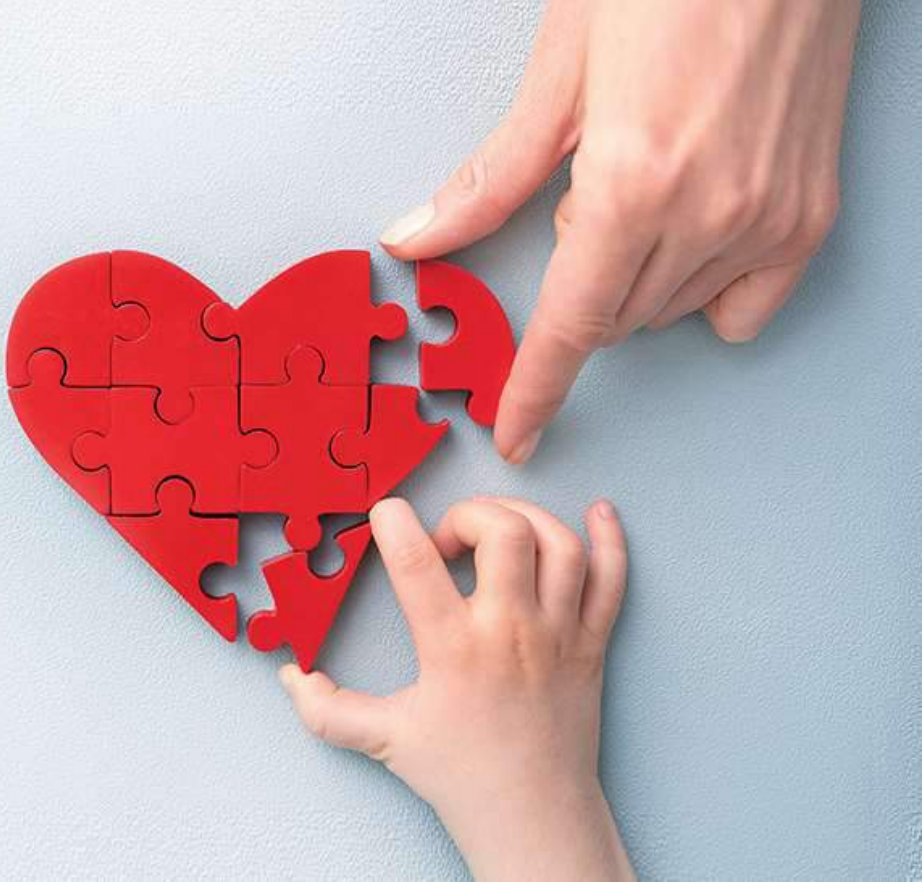
CARDIOLOGY 2024

QI in the CICU: Challenges and Progress



David Hehir MD
Patient Safety Officer, Cardiac Center
Associate Chief, QI, Cardiac Critical Care
Childrens Hospital of Philadelphia

2/14/24

Children's Hospital of Philadelphia
Cardiac Center

NO DISCLOSURES

CHALLENGES:

- Time, people, energy, commitment

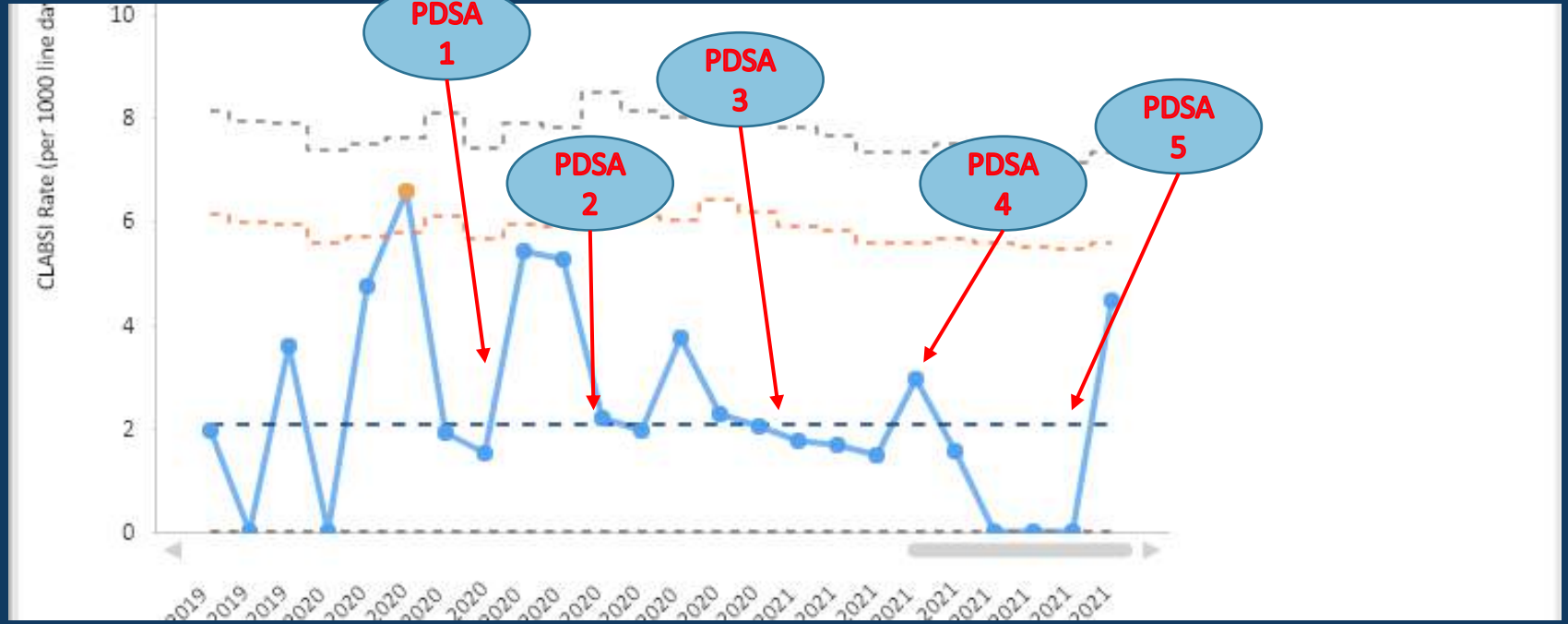
- Matching resources to goals:
  - Moving from rapid cycle projects to long term QI programs
  - Takes a different strategy, and resources

- Coordination of efforts over space and time
  - QI Governance to organize the effort

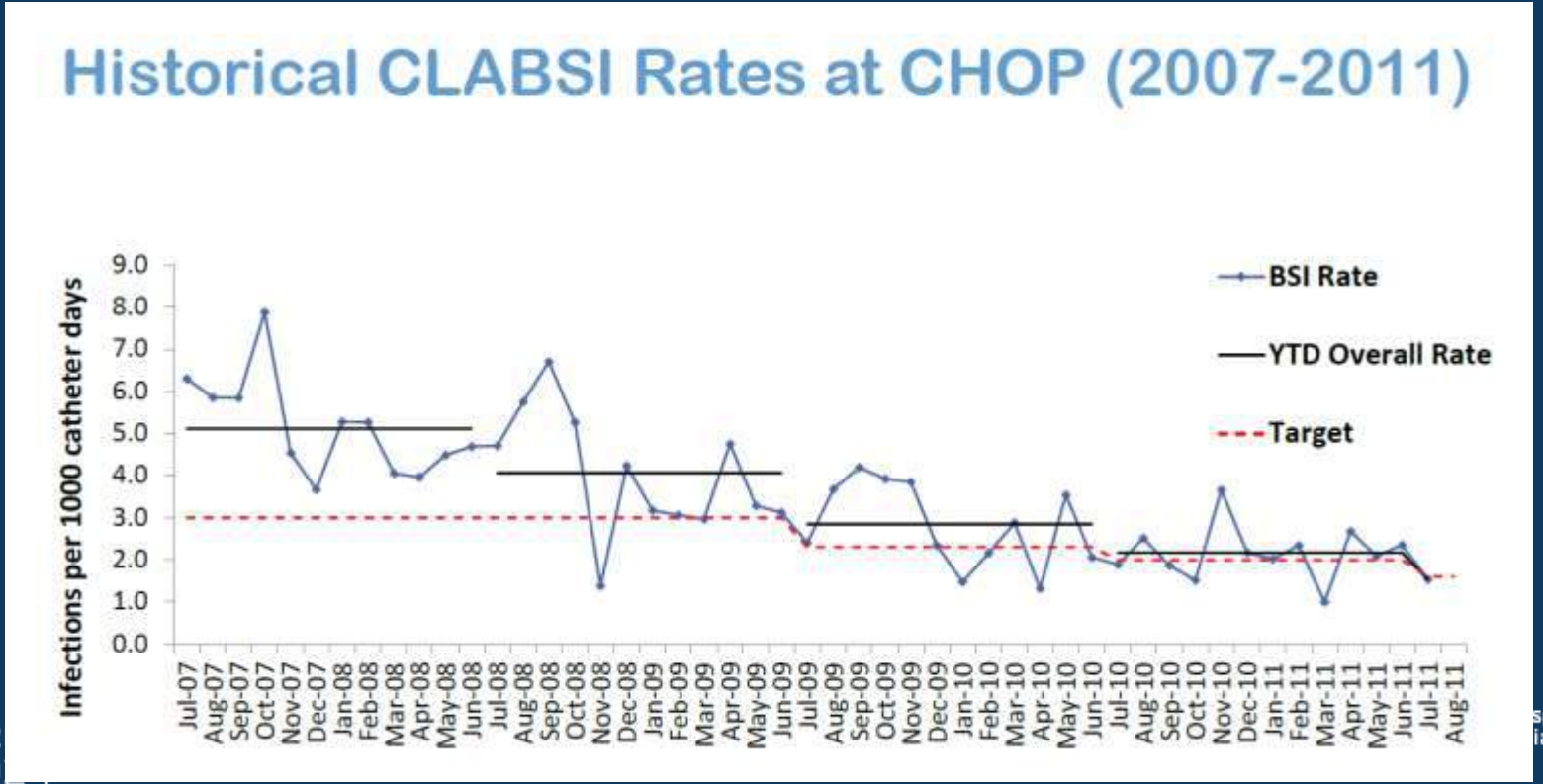
- Sustain the progress, energy and attitude!
  - Celebrate success

ARE WE IMPROVING?

THE CONTROL CHART ROLLER COASTER



SOMETIMES WE NEED TO ZOOM OUT



CAN QI FIX OUR CARDIAC ARREST PROBLEM?

CENTRAL ILLUSTRATION: Trends in Survival to Discharge Stratified by Timing of In-Hospital Cardiac Arrest

Ofoma, U.R. et al. J Am Coll Cardiol. 2018;71(4):402-11.

THE CARDIAC ARREST PROBLEM

- Improving Prediction
  - Early Warning Systems
  - Risk Stratifying
  - Data solutions

- Improving Prevention and Preparation
  - Step-Down: CAT / Rapid Response teams
  - ICU: Pre-arrest huddles

- Providing Quality CPR / Better Rescue

PREVENTING ARREST OUTSIDE THE CICU

- ET = Emergency Transfer (CPR/ECMO, new pressor, ETT within 1 hour of transfer)
- Implementation and impact of cardiac specific “Watcher” and “CAT” programs

Days between ET’s or Codes

- PDSA 1: Watcher Program Initiated
- PDSA 2: EPIC order set
- PDSA 3: Tier 1 review process of unplanned transfers and ETs
- PDSA 4: Joint review of all unplanned transfers, ETs, and codes outside ICU at CICU CQI
- PDSA 5: Implementation of cardiac specific Emergency Response Team (*October 2022*)

PREVENTING CARDIAC ARREST IN THE CICU

framework

Issue 1 • Volume 7

Individual QI projects from single institutions

OPEN

Shifting the Paradigm: A Quality Improvement Approach to Proactive Cardiac Arrest Reduction in the Pediatric Cardiac Intensive Care Unit

Christine M. Riley, BS, MSN, APRN, CPNP-AC; J. Wesley Diddle, MD*; Ashleigh Harlow, BSN, RN, CCRN-K†; Kara Klem, MSN, RN‡; Jason Patregnani, MD§; Evan Hochberg, MBA, RN¶; Jenhao Jacob Cheng, PhD, MS, PSTAT‖; Sopnil Bhattarai, CPHQ**; Lisa Hom, RN, ESQ††; Justine M. Fortkiewicz, MSN, RN-BC, CCRN-K, CPN†; Darren Klugman, MD‡‡*

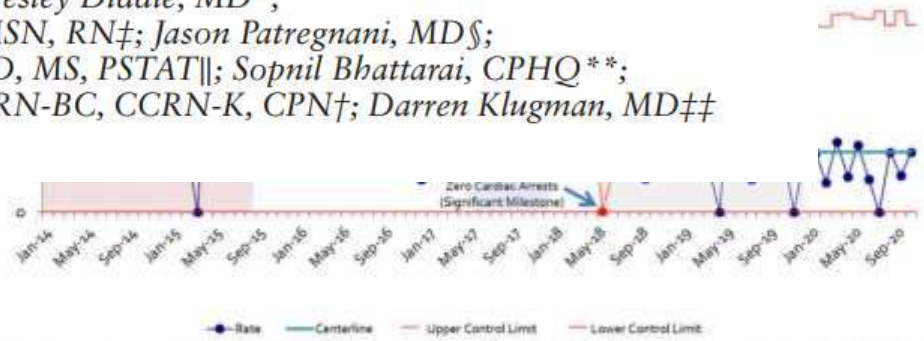
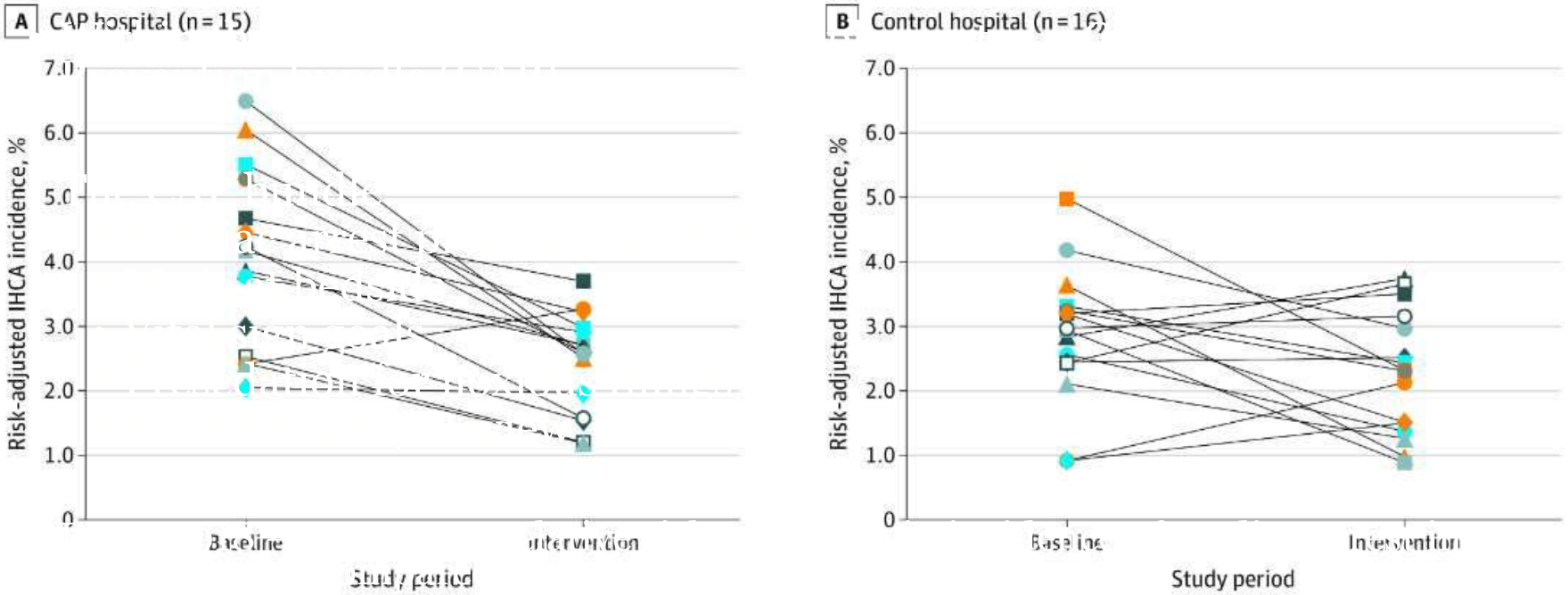
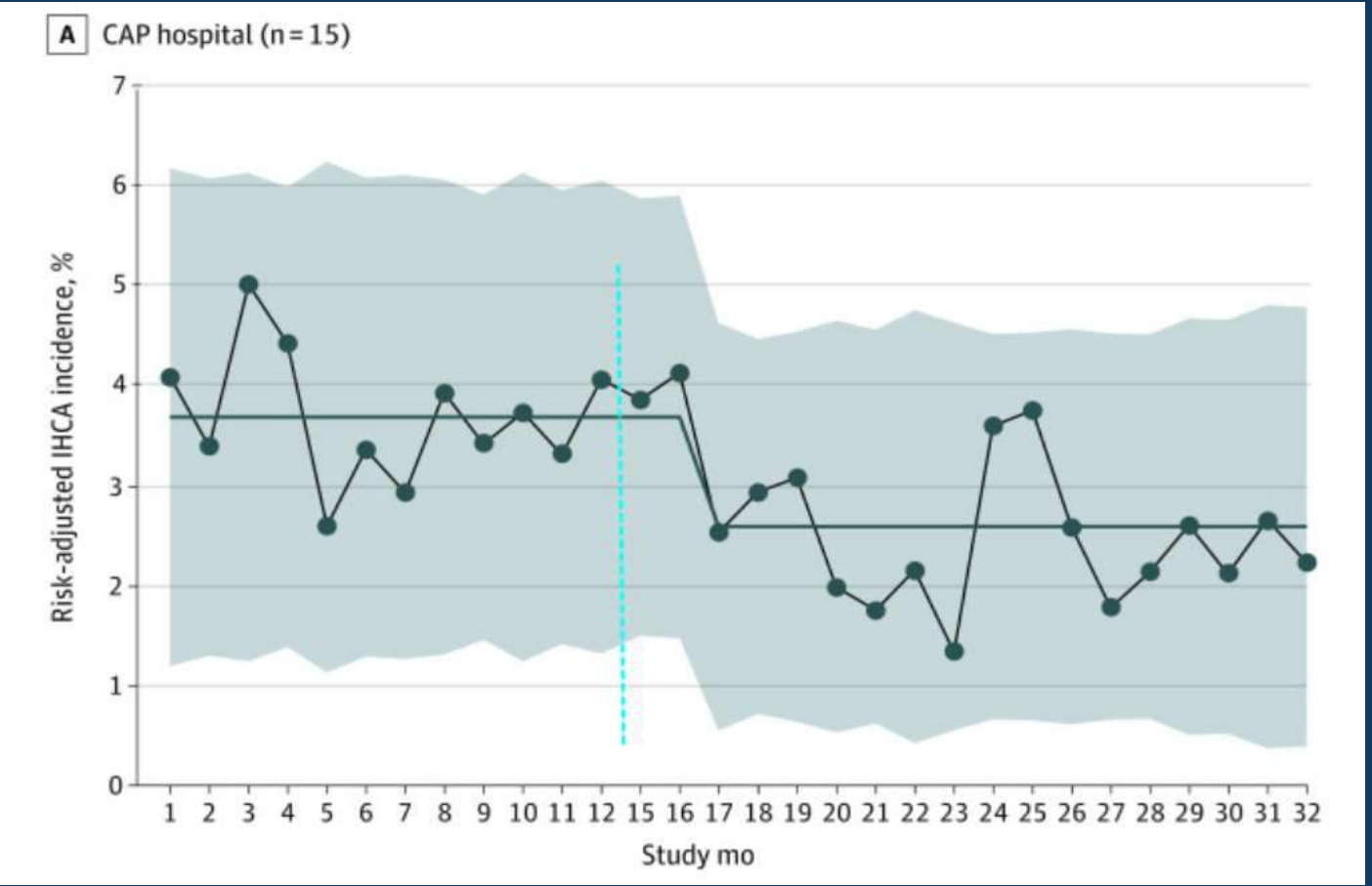


Fig. 3. Cardiac arrest control chart. Depicts monthly arrest rate over time and centerline shifts, annotated with pivotal PDSA cycle implementation time points.

PC4 CARDIAC ARREST PREVENTION BUNDLE

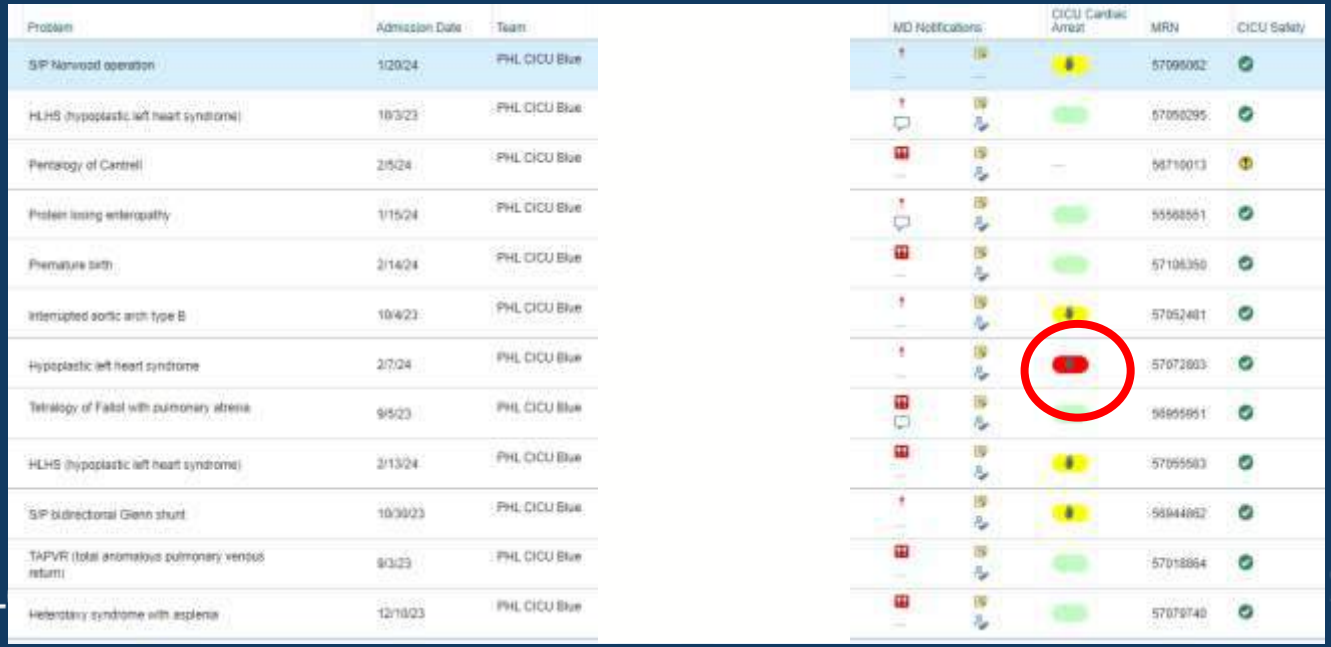


Alten et al 2022


A
CAP hospital (n = 15)
Risk-adjusted IHCA incidence, %
0
1
2
3
4
5
6
7
1 2 3 4 5 6 7 8 9 10 11 12 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
Study mo

PREVENTING ARREST WITHIN THE CHOP CICU

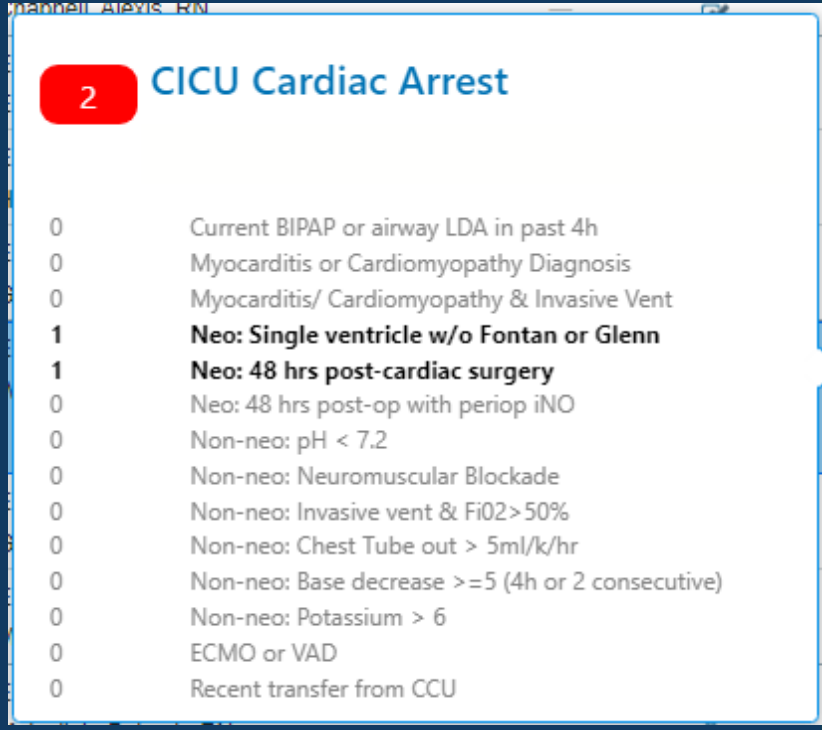
- CHOP approach to CAP bundle formalized in 2019 as local QI effort
- Cardiac arrests huddles driven by risk algorithm deployed in EPIC:



CA FLAG + HUDDLE

- Huddles on high risk patients twice a day

- Huddle questions:
  - Communication / escalation plan
  - Assign code roles
  - VS goals
  - Meds at bedside
  - Early ECMO?
  - Appropriate access?



2 CICU Cardiac Arrest

0	Current BIPAP or airway LDA in past 4h
0	Myocarditis or Cardiomyopathy Diagnosis
0	Myocarditis/ Cardiomyopathy & Invasive Vent
1	**Neo: Single ventricle w/o Fontan or Glenn**
1	**Neo: 48 hrs post-cardiac surgery**
0	Neo: 48 hrs post-op with periop iNO
0	Non-neo: pH < 7.2
0	Non-neo: Neuromuscular Blockade
0	Non-neo: Invasive vent & Fi02>50%
0	Non-neo: Chest Tube out > 5ml/k/hr
0	Non-neo: Base decrease >=5 (4h or 2 consecutive)
0	Non-neo: Potassium > 6
0	ECMO or VAD
0	Recent transfer from CCU

Reducing Cardiac Arrest in the Pediatric Cardiac Intensive Care Unit

Alyssa Tani, CRNP, Jacqueline Zedalis, BS, Kyle Winser, BS, Molly Apple, BSN, Maryam Naim, MD, Michael Goldsmith, MD

Children's Hospital of Philadelphia

Introduction

- Cardiac arrest in the Pediatric Cardiac Intensive Care Unit (CICU) remains a major contributor to patient morbidity and mortality.
- Cardiac arrest prevention (CAP) bundles may reduce rates of cardiac arrest (Alten et al., 2022).
- Our CICU implemented a CAP bundle in 2019 including a risk algorithm to "flag" patients at high-risk for cardiac arrest, and a bedside arrest huddle to mitigate risk factors for arrest.
- Between 2020 and 2022 huddle compliance dropped from 48% to 10%.
- Our Cardiac Arrest Prevention group aimed to improve cardiac arrest huddle compliance to >50% with the goal of decreasing overall cardiac arrest rates.

Figure 1. Risk Algorithm

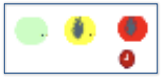
Project Design

- **We completed 3 PDSA cycles to improve huddle compliance:**

Missed huddle report delivered to providers who did not document a high-risk huddle on patients. Included survey to identify barriers to huddling

High-risk cardiac arrest banner integrated into Epic, increasing situational awareness for nurses & providers

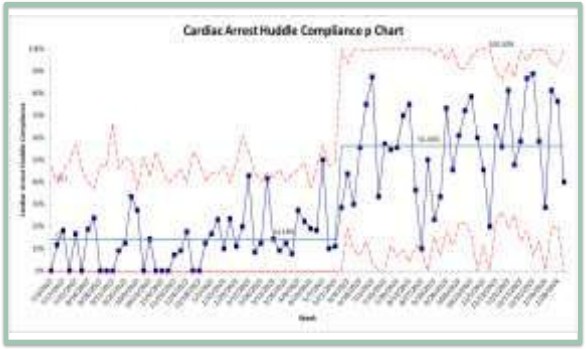
Cardiac arrest flag was updated to include both the patients' risk for arrest flag, and a clock icon indicating when a huddle is due (not completed or > 12 hours since last recorded huddle)



Results

- **Cardiac arrest huddle compliance improved from 14% in the 12 months prior to intervention to 56% in the 5 months following initial implementation of the missed huddle reports.**
- Surveys found the most common reasons for missed huddles were providers not aware of the flag, and huddles being completed but not documented.
- Cardiac arrest rate remained consistent at 3.4 arrests per 1000 CICU patient days
- **There was an increase in potential saves** (use of hypotensive epinephrine within 4 hours of a flag/huddle) from median 1 to 2 hypotensive epinephrine rescues/month in the 5 months before and after updating CAP bundle, respectively.

Cardiac Arrest Huddle Compliance p Chart, July 2022-January 2024



Conclusion

- The multi-armed bundle of interventions **durably improved huddle compliance by 42%.**
- **There was an increase in the rate of rescue therapy, a surrogate for improved situational awareness of high-risk patients**
- While cardiac arrest rate was unchanged, this outcome is impacted by multiple variables, and this intervention is likely underpowered to detect change in cardiac arrest rate

Future Steps

- Implement next-generation risk algorithms to improve deterioration recognition
- Use next-generation risk algorithms to tailor risk mitigation strategies/therapies
- Leverage human factors

References

Alten J, PC4 CAP Collaborators, et al. Preventing Cardiac Arrest in the Pediatric Cardiac Intensive Care Unit Through Multicenter Collaboration. JAMA Pediatr. 2022 Oct 1;176(10):1027-1036.

Contact Information

Alyssa Tani, CRNP
The Children's Hospital of Philadelphia
Cardiac Intensive Care Unit
3401 Civic Center Blvd.
Philadelphia, PA 19104

E: tania@chop.edu
T: (215) 760-5098

We completed 3 PDSA cycles to improve huddle compli

Huddle Compliance Improved 42%

Missed huddle report delivered to providers who did not document a high-risk huddle on patients. Included survey to identify barriers to huddling

High-risk cardiac arrest banner integrated into Epic, increasing situational awareness for nurses & providers

High Risk for Cardiac Arrest click for details

Cardiac a… updated t… the patie… …ior arre… flag, a… …a clock icon indicating when a huddle is due (not completed or > 12 hours since last recorded huddle)

CARDIAC ARREST SURVIVAL IN CHD?

- Hamzah et al 2021
- Nationwide Inpatient Sample 2000-2017
- Survival of IHCA in CHD improved from 30% to 60%

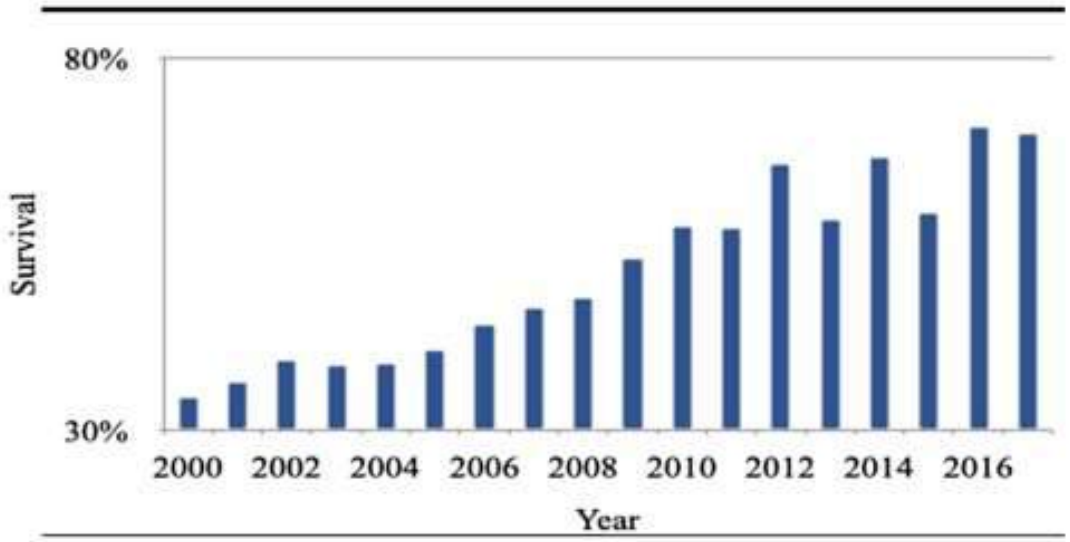


Fig. 3 Trend of survival after in-hospital cardiac arrest in pediatric patients with congenital heart disease

JAMA

QUESTION Does a bundled intervention that emphasizes patient physiology during cardiopulmonary resuscitation (CPR) training and debriefing improve outcomes of pediatric patients who receive CPR in the intensive care unit (ICU)?

CONCLUSION A bundled intervention of physiologically focused CPR training and debriefing vs usual care did not significantly improve survival to hospital discharge with favorable neurologic outcome among pediatric patients who experienced cardiac arrest in the ICU.

POPULATION

575 Male
499 Female

Pediatric patients aged ≥37 weeks' corrected gestational age and <18 years and underwent CPR while in the ICU

Median age: 0.6 years

LOCATIONS

18
Pediatric ICUs in the US

INTERVENTION

1389 Events randomized
1074 Events analyzed

526

Bundled intervention
All ICU staff trained in CPR on manikins provided to their units and participated in monthly clinical event debriefings

548

Usual care
Usual care during cardiac arrest based on the existing resuscitation practices of each ICU

PRIMARY OUTCOME

Survival to discharge with favorable neurologic outcome by a Pediatric Cerebral Performance Category score of 1 to 3 or no change from baseline (score range, 1 [normal] to 6 [brain death or death])

FINDINGS

Survival to hospital discharge with favorable neurologic outcome

Bundled intervention
283 of 526 patients

Usual care
287 of 548 patients

No significant difference between groups:
Risk difference, **3.2%** (95% CI, -4.6% to 11.4%);
Odds ratio, **1.08** (95% CI, 0.76 to 1.53)

SAFETY EVENT ANALYSIS: DOES IT HELP?

- Root cause analysis *not effective* and contributes to culture of blame?

- Safety Event "Investigation" may be harmful to teams:
  - puts providers on defensive
  - discourages learning

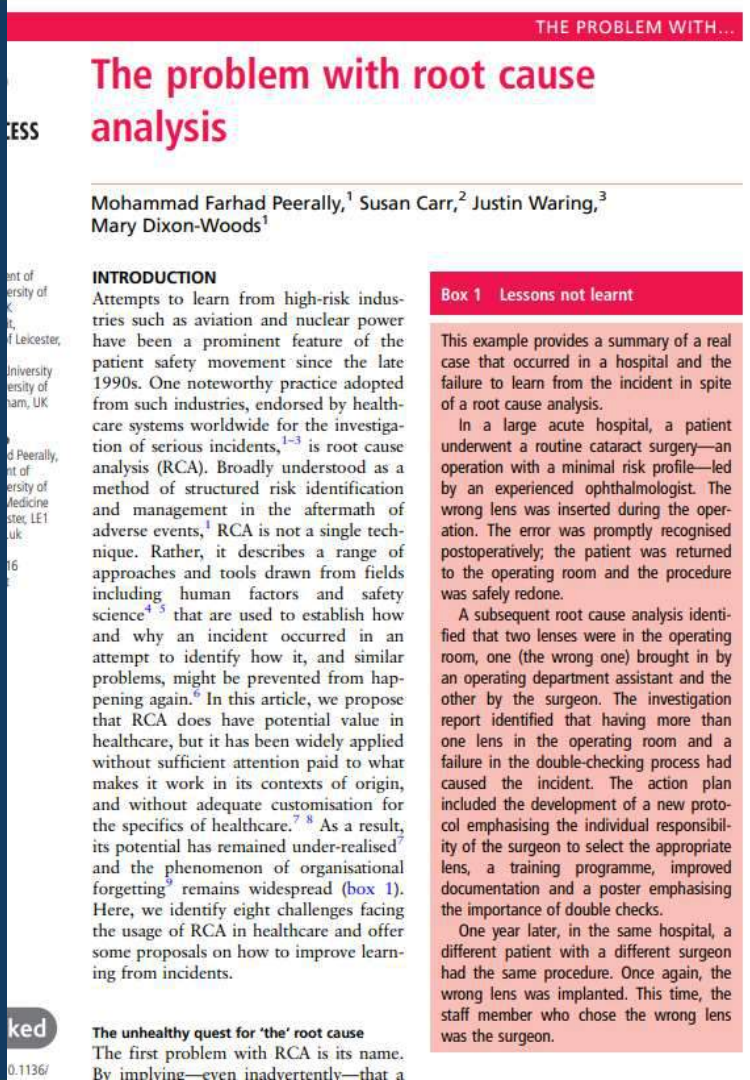
- Time and resource spent on event categorization and risk mitigation better spent on improvement and learning

- Is our culture driven by litigation?

IS RCA EFFECTIVE?

- “The first problem with RCA is its name…by implying that a single cause can be found leads to a flawed, reductionist view of error”
- “(RCA) too often results in a simple linear narrative that displaces more complex, and potentially fruitful, accounts of multiple and interacting contributions to how events really unfold”
- “feedback mechanisms in healthcare RCAs function poorly, contributing to the disenchantment of staff and frustrating the kind of double-loop learning needed to secure change”

CARDIOLOGY 2024



THE PROBLEM WITH...

The problem with root cause analysis

Mohammad Farhad Peerally,[1] Susan Carr,[2] Justin Waring,[3] Mary Dixon-Woods[1]

INTRODUCTION

Attempts to learn from high-risk industries such as aviation and nuclear power have been a prominent feature of the patient safety movement since the late 1990s. One noteworthy practice adopted from such industries, endorsed by healthcare systems worldwide for the investigation of serious incidents,[1–3] is root cause analysis (RCA). Broadly understood as a method of structured risk identification and management in the aftermath of adverse events,[1] RCA is not a single technique. Rather, it describes a range of approaches and tools drawn from fields including human factors and safety science[4 5] that are used to establish how and why an incident occurred in an attempt to identify how it, and similar problems, might be prevented from happening again.[6] In this article, we propose that RCA does have potential value in healthcare, but it has been widely applied without sufficient attention paid to what makes it work in its contexts of origin, and without adequate customisation for the specifics of healthcare.[7 8] As a result, its potential has remained under-realised[7] and the phenomenon of organisational forgetting[9] remains widespread (box 1). Here, we identify eight challenges facing the usage of RCA in healthcare and offer some proposals on how to improve learning from incidents.

The unhealthy quest for ‘the’ root cause

The first problem with RCA is its name. By implying—even inadvertently—that a

Box 1 Lessons not learnt

This example provides a summary of a real case that occurred in a hospital and the failure to learn from the incident in spite of a root cause analysis.

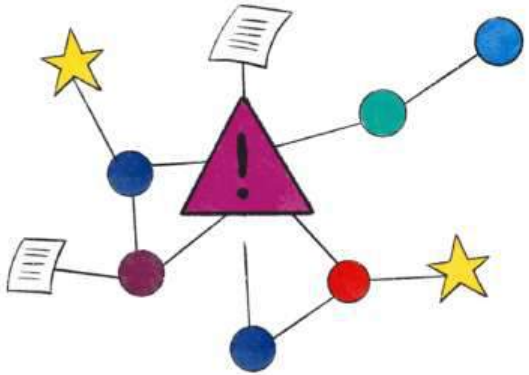
In a large acute hospital, a patient underwent a routine cataract surgery—an operation with a minimal risk profile—led by an experienced ophthalmologist. The wrong lens was inserted during the operation. The error was promptly recognised postoperatively; the patient was returned to the operating room and the procedure was safely redone.

A subsequent root cause analysis identified that two lenses were in the operating room, one (the wrong one) brought in by an operating department assistant and the other by the surgeon. The investigation report identified that having more than one lens in the operating room and a failure in the double-checking process had caused the incident. The action plan included the development of a new protocol emphasising the individual responsibility of the surgeon to select the appropriate lens, a training programme, improved documentation and a poster emphasising the importance of double checks.

One year later, in the same hospital, a different patient with a different surgeon had the same procedure. Once again, the wrong lens was implanted. This time, the staff member who chose the wrong lens was the surgeon.

TOWARD MORE COMPASSIONATE EVENT REVIEW

NHS England



Improving more by investigating less: rethinking patient safety incident response

International Forum on Quality and Safety in Healthcare, Weds 17 May

tracey.herlihey@nhs.net; laurenmosley@nhs.net; matthew.fogarty@nhs.net

@traceyherlihey @Lauren_e_Mosley @safety_matt

FROM SAFETY 1 TO SAFETY 2 IN EVENT REVIEW

- What does it look like when everything goes right? What can we learn?
- MMI case selection:
  - Skip zebras
  - Learning opportunities
  - Illustrate common themes
- The one root cause is less important than the environment it occurred in
- Mandatory: Action items and follow up

KEY POINTS

- QI work making great impacts even when your 1 year data isn't reflecting it!
- Leveraging learning networks to disseminate knowledge accelerates change
  - Adapt change to local environments
- Building QI capacity in cardiac centers is necessary to sustain improvement
- RCA process, Event review and MnM "investigations" should be replaced with compassionate learning models
  - Safety 2!
  - Success cause analysis

THANKS!

- Shobha Natarajan
  - *Medical Director QI*
- Geoff Bird
  - *Godfather of CICU QI/Safety*
- CAPER Group
  - *Alyssa Tani*
  - *Michael Goldsmith*
  - *Maryam Naim*
  - *Monique Gardner*
  - *Wes Diddle*
  - *Anne Marie D'Amato*

CARDIOLOGY 2024

Children's Hospital of Philadelphia®
Cardiac Center