant
- RF= 16% premature and 10% <2.5kg
- 45/92 needed ECMO
- 33% died
- Time to reintervention a/w mortality

	Subcomponent of the Norwood operation						
	Proximal aortic arch (n = 11)	Distal aortic arch (n = 13)	Coronary arteries or DKS (n = 12)	Atrial septum (n = 8)	Neo-aortic valve (n = 5)	BT shunt or RV-PA conduit (n = 48)	Branch PA (n = 25)
Time to reintervention	3 (1-17)	42 (12-56)	4 (2-20)	37 (7-46)	9 (6-16)	7 (3-17)	24 (14-35)



Sengupta et al JTCVS 2023

## Argument Number 8: If it Ain't Broke, Don't Fix It Columbia Norwood Mortality 2021-2024

		Calculation	Norwood
<b>Operative Mortality</b>	<b>Participant</b>	Number of Mortalities	2*
		Number Eligible	51*
		Mortality Rate	3.92%
		Mortality (95% CI)	(0.48-13.46)
	<b>STS Overall</b>	Aggregate Rate (%)	12.59
		Median Rate (%)	10.48
		Range (%)	(0-100)
		Interquartile Range (%)	(7.14-14.29)
	<b>Among Sites with N &gt;= 10</b>	Aggregate Rate (%)	11.93
		Median Rate (%)	10.48
		Range (%)	(0-46.67)
		Interquartile Range (%)	(7.14-13.89)

# Columbia Norwood LOS 2021-2024

		Calculation	Norwood
Postoperative Length of Stay **	Participant	Mean (days)	51.65
		Median (days)	24
		Range (days)	(9-351)
		Interquartile Range (days)	(15-39)
	STS Overall	Aggregate (days)	57.25
		Median (days)	51.65
		Range (days)	(17-336)
		Interquartile Range (days)	(44.61-67.59)
	Among Sites with N >= 10	Aggregate (days)	56.38
		Median (days)	51.65
		Range (days)	(23.87-176.38)
		Interquartile Range (days)	(45.68-64.39)

50% less HLOS than rest comparator centers

# Columbia Norwood Extubation Data

		Calculation	Norwood
Extubated in OR	Participant	Yes (N%)	0/0%*
		No (N%)	29/100%*
		Missing (N%)	0/0%*
	STS Overall	Yes (N%)	16/1.09%
		No (N%)	1454/98.71%
		Missing (N%)	3/0.20%
Time to Initial Extubation	Participant	Median (hours)	52.54
		Range (hours)	(7.33-645.55)
		Interquartile Range (hours)	(26.62-94.65)
	STS Overall	Median (hours)	139.65
		Range (hours)	(0.95-7194.83)
		Interquartile Range (hours)	(91.65-238.69)
Reintubated for Respiratory Failure	Participant	All Patients (N%)	6/11.76%*
		Extubated in the OR (N%)	0/0%*
		Extubated after leaving OR (N%)	6/11.76%*
	STS Overall	All Patients (N%)	524/22%
		Extubated in the OR (N%)	8/0.34%
		Extubated after leaving OR (N%)	475/19.94%

- Extubation was earlier than comparators
- This was coupled with lower reintubation rate
- Earlier extubation likely has positive downstream effects on HLOS

# Argument 9: “Ward ready” NIPPV may suggest a need for reintervention (and we know residual lesions may have significant impact on mortality) as opposed to “slowly de-intensifying”

CLINICAL INVESTIGATION ARTICLE

## Associations With Prolonged Post-Extubation Noninvasive Respiratory Support in Neonates Following the Norwood Procedure: A Two-Center Retrospective Cohort Study, 2019–2023

Feder, Joshua MD<sup>1,2</sup>; Floh, Alejandro MD<sup>2</sup>; Fu, Yuanyuan MA<sup>1</sup>; Hovasapian, Soseh<sup>1</sup>; Lipsitz, Stuart ScD<sup>3</sup>; Lyn, Racquel MS<sup>2</sup>; Reise, Katherine RRT<sup>4</sup>; Guerineau, Luciana Rodriguez MD<sup>2</sup>; Salvin, Joshua W. MD, MPH<sup>1,5</sup>; Hames, Daniel L. MD, MPH<sup>6</sup>

[Author Information](#) ⓘ

*Pediatric Critical Care Medicine* ( ):10.1097/PCC.0000000000003918, February 18, 2026. | DOI: 10.1097/PCC.0000000000003918



- Two-center retrospective cohort (2019–2023) – Boston and SickKids
- Key findings:
  - “Prolonged NRS” defined as  $\geq 72$  hours
  - 47% of neonates required  $\geq 72$  hours of noninvasive support
  - Prolonged NRS associated with:
    - Longer ICU stay (~25 vs 11 days)
    - Worse growth at discharge
  - Strong predictors:
    - Airway anomalies
    - Reintervention
    - Longer invasive ventilation duration
- Interpretation:
  - $\geq 3$  days of NIPPV is not unusual—it’s almost the median experience
  - Many patients likely require **>1 week**, although exact median duration is not explicitly reported

# Argument 10: Unplanned readmission to the CICU from the Wards have consequences

## Unplanned Readmission to the Pediatric Cardiac Intensive Care Unit: Prevalence, Outcomes, and Risk Factors

Marissa A Brunetti <sup>1</sup>, Andrew C Glatz <sup>2</sup>, Ken McCardle <sup>3</sup>, Antonio R Mott <sup>4</sup>, Chitra Ravishankar <sup>2</sup>, J William Gaynor <sup>5</sup>

- Single-center cohort: ~5.7% (37/645 discharges)
- Risk factors:
  - genetic anomaly, **single-ventricle anatomy**, and longer surgical support time
- Majority occur **very early**
  - ~53% within 24 hours
- Clinical significance
- Mortality dramatically higher if readmitted:
  - 16.2% vs 0.5%
- Interpretation
- ICU → ward readmission is:
  - **Relatively uncommon**
  - But **high-risk when it occurs**
- Reflects:
  - Premature transfer OR
  - Unpredictable physiology (especially Norwood/single ventricle)

# Potential Pitfalls and Limitations in Generalizability

- NCICU Pitfalls:
  - Impact of noise on NDV outcomes
  - NCICU not conducive to parent overnight sleeping
  - Wards becoming undertrained
  - Over monitoring may contribute to extended LOS
- Limitations to generalizability of Columbia admission to dc model:
  - NCICUs are uncommon
  - Threats to sustaining this model at Columbia- growing heart center census

# Considerations for Ward Transfer at Columbia

- No vasoactive requirement x 72 hours
- No NIPPV or supplemental fiO2 requirement x 72 hrs
- No sedative infusions x 24-48 hours
- Tolerating some tolerance of weaning withdrawal medication
- Tolerating full enteral feeds even if working on PO/NGT
- No bedside UE/LE BP gradient
- No significant pericardial effusion (must be less than mild on 2 echo reports separated by 48-72 hours)
- No RA lines
- No h/o ECMO
- Echo within 72 hours of transfer
- SV team to meet patient prior to transfer

# Summary

- High risk patients benefit from minimized transitions
- ICU to floor is another handoff and handoffs are a risk for degradation of information
- The NCICU environment is best suited for intensive caregiver training
- NICU extracardiac comorbidities such as prematurity are an added risk factor for mortality beyond the neonatal period
- Standardization improves outcomes and direct ICU admission to discharge reduces standardization variability
- Residual lesions addressed later in hospital course (potentially when the patient is on the wards) are a risk factor for mortality therefore mitigate the risk of mortality by responding to late residual lesions in the ICU
- Ward stable but sustained NIPPV requirement may be a surrogate for a residual lesion warranting reintervention and late reinterventions increase risk of mortality, therefore stay in ICU if still requiring NIPPV
- Unplanned readmission to the CICU from the Wards are associated with increased risk of mortality therefore avoid premature transfer to the ward
- Disposition of the infant with HLHS s/p Norwood may not be generalizable across centers but when at Columbia or places with a NCICU, we advocate for admission to d/c from the NCICU

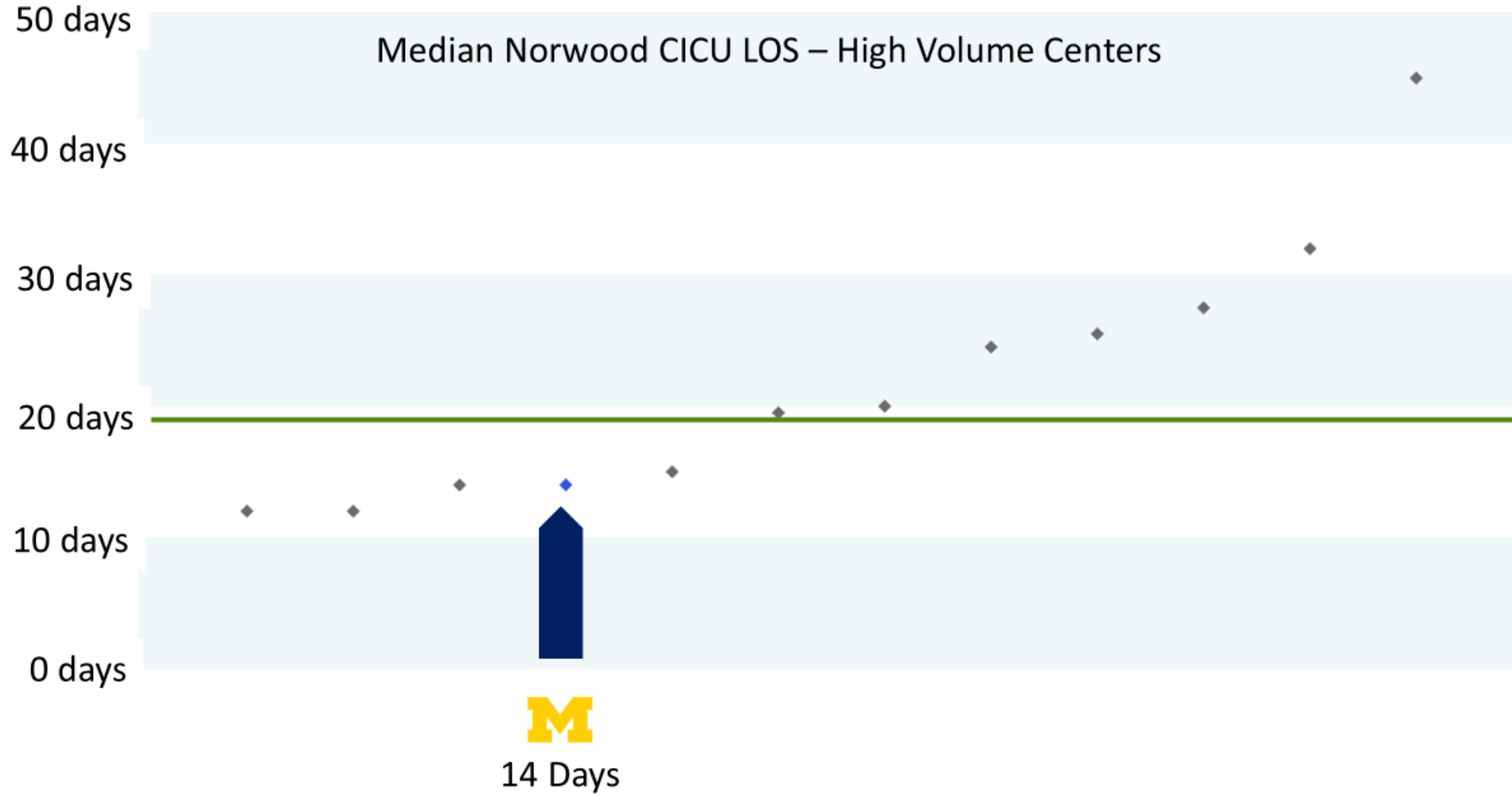
# Thank You!



# Early Transition to ACCU The CICU is No Place for a Baby

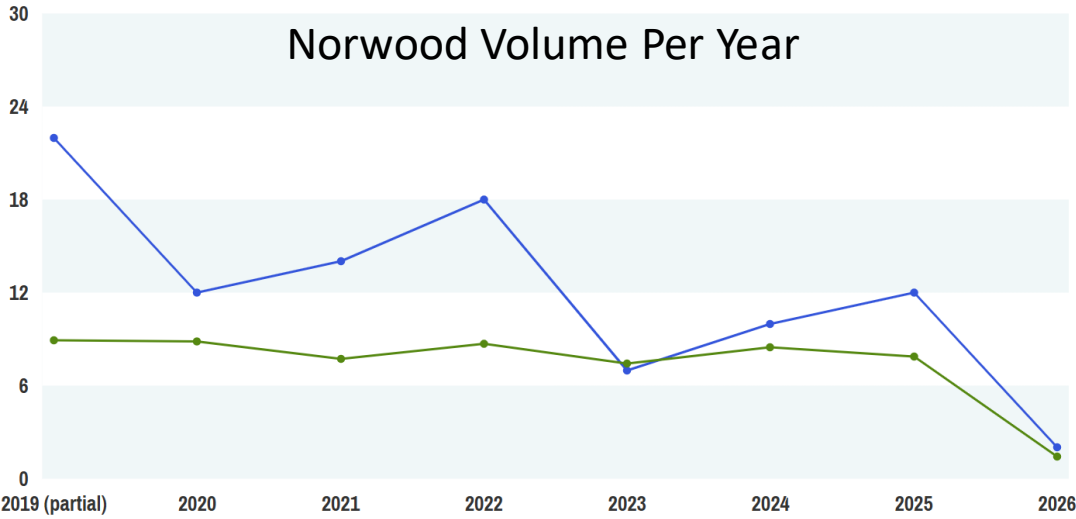
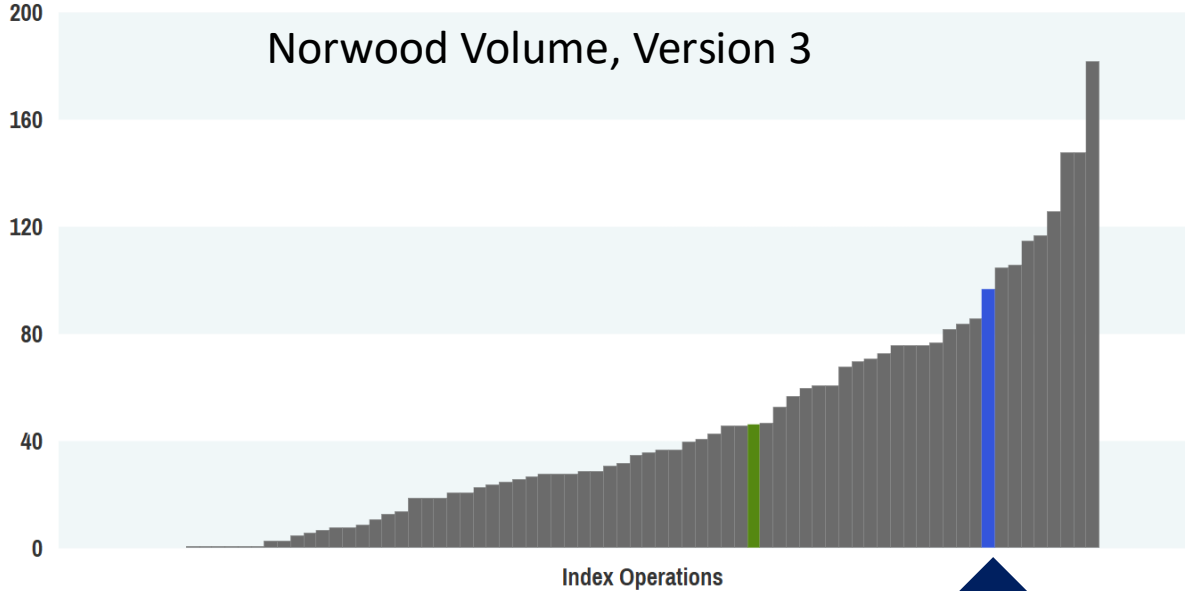
Mary K. Olive, MD and Ilana Schwartz, MD  
Congenital Heart Center  
University of Michigan C.S. Mott Children's Hospital

# How Did We Get Here?



# Surgical Considerations

- High Norwood Volume

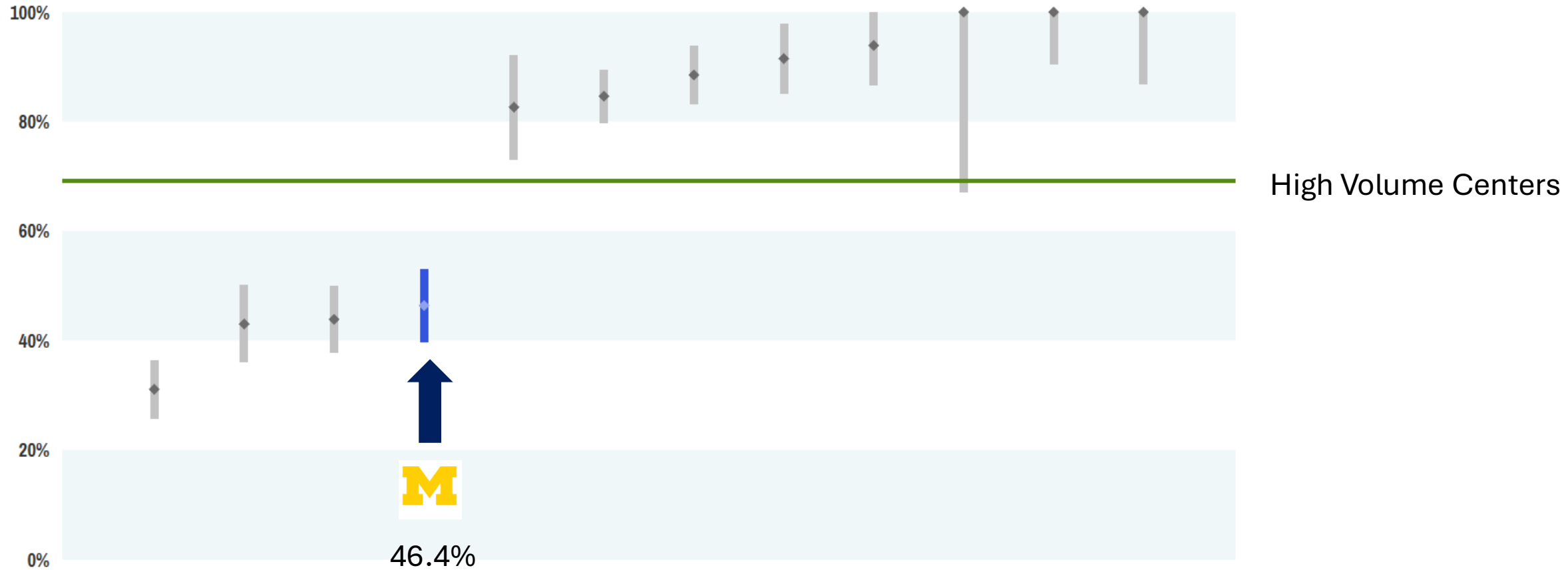


# Surgical Considerations

- High Norwood Volume
- Surgical strategy
  - Norwood with RV to PA conduit
  - Chest closure in the operating room
- High Risk Patients typically undergo Hybrid Stage 1 Palliation
  - Bilateral pulmonary artery bands and PDA Stent, +/- atrial septal intervention
  - Surgical Norwood at 3-5 months of age
  - Genetic syndromes, prematurity, low birth weight, significant extracardiac anomalies

# Chest Closure in the OR

Postoperative Open Sternum, Norwood Operation, High Volume Centers

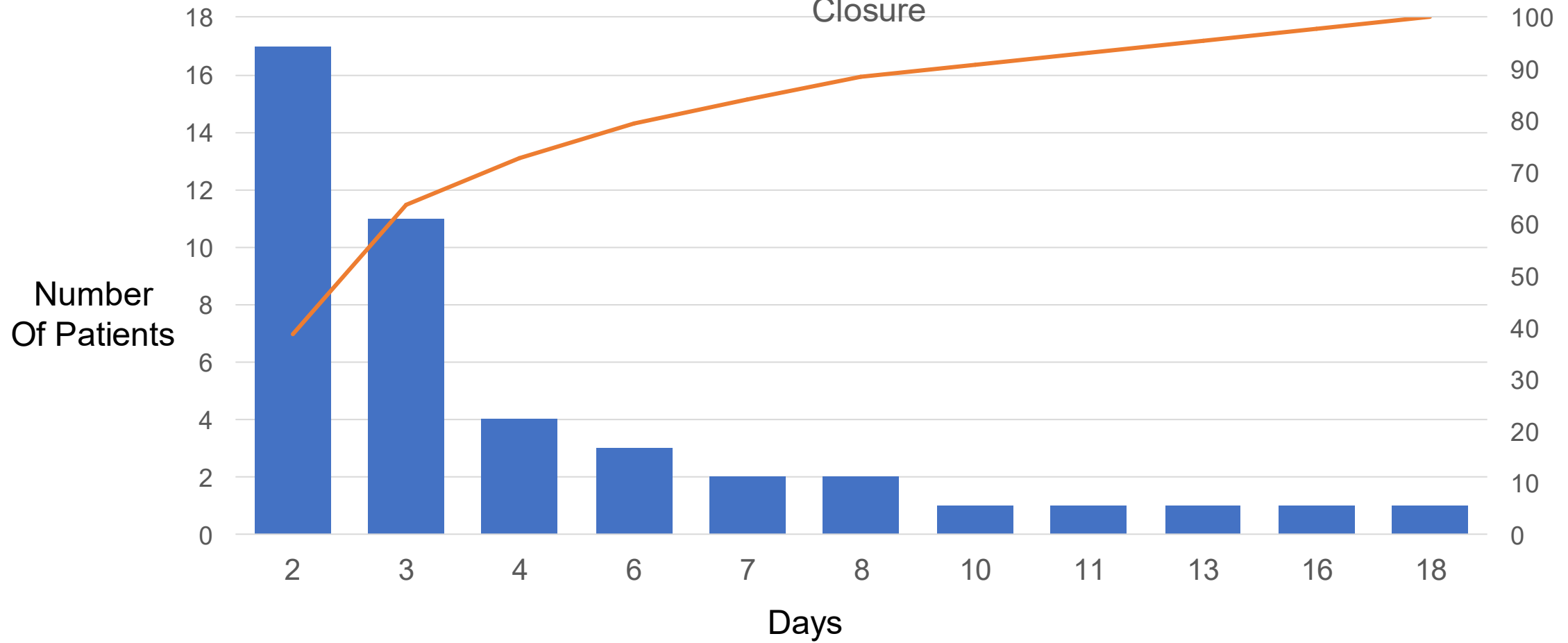


# Or ASAP in the CICU



C.S. MOTT  
CHILDREN'S HOSPITAL  
UNIVERSITY OF MICHIGAN HEALTH

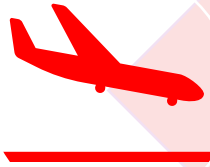
### Open Sternum Days Among Norwood Patients with Delayed Sternal Closure



# Goals of the CICU



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Avoid Complications

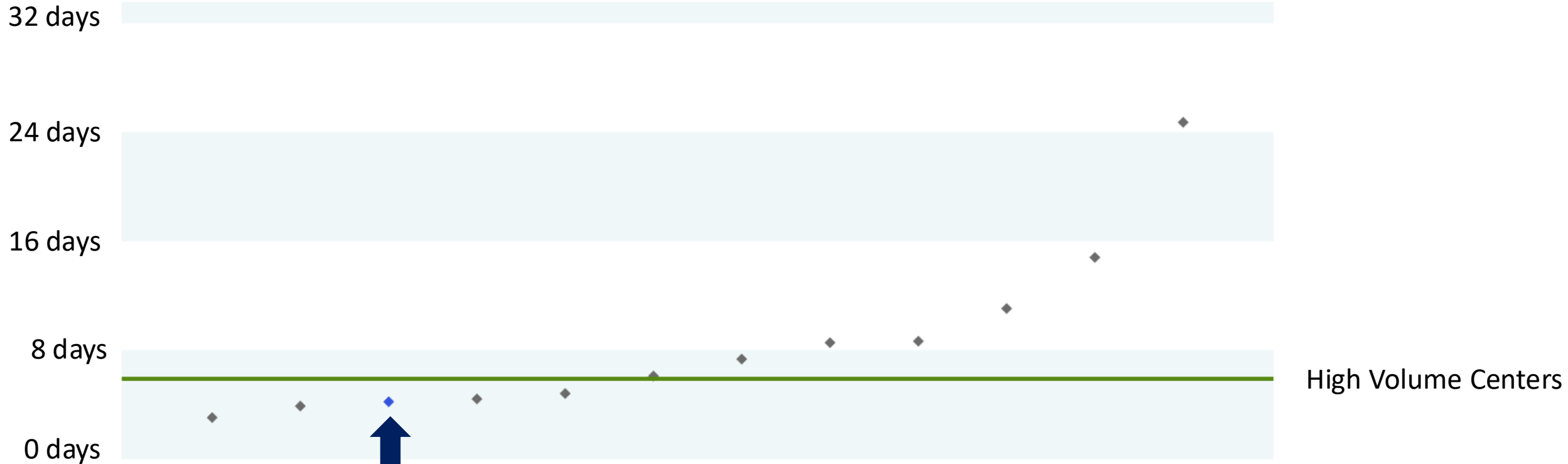


Identify Hemodynamic  
Derangement



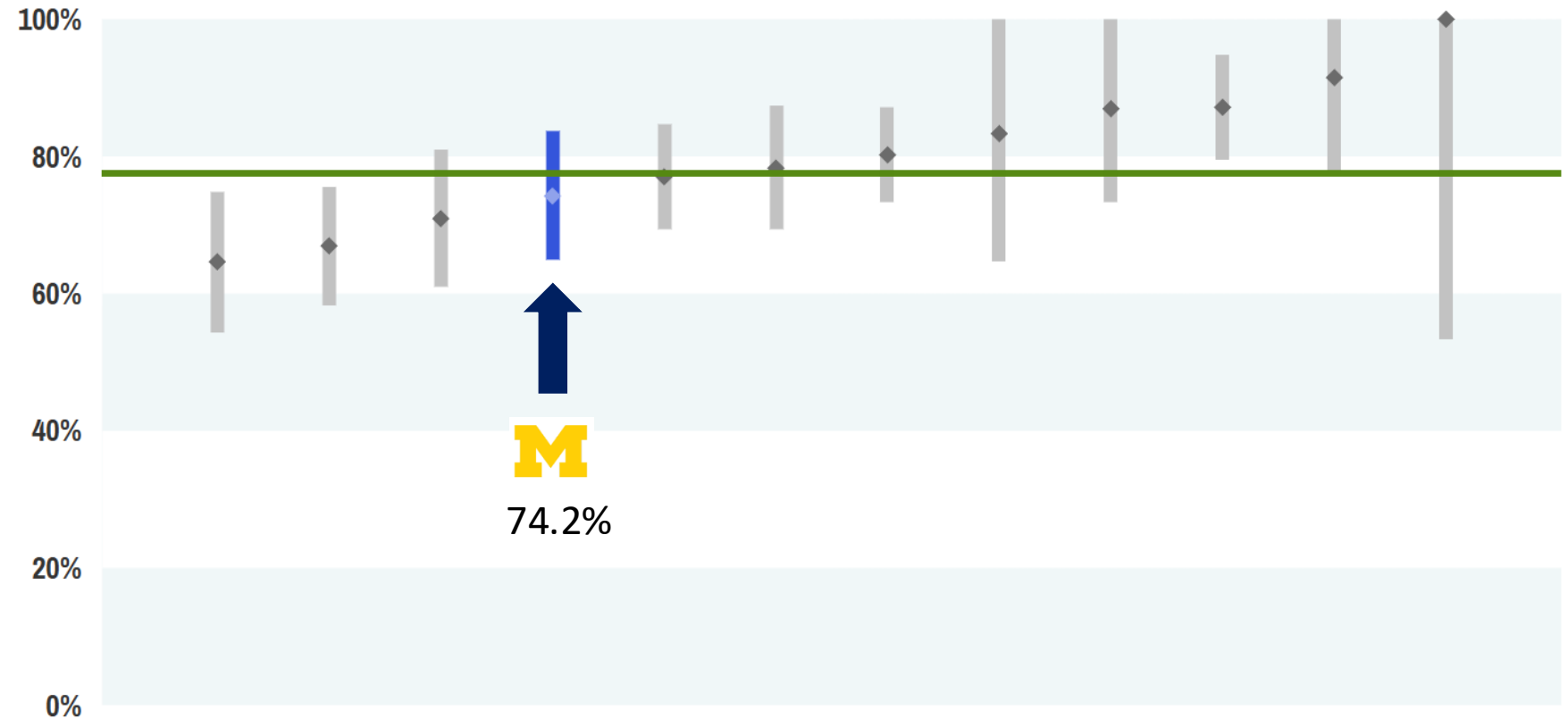
Wean Intensive Care Therapies

# Early Ventilator Liberation



  
5.3 days

# Postoperative Complications



# The Team




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CHILDREN'S HOSPITAL  
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# Capacity and Daytime Staffing Model


## Cardiac ICU (10W)









**21 Beds**  
(8 Open Bay Beds)

Maize Team	Blue Team
 Cardiac Intensivist	
 Cardiology and Critical Care Fellows	
 Surgical NPs	

## ACCU (11W)

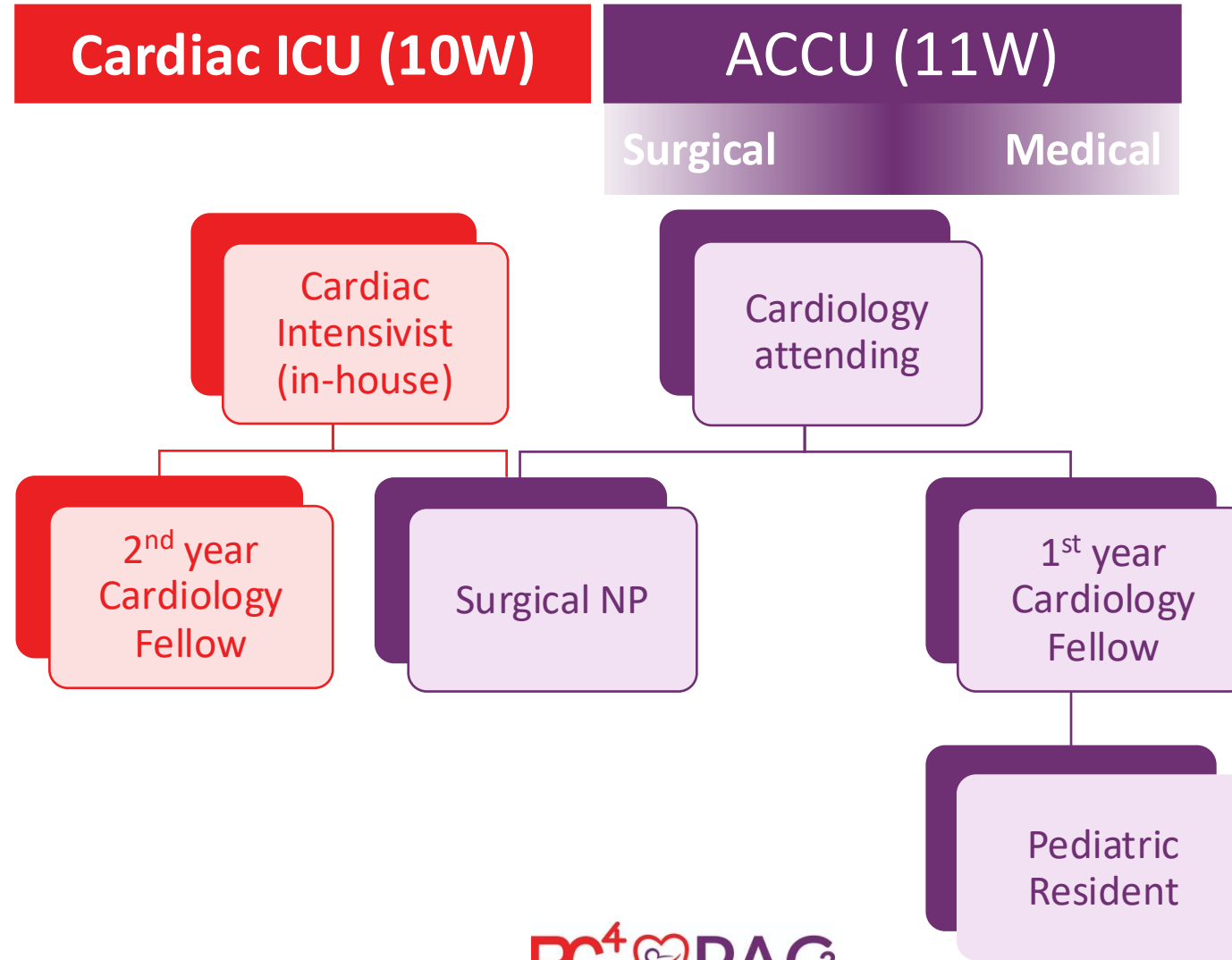


**32 Beds**  
(12 Moderate Care Beds)

Surgical Service	Medical Service
 Cardiology Attending	 Cardiology Attending
	 Cardiology Fellow
 Surgical NPs	 Pediatric Residents
	 Medical NPs



# Overnight Staffing Model



# ACCU Capabilities



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## General Care

- Nursing ratio 4:1
- Cardiac telemetry monitoring
- Respiratory support
  - HFNC max support 2L/kg/min, max FiO2 60%
  - Tracheostomy (without ventilator)
- Umbilical venous catheter, central venous catheters
- Continuous infusions
  - Heparin
  - Milrinone\*
  - Dopamine\*

## Moderate Care

- Nursing ratio 2:1
- Temporary pacing wires in use with stable underlying cardiac rhythm
- Ventricular assist device (VAD): Berlin, Heartmate
- Home CPAP/BiPAP (nasal interface only, patient can take off by self) without escalation
- Umbilical arterial catheter
- Continuous infusions
  - Prostaglandins
  - Dexmedetomidine
  - Esmolol
  - Furosemide or bumetanide infusions

\*Initiate in moderate care, can transfer to general care once stable dosing or weaning

# Cardiac ICU to ACCU Transfer Process

- Criteria for transfer
  - No longer requiring ICU therapies
- Handoff process
  - Morning page sent notifying team of patient's transfer
  - Floor team receives notification 30 minutes and 5 minutes prior to transfer
  - Bedside handoff with CICU and ACCU bedside RN, CICU and ACCU frontline providers, ACCU attending
  - Direct communication between CICU and ACCU attending after bedside handoff

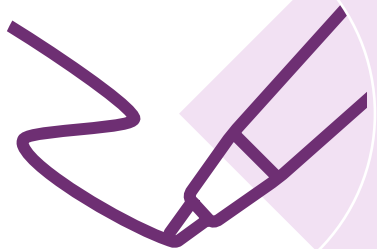
# Advantages of ACCU stay



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Emphasis on feeding  
and weight gain



Education and discharge  
planning

# Feeding and nutrition supports in the ACCU

- ACCU nursing with enteral feeding expertise
- Feeding technicians with specific training on oral feeding infants
- Cardiac dietician present daily on rounds
- Individual rooms to allow for breastfeeding parent to remain at bedside and have a private space for nursing/pumping
- Interstage scale delivered to bedside at ACCU admission

# Prolonged ICU LOS associated with increased oral aversion



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- Single center retrospective cohort study by Goldstein et al of patients undergoing CPB surgery at less than 30 days old
- Found that ICU duration was associated with oral aversion at age 1

Characteristics	Oral Aversion at 1-yr Follow-Up			p*
	All (n = 157)	Yes (n = 37)	No (n = 120)	
Total postoperative cardiac ICU duration, d	8 (6–17)	22 (8–45)	8 (6–13)	< 0.0001
Total duration of postoperative mechanical ventilation, d	5 (3–9)	12 (5–31)	4 (3–6)	< 0.0001
Tracheostomy during postoperative course	6/156 (3.8)	6/37 (16.2)	0/119 (0.0)	0.0001
Total duration of postoperative noninvasive positive pressure ventilation, d	4 (2–7)	6 (3–14)	3 (2–5)	0.002
Diaphragm injury	8 (5.1)	3 (8.1)	5 (4.2)	0.39
Vocal cord paralysis	12 (7.6)	4 (10.8)	8 (6.7)	0.48
Failed swallow study (thin)	33/87 (37.9)	9/22 (40.9)	24/65 (36.9)	0.74
Failed swallow study (thickened)	15/33 (45.5)	6/9 (66.7)	9/24 (37.5)	0.24
Preoperative feeding	58 (36.9)	11 (29.7)	47 (39.2)	0.27
Oral	35/58 (60.3)	7/11 (63.6)	28/47 (59.6)	1.00
Nasogastric/orogastric	36/58 (62.1)	6/11 (54.5)	30/47 (63.8)	0.73
Number of postoperative days until PO feeding initiation, d	10 (7–18)	22 (14–39)	9 (7–13)	< 0.0001
Feeding method at hospital discharge				
Exclusive PO feeding	29 (18.5)	3 (8.1)	26 (21.7)	0.06
Any PO feeding	132 (84.1)	24 (64.9)	108 (90.0)	0.0003
Exclusive tube feeding	25 (15.9)	13 (35.1)	12 (10.0)	0.0003
Gastrostomy tube	6 (3.8)	4 (10.8)	2 (1.7)	0.03
Bypass surgery after discharge (but prior to 1-yr follow-up)	67 (42.7)	26 (70.3)	41 (34.2)	0.0001

PO = per os.

\*p from  $\chi^2$  test or Fisher exact test for categorical variables and Wilcoxon rank-sum test for continuous variables.

Data are presented as n (%) for categorical variables and median (interquartile range) for continuous variables.

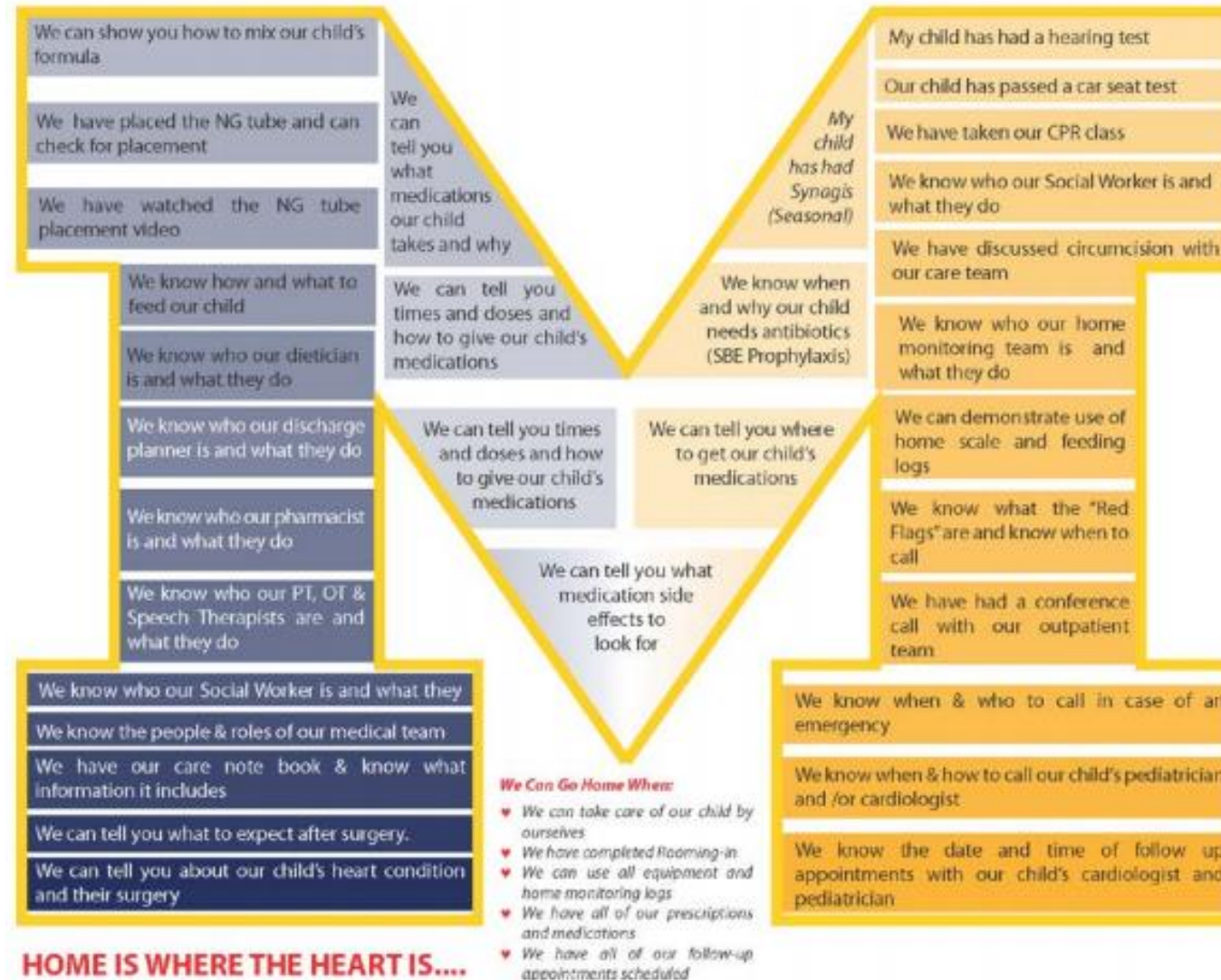
# Interstage teaching and discharge planning

- In ACCU, pre-discharge care and teaching is shared by the inpatient cardiac surgery APPs, clinical care coordinators, inpatient nursing, cardiologists, and outpatient interstage team
- Once in ACCU, discharge planning begins
  - PCP and cardiologist identified
  - Once discharge date is determined, follow up appointments are made
  - Parents complete education modules
  - Infant home scale delivered to room and used for daily weights once in ACCU
  - Pulse oximeter ordered for home
  - 24-hour block of care completed by families once education is completed and patient is on home going feeds and medications

# Interstage teaching and discharge planning



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# Interstage teaching and discharge planning



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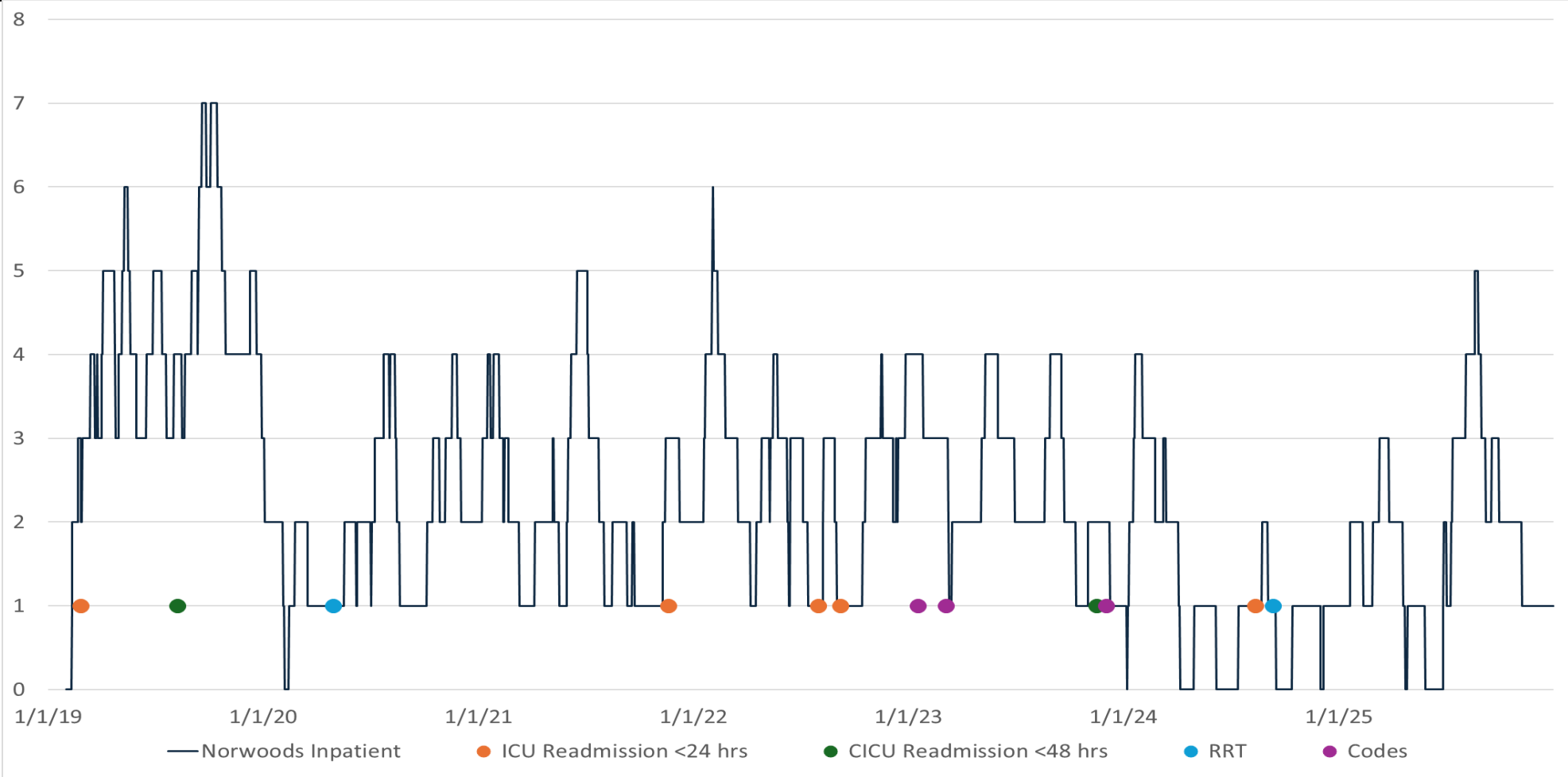
## Surgical Norwood Stage 1 Pre-discharge Checklist

<b>On Transfer to General Care</b>	<b>Date Completed/Initials</b>
Order SLP/OT consult and swallow study	
Letter of necessity for pulse ox to discharge planning	
Scale given to family	
Pulse oximeter delivery arranged	
Discharge Conference Call (see separate sheet for details)	

<b>Discharge Paperwork and Teaching</b>	<b>Date Completed/Initials</b>
Feeding Logs (30)/Scale instructions	
Red Flag Wallet Cards	
"Who to Call" Checklist Sheet	
PCP information Sheet	
Scale/Feeding log teaching	
Red flag teaching	
Nutrition teaching	

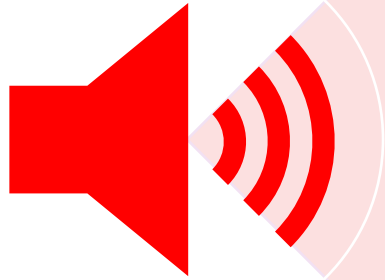
<b>At Discharge</b>	<b>Date Completed/Initials</b>
Re-verify parents phone numbers	
Put completed d/c checklist with Parent Contact info in INSTEP Inbox	
Fax copy of discharge summary to PCP	
Fax copy of discharge summary to cardiologist	
Email INSTEP NP with discharge date and fax this form	

# Care escalation and ICU readmission in the ACCU



**Thank You!**

# Rebuttal: A Short CICU Stay is Ideal



ICUs are Loud and Stressful



Prolonged ICU LOS associated with morbidity and mortality

# Preventing Excessive Noise Exposure in Infants, Children, and Adolescents

Sophie J. Balk, MD, FAAP,<sup>a</sup> Risa E. Bochner, MD, FAAP,<sup>b</sup> Mahindra A. Ramdhanie, AuD, FAAA, CCC-A,<sup>c</sup> Brian K. Reilly, MD, FAAP, FACS,<sup>d</sup>  
COUNCIL ON ENVIRONMENTAL HEALTH AND CLIMATE CHANGE, SECTION ON OTOLARYNGOLOGY-HEAD AND NECK SURGERY

- Technical report by the AAP with background info on available research on noise and its effects on hearing
- Recommends keeping sound levels <45 decibels in hospitals
- Excessive noise can result in sensorineural hearing loss
- Nonauditory effects of excessive noise exposure include increased cortisol levels, higher blood pressure, and sleep disturbances

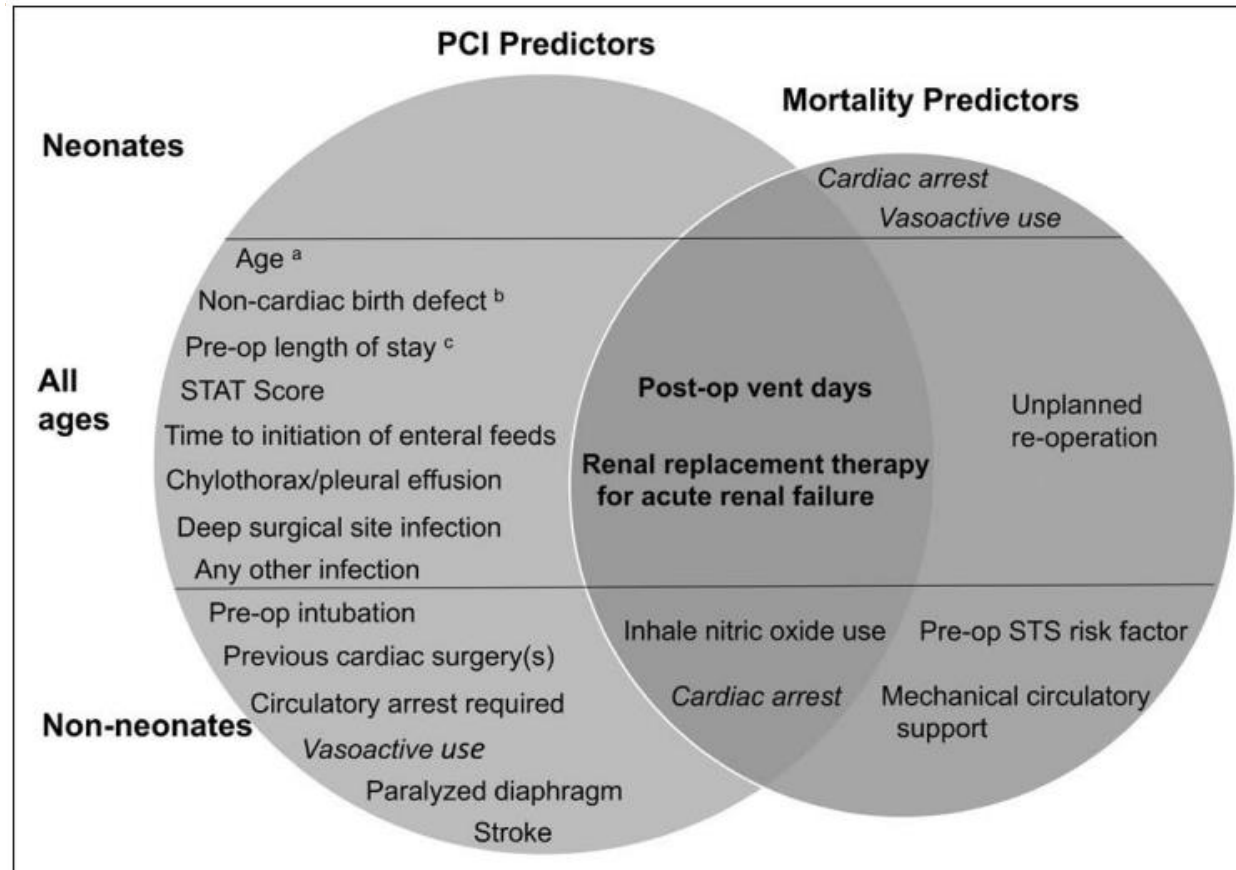
# Prospective cohort study on noise levels in a pediatric cardiac intensive care unit

Gonzalo Garcia Guerra, MD MSc<sup>a,b</sup>, Ari R. Joffe, MD<sup>a,b</sup>, Cathy Sheppard, RN<sup>b</sup>, Jodie Pugh, RN<sup>b</sup>, Elham Khodayari Moez, MSc<sup>c</sup>, Irina A. Dinu, PhD<sup>c</sup>, Hsing Jou, MD<sup>a,b</sup>, Lisa Hartling, PhD<sup>a</sup>, Sunita Vohra, MD<sup>a,\*</sup>, the SedationWithdrawal and Analgesia Team (SWAT) and the Canadian Critical Care Trials Group (CCCTG)

- Prospective cohort study sound levels measured continuously in Stollery Children's Hospital PCICU over a 1-month period
- Average hourly sound level was 59.4 dB in open area and 60.1 dB in private rooms
- Average and maximum hourly sound levels significantly higher during morning rounds
- Significant association between average and peak sound levels and the number of sedation PRNs given

# Predicting and Surviving Prolonged Critical Illness After Congenital Heart Surgery

Aaron G. DeWitt, MD<sup>1</sup>; Joseph W. Rossano, MD<sup>2</sup>; David K. Bailly, DO<sup>3</sup>; Priya N. Bhat, MD<sup>4</sup>;  
Nikhil K. Chanani, MD<sup>5</sup>; Brandon W. Kirkland, MD<sup>3</sup>; Michael-Alice Moga, MD<sup>6</sup>;  
Gabe E. Owens, MD, PhD<sup>7</sup>; Lauren B. Retzlaff, MPH<sup>7</sup>; Wenying Zhang, MS<sup>8</sup>; Mousumi Banerjee, PhD<sup>8,9</sup>;  
Andrew T. Costarino, MD<sup>1</sup>; Geoffrey I. Bird, MD<sup>1</sup>; Michael Cairns, MD, MPH, MS<sup>7</sup>



# Prevalence and outcomes of postoperative infection among pediatric congenital heart disease patients in intensive care units: a single center retrospective study

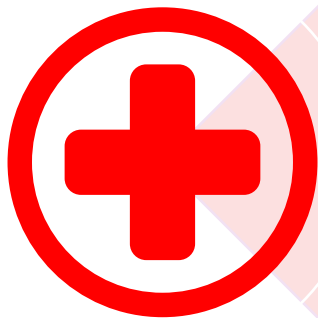
Xianting Jiao<sup>1†</sup>, Jiawei Gao<sup>2†</sup>, Wenyuan Shang<sup>2</sup>, Tingting Zhang<sup>2</sup>, Sun Chen<sup>2</sup>, Huiying Wang<sup>2\*</sup> and Jihong Huang<sup>2\*</sup>

- Retrospective study of 1,131 pediatric CHD patients who underwent surgery at Xinhua Hospital between October 2020 and July 2024
- Infections occurred in 11.6% of patients
- Independently associated with prolonged ICU stay adjusted OR 3.51 (2.01 – 6.12) and adjusted prolonged ventilator time OR 1.85 (1.09 – 3.11)

# Rebuttal: Adapting Our Model



Increased incidence of cardiac arrest on  
ACCU in 2023



Escalation of Care Taskforce  
implemented several interventions

# Heart Watch



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## Heart Watch Huddle Form

To be used to establish a shared mental model for high-risk CHC patients



**Patient Initials:**

**Today's Date:**

- AM
- PM

**Diagnosis:**

### Indications for Heart Watch:

- Interstage with shunted physiology
- VS outside expected parameters
- VAD support
- Other clinical concerns \_\_\_\_\_

### At Risk For:

- 1) \_\_\_\_\_
- 2) \_\_\_\_\_

### Recent VS Trends:

- HR:
- BP:
- SpO2:
- RR:
- Overall Demeanor:

### Warning Signs & Symptoms:

If \_\_\_\_\_, Then \_\_\_\_\_

If \_\_\_\_\_, Then \_\_\_\_\_

If \_\_\_\_\_, Then \_\_\_\_\_

### Intervention/Action Plan:

### Order Review:

- VS Parameters
- CR/Pulse Ox Monitors
- IV Access
- NPO
- Require RN to leave unit
- Confirm code sheet is up to date

### Escalation Plan:

- Please notify first contact with any clinical change or concern.
- When to notify fellow or attending:  
\_\_\_\_\_



## Codes Outside the ICU/1000 Pt Days - u Chart

