Providing High Reliability Care for PICU Patients with Pulmonary Hypertension
A Quality Improvement Project

Anjali Subbaswamy, MD; Nicholas Tan, DO; Iric Guthrie, MD; Cole Linzmeyer, DO; Kelsey Fath, MD; Elizabeth Yakes Jimenez, PhD, RDN, LD
Department of Pediatrics
The University of New Mexico

Quality Problem

Pediatric patients with pulmonary hypertension (PHTN) are a high acuity, low frequency population. To mitigate the risk of precipitating a potentially life-threatening pulmonary hypertensive crisis, health care staff need to take specific precautions.

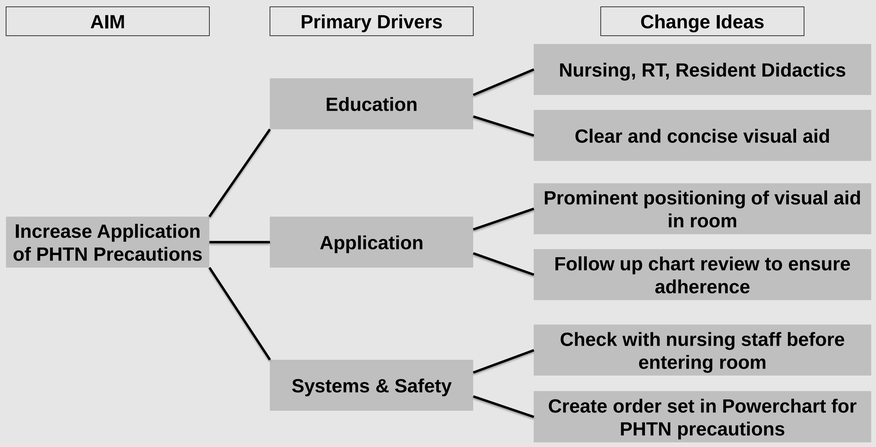
Background

A pulmonary hypertensive crisis can lead to right heart failure and/or cardiac arrest. This occurs when the pulmonary vasculature has a high resistance such that there is little or no preload to the left ventricle as a well as an unsustainable afterload to the failing right ventricle. This can be triggered by multiple inciting factors, including but not limited to increased cardiac demand, parenchymal lung disease, hypovolemia, or fever. Acute pulmonary hypertensive crisis is a life-threatening emergency with a high risk of cardiocirculatory collapse necessitating cardiopulmonary resuscitation.

AIM Statement

This quality improvement project aims to increase the number of inpatient PHTN patients for whom PHTN precautions are applied to 100% by September 2021.

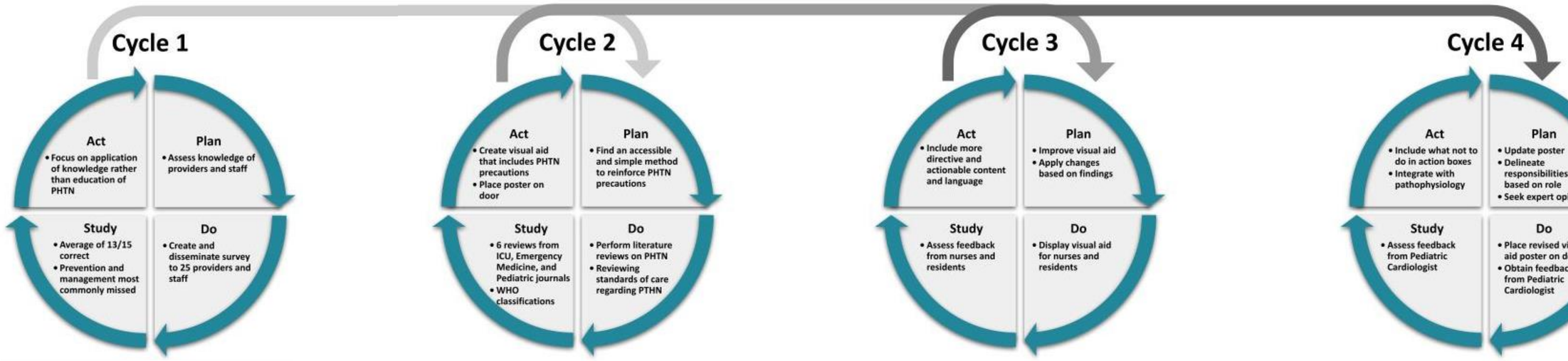
DRIVER DIAGRAM

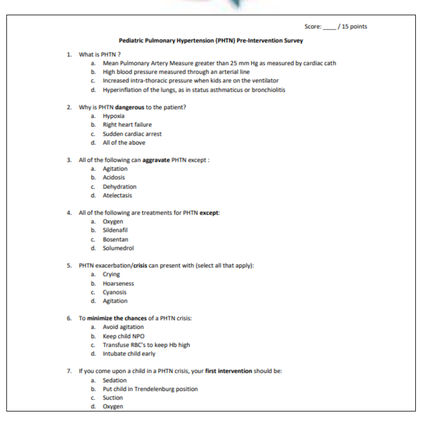


QI Framework

The quality improvement (QI) framework is commonly used in healthcare settings to improve the ways we can deliver care to patients with characteristics that can be measured, analyzed, and improved. In our study, we employed the Model for Improvement (MFI) approach which consists of a rapid cycle process called Plan, Do, Study, Act (PDSA).

Our goal with this QI project was to not only improve understanding of pulmonary hypertension (PHTN) for providers, but to also increase awareness of as well as ways to implement PHTN precautions effectively for all appropriate patients with a clear and concise bedside reference.

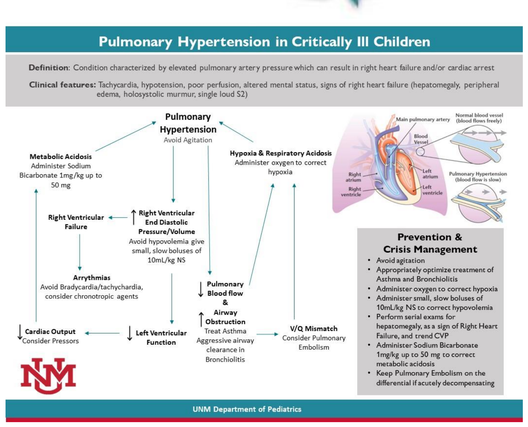


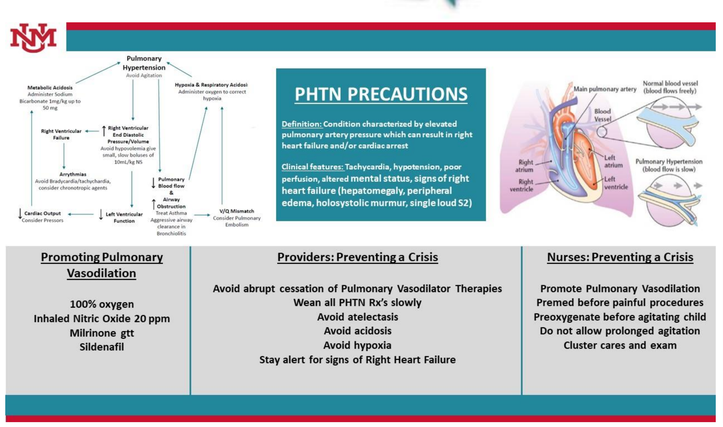


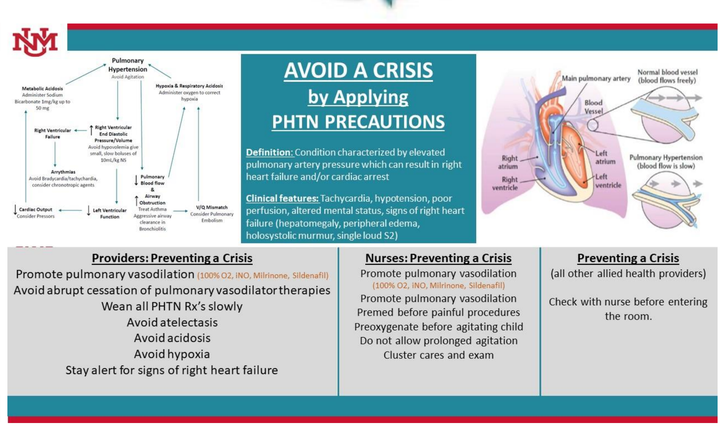
Score: ____ / 15 points

Pediatric Pulmonary Hypertension (PHTN) Pre-Intervention Survey

1. What is PHTN ?
   a. Mean Pulmonary Artery Measure greater than 25 mm Hg as measured by cardiac cath
   b. High blood pressure measured through an arterial line
   c. Increased intra-thoracic pressure when kids are on the ventilator
   d. Hyperinflation of the lungs, as in status asthmaticus or bronchiolitis
2. Why is PHTN **dangerous** to the patient?
   a. Hypoxia
   b. Right heart failure
   c. Sudden cardiac arrest
   d. All of the above
3. All of the following can **aggravate** PHTN except :
   a. Agitation
   b. Acidosis
   c. Dehydration
   d. Atelectasis
4. All of the following are treatments for PHTN **except**:
   a. Oxygen
   b. Sildenafil
   c. Bosentan
   d. Solumedrol
5. PHTN exacerbation/**crisis** can present with (select all that apply):
   a. Crying
   b. Hoarseness
   c. Cyanosis
   d. Agitation
6. To **minimize the chances** of a PHTN crisis:
   a. Avoid agitation
   b. Keep child NPO
   c. Transfuse RBC's to keep Hb high
   d. Intubate child early
7. If you come upon a child in a PHTN crisis, your **first intervention** should be:
   a. Sedation
   b. Put child in Trendelenburg position
   c. Suction
   d. Oxygen







Summary

PDSA Cyle 1 assessed PHTN knowledgeof our providers and staff with a surve. Average score was 13 out of 15 correct responses, with questions related to prevention and management of a PHTN crisis being the most missed. After obtaining and analyzing these results, the QI team decided to reduce our future PDSA cycles on education of PHTN and instead focus on application of knowledge.

PDSA Cycle 2 consisted of researching current articles from various journals regarding PHTN and how best to implement the data into an effective visual tool. After analyzing the research and options for visual aids, we created a poster with the most relevant data regarding PHTN. The poster included brief pathophysiology, classifications, and clinical effects, as well as both prevention and crisis management.

PDSA Cycle 3 comprised of assessing how best to improve the visual tool via obtaining feedback from both nursing staff and residents. After synthesizing the responses, we created a more directive title, simplified action boxes, and provided methods to prevent a crisis for both providers and nursing.

PDSA Cycle 4 focused on clarifying actions based on roles as well as pursuing expert opinion from our Pediatric Cardiologist. Per their recommendations, the poster was revised to include what *not* to do in the action boxes, tying those actions to pathophysiology, and implementing specified roles in each action box.

Next Steps

The QI team will continue to conduct PDSAs to test and refine the visual door prompt, targeting 100% use in all appropriate patients. Future PDSAs may address consistent identification of all patients who require PHTN precautions, systems directed interventions, and other initiatives with the goal of providing high reliability care.

Resources

1. Rosenweig EB, Ahman SH, Adatia I, et al. Paediatric pulmonary arterial hypertension: updates on definition, classification, diagnostics, and management. Eur Respir J 2019; 53: 1801915 [doi.org/10.1183/13993003.01916-2018].

2. Van Loon RL, Roofthooft MT, Hillege HL, et al. Pediatric pulmonary hypertension in the Netherlands. Epidemiology and characterization during the period 1991 to 2005. Circulation 2011; 124: 1755–1764.

3. Del Pizzo J, Hanna B. Emergency Management of Pediatrics Pulmonary Hypertension. Pediatric Emergency Care 2016; 32: 49-55.

4. Kaestner M, Schranz D, Warnecke G, et al. Pulmonary hypertension in the intensive care unit. Expert consensus statement on the diagnosis and treatment of paediatric pulmonary hypertension. Heart 2016;102: ii57–ii66 [doi:10.1136/heartjnl-2015-307774].