Return to Sender: Bouncebacks to the CICU

Moderators:
Mayte Figueroa, Alicia DeMarco, Ryan Closson

Speakers:
Children's Health of Atlanta: Trisha Patel, MD and Keyatta Lackey, PNP-AC
Medical University of South Carolina: Jason Buckley MD and Angie MeKeta, PA-C

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Moderators

Mayte Figueroa, MD
Washington University in St. Louis

Alicia DeMarco, MD
Children's Hospital Los Angeles

Ryan Closson, MD
Inova Children's Hospital

Return to Sender: Unplanned Readmission to the CICU

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Heart Center

Trisha Patel, MD
Children's Healthcare of Atlanta

Keyatta Lackey, PNP-AC
Children's Healthcare of Atlanta

St. Louis Children's Hospital
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musc Children's Health
Medical University of South Carolina

Return to Sender: Bouncebacks to the CICU

Medical University of South Carolina

Jason Buckley MD

Angie McKeta PA-C

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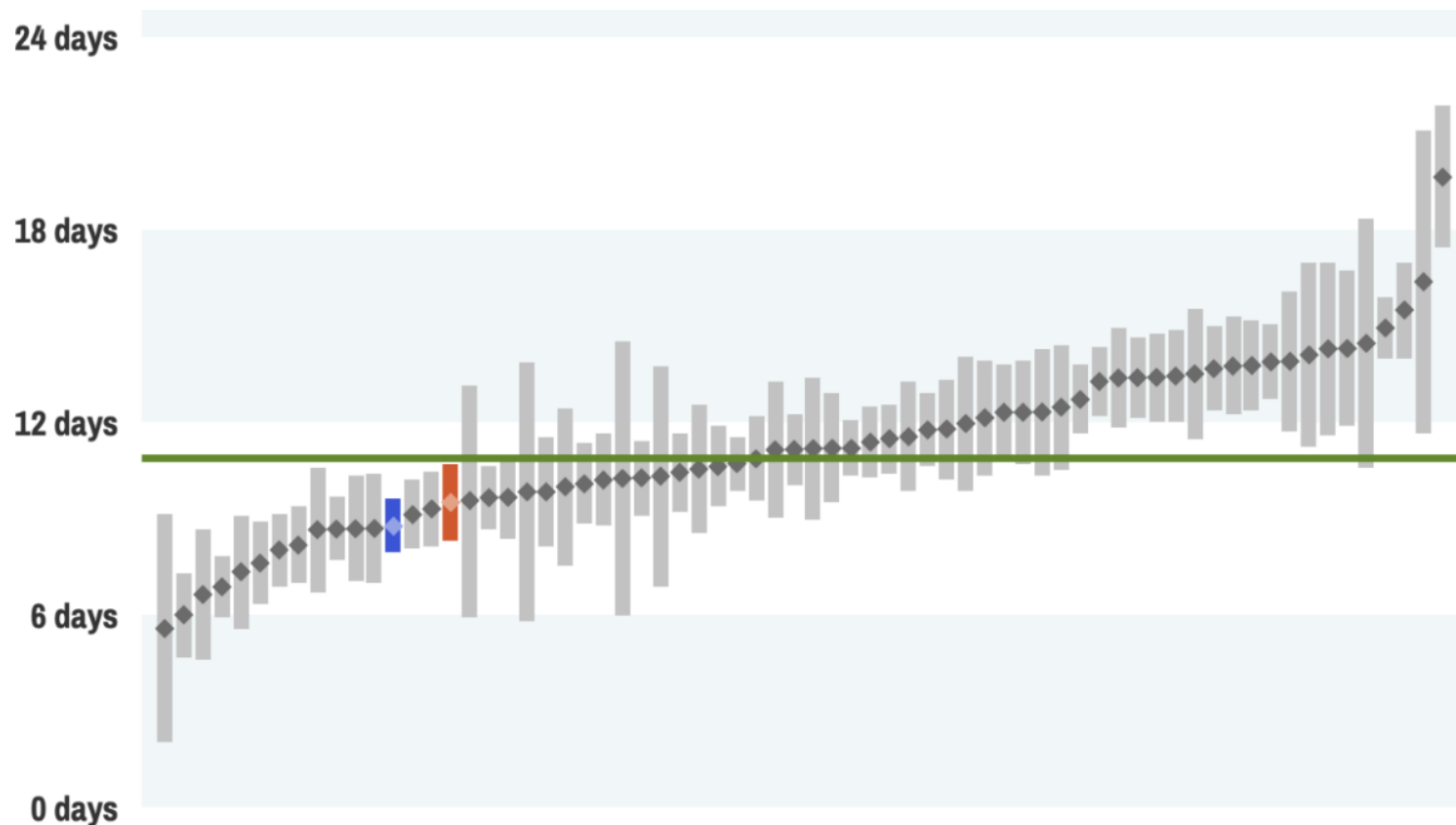
Post-Op ICU Length of Stay



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CICU Readmissions

4%
3%
2%
1%
0%

Other Sites Children's Healthcare of Atlanta South Carolina

Agenda

Presentation	Speakers
Brief Introduction	Moderators
CHOA Experience	Trisha Patel, MD Keyatta Lackey, PNP-AC
MUSC Experience	Jason Buckley, MD Angie McKeta, PA-C
Questions/Comments	

Center and Unit Characteristics

Center Comparison	• Surgical and medical volume • STAT breakdown • Physical space (both had new buildings)
CICU	• Census, day/night coverage model
ACCU	• Census, day/night coverage model, ability to initiate/increase respiratory/inotropes, early warning system
Transfer data	• Timing of transfers, method of transfer, transfer tools used
Rapid Response team	• Team compositions • Goals

Patient Characteristics

- Bounceback patient characteristics
  - Age
  - Admission reason
  - Readmission Cause
  - Time of day
  - Single ventricle?
  - VAD/OHT
  - CICU LOS

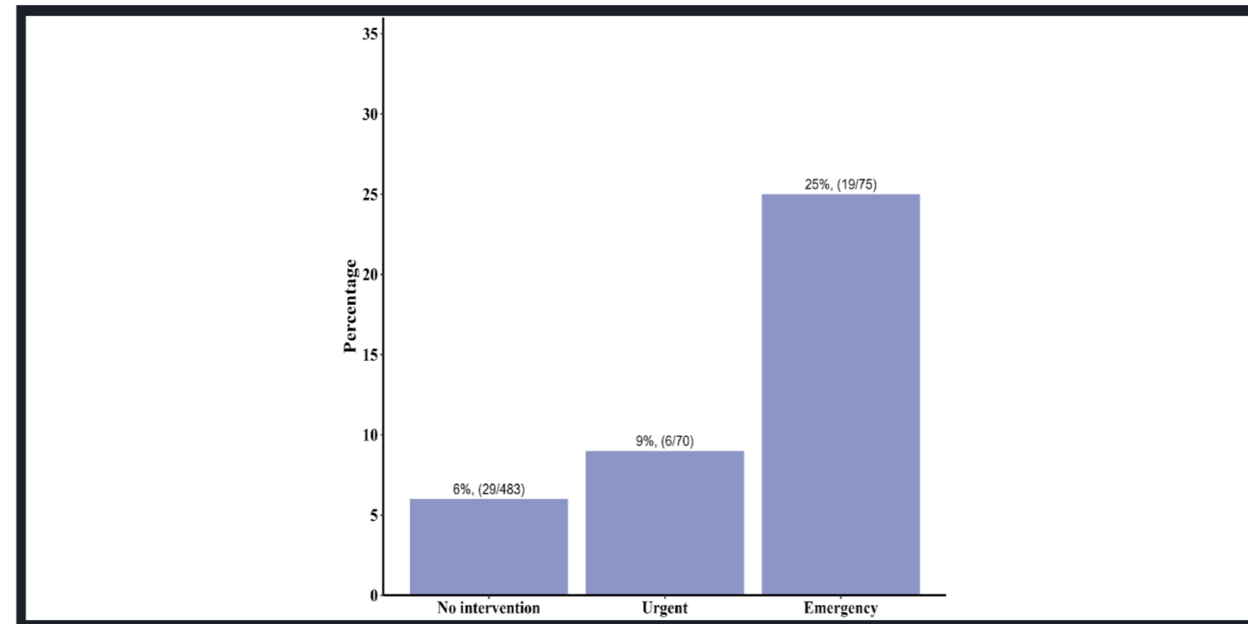
Variables	Adjusted OR[a] (95% CI)	p
Patient and encounter characteristics		
Extracardiac anomaly	1.5 (1.1–2.0)	0.007
Medical vs surgical encounter[b]		
Low complexity surgery	0.5 (0.3–0.9)	0.03
High complexity surgery	1.0 (0.5–2.0)	0.90
Medical	Reference	
Time of discontinuation of vasoactive infusions[c]		
≤ 24 hr prior to discharge/transfer	1.6 (1.03–2.4)	0.04
> 24 hr prior to discharge/transfer	1.2 (0.7–1.9)	0.48

Variables	Adjusted OR[a] (95% CI)	p
Patient and encounter characteristics		
Underweight status	0.6 (0.5–0.7)	< 0.0001
Medical vs surgical encounter[b]		
Low complexity surgery	0.3 (0.2–0.5)	< 0.0001
High complexity surgery	0.7 (0.5–1.2)	0.20
Medical	Reference	
Time of discontinuation of vasoactive infusions[c]		
≤ 24 hr prior to discharge/transfer	1.6 (1.02–2.5)	0.04
> 24 hr prior to discharge/transfer	1.9 (1.1–3.4)	0.02
Time of discontinuation of mechanical ventilation[c]		
≤ 24 hr prior to discharge/transfer	0.6 (0.4–0.9)	0.008
> 24 hr prior to discharge/transfer	0.6 (0.3–1.3)	0.19
Time of discontinuation of noninvasive ventilation[c]		
≤ 24 hr prior to discharge/transfer	1.4 (1.2–1.8)	0.004
> 24 hr prior to discharge/transfer	1.4 (0.6–3.4)	0.46
Nighttime discharge	1.4 (1.05–1.8)	0.02
Pediatric cardiac ICU length of stay prior to discharge/transfer (d)	1.01 (1.01–1.02)	< 0.0001

(Smith, 2018)

Outcomes After Readmission

Total Unmatched Cohort, n = 625				
Outcome	**Overall, N = 625[a]**	**ET, N = 75[a]**	**Non-ET, N = 550[a]**	***P* Value[b]**
CICU LOS (d)	4.83 (2.11, 12.74)	12.82 (4.74, 31.58)	4.26 (2.02, 10.19)	<.001
Post-CICU transfer LOS (d)	22.40 (10.45, 51.82)	40.18 (13.69, 84.90)	21.06 (10.04, 48.01)	.003
In-hospital mortality	54 (9%)	19 (25%)	35 (6%)	<.001



In-Hospital Mortality Rate by Transfer Urgency. Displays the percentage of transfers with in-hospital mortality by transfer urgency. Patients with ET had the highest in-hospital mortality, followed by urgent and no intervention transfers.

(West, 2025)

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Previous Successes

Improving Situational Awareness to Decrease Emergency ICU Transfers for Hospitalized Pediatric Cardiology Patients

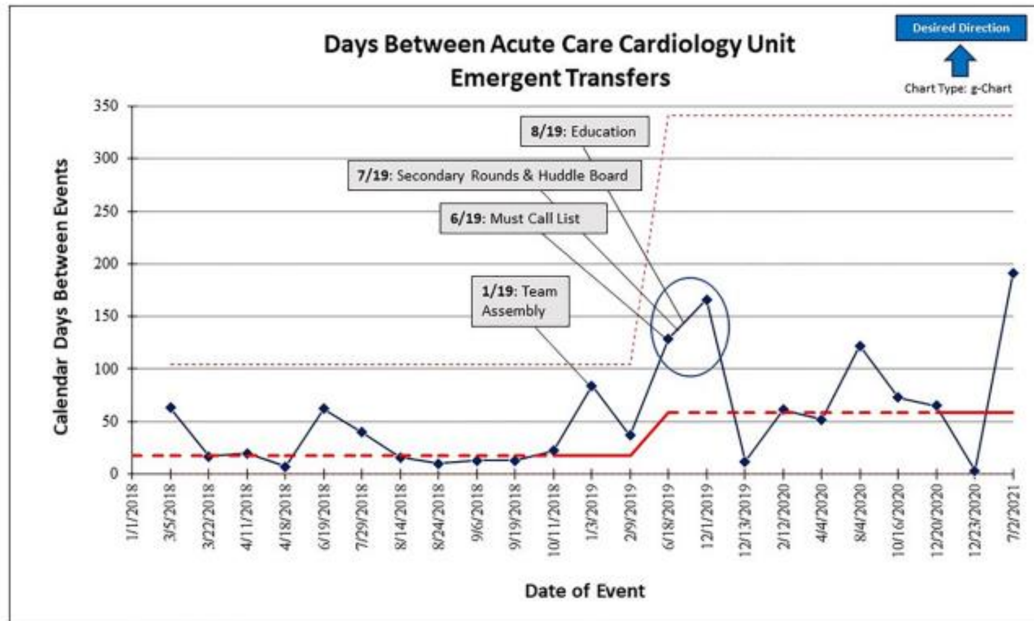

Table 1. "Must Call List" Contents

Clinical Criteria	Definition
Telemetry changes	Change in rhythm, pauses greater than 2 s, complex ventricular ectopy, nonsustained ventricular tachycardia, high grade heart block (second degree type II or greater)
Escalating respiratory support	Starting supplemental oxygen, escalating support (nasal cannula to high flow), maxed out on high-flow nasal cannula (2 L/kg)
Worsening hypoxemia	10 or more point change in oxygen saturation, any desaturation event in a patient with central shunt (eg, BTT shunt)
Pleural chest tube issues	Output abruptly stopped
Fluid balance issues	Positive or negative ≥ 1 L unless intentional goal
Fevers	In neonate (<30 d of life), in patients with central lines or immunocompromised (including transplant recipients)
Perfusion concerns	Loss of pulse in an extremity following cardiac cath procedure, and visible or occult blood in patient's stool
Early warning systems	Escalating PEWS score, patient made a "Watcher"

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Previous Successes

HeartWatch: Implementing a Pediatric Heart Center Program to Prevent Cardiac Arrests Outside the ICU

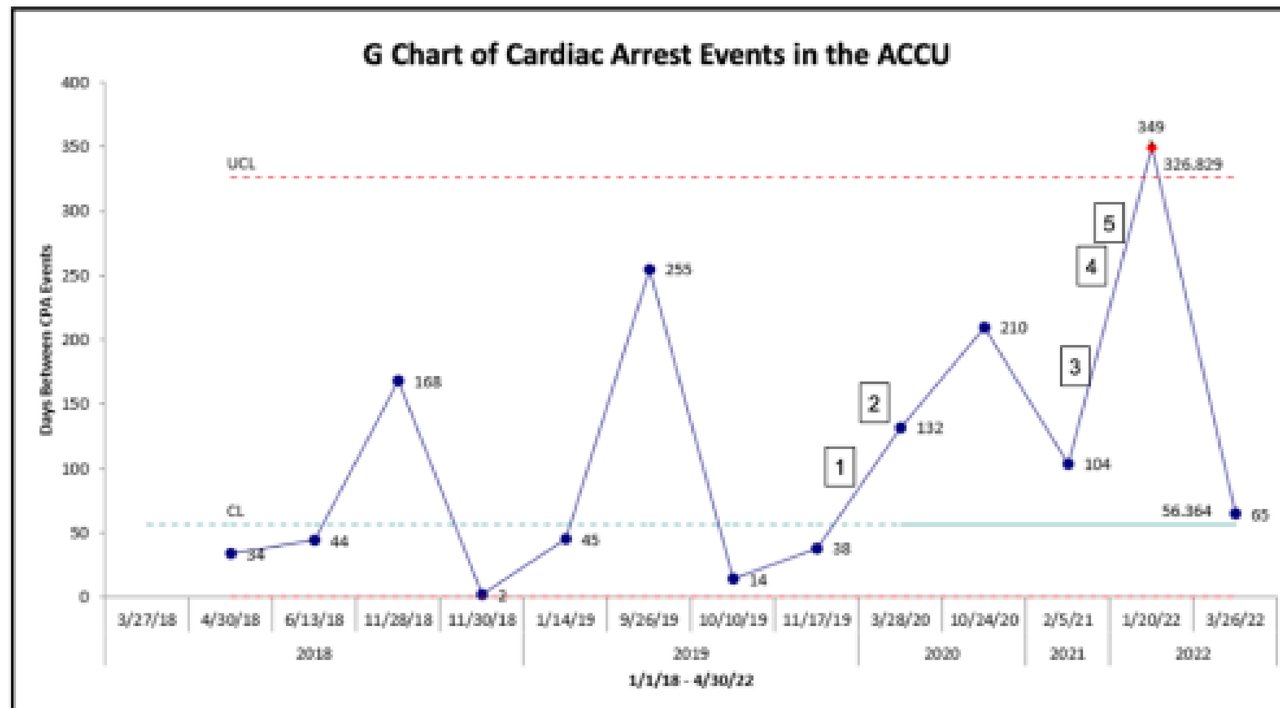

Table 1. HeartWatch Patient Inclusion Criteria

General patient criteria (place on bundle for 24 h unless otherwise specified and reevaluate daily)

- Direct admissions from outside hospitals
- Concern for NEC
- Initiation/discontinuation/titration of milrinone
- Rapid increase in respiratory support or oxygen requirement OR any patient receiving maximum support on high-flow nasal cannula (maximum = 6LPM, 50% FiO_2)
- Emergency event or rapid response within 24 h without transfer to ICU
- Medication error requiring additional monitoring or treatment
- Status postcardiac catheterization with pulmonary capillary wedge pressure >18
- Team member concern
- Interstage single ventricle transferred from ICU (remain on bundle for 7 d from transfer)
- Unpalliated neonate with potential for unbalanced circulation

Heart failure/transplant patient criteria (remain on bundle duration of admission unless otherwise specified)

- Severe ventricular dysfunction as defined by ejection fraction <35% or shortening fraction <17%
- Hypertrophic cardiomyopathy
- Restrictive cardiomyopathy
- Transplant patient with active rejection
- History of TCAD or cardiac allograft vasculopathy
- Patient with VAD or heart failure and known history of arrhythmia
- Heart failure or transplant patient transferred from ICU (remain on bundle for 48 h from transfer)

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Center Interventions, Past and Future

- What interventions brought them here?

- What interventions are planned?

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Children's Healthcare of Atlanta

Keyatta Lackey, PNP-AC
Children's Healthcare of Atlanta

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We didn't know we had a bounceback issue

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CICU and Surgical Characteristics

2025 CICU Characteristics	
Average Daily Census	30-34 (36 bed unit)
Physician Day Coverage Model	4 CICU attending M-Fri 2 CICU attending Sat-Sun
Physician Night Coverage Model	1 Attending
Day Coverage Model Frontline Provider	4-6 Providers (Card/ICU fellows & NPs)
Night Coverage Model Frontline Provider	4 Providers (Cards/ICU fellows & NP)
RNs per Day	26-28 average
Nursing Experience	< 1 yr 9.6%, 1-5 yrs 62% >5+ 28%

2025 Surgical Volume & STAT Breakdown	
Total Surgeries	917
Index Operations	738
STAT 1	48%
STAT 2	23%
STAT 3	13%
STAT 4	12%
STAT 5	5%

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PC4: Green
CHOA: Blue

Total Volume ICU

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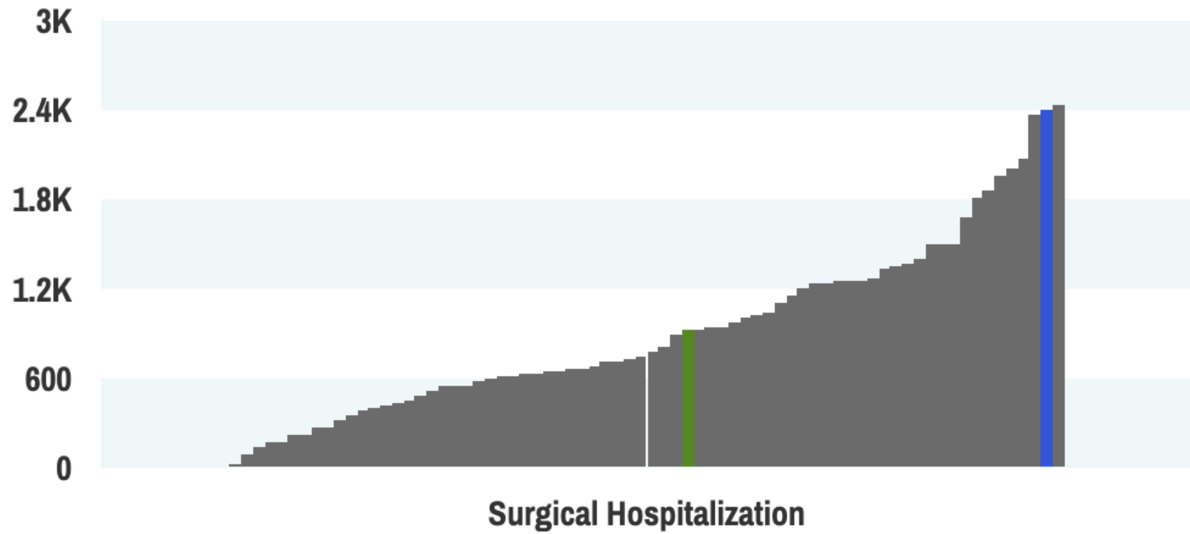
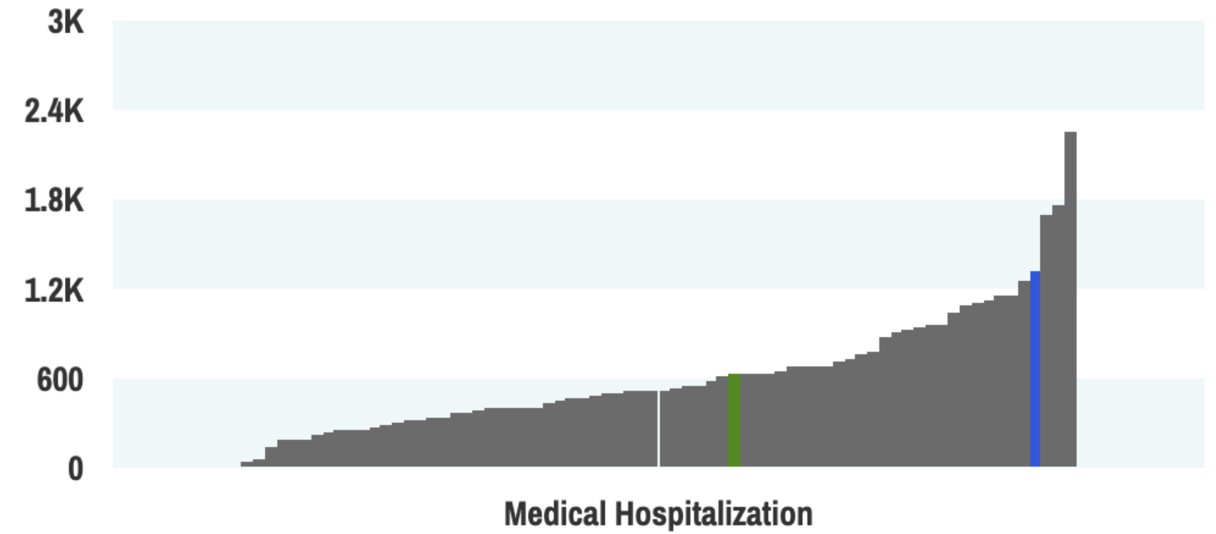
Total Surgical Admissions



Total Medical Admissions



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ACCU Characteristics

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2025 ACCU Characteristics	
Average Daily Census	35-45 (48 bed unit)
Off Service Patients	~10
Early Warning System	None, implementing HeartWatch in the next 1-2 months
Respiratory Support Allowed	HFNC 3-5kg 8L, 5-10kg 10L, >10kg 12L
Respiratory Support Initiation	HFNC, CPAP/BiPAP only in setting of OSA and documented sleep study with pulmonology guiding management
Vasoactives Allowed	Milrinone: stable for 18 hours Dobutamine/dopamine: stable for 24 hours Able to increase or decrease once per day
Vasoactives Initiated	None
Nursing experience	<1 year 10%, 1-5 years 57%, >5 years 33%
Nursing Ratio	1:2 for stable VAD; 1:3 for all else

3 Rounding Teams during the day

1. CT Surgery service for all post-op patients w/ 2 APPs and CT surgeon supervising
2. Medical service w/ 2 APPs with cardiologist
3. Medical service with 1 intern and 1 first-year fellow w/ 1 cardiologist

3 Night Shift Providers

1. APP for CT surgery service
2. APP for APP medical team
3. Rotating resident for trainee medical team supervised by cardiology fellow

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Total Volume ACCU

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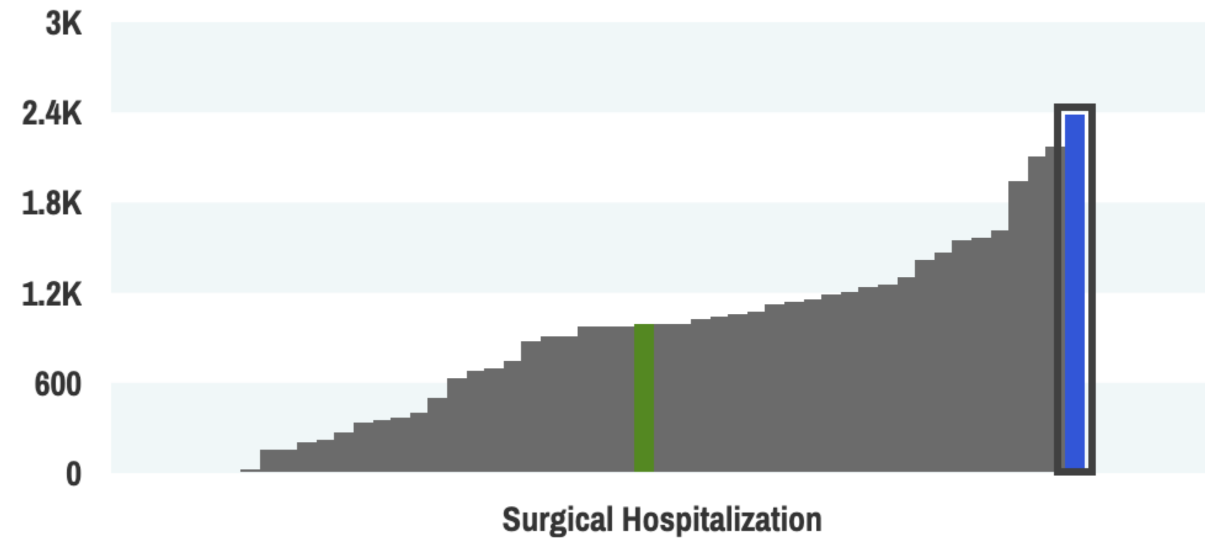
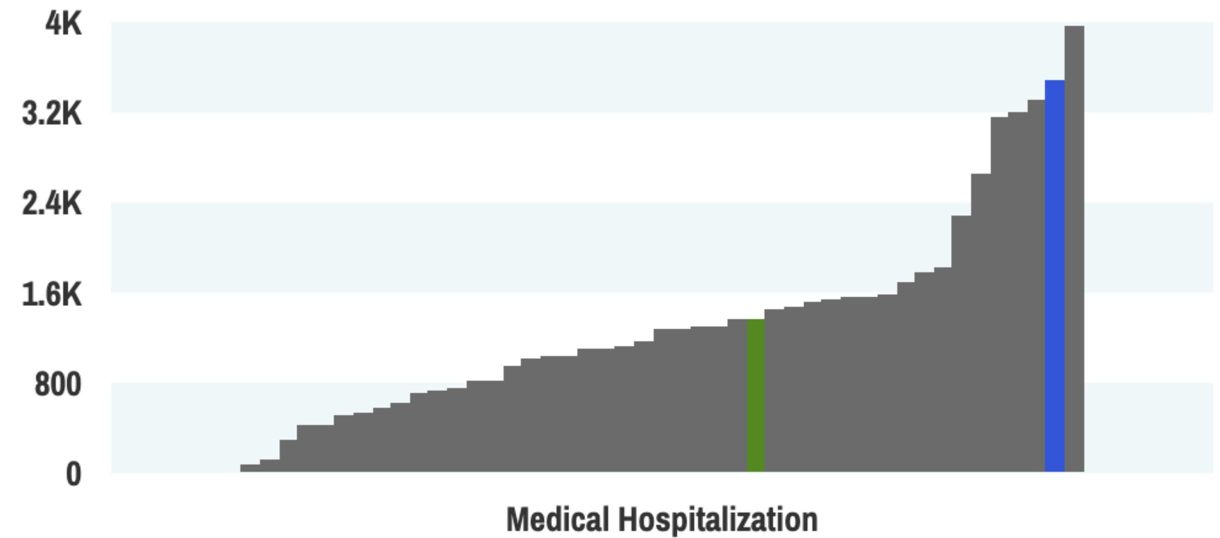
Total Surgical Admissions



Total Medical Admissions



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PC4: CICU Readmissions within 48 hours

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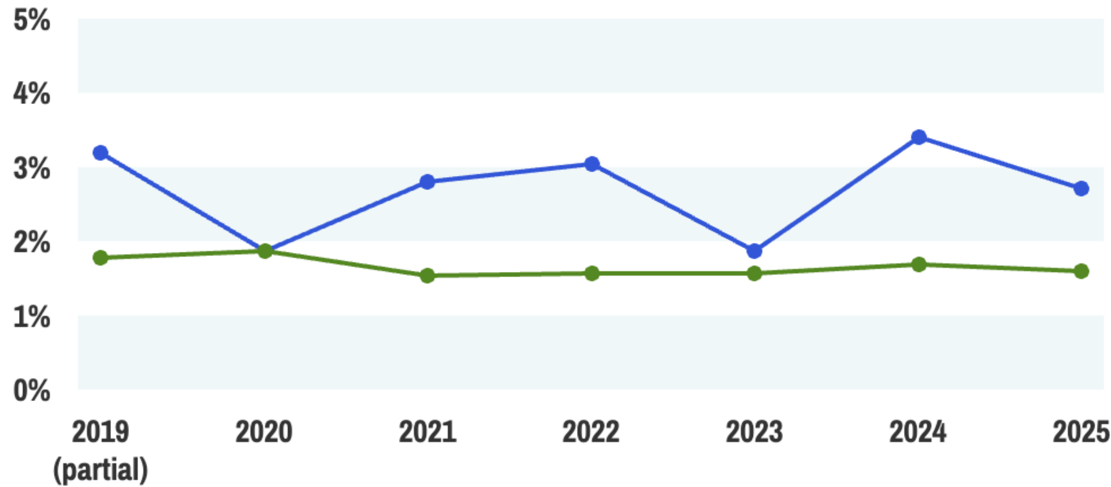
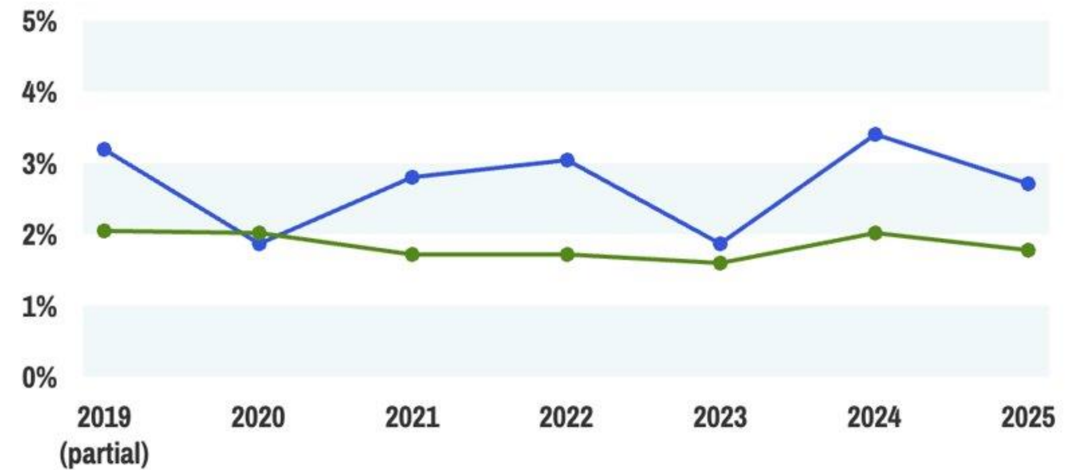
Readmissions: All Centers



Readmissions: High Volume Centers



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PC4: CICU Readmissions within 48 hours

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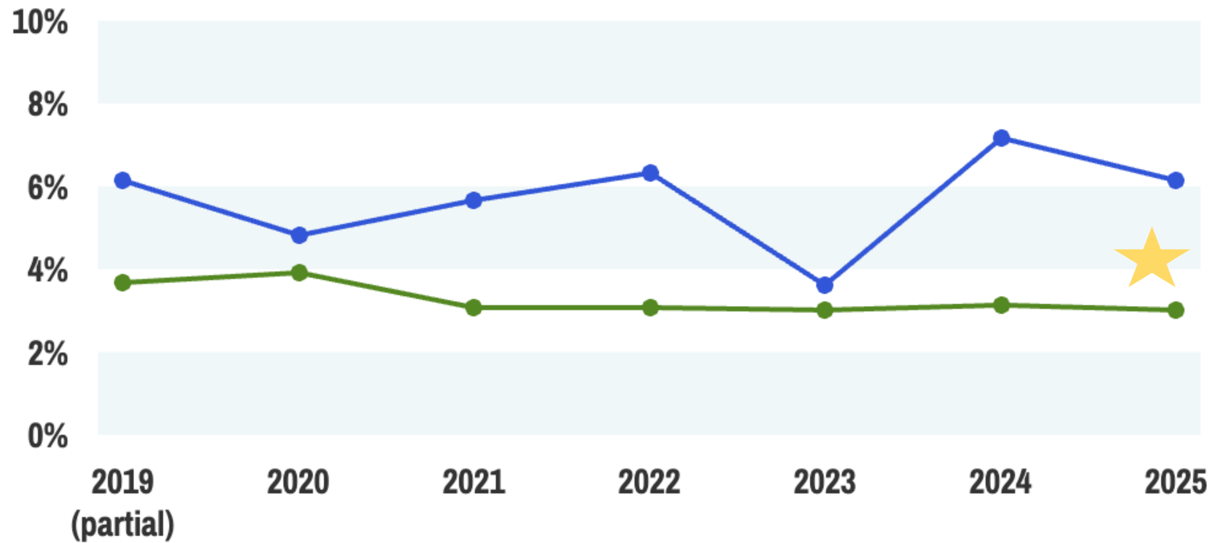
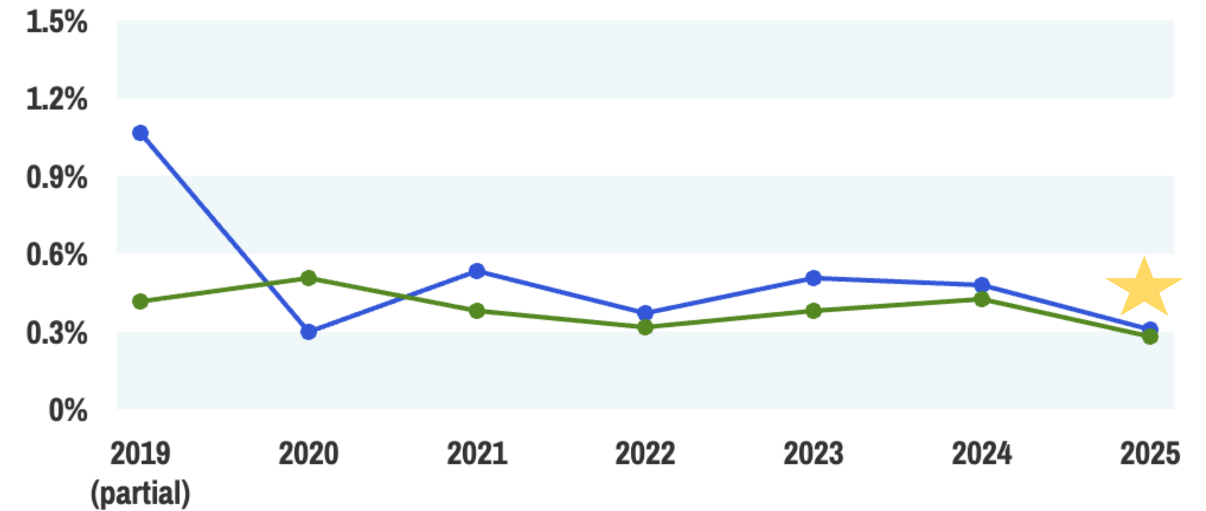
PC4: Green
CHOA: Blue

Medical Readmissions



Surgical Readmissions



PAC3: CICU Readmissions within 48 hours

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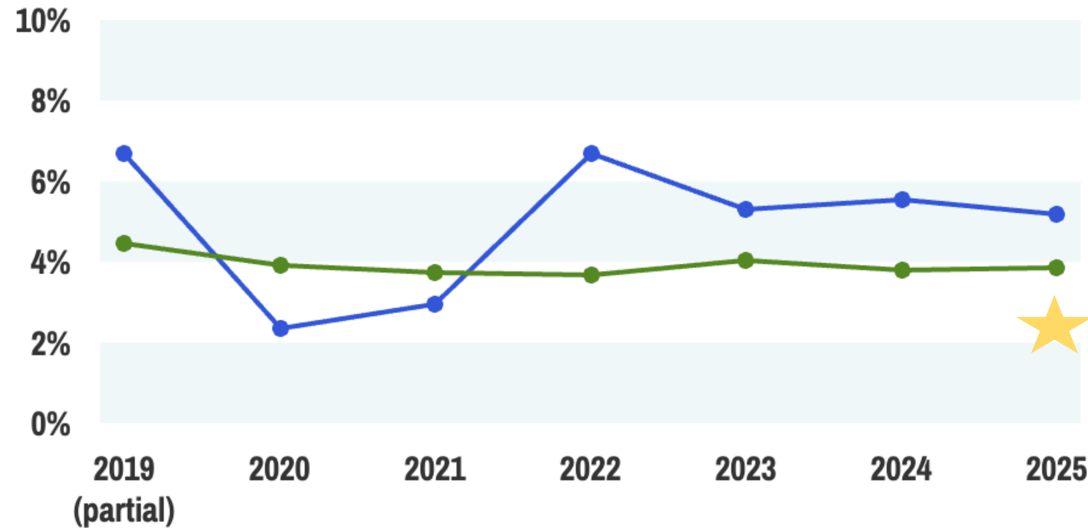
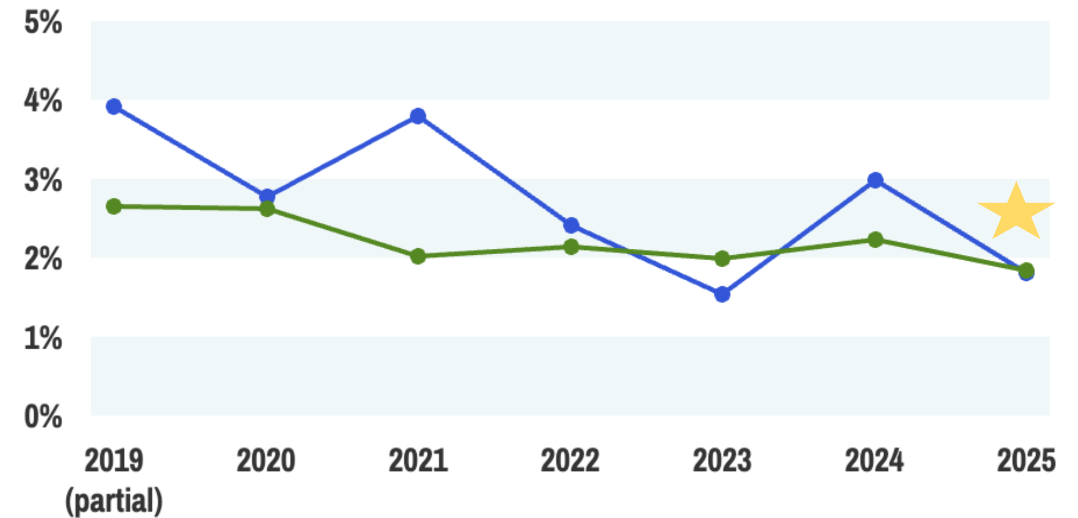
PAC3: Green
CHOA: Blue





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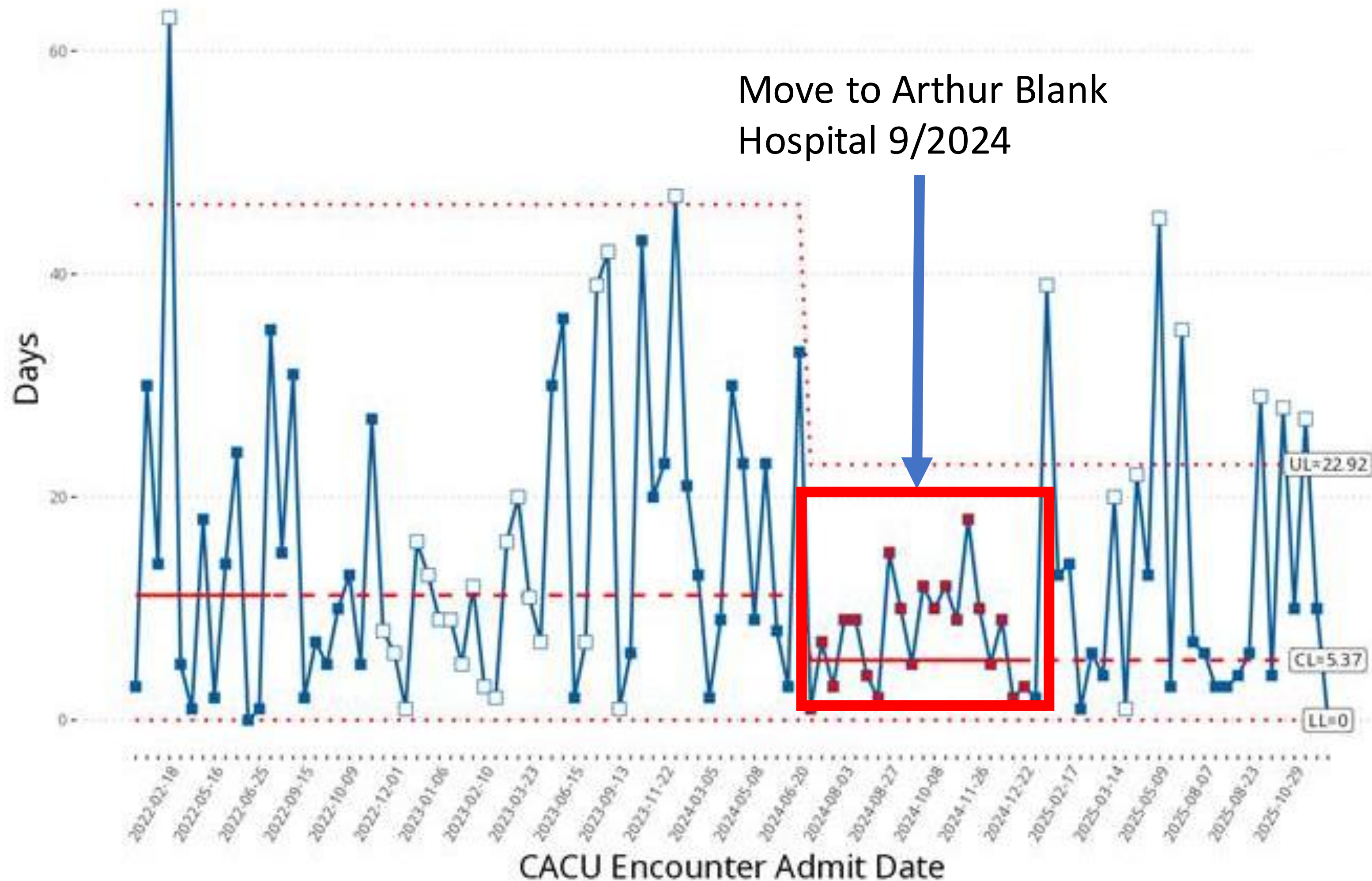
Evaluation of Bouncebacks

- Reviewed patient population = CICU readmissions from the ACCU within 48 hours (PAC3 data) from 1/2022-12/2025
- N for events= 108
  - N for patients= 100
- No VAD readmissions and 3 with history of heart transplant
- Few patients transferred to ACCU on vasoactives--4 patients with bouncebacks were initially transferred from CICU on milrinone (3.5%)
- 27 bouncebacks had single ventricle anatomy (27%)
- 4 months was median age for bounceback patients

Days Between ICU readmissions



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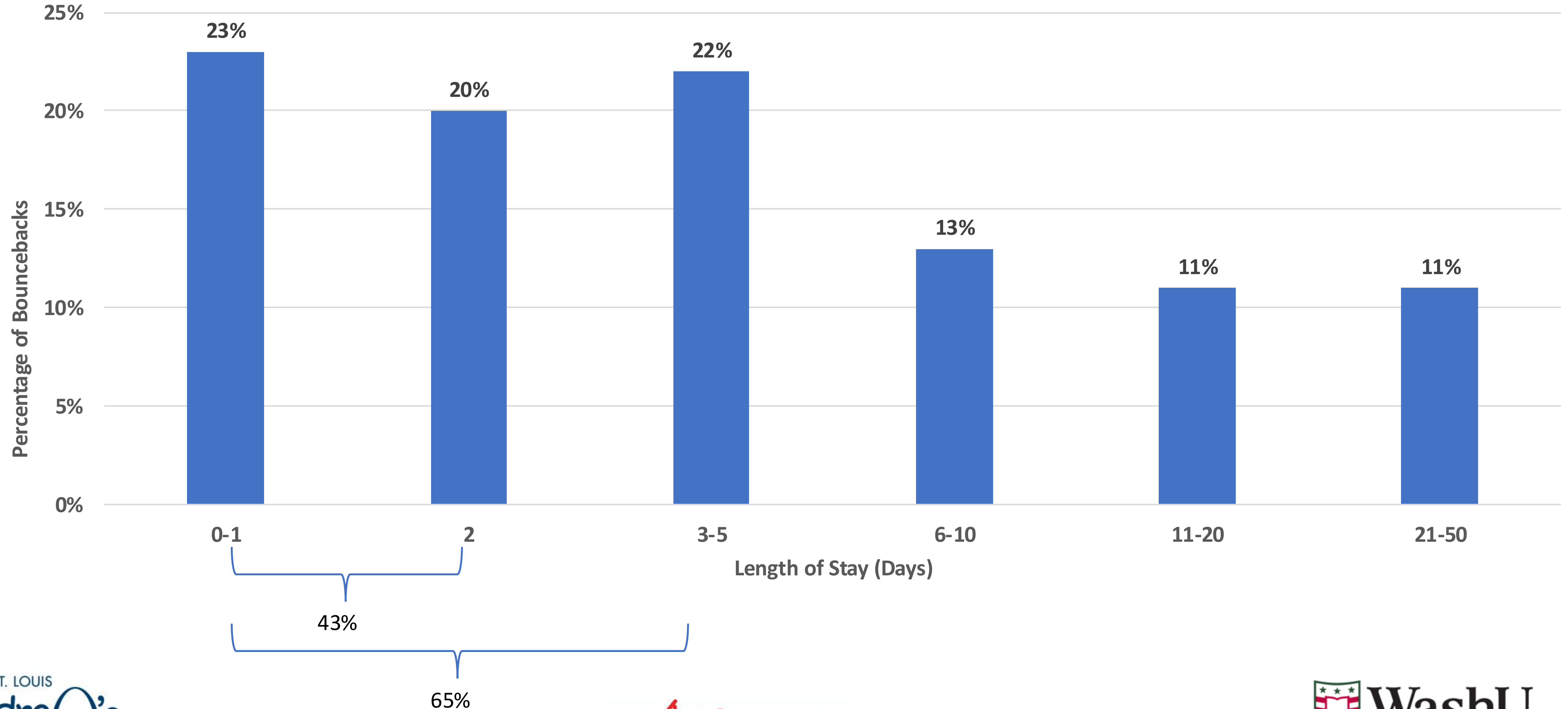
Bounceback Patient Characteristics: CICU LOS



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Bounceback Patient Characteristics: ACCU LOS

ACCU Length of Stay Pre-Bounceback

Length of Stay (Hours)	Percentage of Bouncebacks
0-6	16%
7-13	11%
14-25	27%
26-48	46%

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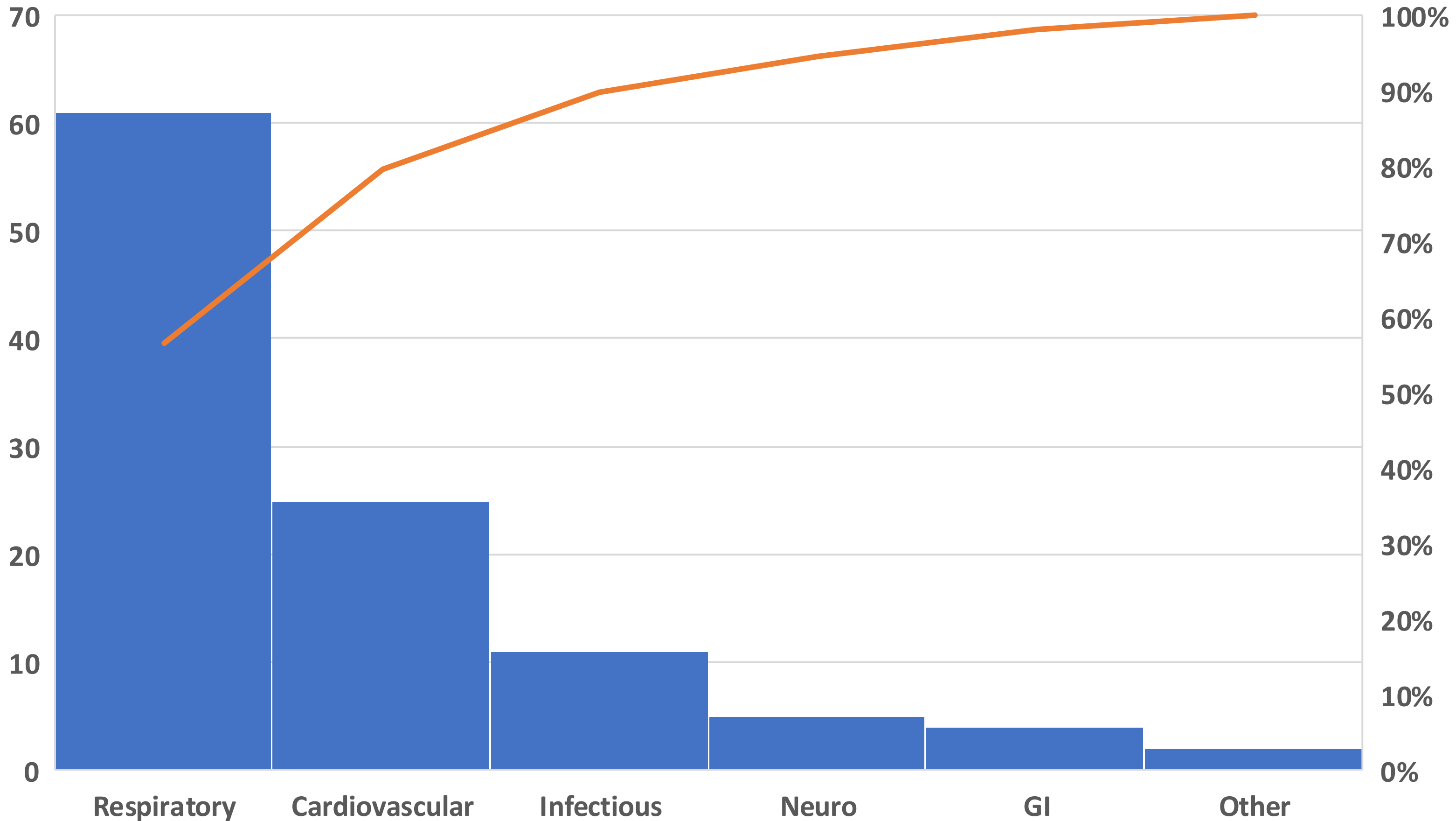
Bounceback Characteristics: Clinical Reasons for Bounceback



- Readmissions:
  - 12 were emergent (~11%)
    - 1 intubated, ECMO, and vasoactive
    - 4 intubation only
    - 6 vasoactive only
    - 1 CPR + vasoactive
  - 23 were urgent (22%)
    - 1 ECMO
    - 1 CPR + vasoactive
    - 2 intubation
    - 6 intubation +.vasoactive
    - 14 vasoactive only

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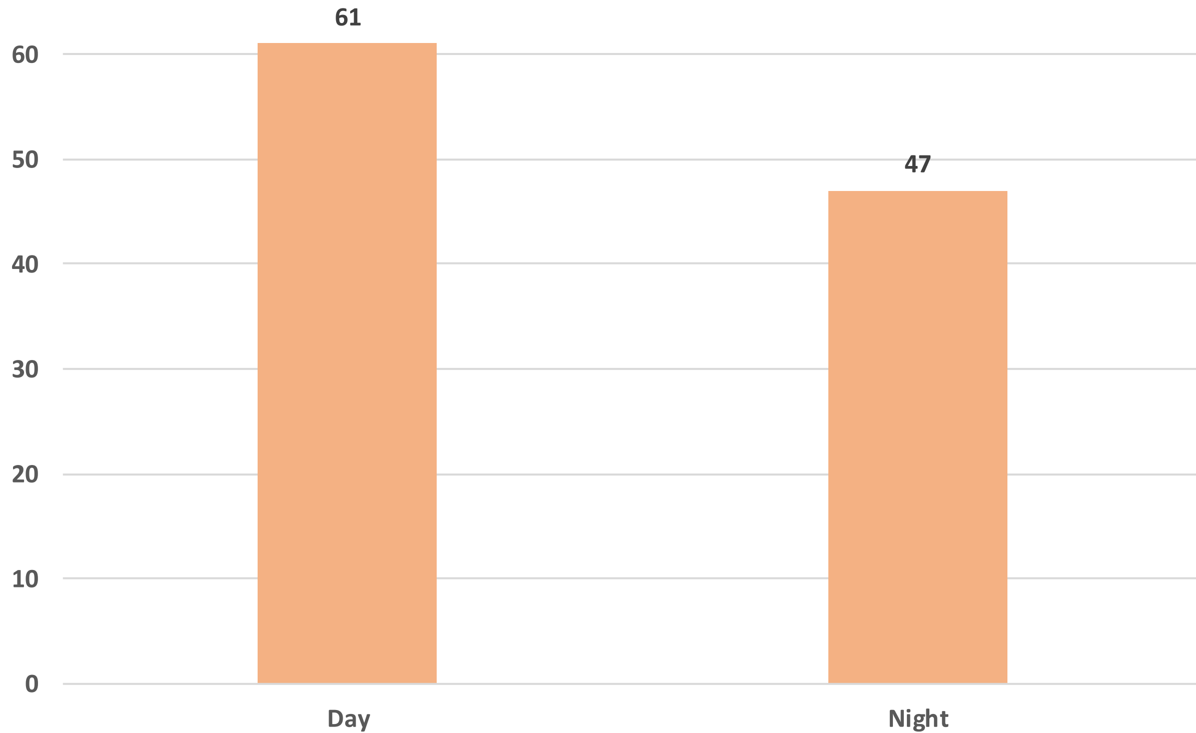
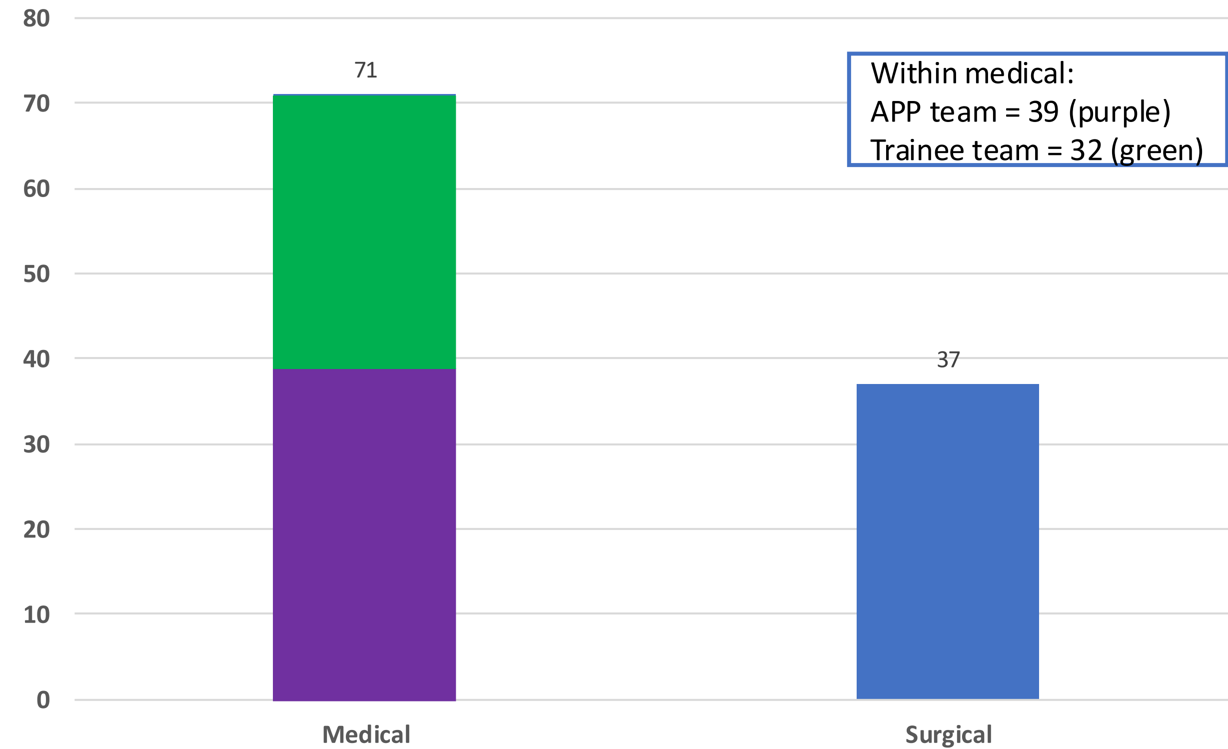
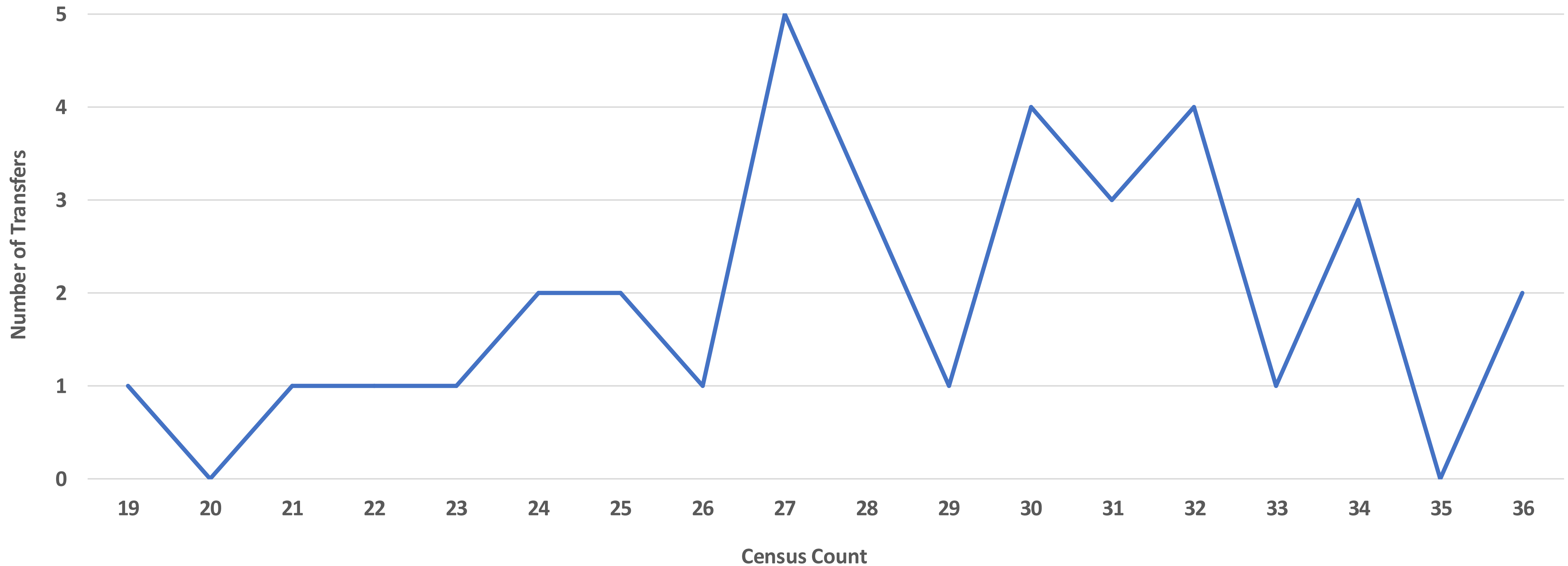
Bounceback by shift & Team transferred from in ACCU





CICU Census at Time of Transfer Out



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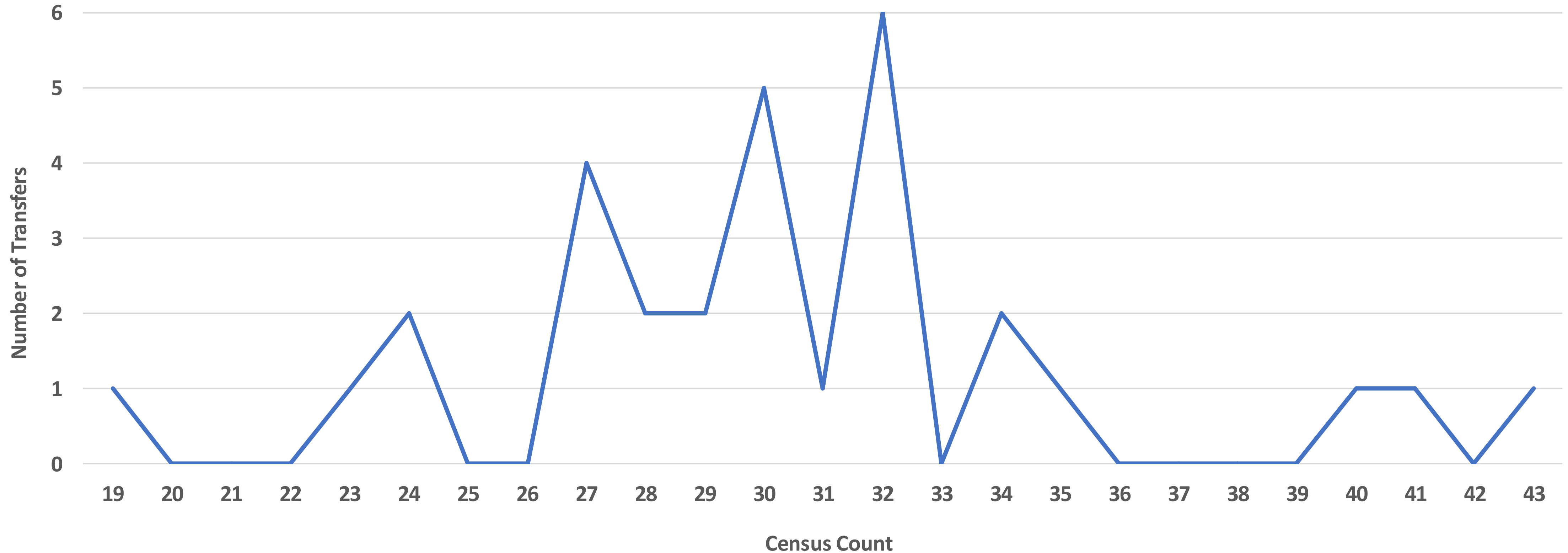
ACCU Census at Time of Transfer In



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How is length of stay affected?

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Overall Length of Stay

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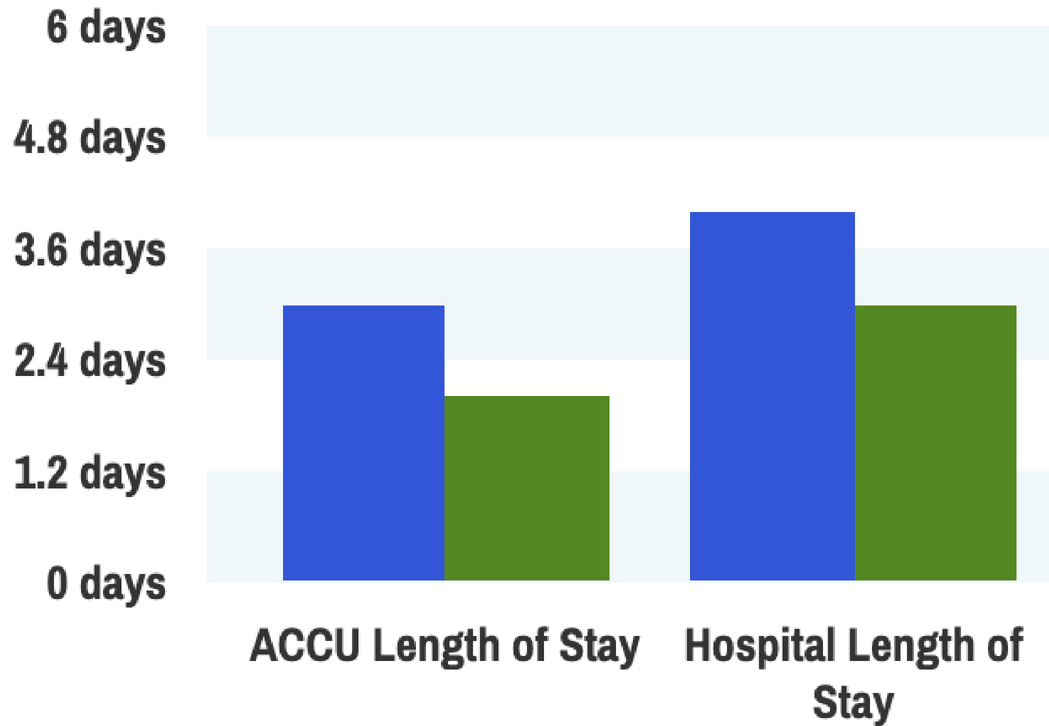

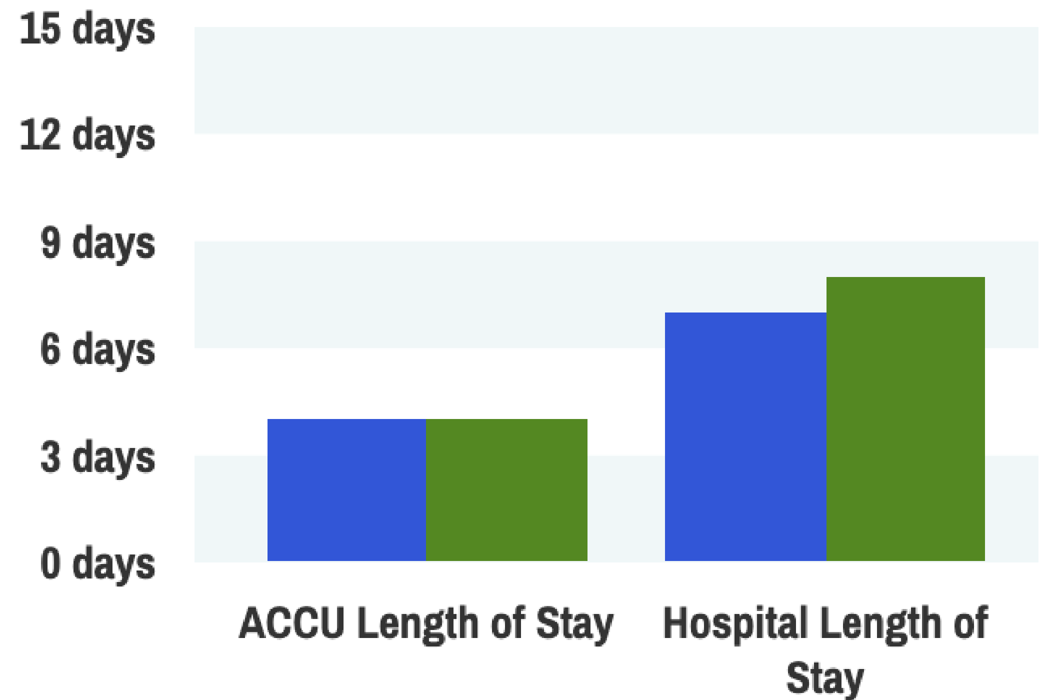

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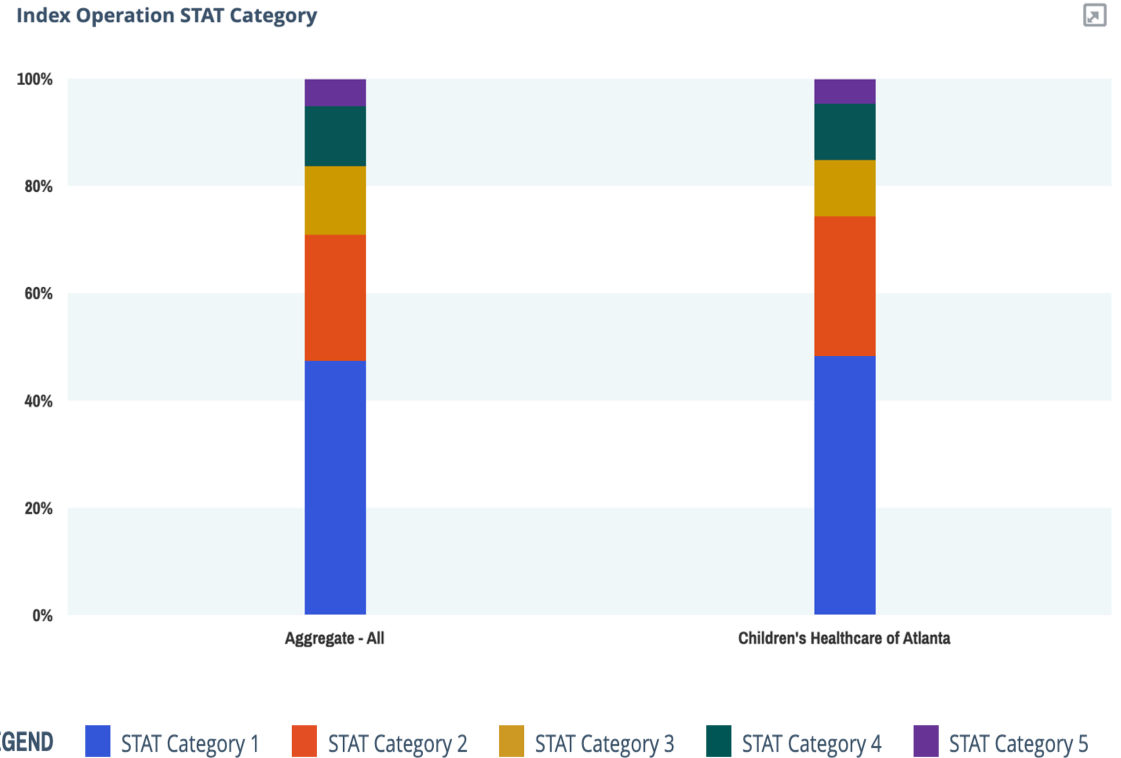
Why is Surgical LOS Lower?

- Case mix with slightly more STAT 1 and 2 than aggregate
- Enhanced Recovery after Surgery (ERAS)



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Why is our bounceback rate higher than average?

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Patient Level Issues

Respiratory deterioration is the major cause for readmission

Management of patients with breakthrough arrhythmia on ACCU

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Unit/System Level Issues

RT staffing concerns on ACCU at night

Lower limit of HFNC on the ACCU

Unique model with cardiothoracic surgeons supervising post-surgical patients on ACCU

Short CICU LOS on average for bouncebacks- are patients being transferred too early due to census and acuity in CICU?

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Improving CICU Readmission Rate

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What is our plan of action?

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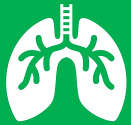
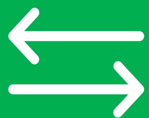
QI Project Group established to address 48-hour bouncebacks

CICU Rapid Response Rounding


Evaluate Respiratory Therapist staffing

CACU RN & Provider simulation for respiratory escalation


Consideration for changing ACCU coverage model

Multi-Disciplinary QI Project Group

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Representation from:

CICU Providers (Drs & APPs)	CACU Providers (Drs & APPs)	Respiratory Therapists
CICU RNs	CACU RNs	Clinical Admin
Fellows	Educators	Non-Clinical Admin

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CICU Rapid Response Rounding Tool

Date:________________ Shift: AM/PM Name:________________

Shift Start Checklist

- ☐ 0700/1900 Receive Report as Team
- ☐ 0800/2000 Round on CACU
- ☐ Write Event Note ("RRR Completed")
- ☐ Huddle with TL/CICU4
- ☐ Complete Time off Unit Survey

Inclusion Criteria

1. Transfer from CICU within the last 24 hours (Not ERAS)
2. Rapid Response in the last 24 hours without ICU transfer
3. Higher oxygen demand outside of the ICU
4. The "sickest 3" from CACU charge or resource nurse
5. Patients on both milrinone & dobutamine
6. VADS

Time Off Unit Tracker

Room # ☐Rounds Note Completed

Rounding Criteria: ________________

VS:

- HR:
- BP:
- Temp:
- O2 sats:

Current respiratory support: ________________

Concerning lab values:

Additional assessment concerns:

Room # ☐Rounds Note Completed

Rounding Criteria: ________________

VS:

- HR:
- BP:
- Temp:
- O2 sats:

Current respiratory support: ________________

Concerning lab values:

Additional assessment concerns:

Room # ☐Rounds Note Completed

Rounding Criteria: ________________

VS:

- HR:
- BP:
- Temp:
- O2 sats:

Current respiratory support: ________________

Concerning lab values:

Additional assessment concerns:

Room # ☐Rounds Note Completed

Rounding Criteria: ________________

VS:

- HR:
- BP:
- Temp:
- O2 sats:

Current respiratory support: ________________

Concerning lab values:

Additional assessment concerns:

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- Resource RN from CICU
- Inclusion criteria- requires an assessment
- Write event note
- Huddle with ICU provider or attending

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RT Staffing Concerns

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- Current staffing model: 2 RT during day for ACCU, 1.5 at night
- Escalated to Heart Center and RT leadership
- In order to increase RT staffing, we merged RT staffing on the cardiac floor with the Gen peds floor
  - Increased education for General Pediatrics Respiratory Therapist staff when working on cardiac floor
  - Goal is to expand "cardiac core" RT members who specialize in the respiratory care of patients with congenital heart disease and are trained to work both in CICU and ACCU

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ACCU Provider/RN Simulation

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- Rapid cycle deliberate practice simulations for most common reasons for bouncebacks- real time
- Introduction of new protocols

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ACCU Coverage Model

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- Reflection that there is utility in cardiology collaboration for post-surgical patients
- Revisit established criteria outlining which post-operative patients should be admitted to the medical service

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Summary

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Small gradual changes with meaningful improvements

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Thank You!

- Jenna Marie Hall, MPH
- Sherry Smith, RN
- Mary Lukcas, RN
- Shelly Gleason, MPH
- Nikhil Chanani, MD
- Shanelle Clarke, MD

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Return to Sender: Bouncebacks to the CICU

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ST. LOUIS Children's HOSPITAL BJC HealthCare

PC4 PAC3

WashU Medicine

Disclosures

Jason Buckley MD

- AltaThera medical advisory board

Angie McKeta PA-C

- none

MUSC Surgery and CICU Characteristics

PC4 Total Hospitalizations	391 (1/1/25 – 12/31/25)
Surgical Hospitalizations	307
Medical Hospitalizations	84
STAT Breakdown	1 (42%), 2 (26%), 3 (17%), 4 (9%), 5 (5%)
CICU Beds	15 (+ 4 "flex" beds depending on unit/acuity needs)
CICU Coverage Model (Day)	1 attending, 1 card fellow, 1 APP, 1 back-up attending
CICU Coverage Model (Night)	1 attending, 1 card fellow, 1 APP
CICU Average Daily Census	15

MUSC ACCU Characteristics

ACCU Beds	14 (+ 4 "flex" beds depending on unit/acuity needs)
Coverage Model (Day)	1 card attending, 1 card fellow, 1-2 APPs
Coverage Model (Night)	1 card attending (home call), 1 APP, card fellow covering CICU assists as needed
EWS System	C-CHEWS since 2015 (modified based on local events and expert opinion)
Respiratory Support Allowed	HFNC (Vapotherm), nighttime CPAP (OSA), trach and home vent
Resp Support Initiation	HFNC allowed to be initiated and flow increased (max ~2L/kg for infants)
Vasoactives Allowed	Milrinone (most common), Dopamine (rare), PGE
Vasoactive Initiation	Milrinone
VADs	Berlin, HeartMate III patients cared for in ACCU

What does this even mean?

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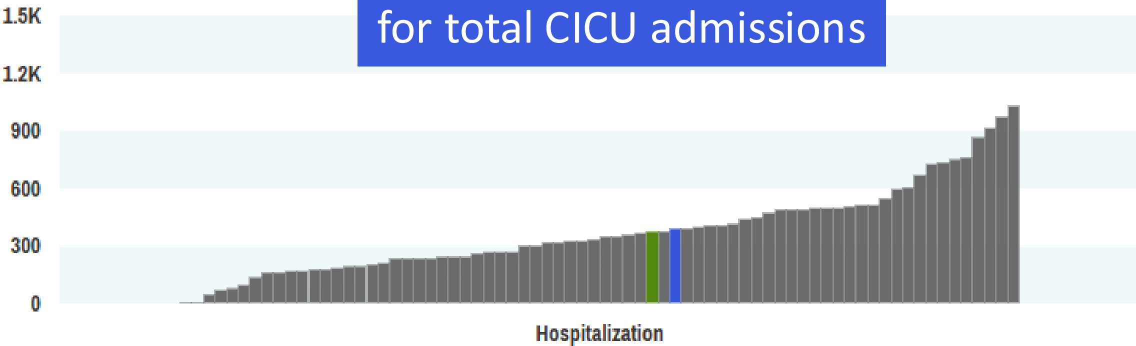
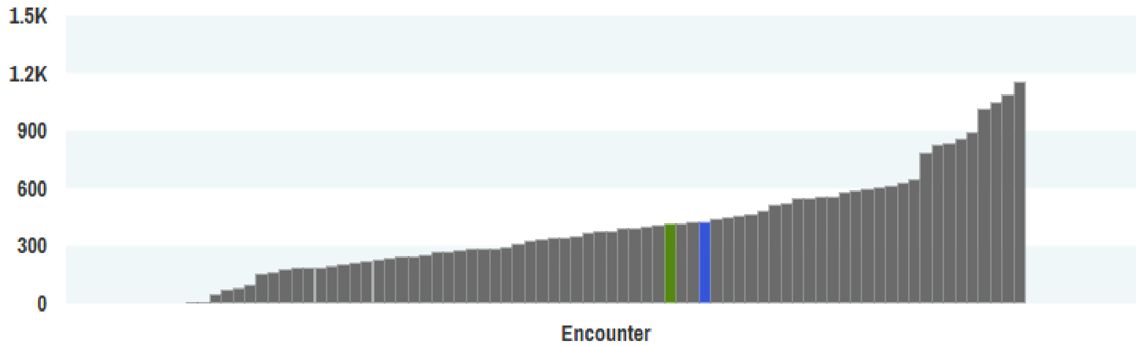
Total Admissions

Slightly above average for total CICU admissions

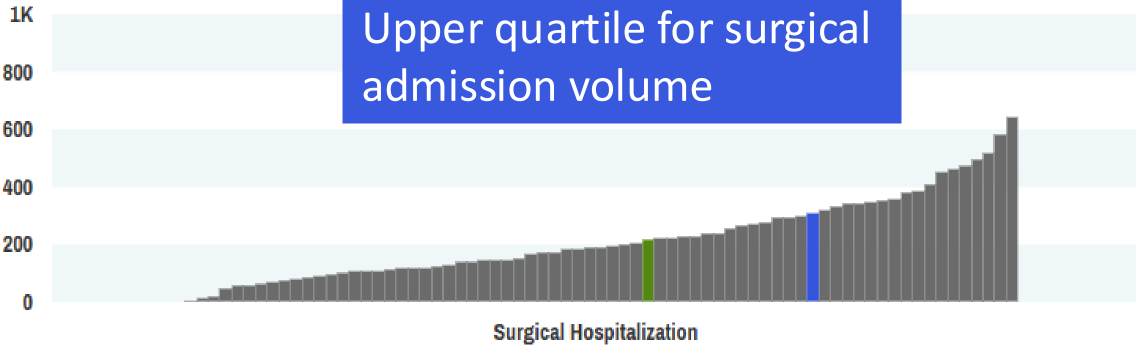


Total CICU Encounters



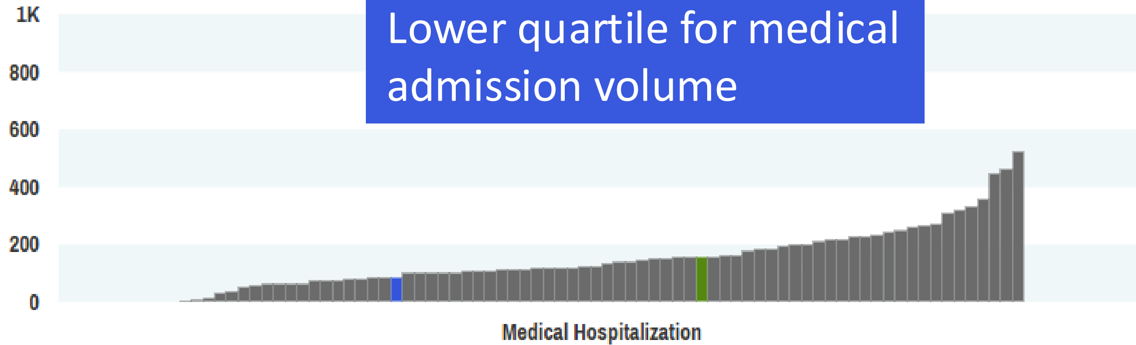
Total Surgical Admissions

Upper quartile for surgical admission volume



Total Medical Admissions

Lower quartile for medical admission volume



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What does this even mean?

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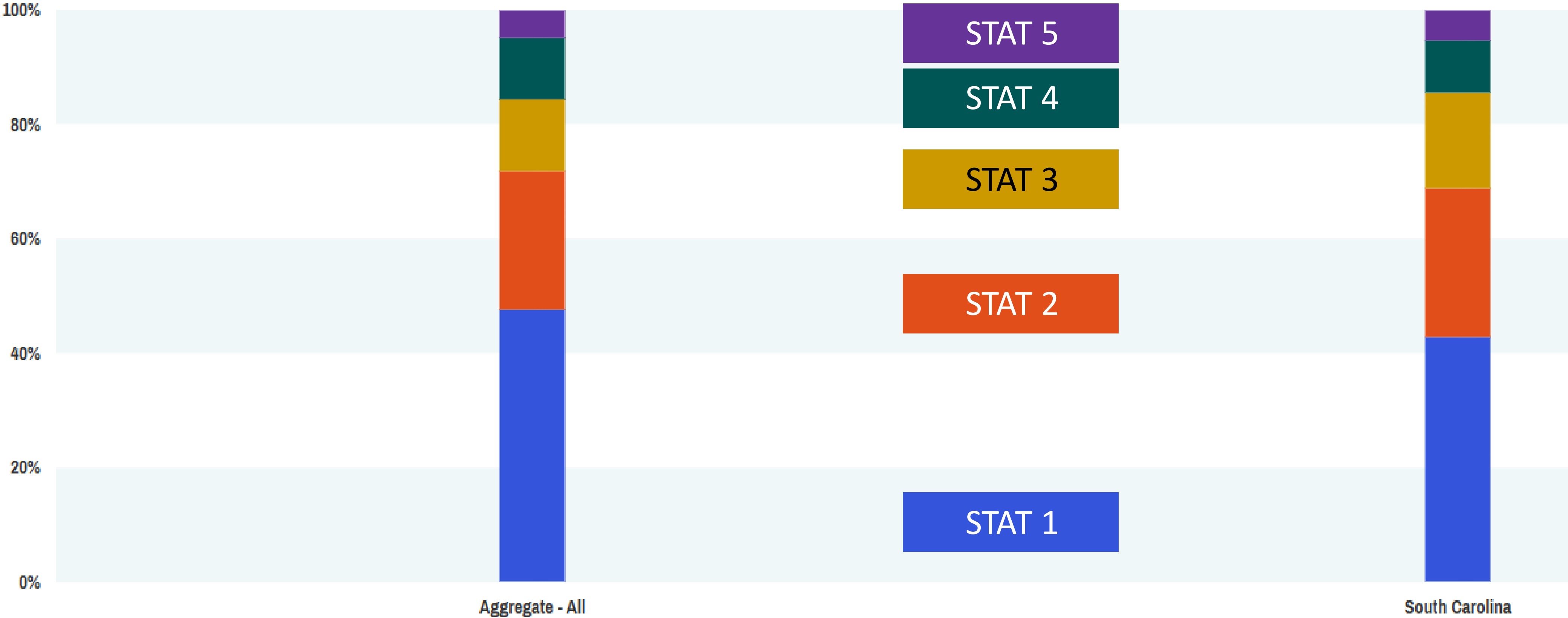

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What does this even mean?

30
25
20
15
10
5
0

2020 2021 2022 2023 2024 2025

29 bed Heart Center…

***running at capacity the past 2 years**

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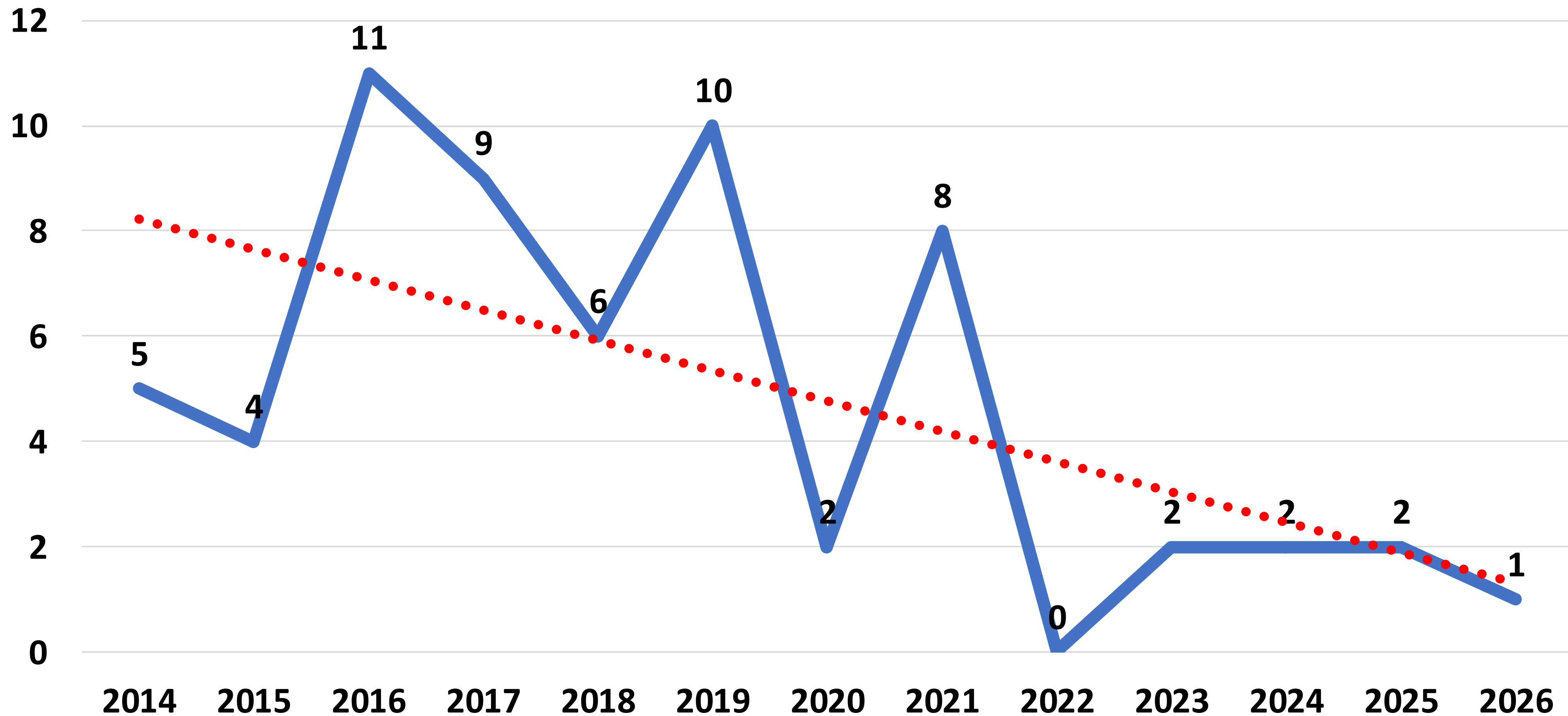
CICU Readmissions (Bouncebacks) < 48h, 2014-Current



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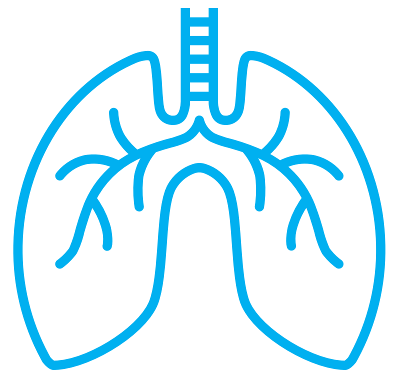
Reasons for Bouncebacks 2019-2025

N= 24

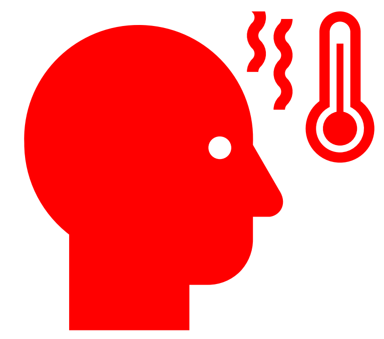


33%

O2 desaturation
Increased WOB
Tet Spell
Pneumothorax

29%

Arrhythmia
Pericardial Effusion



25%

Fever
Infection
Sepsis

13%

NEC
Oversedation
Other

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So JB, does MUSC not have many bouncebacks because you don’t have CICU beds and so you drag your feet about bringing em back so that they end up coming back > 48h?

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Total Unplanned Transfers from ACCU to CICU

(not just "Bouncebacks")

2014-2025

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Transfers	28	42	47	36	33	29	20	33	19	22	18	19

Well JB, maybe the ones that do eventually come back to the CICU are coming back sicker (more “emergent”)?

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Care Escalation - Emergent Transfers

3%
2.4%
1.8%
1.2%
0.6%
0%

2020 2021 2022 2023 2024 2025

South Carolina
Aggregate - All

Okay JB, well maybe because of a lack of ACCU beds your CICU LOS is increasing and therefore patients are transferring to the ACCU in a lower acuity state with less risk for bouncing back??

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Postoperative CICU LOS (Mean) - Postop CICU LOS

20 days
16 days
12 days
8 days
4 days
0 days

2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025

South Carolina | Aggregate - All

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Things that might be contributing to low bouncebacks (we think)…

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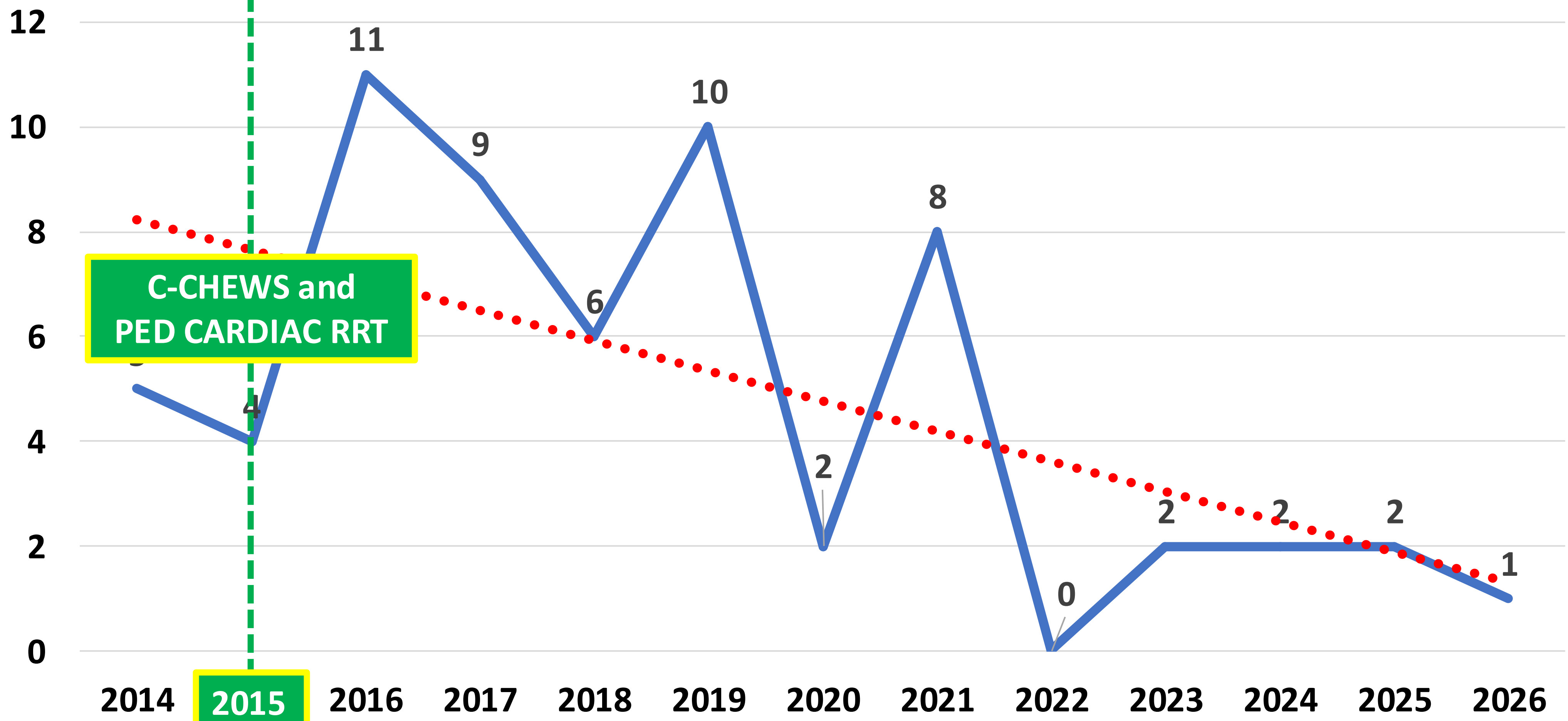

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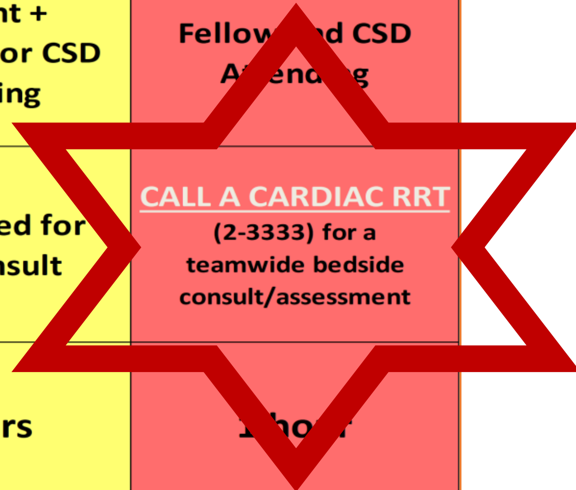
Cardiac Children's Hospital Early Warning Score (C-CHEWS) Action Algorithm				
	Score 0 - 2	Score of 3	Score of 4	Score ≥ 5
Notification		Resident	Resident/PA, Fellow, CSD Charge RN, CSD Attending	Resident/PA, Fellow, CSD Charge RN, CSD Attending
Bedside Evaluation		Resident	Resident + PA/Fellow or CSD Attending	Fellow and CSD Attending
Escalation of Care		Assess need for CICU consult	Assess need for CICU consult	CALL A CARDIAC RRT (2-3333) for a teamwide bedside consult/assessment
Re-assessment	4 hours	2 hours	2 hours	1 hour



Clinical Alert:

* Clinical suspicion and concern can override the C-CHEWS algorithm at any time. Call a Ped Cardiac MET for immediate assistance whenever needed. C-CHEWS scoring should supplement clinical judgement, not override it

* Families often know their child best. If a family member is concerned about their child, listen and respond to their request. **REMEMBER** family members may request to speak with the Attending and/or request a Ped Cardiac MET be called.

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PEDIATRIC CARDIAC RAPID RESPONSE TEAM

2015-2025

- **463** Activations (~46 per year)
- **177** Transfers to CICU (~38%)
- **69** Critical Deterioration Events (39%)
  -Intubation or pressor within 12h of transfer
- **20** Cardiac Arrests on ACCU
- **0** Deaths on ACCU

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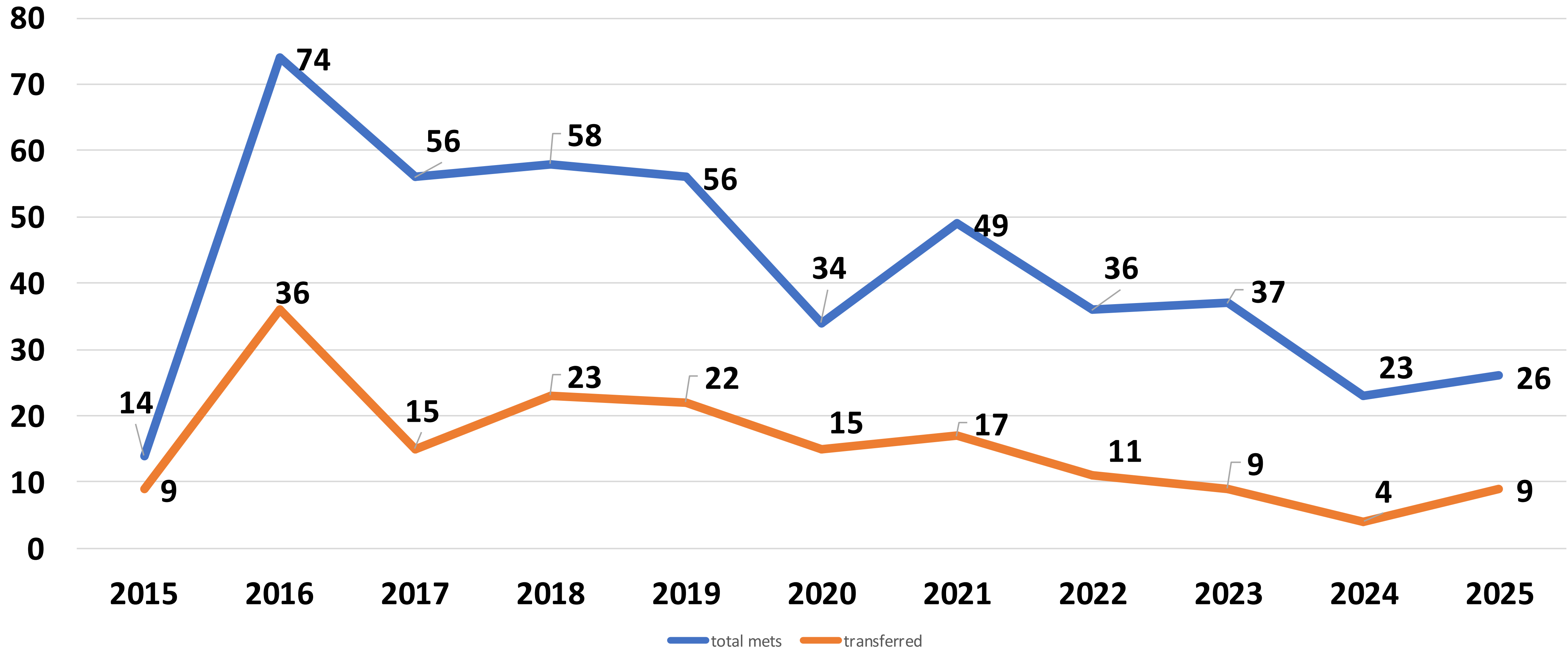
Total RRTs vs Total Transfers to CICU after RRT 2015-2025



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CICU Readmissions (Bouncebacks) < 48h, 2014-Current

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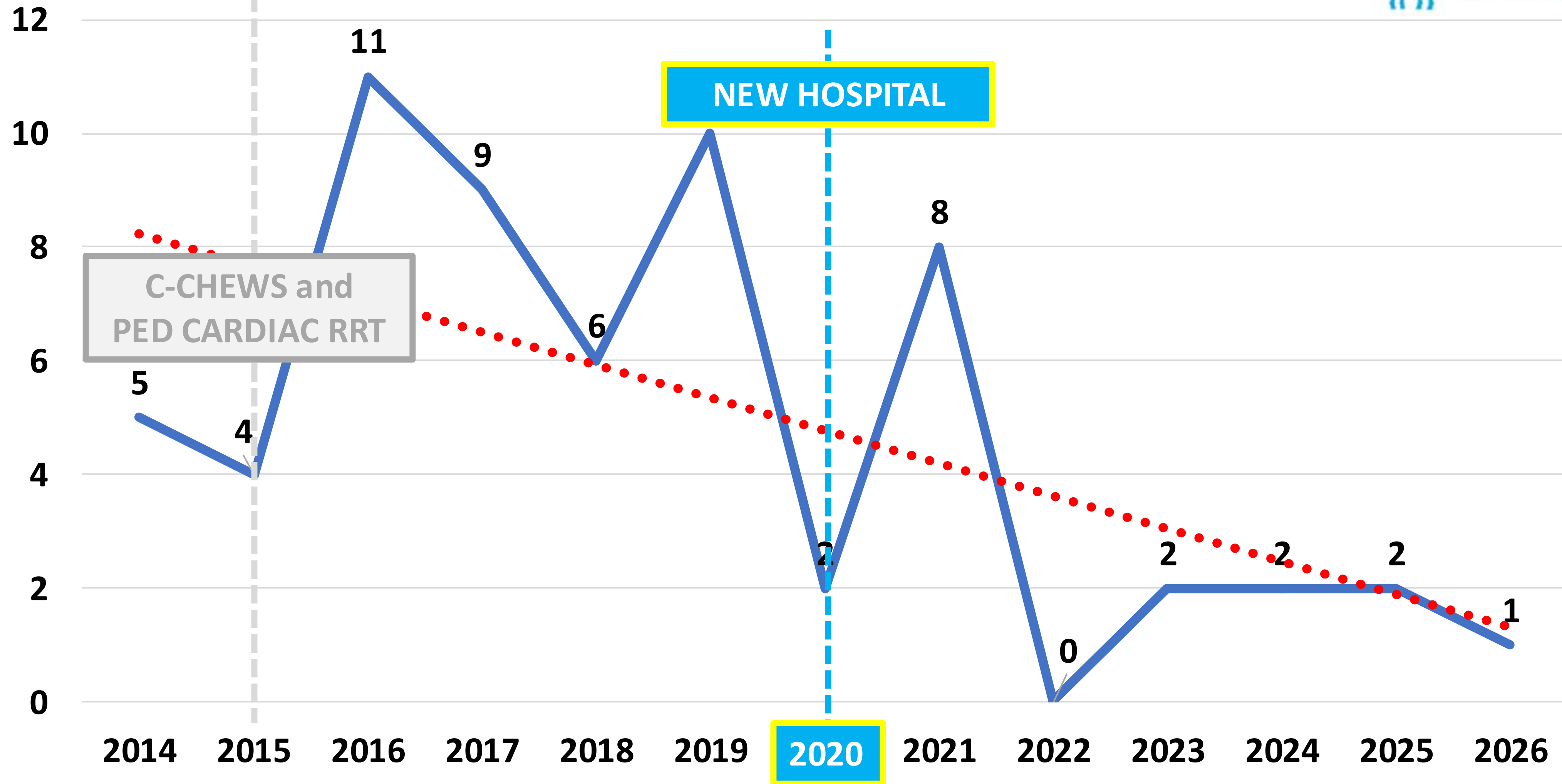

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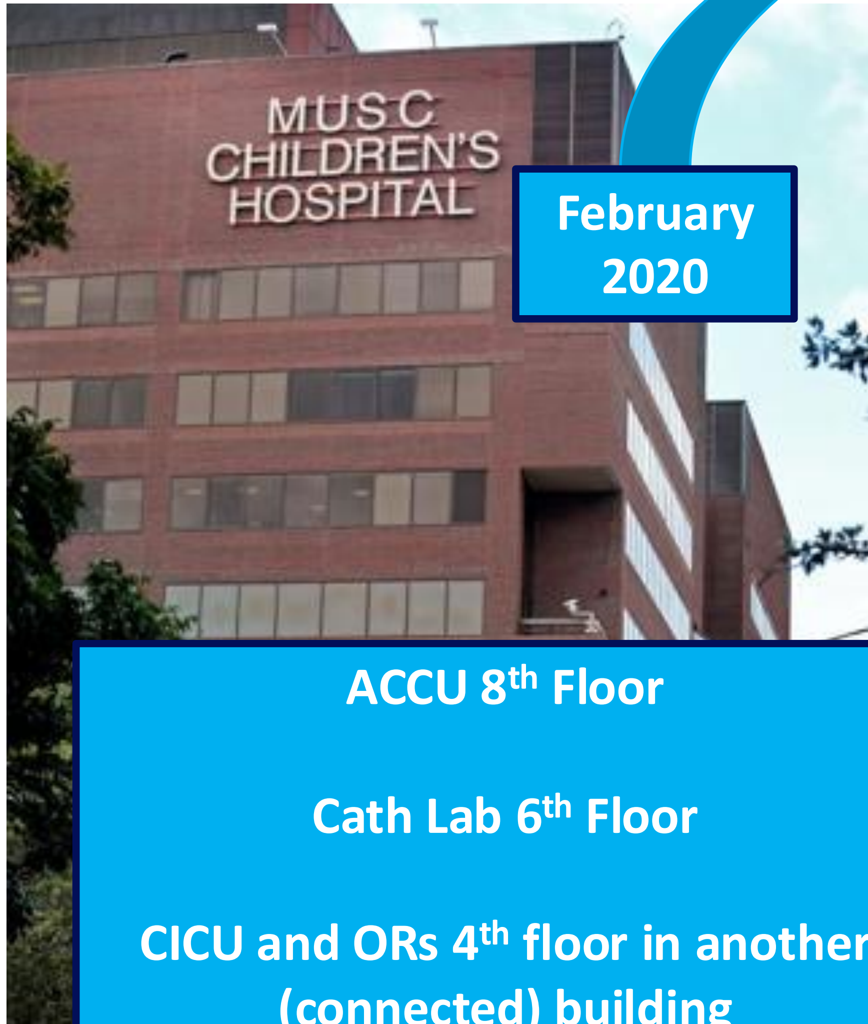
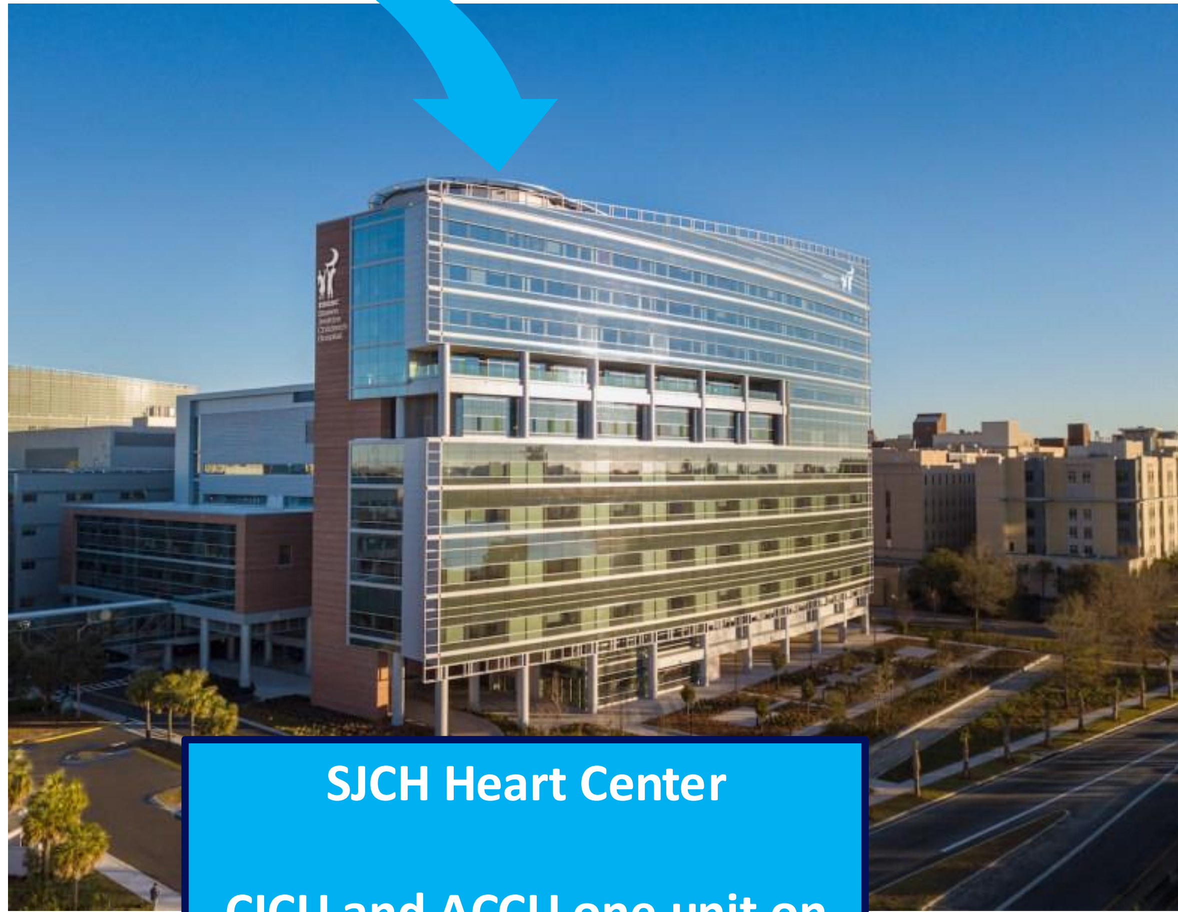
February 2020



ACCU 8th Floor

Cath Lab 6th Floor

CICU and ORs 4th floor in another (connected) building

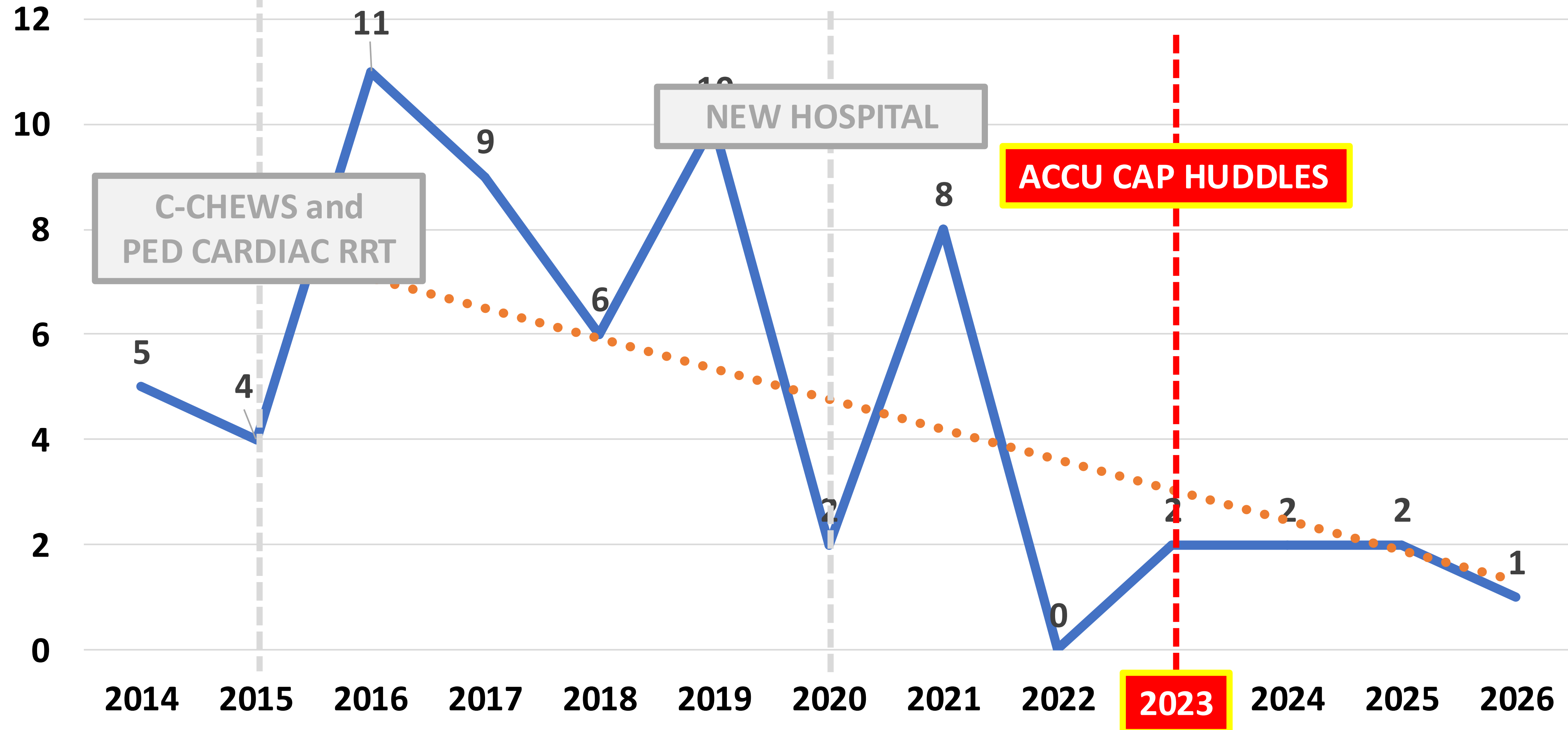


SJCH Heart Center

CICU and ACCU one unit on 3rd Floor

Cath lab and ORs 3rd Floor

CICU Readmissions (Bouncebacks) < 48h, 2014-Current



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CAP Safety Huddle Form -- CSD

Cardiac diagnosis: ______________________________

High Risk due to:	
C-CHEWS in "red" category	Triggered the cardiac RRT in the preceding 24 hrs
Admission from ED or OSH in the preceding 24 hours with: a. Increased respiratory support b. Worse cardiac function c. New arrhythmias	Transfer from CICU and: a. Moderate+ dysfunction b. CICU stay > or = 30 days c. Single ventricle physiology
S/p high risk cath	Other: ____________

Etiology of clinical decompensation/cardiac arrest:	Patient specific warning signs:
Heart failure Respiratory failure Arrhythmia Thrombus Bleeding Other ____________	____________ ____________ ____________

Preventative measures:

- ☐ Maintain vascular access
- ☐ Keep external pacer at bedside
- ☐ Confirm updated Type & Screen
- ☐ Discuss need for transfer with CICU
- ☐ Other: ____________

Other Pertinent Information? (optional)

- Epi dose? ____________
- Defib energy? ____________
- Other? ____________
- ECMO candidate? ☐ Yes ☐ No

Daily Trajectory:	__/__ am/pm	__/__ am/pm	__/__ am/pm	__/__ am/pm
Heart rate range:				
SaO_2 range:				
Respiratory support:				
Baseline / improving / worsening				

Vascular Access:				

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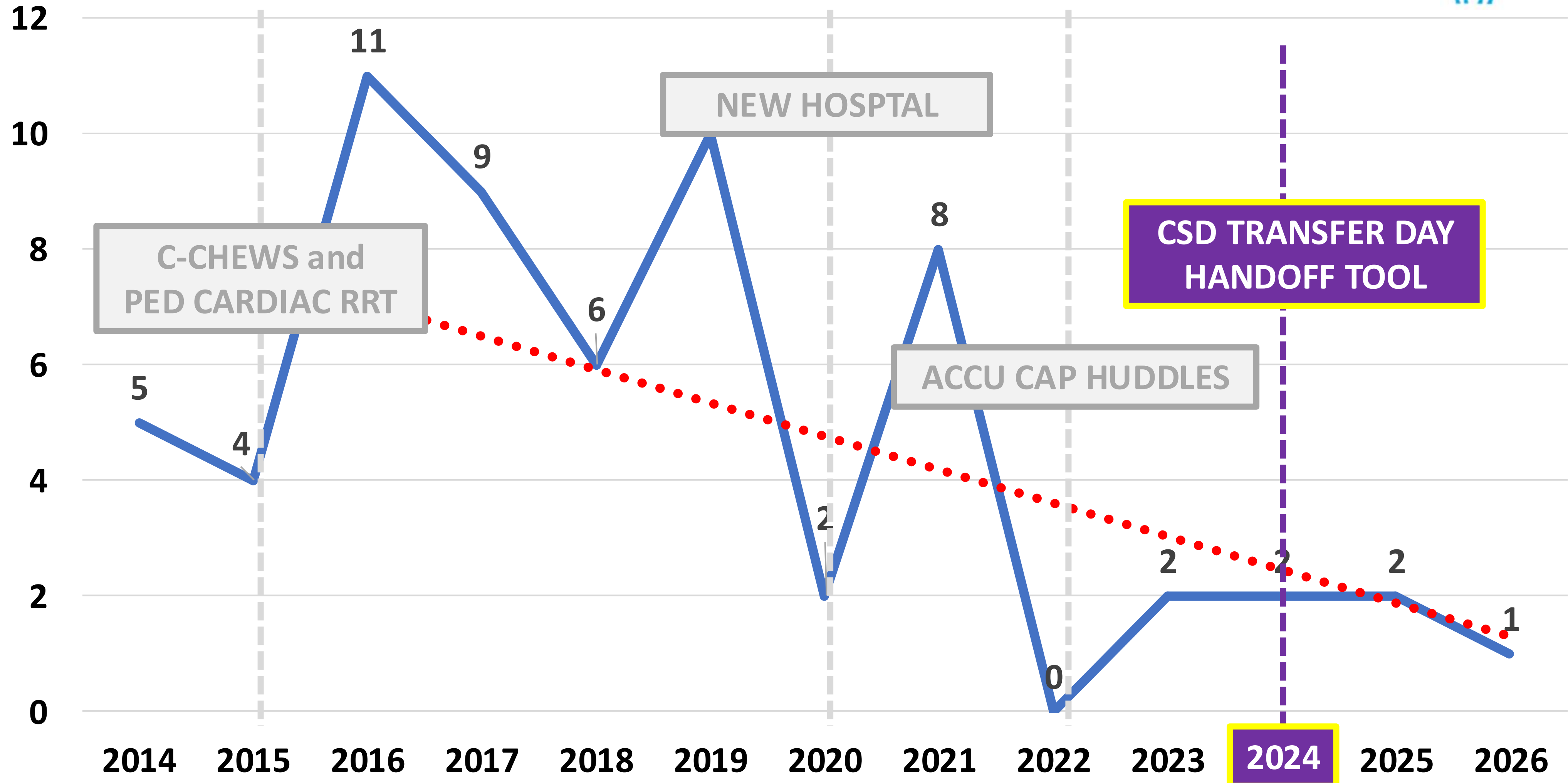
CICU Readmissions (Bouncebacks)< 48h, 2014-Current



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Patient:

Diagnosis:

DATE:

Daily Goal Sheet / CSD Transfer Day

Baseline Vitals

Heartrate	
O2 sats	
Resp Rate	
Blood Pressure	

Feeds	Access

	Last Med	Date/Time
Pain		
Anxiety		

Chest tube(s): YES / NO

Pacing wire(s): YES / NO

Morning Labs: YES / NO

Morning XR: YES / NO

CAP HUDDLE: YES / NO

Patient-Specific Risk Factors

- ☐ History of cardiac arrest (CPR) or ECMO
- ☐ Single ventricle or shunted physiology
- ☐ Poor function (moderately or severely decreased)
- ☐ Moderate or severe AV valve regurgitation
- ☐ Arrhythmia requiring medication/pacing
- ☐ Coronary abnormality – risk for ST-segment changes
- ☐ Intubation >2 weeks or >1 failed extubation
- ☐ Pulmonary hypertension
- ☐ History of prematurity < 37 weeks
- ☐ Vocal cord dysfunction
- ☐ Aspiration on swallow study
- ☐ Chromosomal abnormality or syndrome
- ☐ Seizures
- ☐ ICU course > 1 month
- ☐ Sedation medications/wean schedule adjustments
- ☐ Hx of needing Narcan or Flumazenil
- ☐ Heterotaxy
- ☐ Other concerns/risk factors

Today's Plan:

"RED FLAGs" (i.e. ST-segment changes, ectopy, stridor, sedation med sensitivity etc.)

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What’s really driving low bouncebacks at MUSC (our opinion)?

1. Teamwide in-person handoff communication
2. Fellow/APP/Charge Nurse “night rounds” in the ACCU
3. A mature early warning and cardiac rapid response system
4. ACCU team adapting to higher acuity over the years
5. Recent years: capacity issues driving some decision-making about transfers
   - If there’s one bed… the POD 4 TOF is transferring over the POD 45 heterotaxy shunt/TAPVR w/chyle

Thank you!

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Thank You!

Appendix

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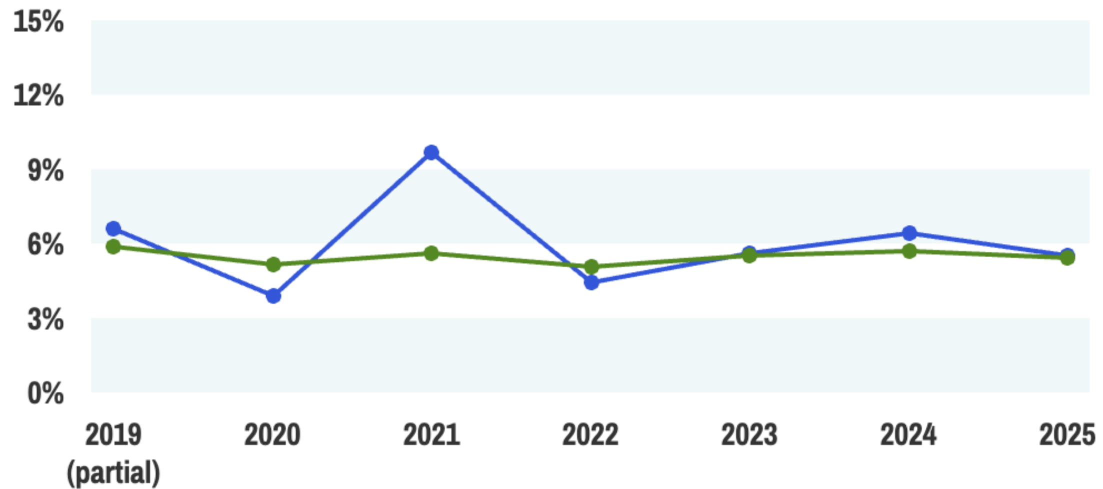
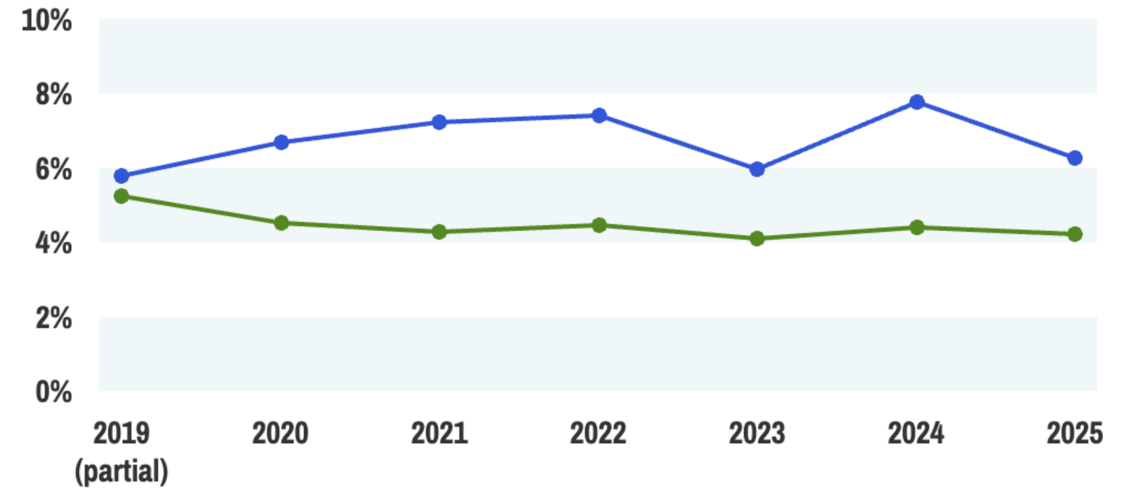
Medical

Surgical





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Bounceback Patient Characteristics: CICU LOS

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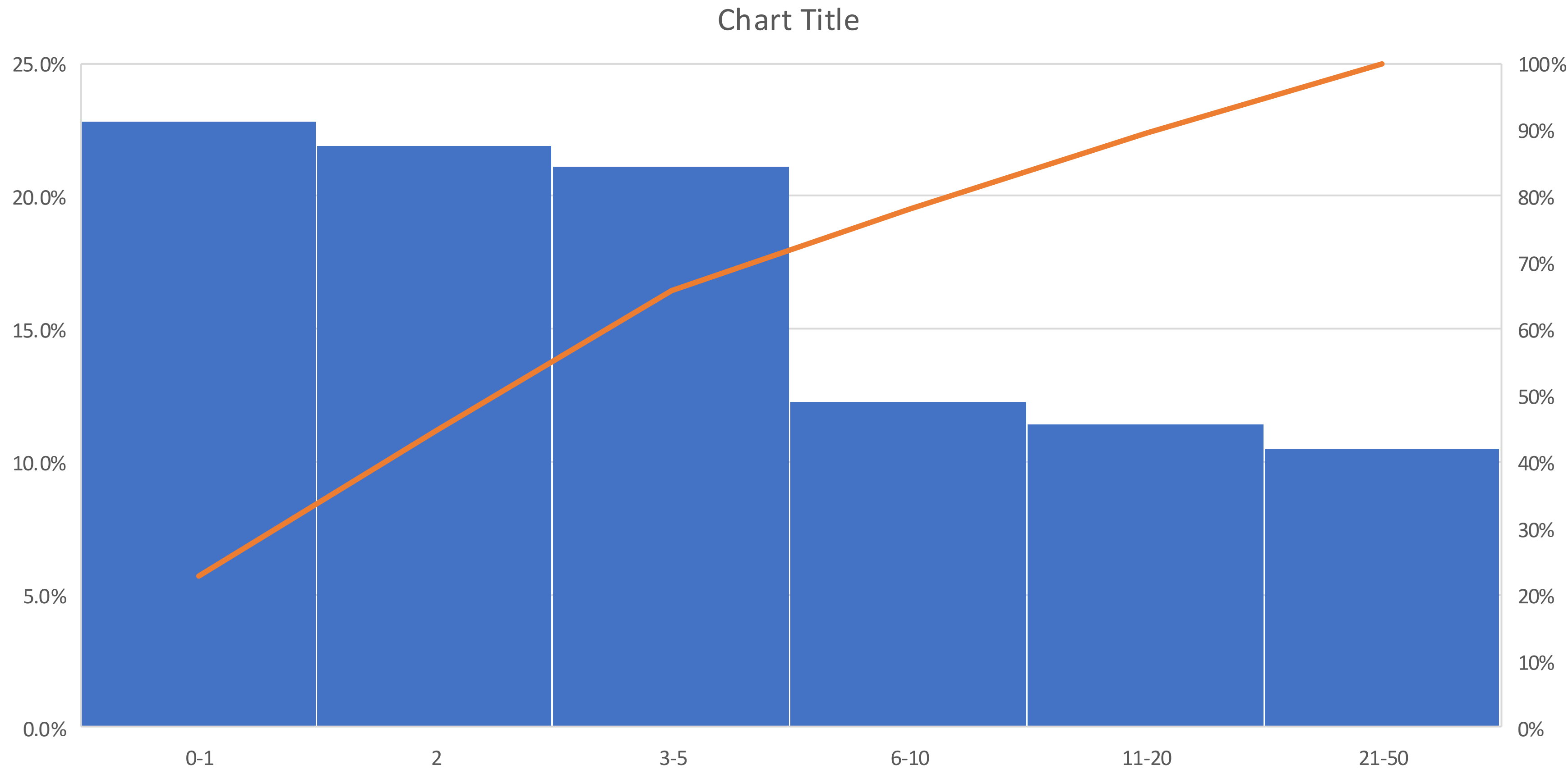
Heart Center



Pareto option… I personally don't think the line shows anything (just confusing to me but hey!)

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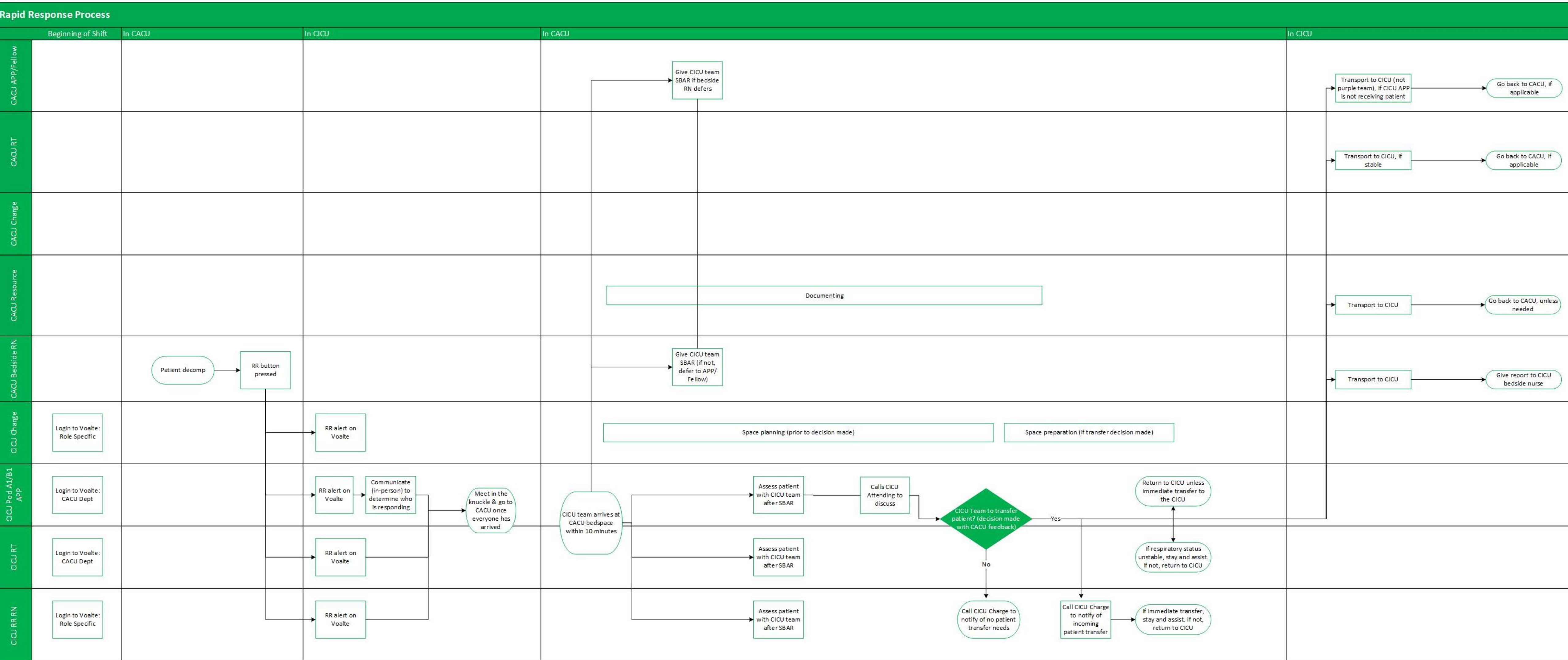
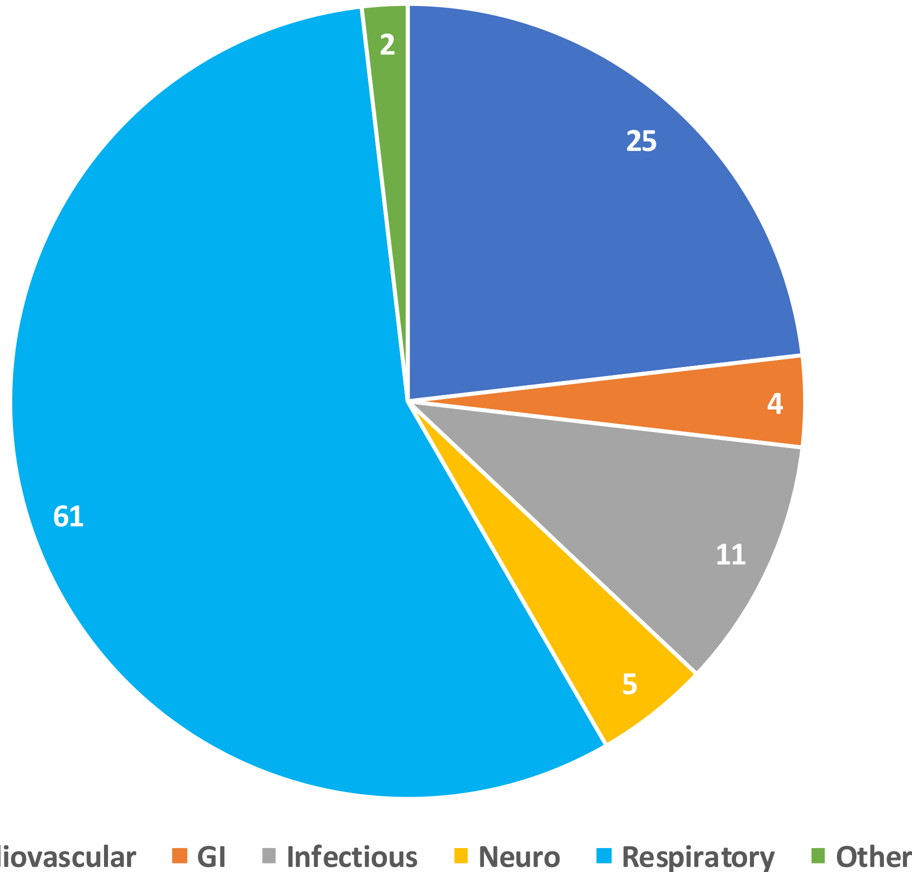
No way to get it less blurry due to size- I suggest not using. Could just talk about it or I can try to make another graphic that is very simplified



Bounceback Characteristics: Clinical Reasons for Bounceback

Is the pareto chart versus this slide with pie chart better representation?



- Readmissions:
  - 12 were emergent (~11%)
    - 1 intubated, ECMO, and vasoactive
    - 4 intubation only
    - 6 vasoactive only
    - 1 CPR + vasoactive
  - 23 were urgent (22%)
    - 1 ECMO
    - 1 CPR + vasoactive
    - 2 intubation
    - 6 intubation +.vasoactive
    - 14 vasoactive only

Medical Length of Stay

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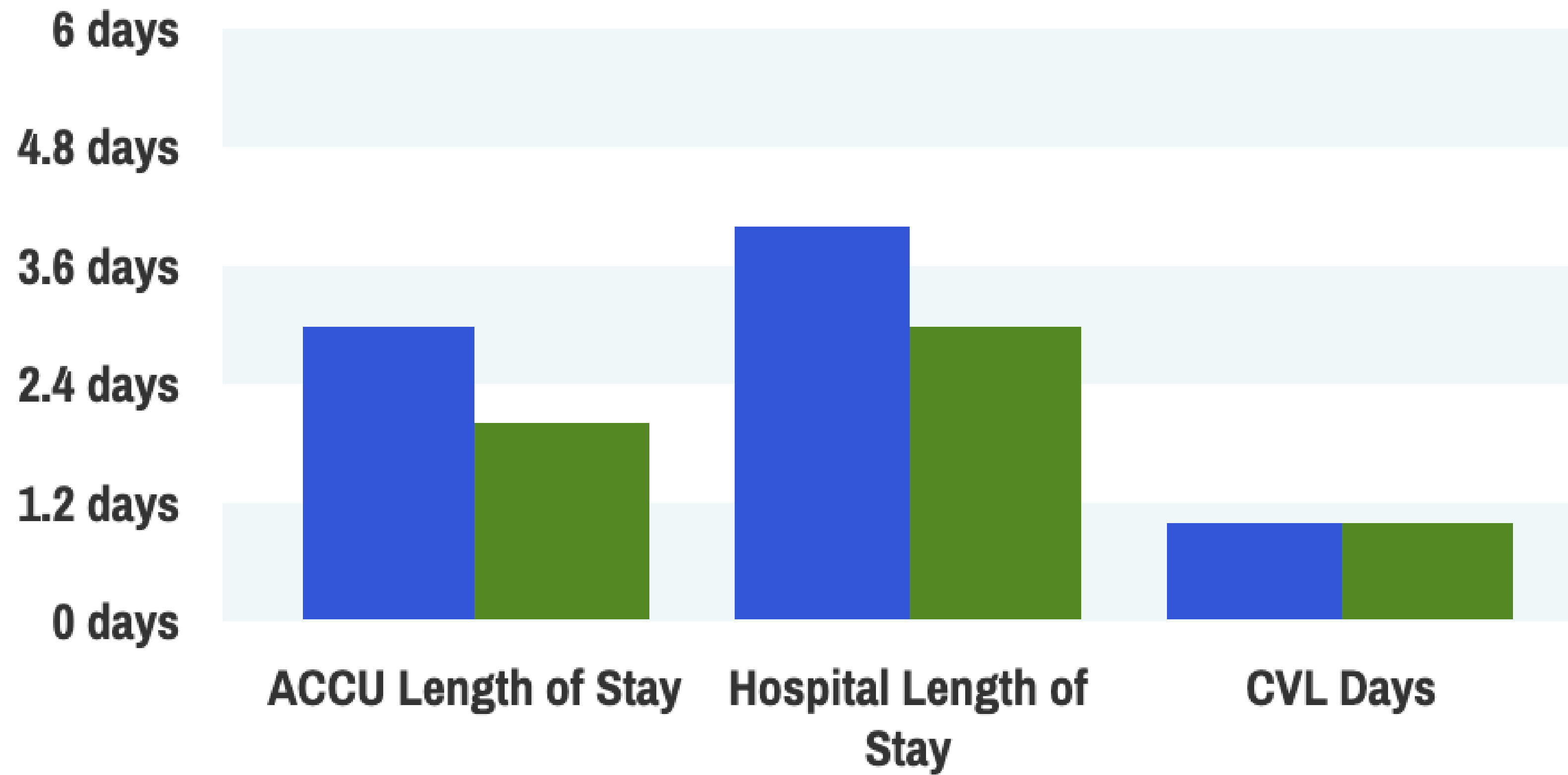
Heart Center



PC4: Green
CHOA: Blue

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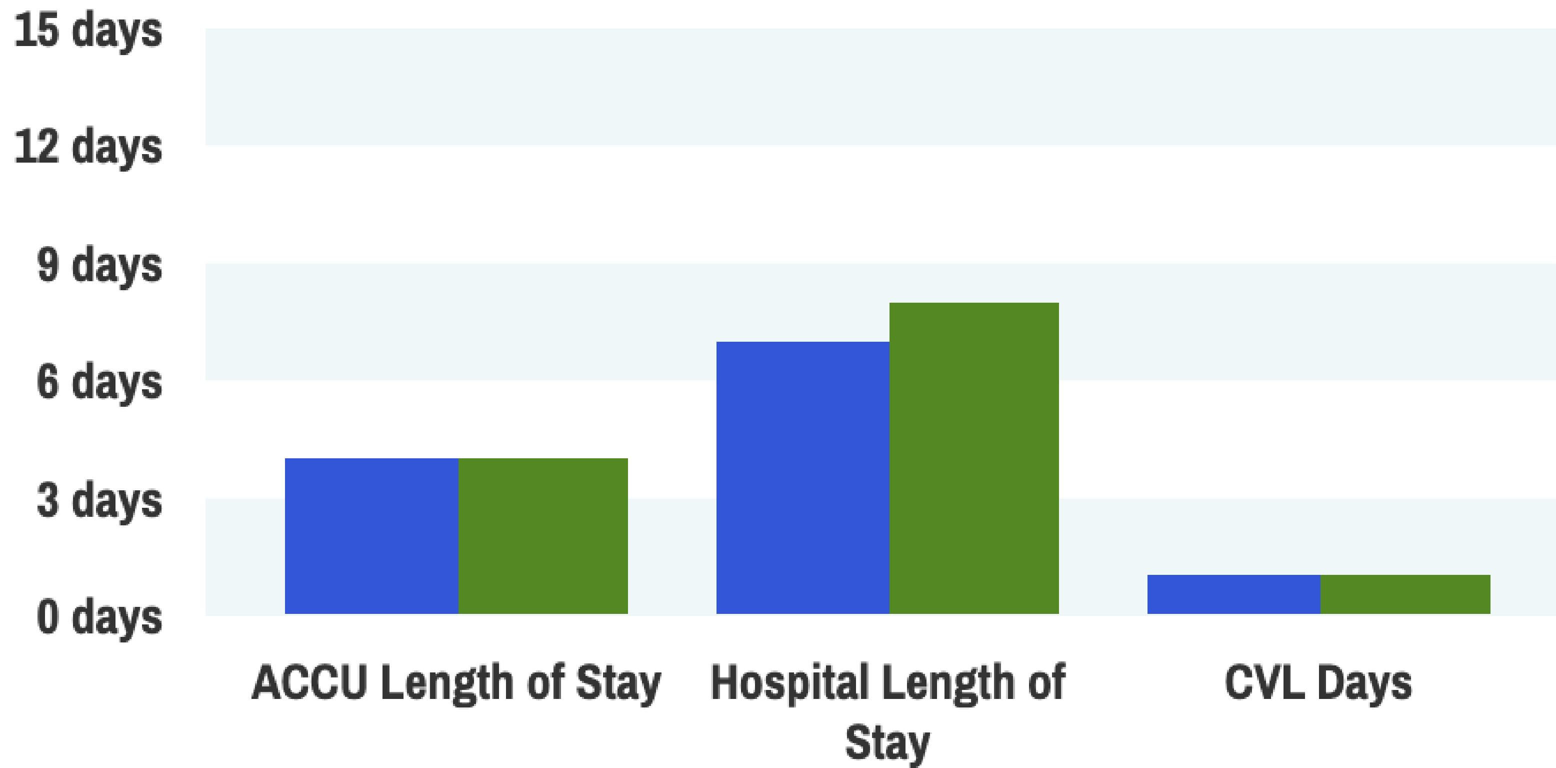
Surgical Length of Stay



PC4: Green
CHOA: Blue

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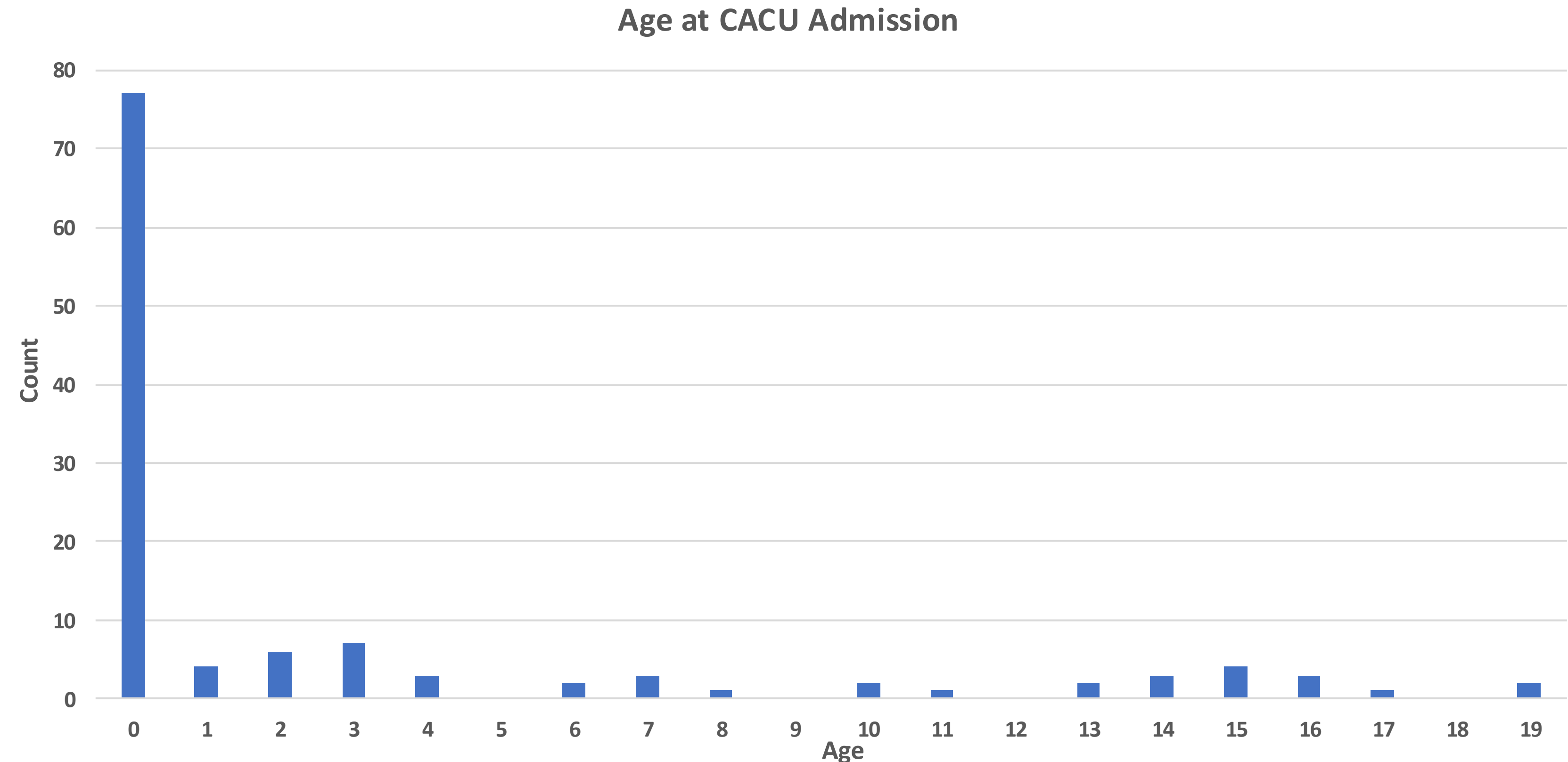
Bounceback Patient Characteristics: Age

- Mean = 3 years old
- Median = 4 months old
- Age range = 0-19



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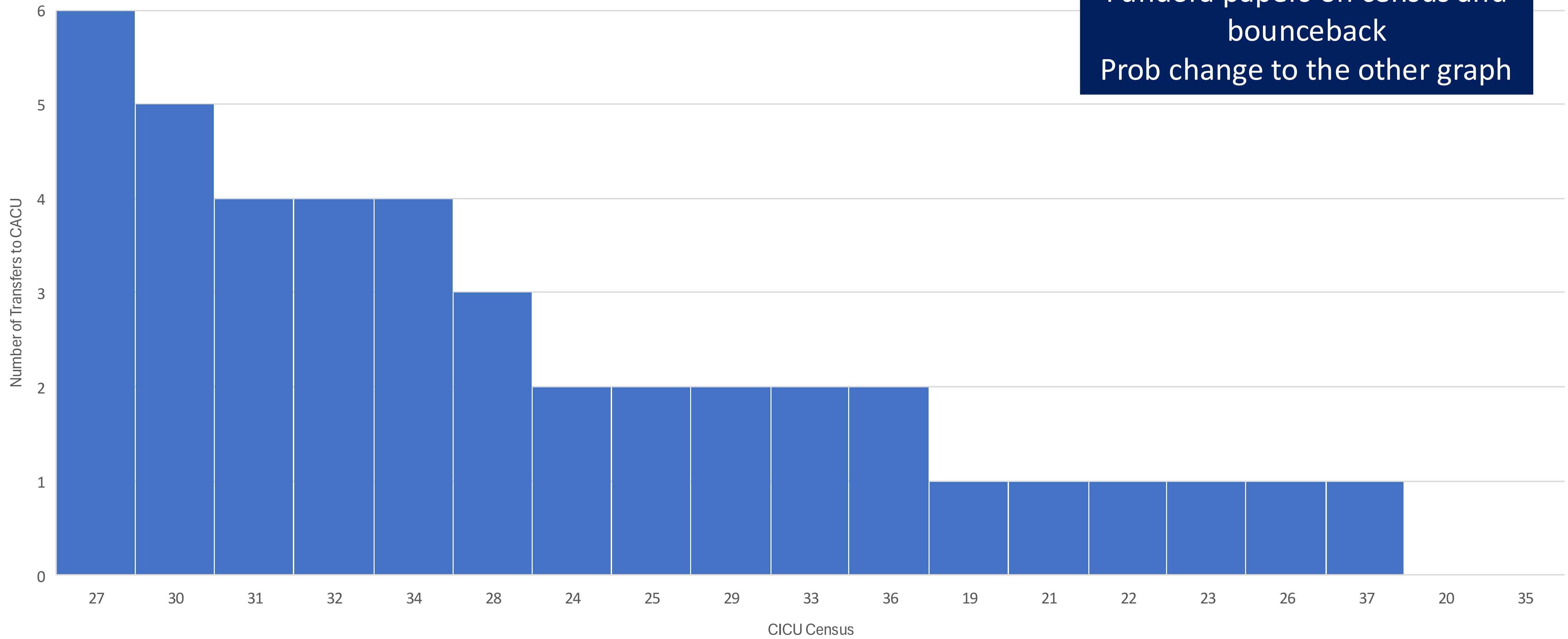

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