Length of Stay Reduction: A Quality Improvement Project for Neonatal Abstinence Syndrome

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Disclosures

- **I received a grant from the Cardinal Health Foundation for an ADE reduction QI project, a portion of which was used to provide consultation services to the NICU LOS reduction project.**
- **Few pharmaceuticals routinely used in the NICU are FDA approved for use in neonates. The reference to medications used in this work will be identified by generic names. Their use are based on accepted pharmacology and neuropharmacology concepts.**
- **I have no other conflicts to disclose.**

Objectives

1. To describe a clinical convention for determining when LOS is prolonged in a regional neonatal referral center
2. To describe how local data from the Vermont Oxford Network can be used with the Model of Improvement to reduce LOS in a regional neonatal referral center
3. To list 3 interventions (PDSA) associated with decrease LOS for NAS patients

Background

- **Nationwide Children's Hospital is a large, free-standing academic pediatric facility in Columbus, Ohio**

  353 beds

  > 19,000 admissions/year

  > 19,000 surgeries/year

  > 950,000 outpatient visits/year

  New 12 story tower opening in 2012

MAGNET RECOGNITION
AMERICAN NURSES CREDENTIALING CENTER

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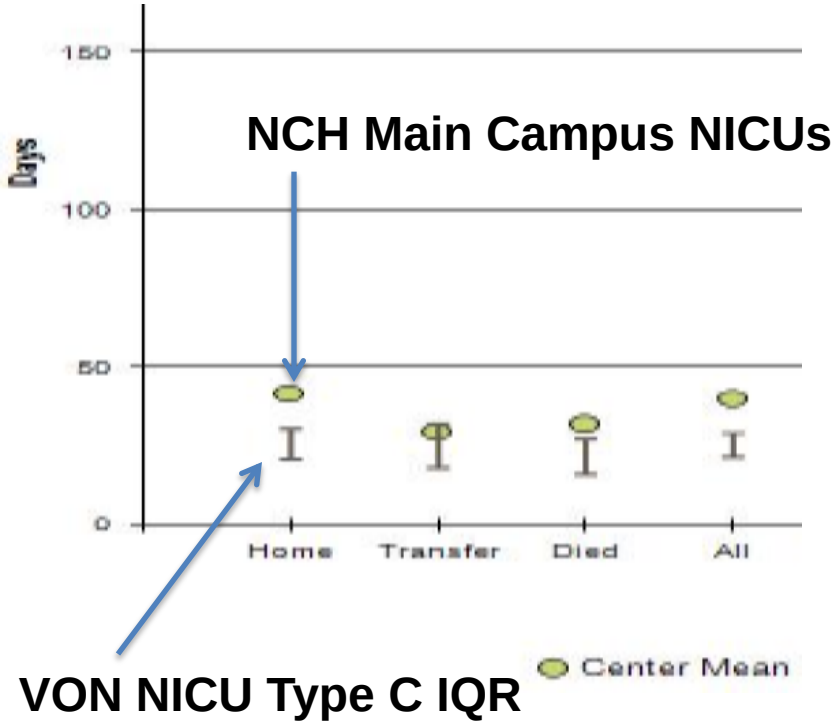
Background

- **Neonatal Services at NCH is one of the largest neonatal programs in US**
  - **191 NICU/SCN beds**
  - **6 Level III NICUs, 2 level II SCNs**
  - **> 2100 admissions per year**
    - **22% < 1500 g birth weight**
    - **7.2% ≤ 26 weeks gestation**
    - **14.6% major birth defects**
    - **16.9% surgical cases**
  - **Diverse group of private and academic neonatologists and pediatric surgeons**

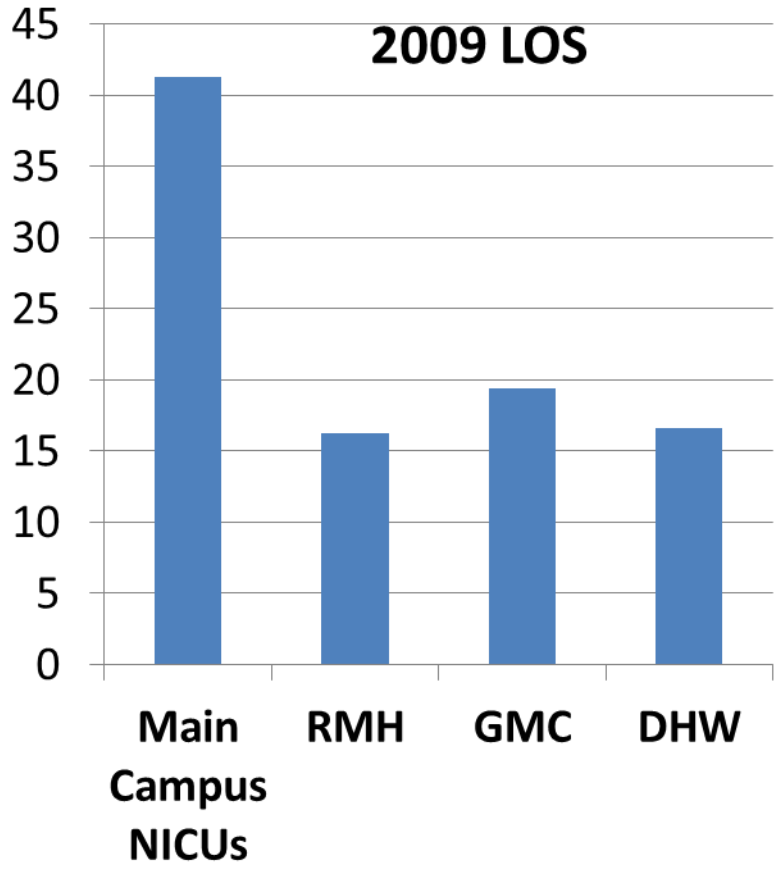
Why is a prolonged NICU LOS so bad?

- **Increased risk of medication errors, other adverse events (e.g. CLABSI, VAP, pressure ulcers, & SSE)**
- **Increased stress on families already stressed**
- **Impaired parent-infant attachment**
- **Increased financial burden on families & society.**
  - **Hospitalization for a healthy premature infant is $1500-2000/ day.**
  - **The daily cost for infants dependent on life support exceeds $5,000.**
  - **IOM estimated total cost of prematurity at more than $26.2 billion (2005).**
- **At NCH, nearly half of the our neonates are capitated Medicaid manage care patients.**

Main Campus NICU LOS Exceeds 75th Percentile for VON Expanded Database



2008 VON LOS Data-Main Campus



Global Aim: To Reduce LOS among NCH Neonatal Services Eight Nurseries

- **Methodology:**
  - **Began in summer of 2009 at the request of the CEO**
  - **Initially focus on 3 Main Campus Level III NICUs**
  - **Conduct univariate analysis of our 2008 VON expanded database to determine factors associated with prolonged LOS**
  - **Use IHI Model for Improvement to establish specific aims and key drivers for improvement in LOS**
  - **Establish neonatal QI teams with specific interest in selected key drivers**

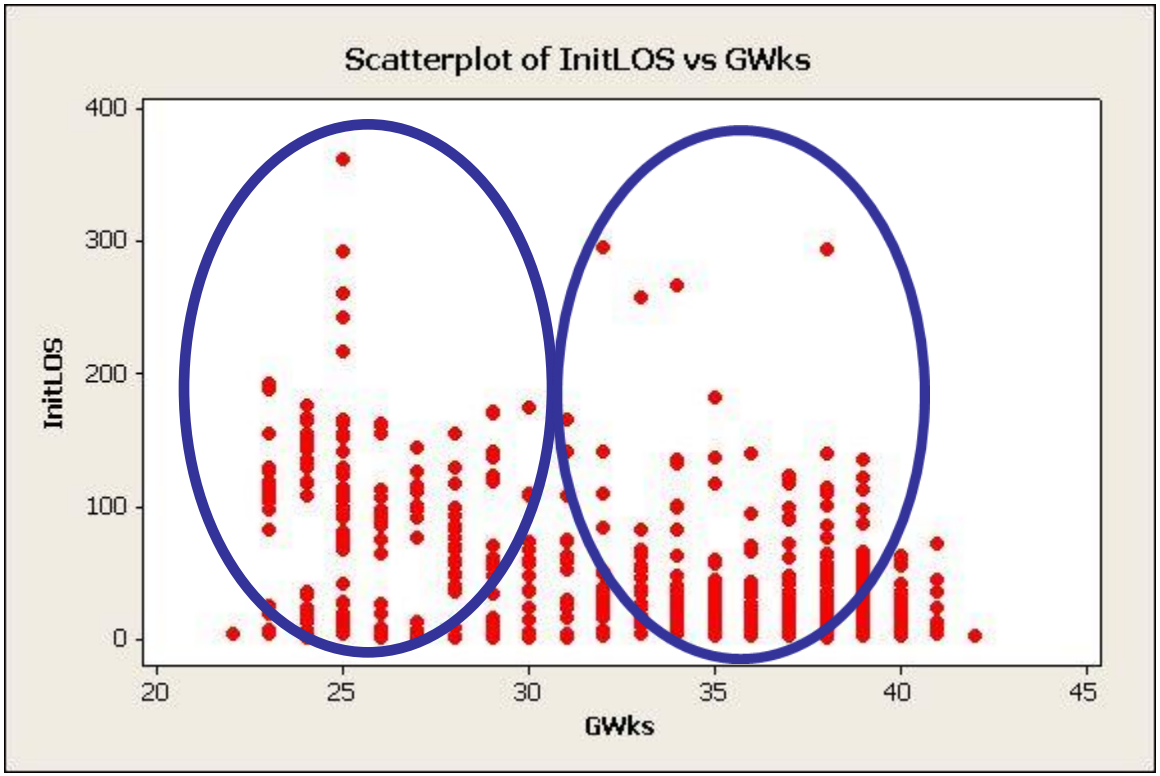
Vermont Oxford Network Expanded Database

“The Vermont Oxford Network is a non-profit, voluntary collaboration of health care professionals dedicated to improving the quality and safety of medical care for newborn infants and their families.”

“The Network maintains a VLBW Database for infants 401 to 1500 grams or gestational age between 22 weeks 0 days and 29 weeks 6 days who are born at participating hospitals or admitted to them within 28 days of birth.

Member institutions also have the option of submitting data for infants weighing over 1500 grams at birth, who are admitted to a participating hospital neonatal intensive care unit or who die within 28 days of birth. “

When is NICU LOS prolonged?



2008 Main Campus NICU
VON Expanded Database

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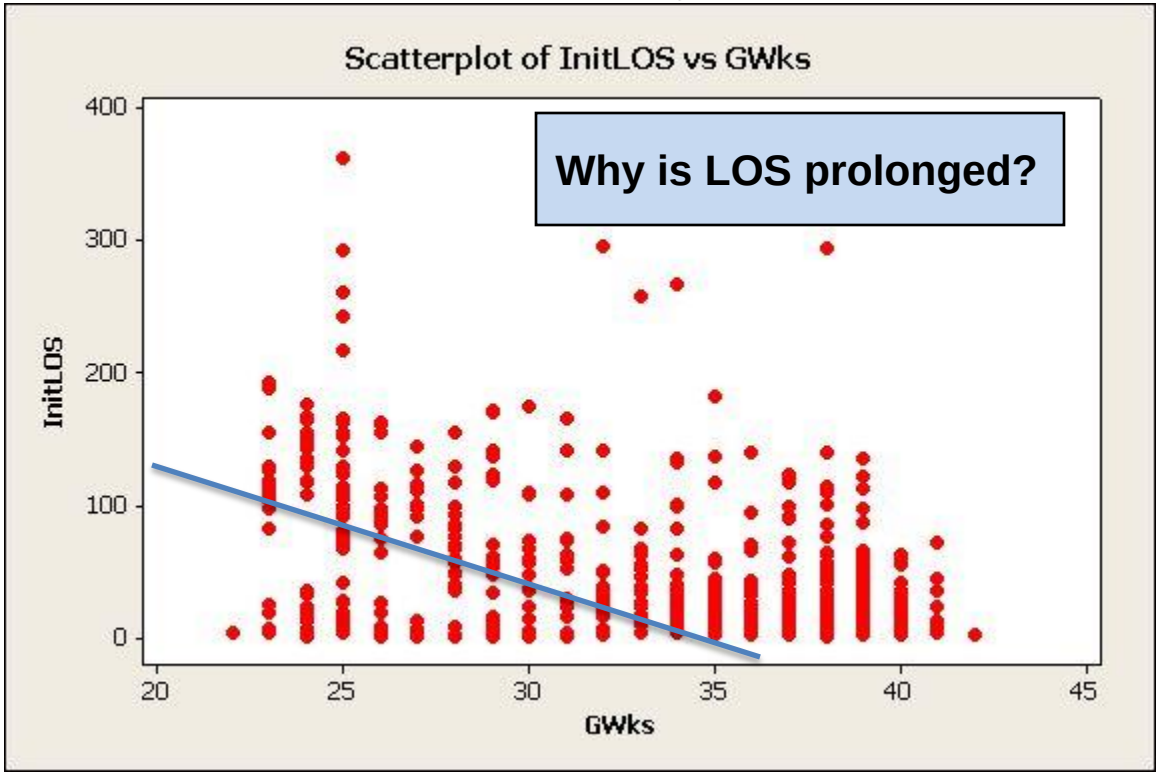
When is NICU LOS prolonged?

When the postmenstrual age exceeds 37 weeks!



2008 Main Campus NICU
VON Expanded Database

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Key Drivers of Prolonged LOS

Significant Variables

- **Lower EGA**
  - Inborn
  - No Antenatal Steroids
  - Male Gender
  - PDA
  - PDA Ligation
  - Severe ROP/ ROP Surgery
- **NAS**
  - Other Surgery
  - Pneumothorax
  - GI Perforation
- **Gastroschisis**
  - CONS Sepsis
  - Oxygen at 36 weeks CGA

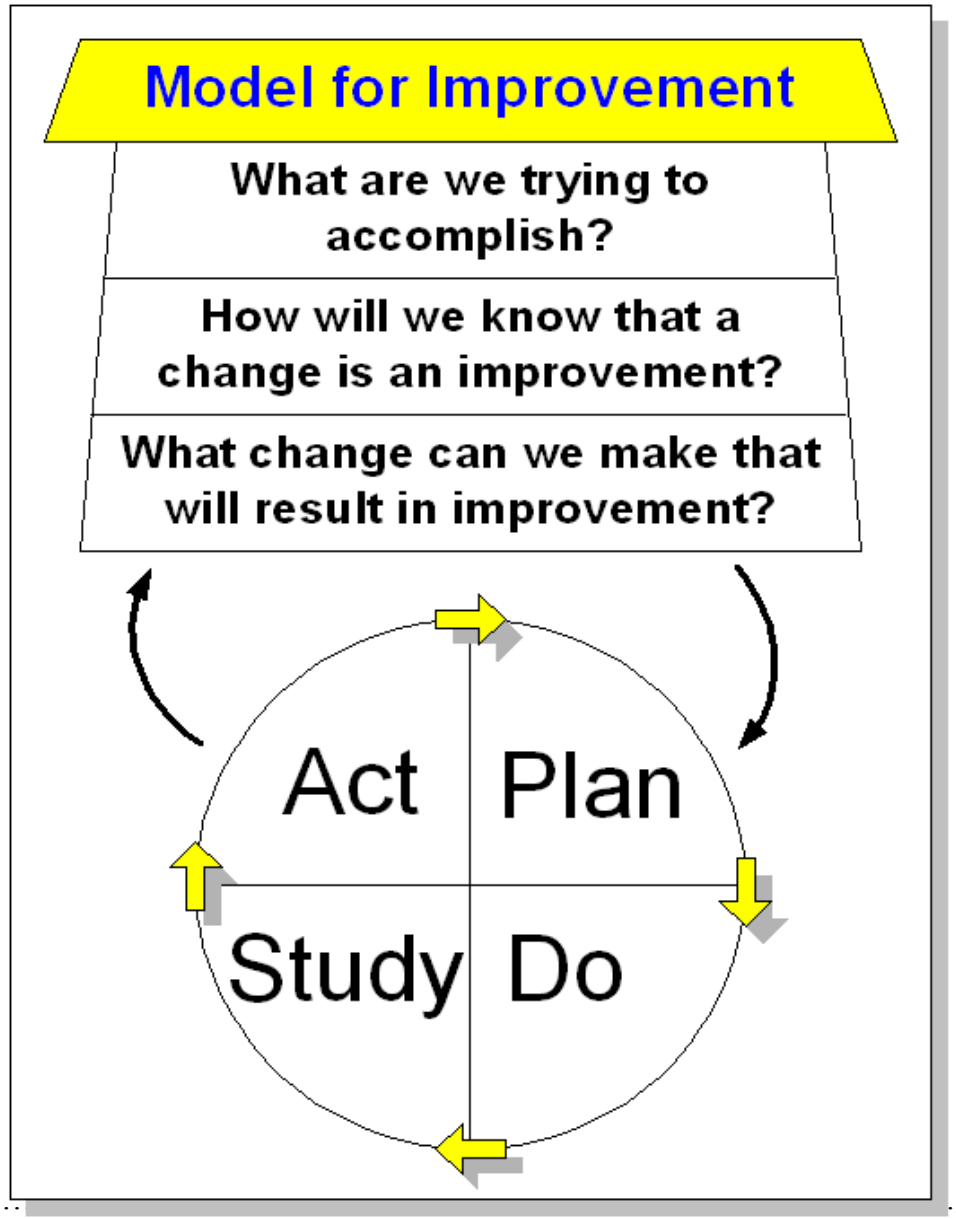
Reduce LOS of main campus NAS Patients By December 31, 2010

Background

- **Neonatal Abstinence Syndrome (NAS) refers to a constellation of typical signs and symptoms of withdrawal that occurs in infants that have been exposed to, and have developed dependence to certain illicit drugs or prescription medications during fetal life. These symptoms are characterized by CNS irritability, gastrointestinal dysfunction, and autonomic abnormalities. Symptoms require drug-specific pharmacologic intervention.**

NAS Facts at NCH

- **6-fold increase in the number of patients at NCH with NAS from 2004-2008**
  - **Opiates, especially methadone, heroin, oxycodone**
  - **Lack of consensus on recommended management, variable management**
  - **NAS LOS exceed 58 days prior to 2009**
  - **Methadone protocol established in early 2009**
    - **LOS decreased to 31 days**
    - **Literature suggested decreased LOS with oral morphine**

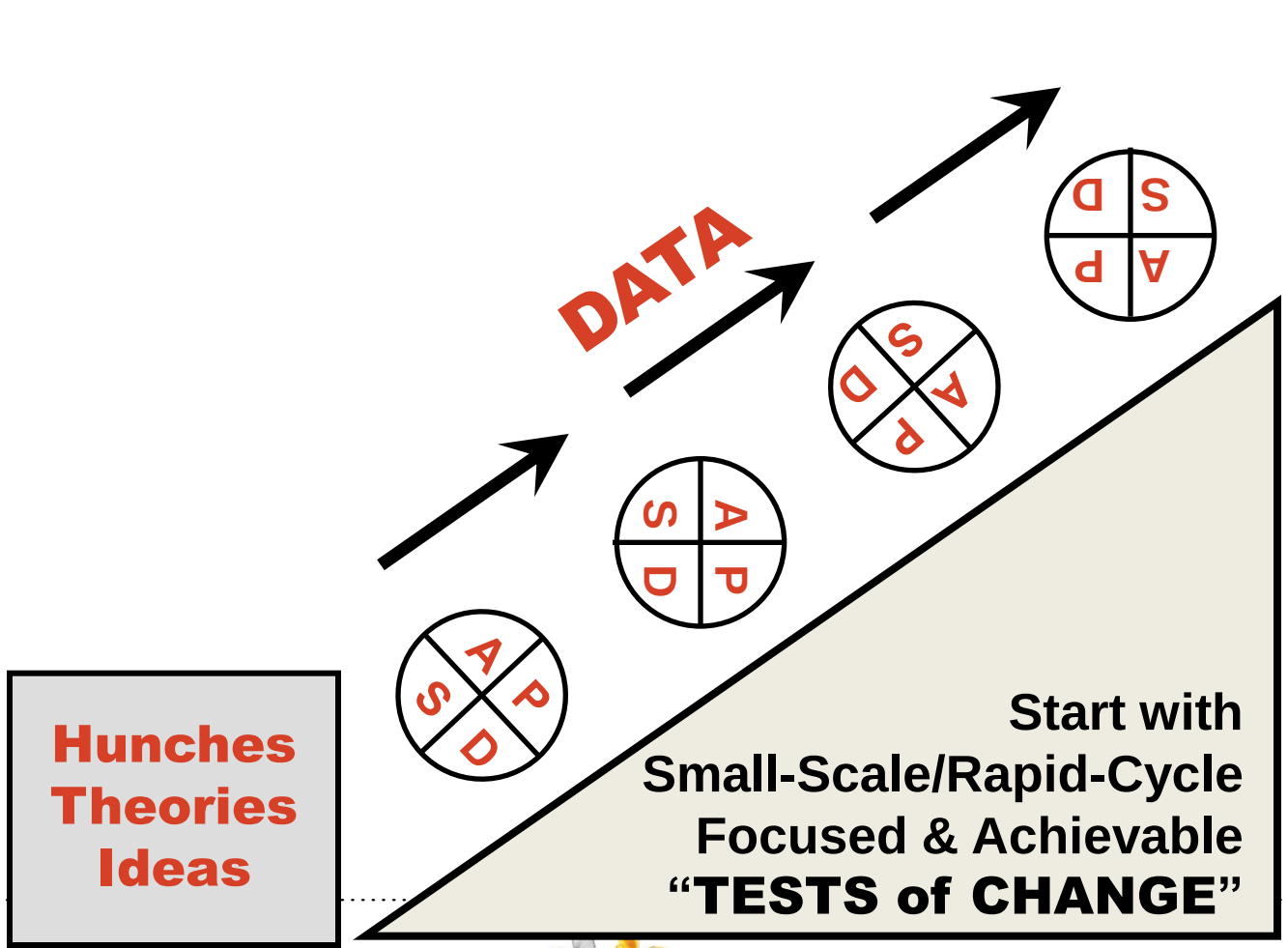


PDSA Cycles

Also known as:

- Shewhart Cycle
- Deming Cycle
- Learning and Improvement Cycle

PROCESS Allows QI Projects to EVOLVE!



It is all about creating a belief that your changes will result in improvement!!

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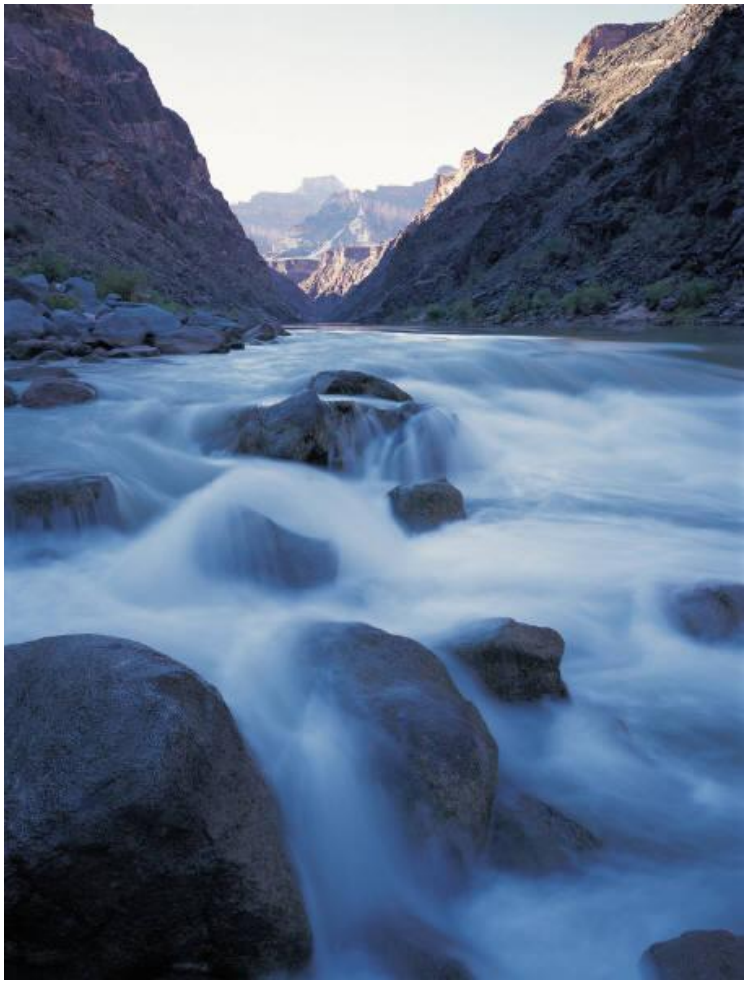
Research v Quality Improvement

Adapted from Lloyd Provost, Associates in Performance Improvement

Well Controlled RCT



Less Controlled QI Project

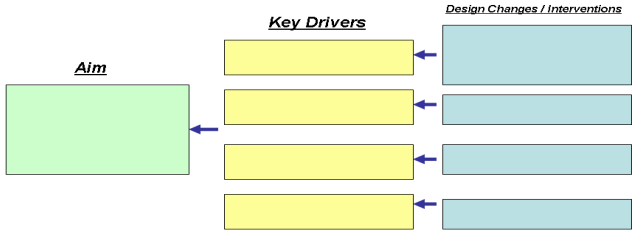
Developing Key Driver Diagrams

- **Simply a project summary**

Goal	--	**Specific (SMART*) Aim**
Influencing Factors	--	**Key Drivers**
Specific Changes	--	**Interventions (PDSAs)**

*** Specific, Measurable, Actionable, Realistic and Timely**

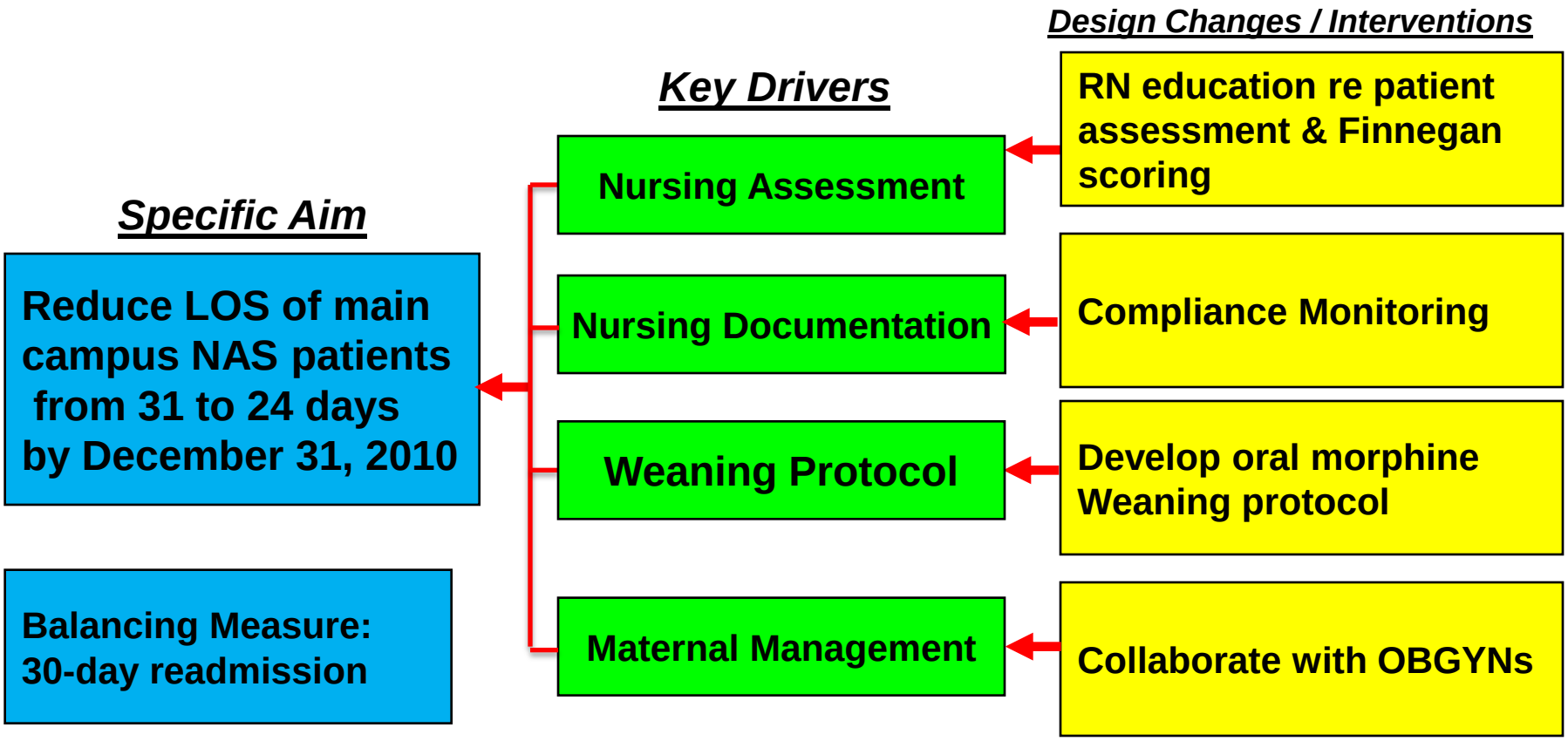
"A framework to effectively focus change efforts"



Specific Aim

Reduce LOS of main campus NAS patients from 31 to 24 days by December 31, 2010

Aim & Key Drivers for NAS



All improvement involves change, but not all change is an improvement.

Michael Fullan, 1992

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PDSA / Interventions / Actions

1. Develop Awareness and Achieve Buy In:

- **Intervention:**
- **Designed & implemented monthly, interdisciplinary NAS Taskforce: 12/2009**

2. Education and Training:

- **Intervention:**
- **Two half day NAS Workshops provided 3/24-25/2010 with nationally recognized nursing expert**
- **Train the trainer-completed in 4/2010**
- **Implement standardized training of new staff**
- **Conduct reliability testing using video assessments**
- **Conduct nursing documentation audits**

Nursing Assessment & Documentation of NAS Symptoms

- **Finnegan Scoring system (1975)**
  - **Inconsistency in symptom definitions**
  - **Interpretation of definitions left to staff**
  - **Wide variability in scores from nurse to nurse and shift to shift**
  - **Difficult for practitioners to make decisions regarding medication weaning**
  - **Infants may be under-treated or over-treated**
  - **Weaning may be prolonged**

K. D'Apolito, 2011

Finnegan Scoring System

Modified Finnegan Neonatal Abstinence Score Sheet[1]

System	Signs and Symptoms	Score	AM						PM						Comments
Central Nervous System Disturbances	Excessive high-pitched (or other) cry < 5 mins	2													
	Continuous high-pitched (or other) cry > 5 mins	3													
	Sleeps < 1 hour after feeding	3													
	Sleeps < 2 hours after feeding	2													
	Sleeps < 3 hours after feeding	1													
	Hyperactive Moro reflex	2													
	Markedly hyperactive Moro reflex	3													
	Mild tremors when disturbed	1													
	Moderate-severe tremors when disturbed	2													
	Mild tremors when undisturbed	3													
	Moderate-severe tremors when undisturbed	4													
	Increased muscle tone	1													
	Excoriation (chin, knees, elbow, toes, nose)	1													
	Myoclonic jerks (twitching/jerking of limbs)	3													
	Generalised convulsions	5													
Metabolic/ Vasomotor/ Respiratory Disturbances	Sweating	1													
	Hyperthermia 37.2-38.3C	1													
	Hyperthermia > 38.4C	2													
	Frequent yawning (> 3-4 times/ scoring interval)	1													
	Mottling	1													
	Nasal stuffiness	1													
	Sneezing (> 3-4 times/scoring interval)	1													
	Nasal flaring	2													
	Respiratory rate > 60/min	1													
	Respiratory rate > 60/min with retractions	2													
Gastrointestinal Disturbances	Excessive sucking	1													
	Poor feeding (infrequent/uncoordinated suck)	2													
	Regurgitation (≥ 2 times during/post feeding)	2													
	Projectile vomiting	3													
	Loose stools (curds/seedy appearance)	2													
	Watery stools (water ring on nappy around stool)	3													
	Total Score														
	Date/Time														
	Initials of Scorer														

1. Finnegan LP. Neonatal abstinence syndrome: assessment and pharmacotherapy. In: Nelson N, editor. Current therapy in neonatal-perinatal medicine. 2 ed. Ontario: BC Decker; 1990.

Effectiveness of the NAS Training Workshops

Paired T-Test and CI: Post-Workshop, Pre-Workshop

	N	Mean	StDev	SE Mean
Post-Workshop	82	13.805	1.614	0.178
Pre-Workshop	82	12.110	2.667	0.294
Difference	82	1.695	2.959	0.327

95% CI for mean difference: (1.045, 2.345)

T-Test of mean difference = 0 (vs not = 0): T-Value = 5.19 P < 0.001

Erin Keels, RN NNP, ATP Project 2010

Other PDSA / Interventions / Actions

3. Develop Oral Morphine Protocol
4. Train Mother-Infant Staff in Finnegan scoring system
5. Established relationships with Maternal Providers
6. Develop additional tools at offsite nurseries
7. Obtained March of Dimes grant to educate pregnant women attending a local methadone clinic re NAS
8. Establish an NAS Developmental Follow up clinic
9. Developed NAS Clinical Guideline

Enteral Morphine Protocol for
Neonatal Abstinence Syndrome (NAS)

Protocol should be initiated if an infant has 2 consecutive scores ≥ 8 or 1 scores ≥ 12 within a 24 hour period (just as was done previously with the methadone taper).
Concentration of Enteral Morphine to be used for ALL doses: 0.2 mg/ml

Starting Dose:

Enteral: 0.05 mg/kg/dose po q3hr

IV: 0.02 mg/kg/dose (IV morphine and enteral morphine doses are not equivalent)

Titration:

Enteral: Increase by **0.025-0.04 mg/kg every 3 hrs until controlled (NAS < 8)**

IV: increase by **0.01 mg/kg every 3 hrs until controlled (NAS < 8)**

***Rescue Dose*:** If infant has 1 score of ≥ 12, double the previous dose given (enteral or IV) x 1 and then adjust accordingly:

- If NAS score now < 12: make the scheduled maintenance dose (MD) the same as the rescue dose that was just administered. The first higher MD should be given at the next scheduled care/feed.
- If NAS score still ≥ 12: increase next dose by 50%. Continue to do so until score is < 12. Once < 12, then follow guideline listed above.

Enteral Morphine Protocol for
Neonatal Abstinence Syndrome (NAS)

Wean: Once stabilized on a dose for 72-96 hours, use this dose as the starting point of the wean (*please note this dose on infant's card*). Begin weaning the dose by 10% (of the original dose when the first wean was started) every 24-48 hours. Drug may be discontinued when a single dose is < 0.02 mg/kg/dose. Please see below for example.

__Ad lib infants__: Given the shorter duration of action of enteral morphine, it is best suited to be dosed on a q3hr schedule. Infants should be allowed to ad lib feed volumes but kept on a q3hr schedule.

__Backslide__: If infant's NAS scores become consistently elevated (ex: 2 consecutive ≥ 8) during the weaning process, assure that nonpharmacological measures are optimized (ie: swaddling, holding, decreased stimuli, etc) before going back to previous dose at which patient was stable. If infant's scores continue to be elevated (even after physical exam to ensure nothing else is wrong/bothering the infant), either weight adjust medication and/or continue to back up in a stepwise fashion until patient's scores are <8. Once stabilized on new dose for minimum 48 hrs, resume 10% wean but consider weaning at longer intervals.

Discharge: Observe in-house x 48-72 hours off of medication before discharge.

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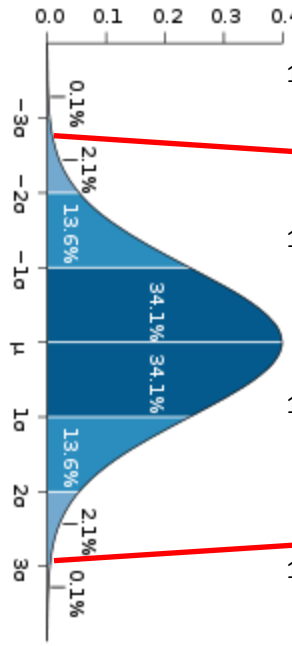
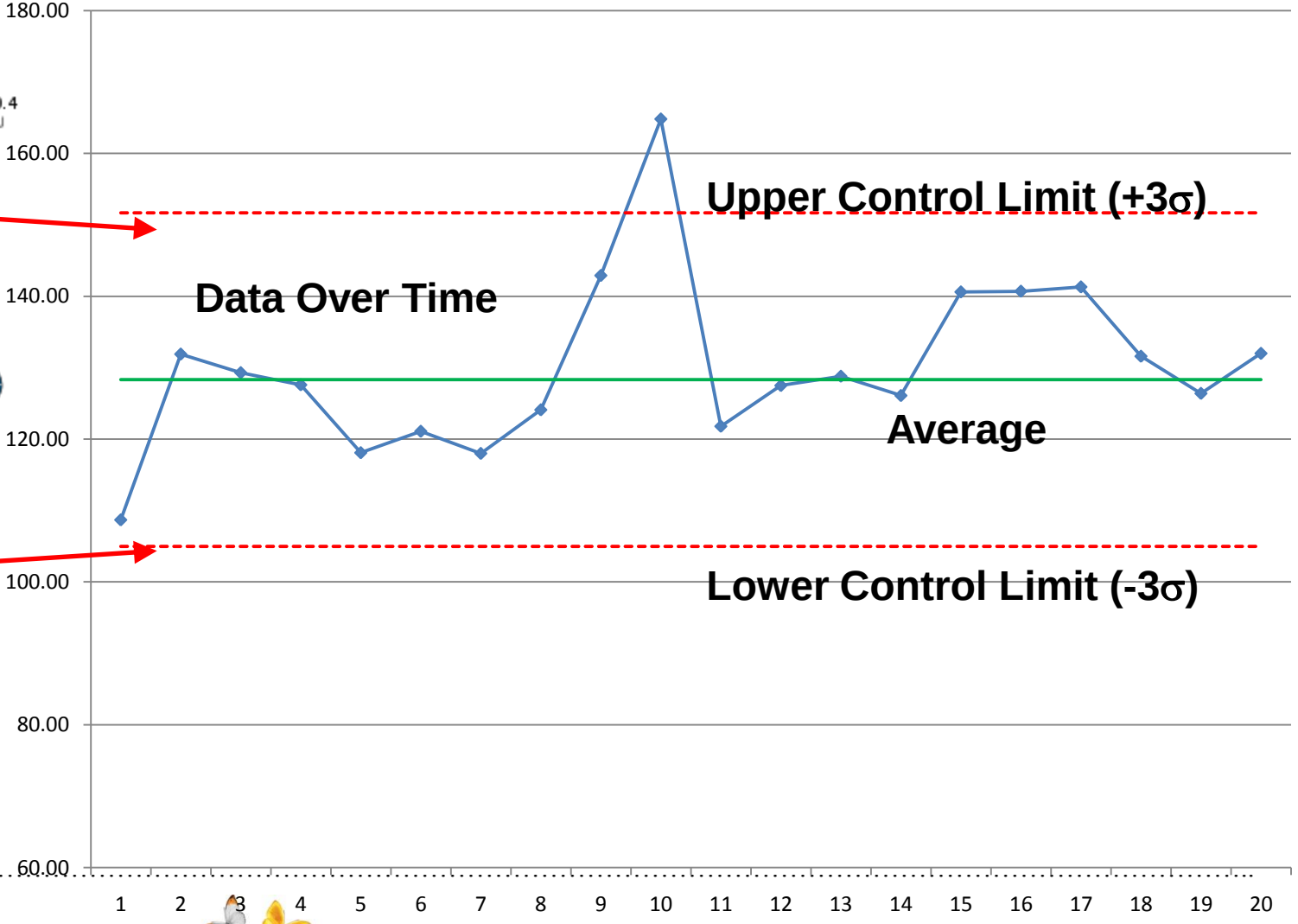
"10) The limited available evidence from controlled trials of neonatal opioid withdrawal supports the use of oral morphine solution and methadone when pharmacologic treatment is indicated…"

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://pediatrics.aappublications.org/content/early/2012/01/25/peds.2011-3212

Control Charts





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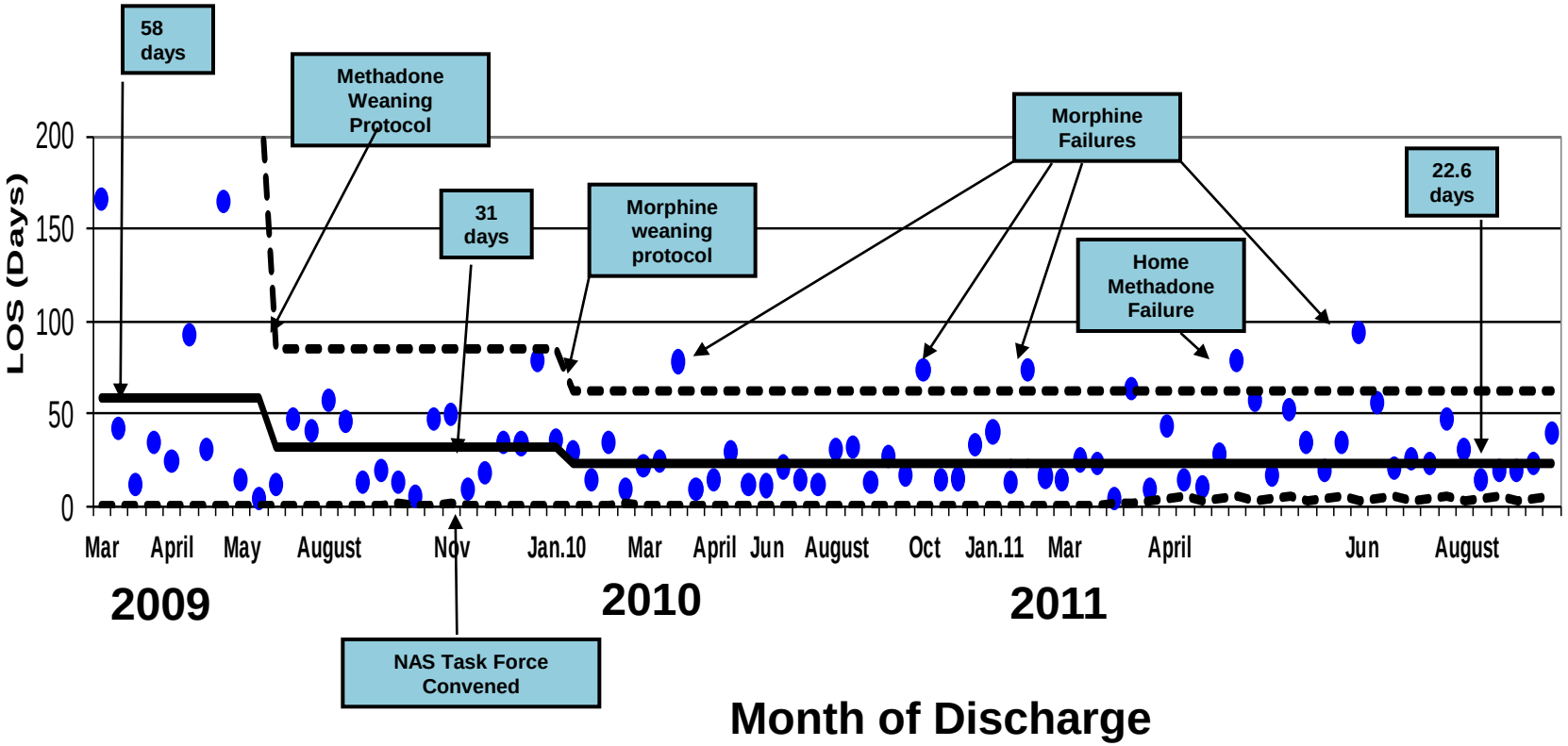
LOS Data for Main Campus NAS Patients

X chart



Content of NAS Guidelines

- Maternal History Taking and Drug Testing Recommendations
- Neonatal Testing and Assessment
- General Supportive and Environmental Care of the Infant with NAS
- Creating Collaborative Relationships with Families
- Nutrition
- Pharmacologic Treatment
- Discharge Planning
- Follow Up
- Prevention and Outreach
- Appendices
- References

Going Home!

A Newsletter for the NCH NICU LOS Reduction Collaborative
Vol I Issue 2 *Rick McClead MD, Editor*

Welcome to the second issue of *Going Home!* , a monthly newsletter for the NICU Length of Stay (LOS) Reduction Collaborative. His project has avoided 4029 patient-days and $6M of hospital costs since June 2010. This month, I focus on Neonatal Abstinence Syndrome (NAS).

Neonatal Abstinence Syndrome

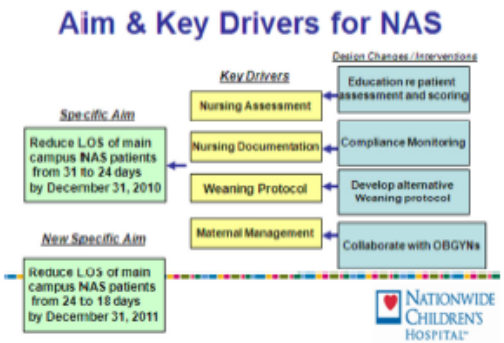
When we analyzed the factors that contributed to prolonged LOS in the NICU, I was surprised to find that withdrawal from *in utero* exposure to opiates, NAS, was an issue. Although many maternal medications can precipitate NAS, opiate withdrawal (eg. methadone, heroin, Vicodin, etc) is the major problem in Central and Southeastern Ohio. Infants experiencing opiate withdrawal exhibit a variety of symptoms including irritability, excessive crying, vomiting and diarrhea. Symptoms usually begin within 1-3 days after birth, but can be delayed for several days to weeks. Treatment, both pharmacologic and non-pharmacologic, is directed at relieving symptoms. The pharmacologic therapy involves treating the infant with a medication similar to that which the mother consumed during pregnancy. The neonatal opiate dose is slowly decreased over time while the infant remains hospitalized. This process can take many days to weeks.

In the past 5 years, NCH has experienced an 8-fold increase in the numbers of infants with NAS. Prior to May 2009, the infants were treated at the discretion of the attending physician. At that time, the average LOS of NAS infants was > 58 days.

In May 2009, a standard oral methadone weaning protocol was implemented. Protocol compliance was fairly good. Average LOS decreased to ~31 days.

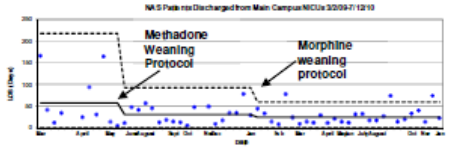
However, the literature indicated that even lower LOS could be achieved with an oral morphine protocol. Jackie Schneider Pharm D. BCPS and Jon Wispe MD developed an oral morphine weaning protocol. A specific aim to reduce the LOS of NAS infants admitted to the main campus NICUs from 31 to 24 days by December 31, 2010 was established.

Key drivers identified included a) a process for regular communication, b) implementation of an oral morphine weaning protocol, c) a nursing educational and training program regarding proper use of the Finnegan scoring system, and d) improved collaboration with obstetric colleagues managing maternal opiate addiction.



In the Fall of 2009, Erin Keels RN NNP established an NAS Taskforce to facilitate communication and learning. In November, 2009, a nationally recognized expert on Finnegan scoring, Karen D'Apolito PhD from Vanderbilt University, conducted "train-the-trainer" seminars. The newly trained NCH Finnegan scoring "experts" then trained smaller groups of NICU nursing staff.

As soon as the oral morphine weaning protocol was implemented, LOS decreased. The target of an average LOS of 24 days was easily met by the target date of December 31, 2010.



Successful QI projects must be spread to other units. The GMC nursery staff had used a methadone weaning protocol. However, the average LOS for NAS patients at GMC in the first quarter of 2009 had increased to over 78 days from a historic average of around 31 days. The GMC staff led Barry Halpern MD and Stephanie Stafford RN independent of the main campus effort, adopted a similar protocol with great success. LOS for these patients plummeted to < 18 days, and more recently to 12 days.

The Pediatrix group that covers the NCH nurseries at Riverside Methodist Hospital, Dublin Methodist Hospital, and St Ann's Hospital successfully implemented the oral morphine weaning protocol for NAS patients as well. Although these nurseries have many fewer NAS patients, when their data are combined, they have achieved LOS reductions comparable to that on main campus.

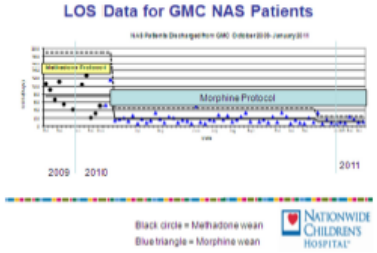
There are other approaches to management of the patient with NAS. The NCH nursery at Doctor's Hospital West has utilized an oral methadone weaning program with early discharge, and close physician monitoring of the methadone weaning process as an outpatient. This approach led by Carl Backes DO and Terry Elifritz RN has achieved a LOS reduction that is similar to that of the oral morphine program at GMC.

In 2011, our goal is to reduce LOS for NAS patient admitted to all NCH nurseries to < 20 days. We also plan to spread this improvement work to nurseries within perinatal Region IV that have large populations of NAS patients.

Next time in *Going Home!*

In next month's issue of Going Home!, we shall focus of the management of gastroschisis.

Check out the NAS podcast at www.childrensonquality.com or use your smart phone to access the podcast via the 2-D barcode below.



Children's on Quality Podcast

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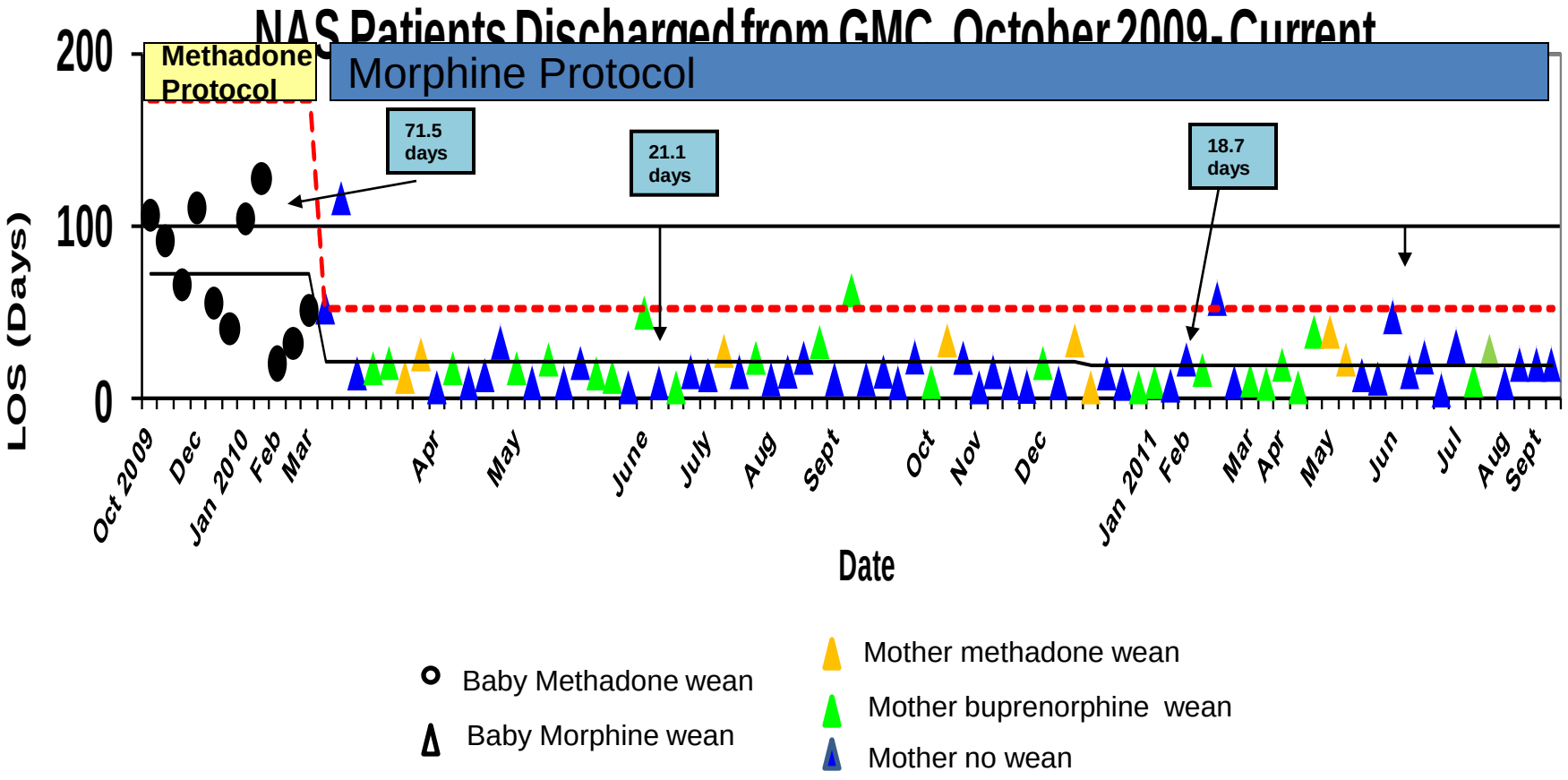
Spreading the news!

LOS Data for GMC NAS Patients



What drugs can cause withdrawal in my baby?

•Opiates (Heroin, morphine, Percocet, oxycotin, methadone, subutex, suboxone etc)

- Narcotics Barbiturates
- •Alcohol Amphetamines
- •Cocaine Narcotics
- •Nicotine Caffeine

If I am in a methadone program or am taking subutex or suboxone should I continue?

- Yes, it is healthier for mom and baby to be on a consistent dosing than fluctuations of illicit drugs.
- It decrease exposure to other toxins and HIV risk of exposure.
- Allows access to services and support
- Allows breast feeding

Withdrawal symptoms

- High pitch crying
- Sleeplessness /Cranky
- Feeding problems
- Diarrhea/vomiting
- Shakes/tremors
- Overactive suck

***It is important to tell your health care provider about any drugs, medications or herbal supplements you may be taking (prescription on non- prescription**

Will my baby have to stay in the hospital?

Some babies have mild signs of withdrawal and need only normal newborn care. Others can have severe withdrawal and need medical treatment. This may include being admitted to a special care nursery where they can receive medicine to help ease their discomfort. If your baby is admitted to the special care nursery, they will be watched for these signs and scored to help the health care team decide what kind of care your baby needs.

What can I do for my baby?

As a parent, in the hospital or at home, spend as much time with your infant as possible. Your baby will be comforted by your close contact.

Talk with your nurse about comfort techniques for your baby.

Keep in close contact with your doctor.

Resources:

SAMHSA (Substance Abuse and Mental Health Services)

- 1-800-662-HELP (4357) **24 hour Hotline**
- www.samhsa.gov

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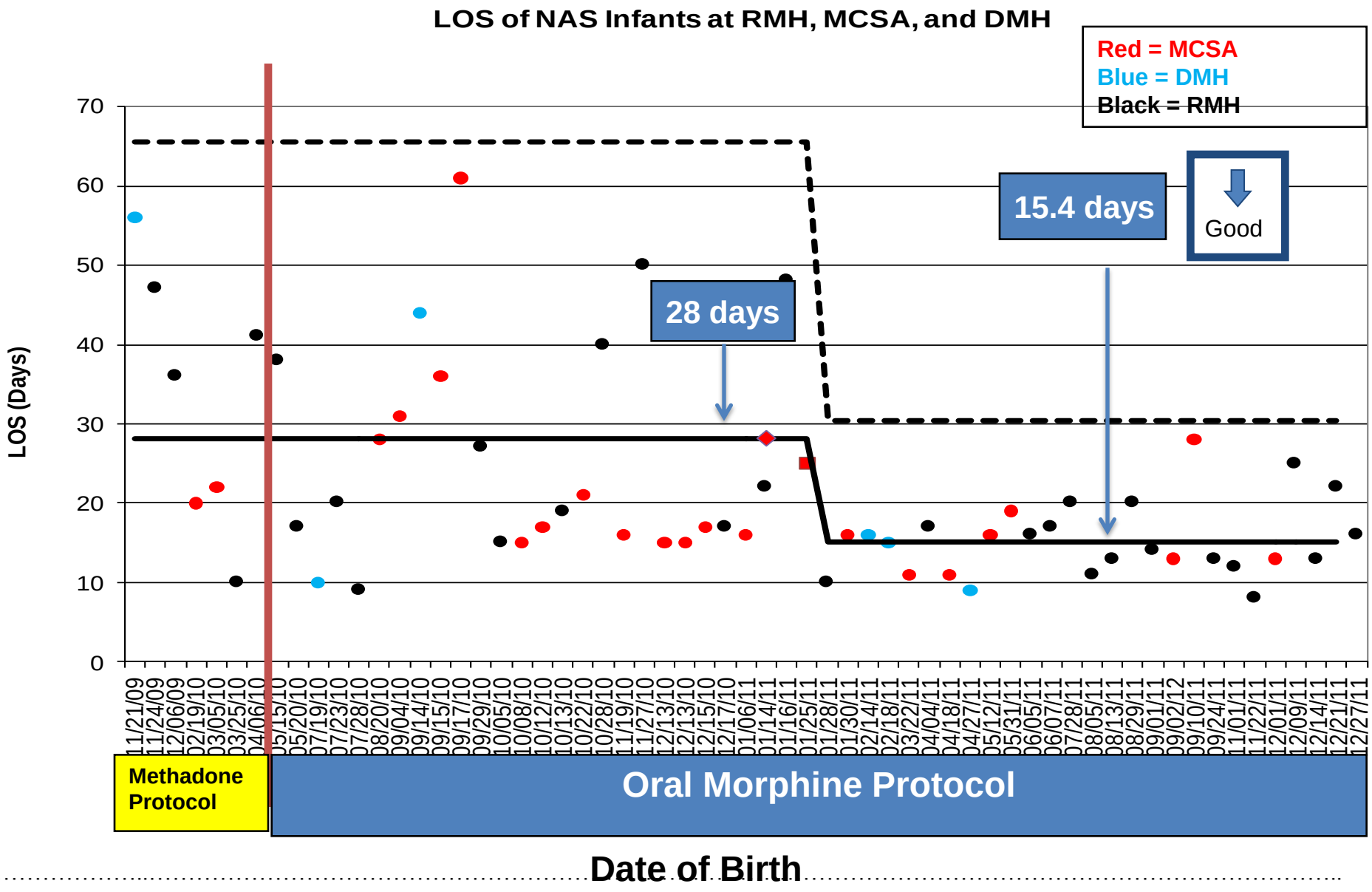
Will your Newborn Have Withdrawal ?

A Parents Guide

Neonatal Abstinence Syndrome (NAS)

Is a condition that starts at birth when an infant's mother has used drugs (legal or illegal) or alcohol during her pregnancy. When the infant is born their drug supply stops and he or she goes through a time of withdrawal. The signs and symptoms of this withdrawal is called Neonatal abstinence syndrome (NAS).

Draft developed by Michelle Doughty RN Clinical Nurse Manager, Doctor's Hospital West



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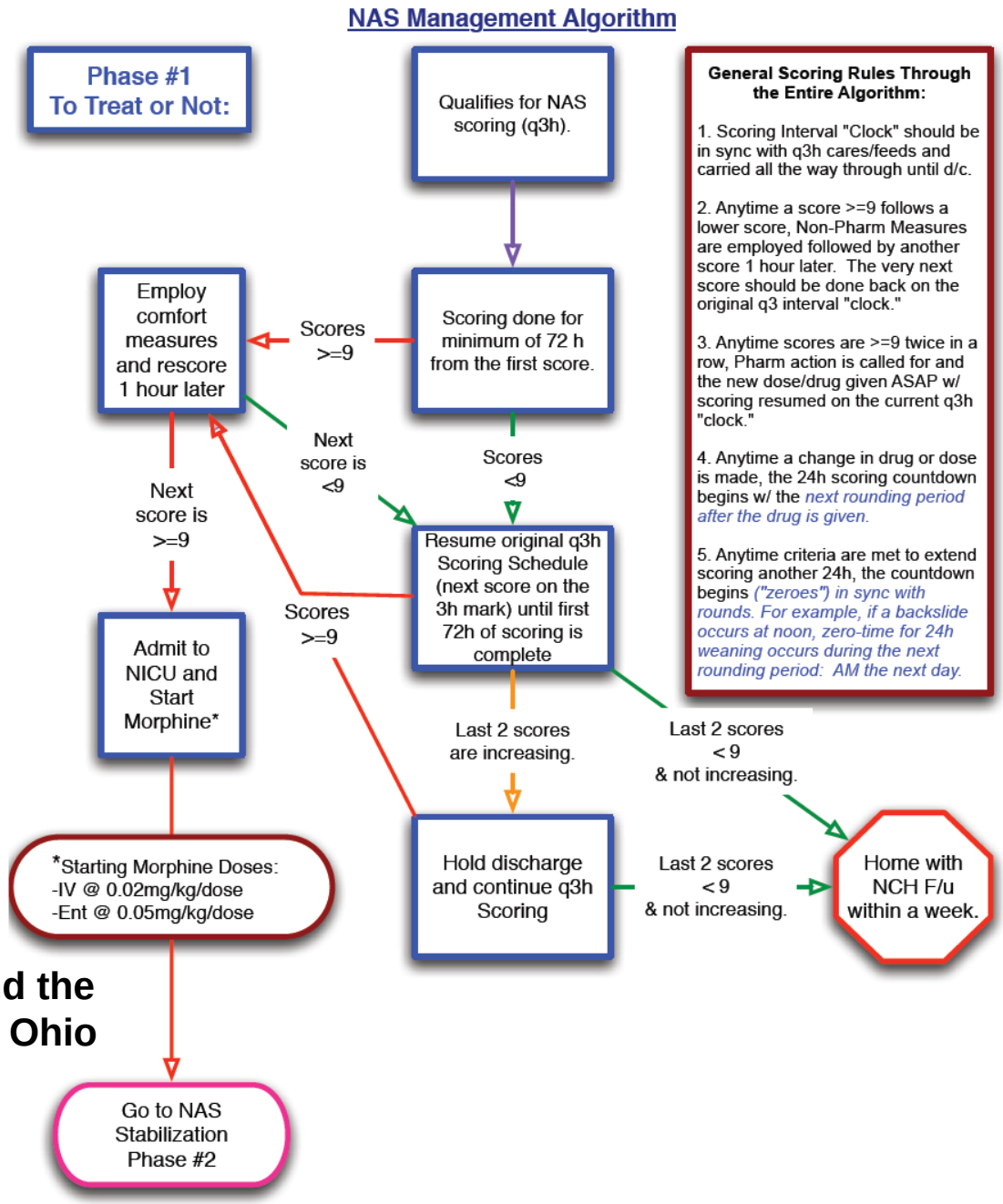
People do that which gets measured!

NAS Management Algorithm

(Phase I: To Treat or not to treat)

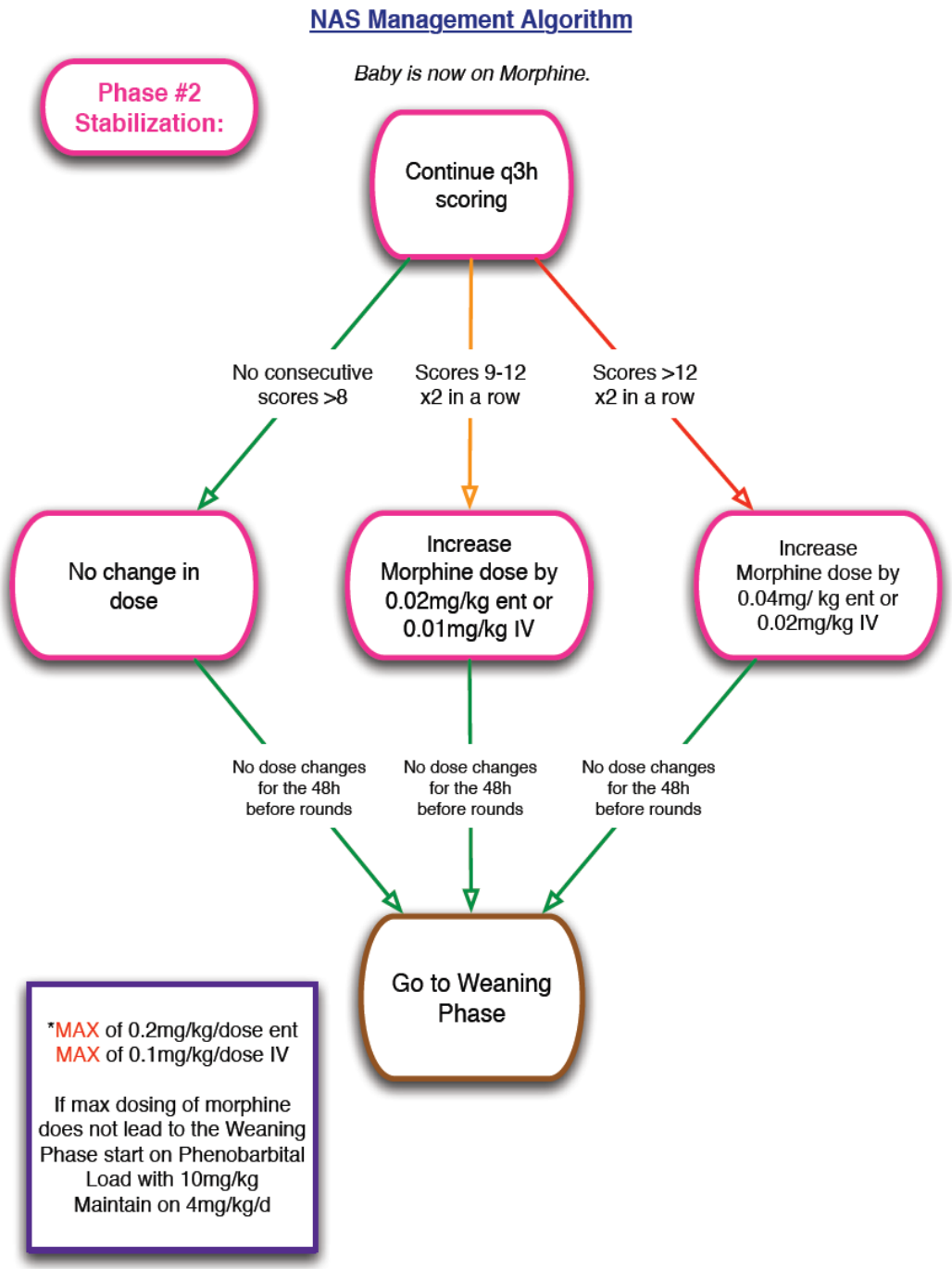


Developed by Gary Snyder, MD, and the Pediatrix Medical Group of Central Ohio

NAS Management Algorithm

(Phase II: Stabilization on Morphine)

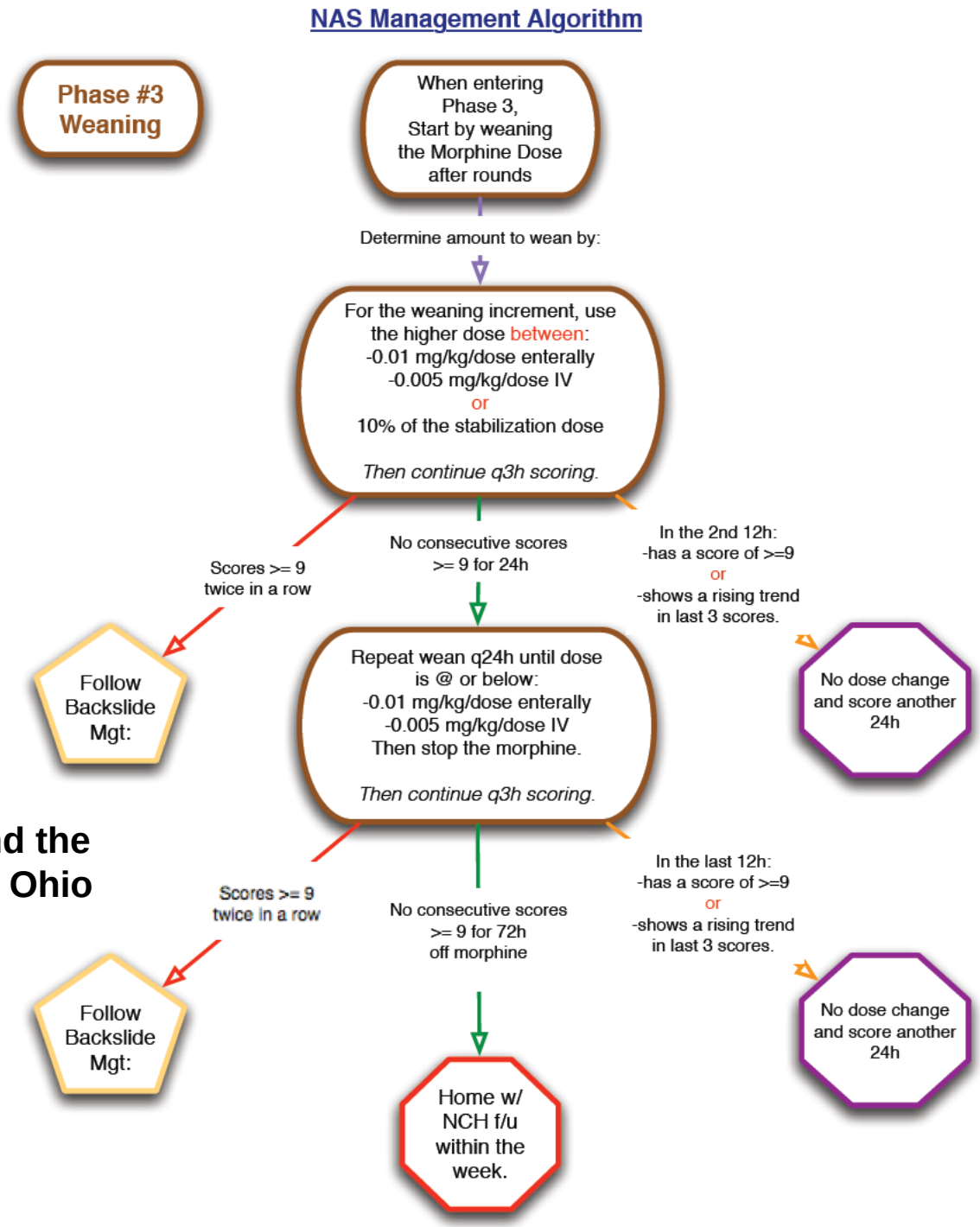
Developed by Gary Snyder, MD, and the Pediatrix Medical Group of Central Ohio



NAS Management Algorithm

(Phase III: Weaning)

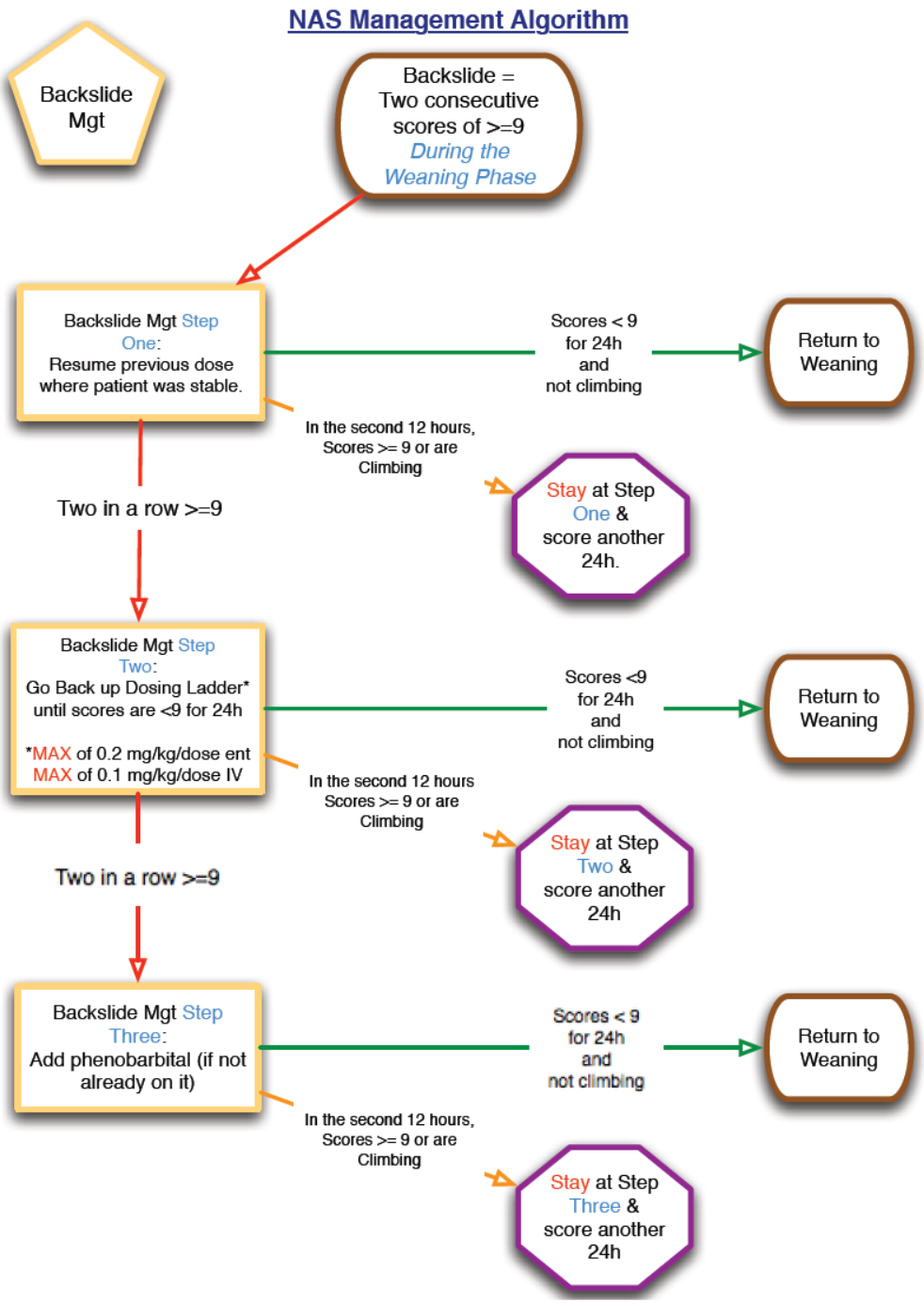
Developed by Gary Snyder, MD, and the Pediatrix Medical Group of Central Ohio



NAS Management Algorithm

(Phase III: Backsliding)

Developed by Gary Snyder, MD, and the Pediatrix Medical Group of Central Ohio



30 Day Readmission of NAS Patients Balancing Measure

15 Readmissions in 2 years

- 2 patients for NAS symptoms (last 6/09)
- 5 cases of bronchiolitis/RSV
- 3 CNS symptoms unrelated to NAS Hx
- 3 feeding issues unrelated to NAS Hx
- 1 r/o sepsis
- 1 BPD exacerbation

Summary

- **Formal training of staff in the use of the Finnegan tool led to better assessment and documentation of withdrawal symptoms, and a more reliable weaning program.**
- **Standardize pharmacotherapy can impact LOS of NAS patients**
- **Oral morphine weaning protocol associated with a significant decrease in LOS for NAS patients.**
- **Maternity centers with NAS babies can achieve LOS of < 20 days.**

Next Steps

- **Decrease LOS for all units to < 18 days**
- **Spread project to Level I referring hospitals in Southern Ohio**
- **Engage with Ohio Children's Hospitals to address the statewide NAS problem (N > 1000)**
- **Explore impact of buprenorphine v morphine for mothers (and babies?)**
- **Assess developmental impact of *in utero* drug exposure and weaning therapy**

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