Proactive Risk Mitigation Reduces Post-Procedural Cardiac Arrests in High Risk Congenital Cardiac Patients

Objective: The prevalence of postoperative cardiac arrest (CA) increases with cardiothoracic surgical case complexity in pediatric cardiac patients and is associated with an overall mortality of 50%. Despite being a high performing cardiothoracic program with an overall surgical mortality rate under 2%, our rates of postoperative CA were higher than desired when compared to national registry data with an observed to expected (O/E) ratio well above 1. Utilizing quality improvement methodology we evaluated the impact of pro-active risk mitigation on post-procedural CA (pCA) in a high risk cohort of pediatric and congenital cardiac patients.

Methods: This single-center study utilized the Institute for Healthcare Improvement model to achieve the project aim. The PROMISE (PRO-active MItigation to decrease Serious adverse Events) program was implemented in July 2020 with prospective enrollment of pre-identified high-risk patients based on institution-specific historical data. PROMISE patients underwent a scheduled multi-disciplinary review via virtual platform at 4 timepoints peri-procedure (1 pre and 3 post) with discussion of patient-specific, anesthetic and procedural risks and subsequent development of a pro-active risk mitigation plan. Process measures analyzed included compliance with enrollment of eligible high-risk patients and completion of peri-procedural reviews. Outcome measures were derived from the Pediatric Cardiac Critical Care Consortium (PC4) national registry and included pCA occurring within 7 days of the index procedure and institution-specific O/E ratio for risk adjusted postoperative CA.

Results: Our baseline median cases between pCA in high risk patients was 3.5 cases and baseline median calendar days between pCA events was 21 days. Following implementation of the PROMISE program, we saw a shift on our statistical process control charts (Figure 1) with an increase in median cases between events to 14 cases and median calendar days between events to 110 days. Despite a low mortality rate, in the 12 months preceding PROMISE implementation, our O/E ratio for postoperative CA was 2.56, indicating more CAs than expected based on case-mix. In comparison to all PC4 centers (n = 49), we were the poorest performing center and a statistical outlier during the baseline period. In the 12 months following PROMISE implementation, we saw a reduction in our O/E ratio to 1.01, indicating a rate that would be expected based on case-mix and consistent with the aggregate mean PC4 CA rate (n = 61 centers).

Conclusions: Implementation of proactive risk mitigation strategies peri-procedurally in a high risk cohort of pediatric and congenital cardiac patients led to improvement in pCA with an increase in cases and calendar days between events. We additionally observed a decrease in postoperative CA O/E ratio.

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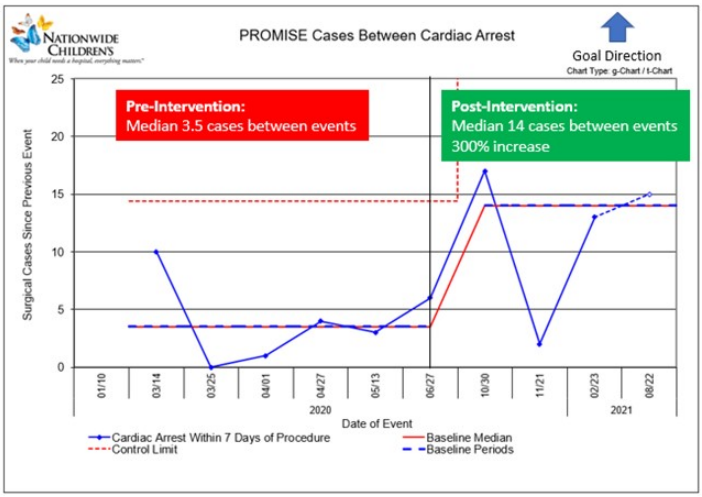
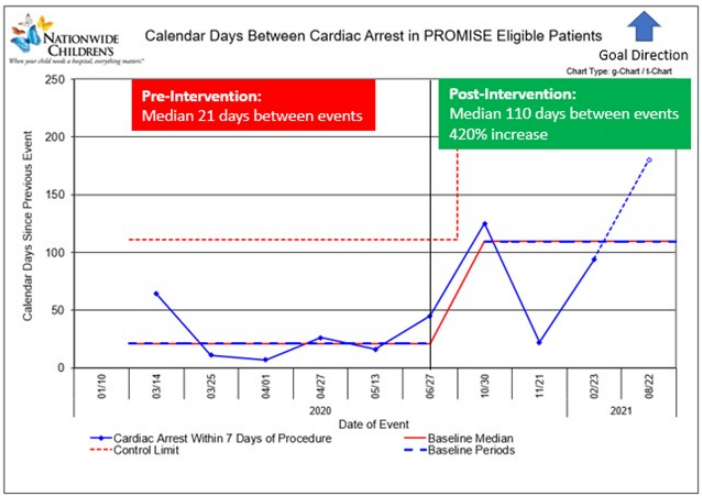

Nationwide Children's
PROMISE Cases Between Cardiac Arrest
Goal Direction
Chart Type: g-Chart / t-Chart
Pre-Intervention:
Median 3.5 cases between events
Post-Intervention:
Median 14 cases between events
300% increase
Surgical Cases Since Previous Event
25
20
15
10
5
0
01/10
03/14
03/25
04/01
04/27
05/13
06/27
10/30
11/21
02/23
08/22
2020
2021
Date of Event
Cardiac Arrest Within 7 Days of Procedure
Control Limit
Baseline Median
Baseline Periods


Nationwide Children's
Calendar Days Between Cardiac Arrest in PROMISE Eligible Patients
Goal Direction
Chart Type: g-Chart / t-Chart
Pre-Intervention:
Median 21 days between events
Post-Intervention:
Median 110 days between events
420% increase
Calendar Days Since Previous Event
250
200
150
100
50
0
01/10
03/14
03/25
04/01
04/27
05/13
06/27
10/30
11/21
02/23
08/22
2020
2021
Date of Event
Cardiac Arrest Within 7 Days of Procedure
Control Limit
Baseline Median
Baseline Periods