Pediatric Strokes

Implementing a New Process

Lauren Macko, MSN, APRN, ACCNS-AG, CCRN-K, SCRN
Clinical Nurse Specialist, Neurosciences Institute

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Pediatric Stroke Background

- Although relatively rare when compared to adults, stroke in children is estimated to occur as frequently as brain tumors; incidence of 1-2 per 100,000 children (nonneonates)

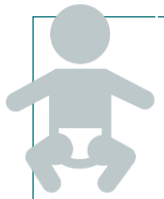
- Up to 75% of pediatric stroke patients experience long term sequelae including motor & neuro-psychological deficits, seizure disorders, stroke recurrence (> 10% within the 1st year)

- Both ischemic and hemorrhagic stroke are seen in children

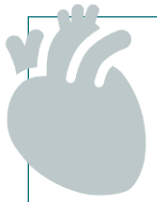
(Ferriero et al, 2019; Rajani et al, 2018; DeLaroche et al 2016; Rivkin et al, 2016; Elbers et al, 2015)

Pediatric Stroke Background

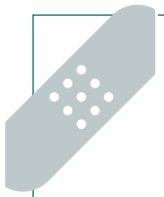
Ischemic Stroke in Children



Most often occurs in infants and children < 5 years of age

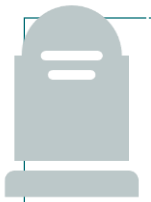


Majority occur in children with predisposing cardiac, vascular or hematologic conditions



Sickle cell disease amplifies stroke risk > 200- fold

Higher #'s in boys than girls; seen more often in non-Caucasian children



From 5-20% mortality has been reported

(Ferriero et al, 2019; Rajani et al, 2018)

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Pediatric Stroke Considerations

- Up until recently, no guidelines existed for pediatric stroke

- A prospective, NIH-funded clinical trial to determine the safety of intravenous tPA in children – the Thrombolysis in Pediatric Stroke, or TIPS Study- was closed d/t low patient enrollment & subsequent funding withdrawal
  - Despite early closure, this helped define initial safety guidelines of the use of tPA for children as well as organizational systems required to respond & care for children presenting with acute arterial stroke

(Rivkin et al, 2016; DeLaroche et al, 2016)

Pediatric Stroke Considerations

Stroke
Volume 50, Issue 3, March 2019; Pages e51-e96
https://doi.org/10.1161/STR.0000000000000183

AHA/ASA SCIENTIFIC STATEMENT

Management of Stroke in Neonates and Children: A Scientific Statement From the American Heart Association/American Stroke Association

Donna M. Ferriero, MD, MS, FAHA, Co-Chair, Heather J. Fullerton, MD, MAS, Co-Chair, Timothy J. Bernard, MD, MSCS, Lori Billinghurst, MD, MSc, FRCPC, Stephen R. Daniels, MD, PhD, Michael R. DeBaun, MD, MPH, Gabrielle deVeber, MD, Rebecca N. Ichord, MD, Lori C. Jordan, MD, PhD, FAHA, Patricia Massicotte, MSc, MD, MHSc, Jennifer Meldau, MSN, E. Steve Roach, MD, FAHA, Edward R. Smith, MD, and on behalf of the American Heart Association Stroke Council and Council on Cardiovascular and Stroke Nursing

PURPOSE— Much has transpired since the last scientific statement on pediatric stroke was published 10 years ago. Although stroke has long been recognized as an adult health problem causing substantial morbidity and mortality, it is also an important cause of acquired brain injury in young patients, occurring most commonly in the neonate and throughout childhood. This scientific statement represents a synthesis of data and a consensus of the leading experts in childhood cardiovascular disease and stroke.

METHODS— Members of the writing group were appointed by the American Heart Association Stroke Council's Scientific Statement Oversight Committee and the American Heart Association's Manuscript Oversight Committee and were chosen to reflect the expertise of the subject matter. The writers used systematic literature reviews, references to published clinical and epidemiology studies, morbidity and mortality reports, clinical and public health guidelines, authoritative statements, personal files, and expert opinion to summarize existing evidence and to indicate gaps in current knowledge. This scientific statement is based on expert consensus considerations for clinical practice

Pediatric Stroke Considerations

- Studies have demonstrated considerable diagnostic delays for pediatric stroke, both in their delivery to a medical setting and significantly, once in a medical setting

- Although children and adults experience strokes that affect similar vascular territories and share similar features on imaging, the course of their clinical management varies

- High stroke mimic rates in children

(Mackay et al, 2017; Rivkin et al, 2016; Shack et al, 2016; Elbers et al, 2015)

About Us

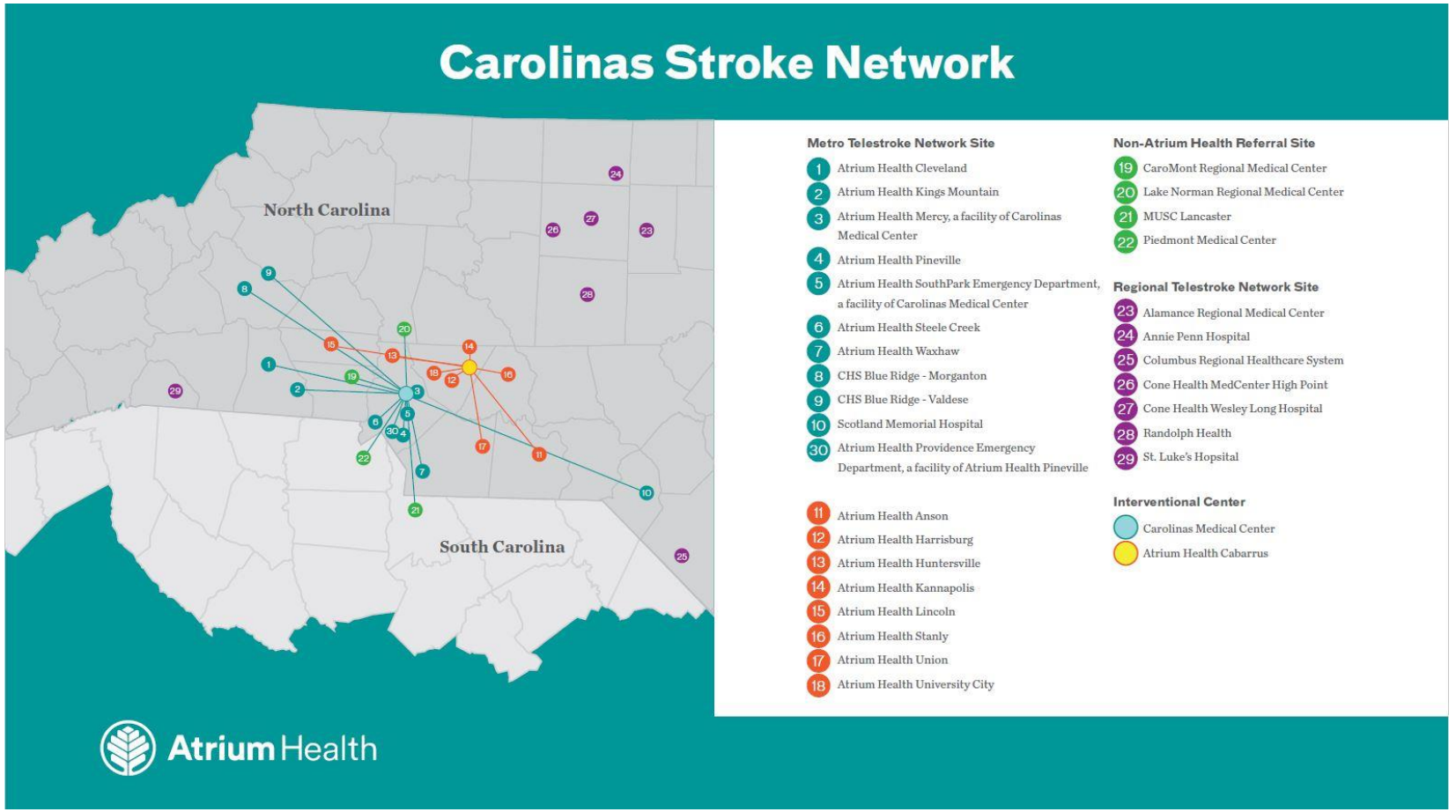
Levine Children's Hospital is a 236-bed full-service children's hospital located on the main campus of Atrium Health's Carolinas Medical Center.

- **30+ Pediatric Specialties – Recognized by US News & World Report in 8 Specialties (incl. Neurology & NSGY)**
- **Level 1 Pediatric Trauma Center, Ped Transplant Program, Ped Heart Surgery Program, Cellular Therapies Program**
- **35,785 Peds ED visits in 2022**
  6818 Hospital Admissions in 2022

What brought us to the point of creating a pediatric stroke protocol?

Multiple cases of pediatric patients presenting with stroke symptoms which highlighted the lack of a defined process

Our Adult Process



Code Stroke Activations:

YTD 2023: (through 10/29/23)

6222

2022:

6283

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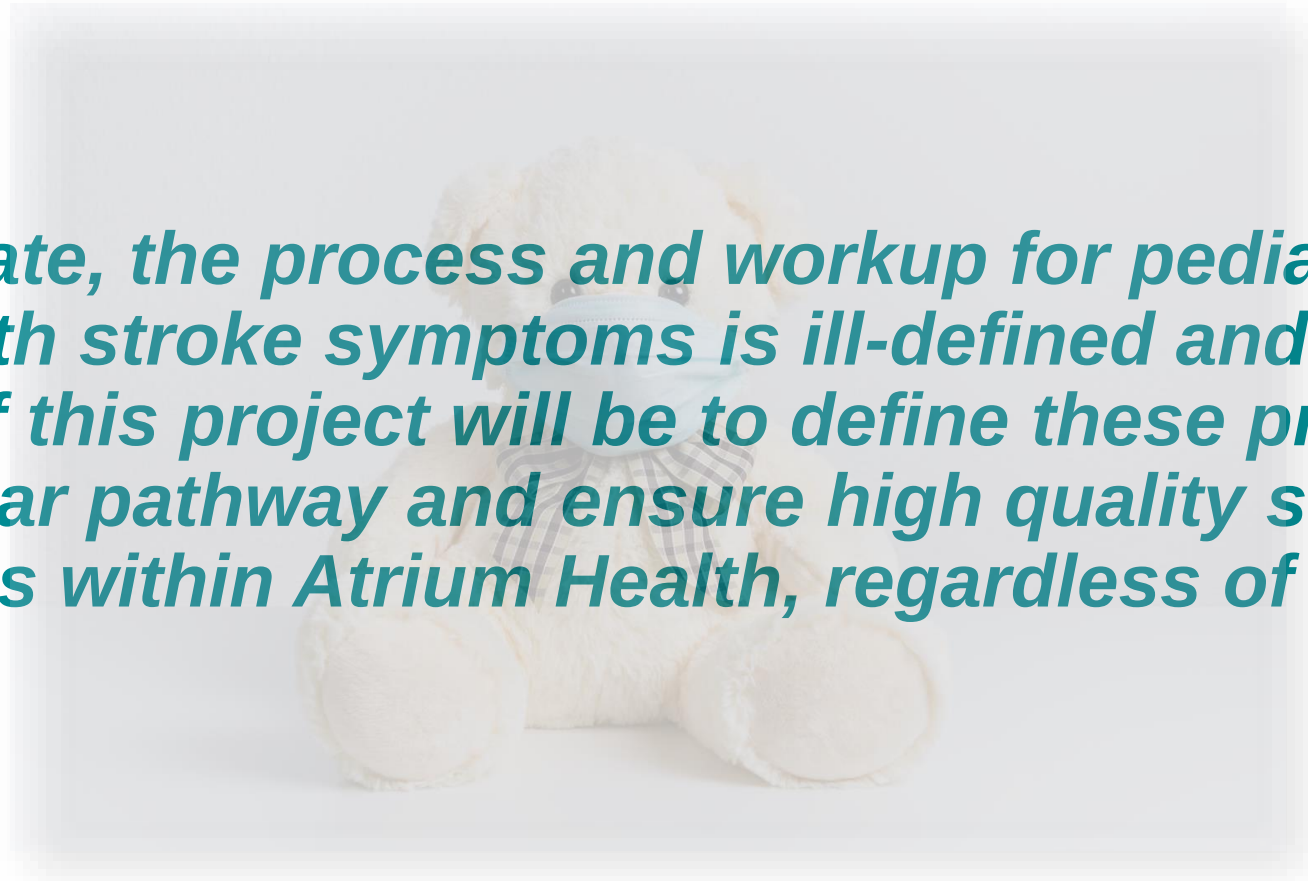
Identification of Stakeholders

- Stakeholders included key team members from both pediatric and adult services
- Each member brought their perspective and experience to the creation of this protocol

Project Team Members

Name	Organization/Department	Role/Resource Type
	Neurosciences Institute,	Facilitator, clinical expert
	Neurosciences Institute	Cerebrovascular Leadership
	Neurosciences Institute & CMC ED	Cerebrovascular Leadership and ED
	CMC	Stroke Program Coordinator
	LCH	Pediatric clinical expert
	LCH, Neurology	Pediatric Neurology Representative
	LCH, Pediatric ED	Pediatric ED Representative
	LCH, CVICU	Peds CVICU Representative
	LCH, CVICU	Peds CVICU Representative, ACP
	LCH, PICU	PICU Representative
	LCH, CHIPS	Peds Hospitalist Representative
	LCH, PICU/CVICU	Pediatric Clinical Expert
	LCH, CVICU	Pediatric Nursing CVICU
	LCH, ED	Pediatric Nursing ED
	CMC, Neurology	Adult Neurology Representative
	CMC, Neurology	Adult Neurology Representative, ACP
	CMC, CNSA	Neurointerventional Representative
	CMC, Charlotte Radiology	Adult Neuro Radiology
	CMC, Charlotte Radiology	Adult Neuro Radiology
	LCH, Charlotte Radiology	Pediatric Radiology
	CMC, Radiology Department	MRI/CT Departments
	CMC, NSICU	Neuro clinical expert
	CMC, Neuro Service Line	Neuro Education

Project Purpose



In current state, the process and workup for pediatric patients presenting with stroke symptoms is ill-defined and inconsistent. The work of this project will be to define these processes to provide a clear pathway and ensure high quality stroke care to all patients within Atrium Health, regardless of their age.

Identification of Barriers

1. Competing priorities from team members.

2. Limited labor resource availability regarding specialized providers.

3. Limited high-quality research and recommendations for this patient population.

First Steps

1. Complete literature review
2. Compile protocols from other organizations
3. Evaluate protocols to see what's translatable to our organization

Treatment and Patient selection

- The treatment options drive patient selection and process initiation
- Many organizations used thrombolytics as their treatment of choice in pediatric stroke
- Working within our barriers, the team decided to have mechanical thrombectomy as the treatment of choice
- Patient selection for process initiation:
  - Symptoms of large vessel occlusion: hemiplegia, aphasia, sudden onset ataxia, and/or unexplained coma
  - Last known well <24 hr

Imaging Choice and Provider Notification

- MRI is imaging of choice
  - Consistent among other protocols
  - Developed “Limited Brain MRI” for adults that can be used in pediatric
  - NCCT/CTA/CTP is an option for certain situations

- Provider Notification
  - Stroke mimics higher in children than in adults
  - Balancing over-notification with timely notification

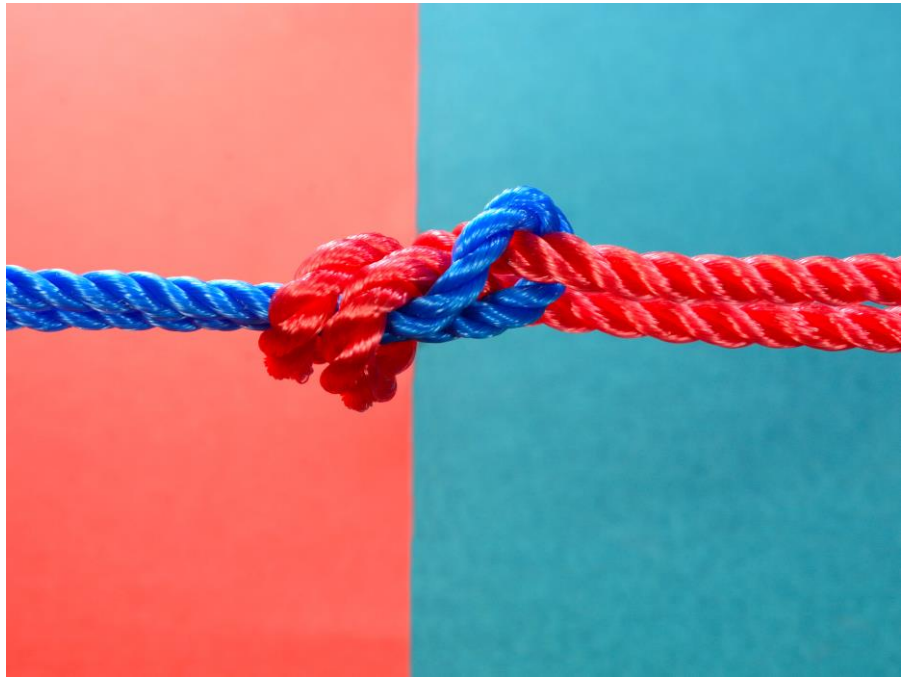
Bringing it Together

- Decision was made to notify team once imaging resulted
- If no large vessel occlusion found, pediatric neurology would be consulted as normal
- If imaging showed large vessel occlusion, then the following were notified: pediatric neurology, neurointerventionalist, PICU attending, ED provider (if patient is in ED), RRT provider (if inhouse)

Barrier: Who would be responsible for getting all the players on a phone call for discussion?

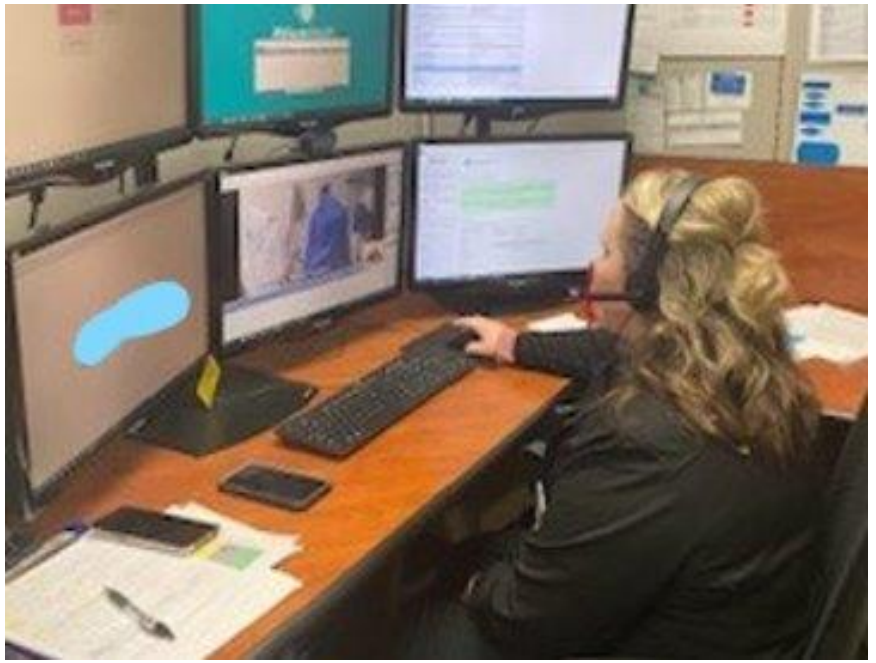
Bringing it Together

- We recognized that communication between all parties was a barrier
- In adult process, this is overcome through use of our telestroke nursing team
- In reviewing all options, it was decided to incorporate the telestroke nursing team into this process

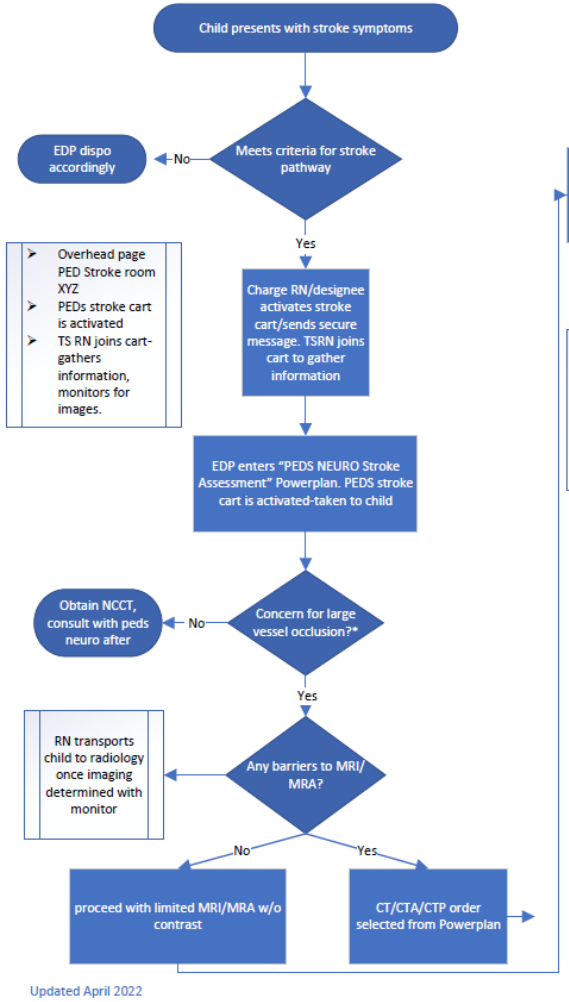


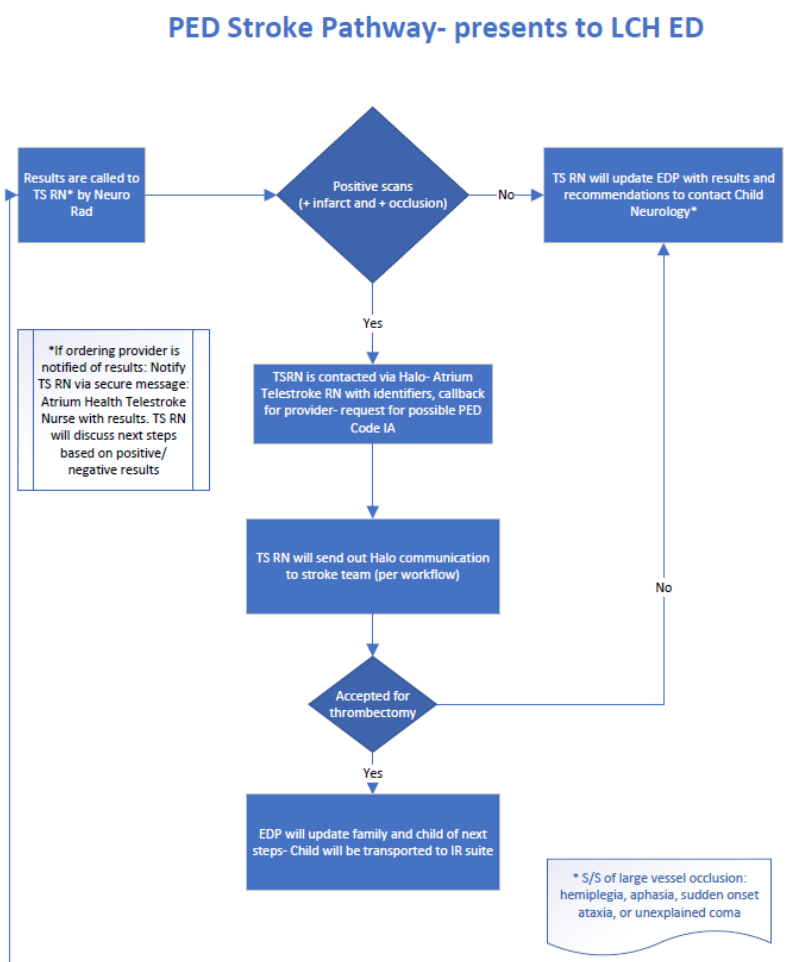
Telestroke Nursing

- 24/7/365 availability
- Involvement in ALL Code Strokes at non-thrombectomy centers
- Specialized education/training
- Conduit between bedside and thrombectomy center
- Content expert related to hospital stroke pathways



ED Pediatric Stroke Pathway





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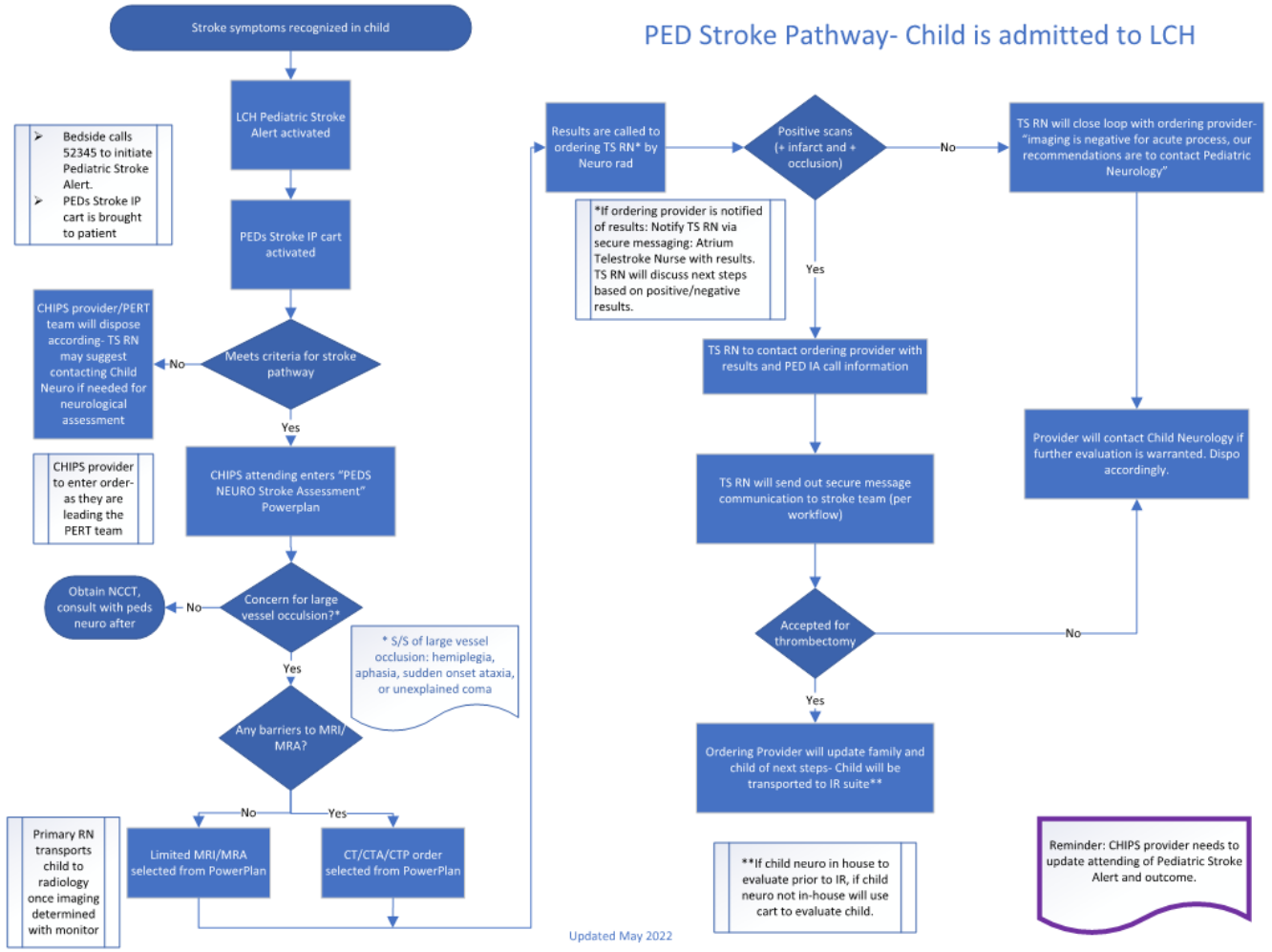
In-house Pediatric Stroke Pathway



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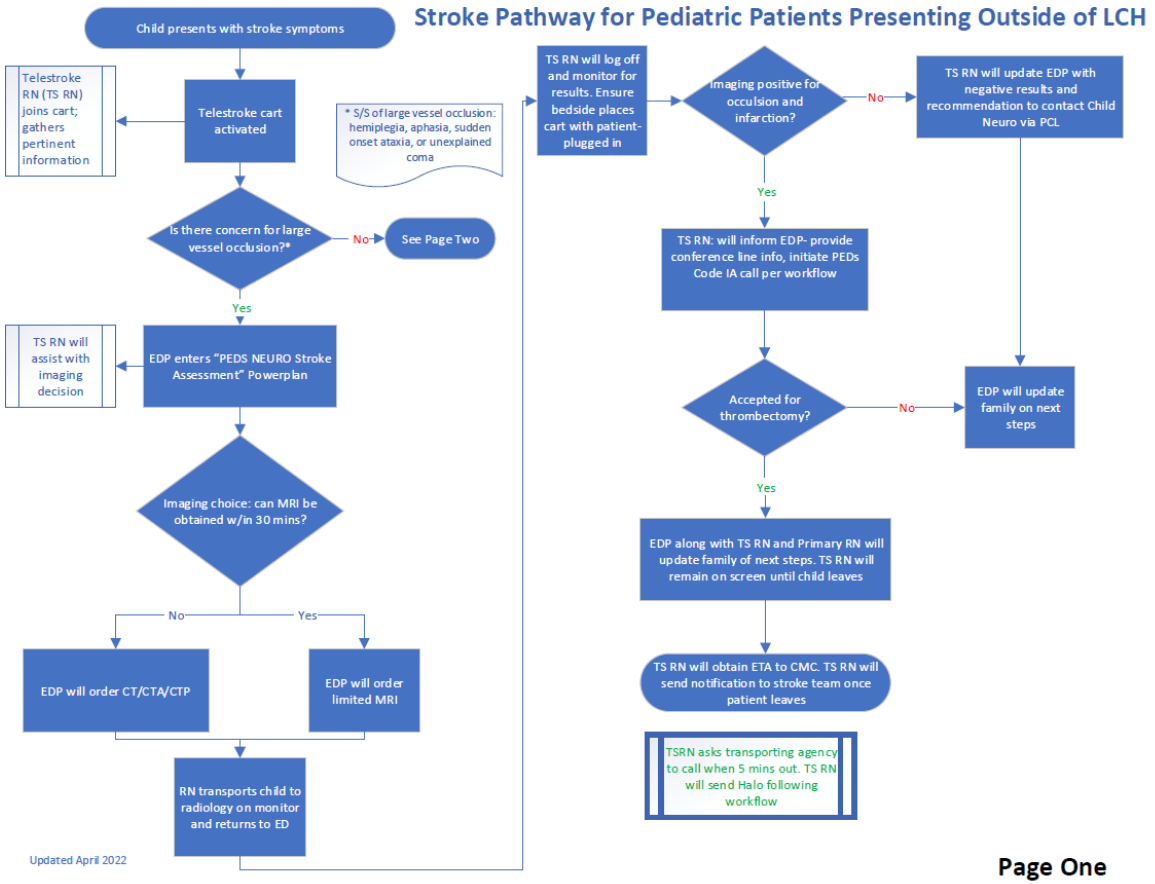
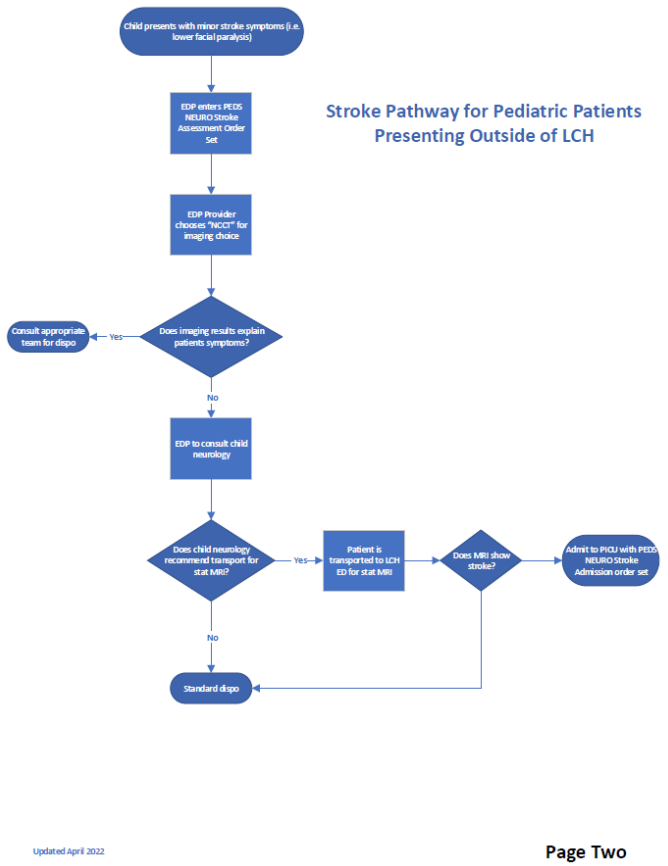
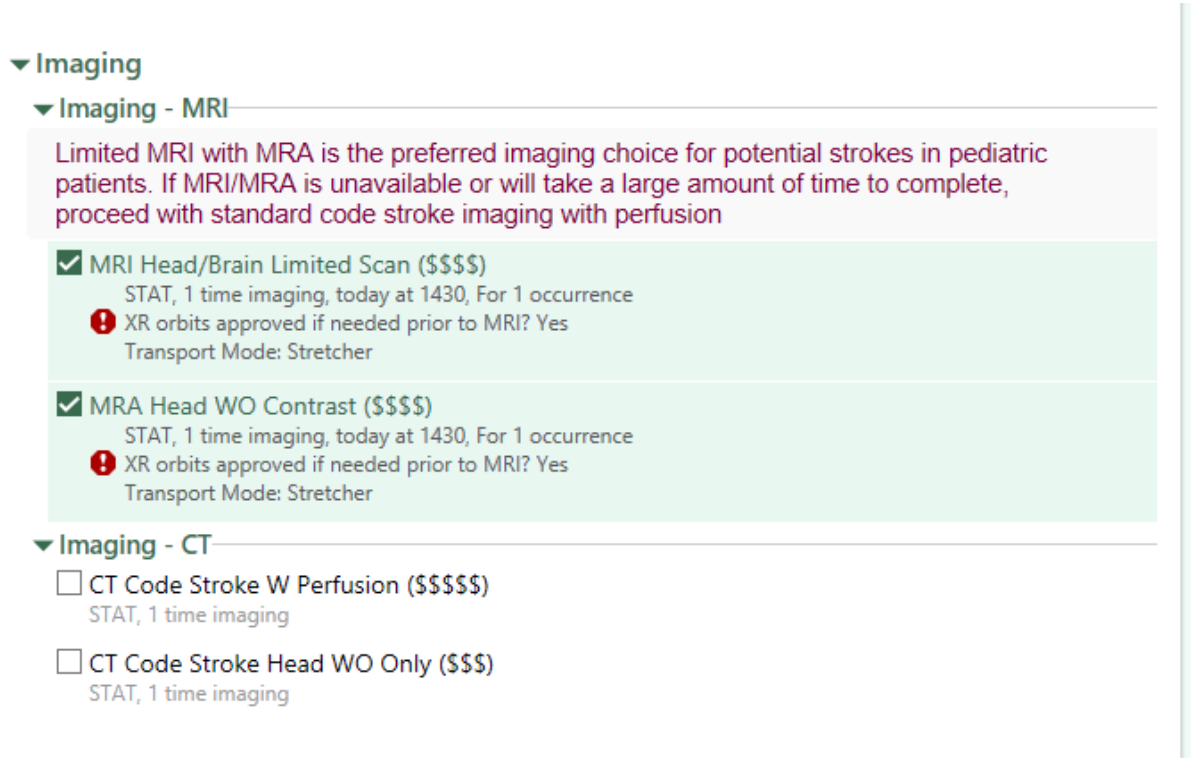
Outside Hospital Pediatric Stroke Pathway





Pediatric Stroke Order Sets

- PED NEURO Code Stroke Assessment
- PED NEURO Ischemic Stroke TIA Admission
- PED NEURO Alteplase Administration



Education

EDUCATION: Change Alert **Go-live: 2/14/2022**

LCH In-house PEDIATRIC STROKE ALERT

Atrium Health Levine Children's

LCH Pediatric Nursing Education

TYPE OF CHANGE: X Process ___Product _____ Practice _____ Protocol ____EMR

WHAT	Brief description of change	LCH is initiating a new **Pediatric Stroke Alert** response for patients exhibiting *stroke symptoms in-house. (* Stroke symptoms include hemiplegia, aphasia, sudden onset ataxia, lower facial paralysis, or unexplained coma)
WHY	Reason for change	Stroke symptoms necessitate a timely & coordinated response. When a **Pediatric Stroke Alert** is activated, the PICU Rapid Response RN will bring a Telestroke cart to the bedside. Activating the Telestroke cart allows an experienced Telestroke RN to help guide the stroke work-up & interdisciplinary communication.
WHEN	Go-live date	• **Go-live: February 14, 2022**
IMPACT	Impact of change on operations	• **The LCH bedside team** (provider or nurse) should initiate a **Pediatric Stroke Alert** whenever stroke-like symptoms are observed. This uses the same initiation process (5-2345) & same responders as a Pediatric Rapid Response activation. • **The PICU Rapid Response RN** should bring & initiate the **Telestroke cart** during a Pediatric Stroke Alert. • **The GEN PEDS Rapid Response Team Leader** should enter the **PEDS NEURO Stroke Assessment PowerPlan** when stroke criteria are confirmed. • **Both LCH providers & nurses** should be familiar with the **Pediatric Code Stroke Pathway** which delineates the process & team member responsibilities during a pediatric stroke work-up. The Pediatric Code Stroke Pathway will be attached to the Telestroke cart for easy reference at the bedside.
CONTACT PERSON(S)	Persons/Committee responsible	• Nora Raynor, MSN, APRN, CNS, CPN LCH Clinical Nurse Specialist • Maria (Anna M.) Helms, MSN, RN, SCRN, CCRN-E, ASC-BC TeleStroke Clinical Nurse Program Coordinator

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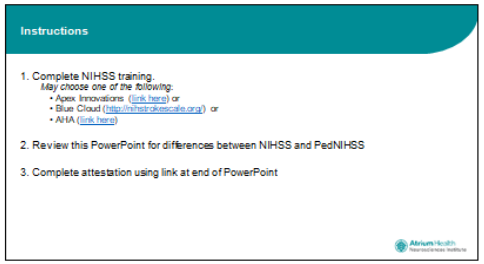

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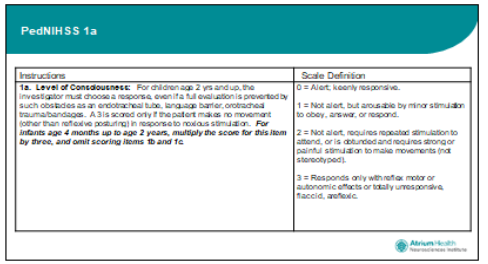

Details

Peds NIHSS younger child

Published on 5/24/2021 by Helms, Anna M Company 70 0

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Details

Peds Stroke Education Module

Published on 4/27/2020 by Macko, Lauren Y Company 237 0

Module for overview of pediatric stroke pathway. Please be sure to complete post-test at the end of the video for stroke hour certificate.

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Timeline

Pediatric stroke case occurred that demonstrated needed for clear process

12/2018

1/2019

First meeting of pediatric stroke stakeholders

AHA/ASA Management of Stroke in Neonates and Children: A Scientific Statement From the American Heart Association/American Stroke Association Published

3/2019

First "Final" Version of pathway implemented

9/2019

4/2020

Recognition of opportunity for better communication. Telestroke Nursing team included

First version of pathway with TSRN team implemented

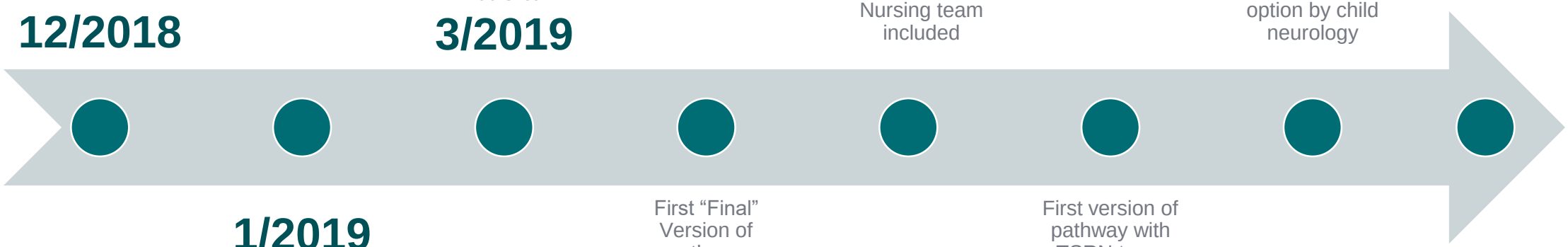
8/2020

8/2021

Version of pathway with virtual assessment option by child neurology

Ongoing review of process. Education as needed

8/2021 to present



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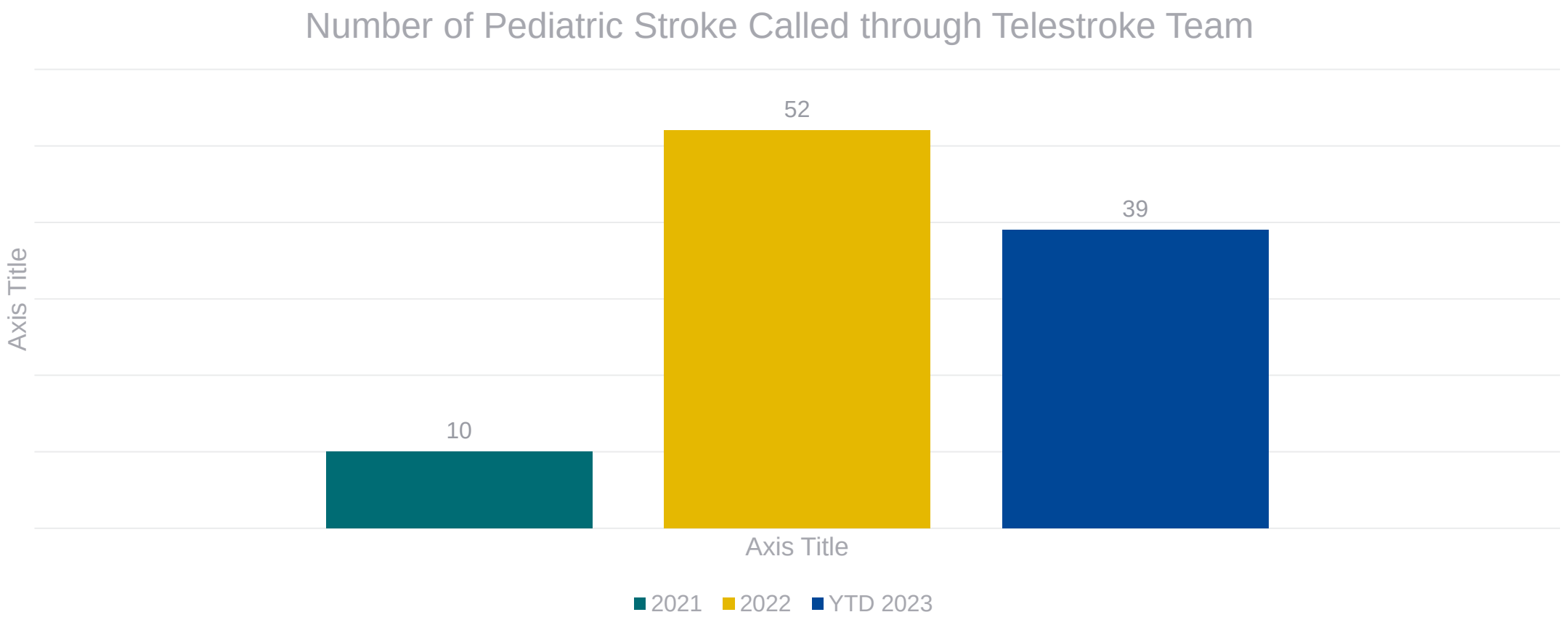
Pediatric Stroke Volumes



YTD 2023 defined as: 1/1/23-10/20/2023

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Lessons Learned

- Takes time “Herding cats”
- Takes leadership, skillful negotiation to gain buy-in
- Lots of refining, re-education, re-addressing needs that arise
- Initially we were seeking a “Captain of the Ship,” but we soon realized what was more important was a skilled and cohesive crew

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Questions?

Feel free to email:

Lauren.Macko@atriumhealth.org