Implementation of a Comprehensive Program to Improve Neurodevelopmental Outcomes for Inpatients with Congenital Heart Disease: Cardiac Inpatient Neurodevelopmental Care Optimization (CINCO)

Laura Evers, RN BSN, Colton Hageman, BS, Kimberly Di Maria, CPNP-AC, Jesse Davidson, MD, MPH, Kelly R. Wolfe, PhD, ABPP-CN

Background
- Children with congenital heart disease (CHD) are at risk for long-term neurodevelopmental disabilities, which result in reduced educational and vocational achievement and decreased quality of life.
- In spring 2019, a multidisciplinary group at Children’s Hospital Colorado (CHCO) Heart Institute (HI) began to discuss opportunities to alter aspects of our inpatient environment and care practices that were suboptimal for neurodevelopment.
- As a result, the Cardiac Inpatient Neurodevelopmental Care Optimization (CINCO) program was developed, which standardizes consistent, comprehensive neurodevelopmental care using well-established interventions for our most vulnerable patients.

Primary Aim
- Demonstrate feasibility of implementation of the CINCO program in the Cardiac Intensive Care Unit (CICU) and Cardiac Progressive Care Unit (CPCU) by the following process measures, focusing on patients age 0-2 years for Phase 1 (12 mo.)
- Improve long-term neurodevelopmental outcomes for hospitalized infants and children with CHD.

Secondary Aim
- Increase our implementation goals from Phase 1 two year old BSID Score
- Increase volunteer presence in CICU
- Compete for additional funding to further grow the program

Methods/Timeline
- Spring 2019: CINCO was then proposed to stakeholders throughout the HI, including: parents, nurses, medical providers, therapists, social workers, psychologists, volunteers, and hospital leadership
- Fall 2019: CINCO was refined based on stakeholder input and launched in both the CICU and CPCU.
- September 2020: CINCO was designed pre-COVID; as a result, the volunteers have not been allowed at the bedside. This pillar will now be implemented into a Phase 2 implementation.

Goals
- Next Steps: Perform first PDSA cycle in December 2020. Refine program and continue to promote CINCO and establish culture change.
- Plan for Phase 2 implementation and collection of neurodevelopmental outcomes data. Compete for additional funding.

Key Interventions

<table>
<thead>
<tr>
<th>Key Interventions</th>
<th>Medical/Nursing</th>
<th>Neurodevelopmental Plans</th>
<th>Volunteers</th>
<th>Mental Health</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order panel to minimize disruption to sleep/wake cycles, bundle medications with hands-free, and increase the frequency of infant holding</td>
<td>Weekly bedside developmental plans/kits created by therapy teams to guide families, volunteers, and providers regarding age-appropriate “homework” activities</td>
<td>Provide respite to caregivers and improve stimulation to patients when parents are not present</td>
<td>Provide educational handouts for parents on the importance of mental health, risks specific to CHD families, and resources for self-care</td>
<td></td>
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Results
- Design phase resulted in development of four intervention pillars.
- Each pillar has a multidisciplinary working group of clinical leaders working to implement CINCO interventions in their team’s practice.
- Obtained internal funding to support Phase 1 implementation: September 2020-August 2021.
- Formal Plan, Do, Study, Act (PDSA) cycles will occur every 3-6 months for each of the four intervention arms.
- This will involve pulling primary and secondary process metrics (see table) as well as balancing metrics.

Phase 1: Feasibility
- Measure implementation success of the program for inpatients on the CICU and CPCU, age 0-2 years, between September 2020 and August 2021.
- First PDSA cycle with data collection is scheduled for December 2020.

Phase 2: Neurodevelopmental Outcomes
- Increase our implementation goals from Phase 1.
- Collect neurodevelopmental outcomes data, as well as implement the volunteer pillar (delayed due to COVID-19).
- Compete for additional funding to further grow the program.

Barriers/Limitations
- CINCO was implemented into a Phase 2 implementation.
- Unable to isolate the individual effects of the different interventions on our outcomes of interest.

Conclusion
- In this initial design phase, we have demonstrated that interest at our institution is high for this type of comprehensive program across multidisciplinary clinical team members, executive leadership, and families of children with CHD.
- CINCO uses well-established interventions known to promote healthy neurodevelopmental outcomes and the low cost and ease of operation (requiring minimal provier and staff time above and beyond standard clinical roles) favors successful implementation.
- Furthermore, the generalizability of CINCO is potentially very high; if successful at our institution, CINCO could be implemented across cardiac inpatient care centers.

Next Steps
- Perform first PDSA cycle in December 2020. Refine program and continue to promote CINCO and establish culture change.
- Plan for Phase 2 implementation and collection of neurodevelopmental outcomes data. Compete for additional funding.

Key Processes

<table>
<thead>
<tr>
<th>Key Measures</th>
<th>Definitions</th>
<th>Baseline</th>
<th>12 mo Goal</th>
<th>Progress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Process</td>
<td>Implement CINCO CICU/CPCU Neurodevelopmental Order Panel</td>
<td>0%</td>
<td>50%</td>
<td>In Progress</td>
</tr>
<tr>
<td>Secondary Process</td>
<td>Effectiveness of individual orders to result in changes in care</td>
<td>0%</td>
<td>50%</td>
<td>In Progress</td>
</tr>
<tr>
<td>Outcomes</td>
<td>Total opioid dose during admission</td>
<td>0%</td>
<td>50%</td>
<td>In Progress</td>
</tr>
<tr>
<td></td>
<td>ICU length of stay</td>
<td>0%</td>
<td>50%</td>
<td>In Progress</td>
</tr>
<tr>
<td></td>
<td>1 year old Bayley Scales of Infant and Toddler Development (BSID) Score</td>
<td>0%</td>
<td>50%</td>
<td>In Progress</td>
</tr>
<tr>
<td></td>
<td>2 year old BSID Score</td>
<td>0%</td>
<td>50%</td>
<td>In Progress</td>
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