Clinical Safety & Effectiveness
Cohort # 16

Implementation of T-Piece Resuscitator (Neopuff) in University Hospital NICU

CENTER FOR PATIENT SAFETY & HEALTH POLICY

UT HEALTH SCIENCE CENTER™

SAN ANTONIO

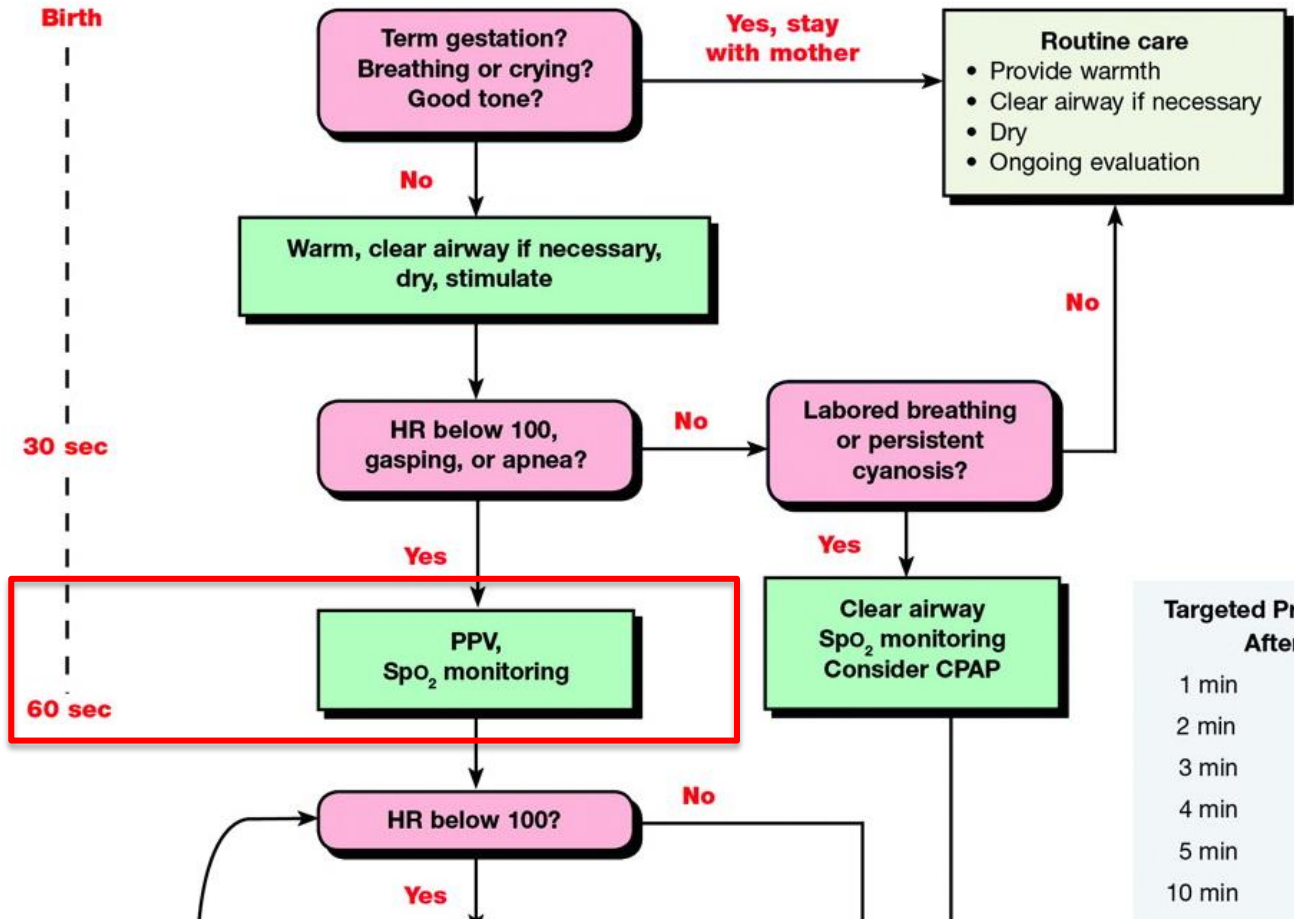
Background

- ~10% neonates require resuscitative efforts at birth

- Positive Pressure Ventilation (PPV) is key to successful resuscitation

  - Positive pressure support should be commenced at 30-60sec

Newborn Resuscitation Algorithm



Targeted Preductal SpO_2 After Birth	
1 min	60%-65%
2 min	65%-70%
3 min	70%-75%
4 min	75%-80%
5 min	80%-85%
10 min	85%-95%

John Kattwinkel et al. Pediatrics 2010;126:e1400-e1413

PEDIATRICS®

Choice of Device for PPV

- Depends on availability of gas supply
- Skills of resuscitator
- Desire to deliver pressures:
  - Peak inspiratory pressures (PIP)
  - Positive end expiratory pressures (PEEP)

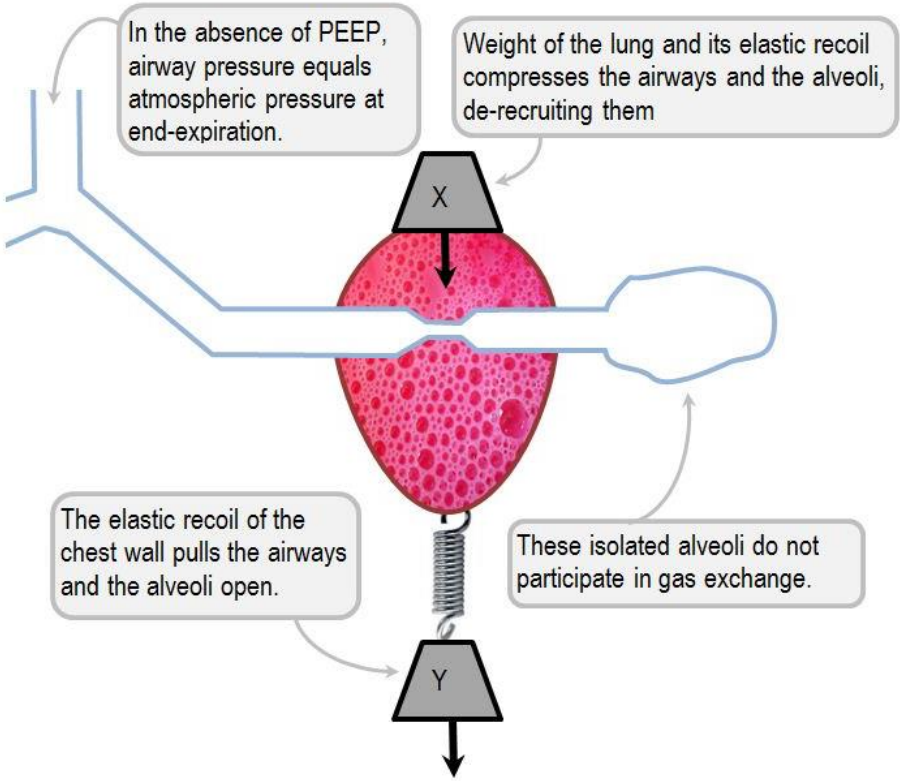
Basics of Positive Pressure Support

Ideally, PPV should be given with PEEP

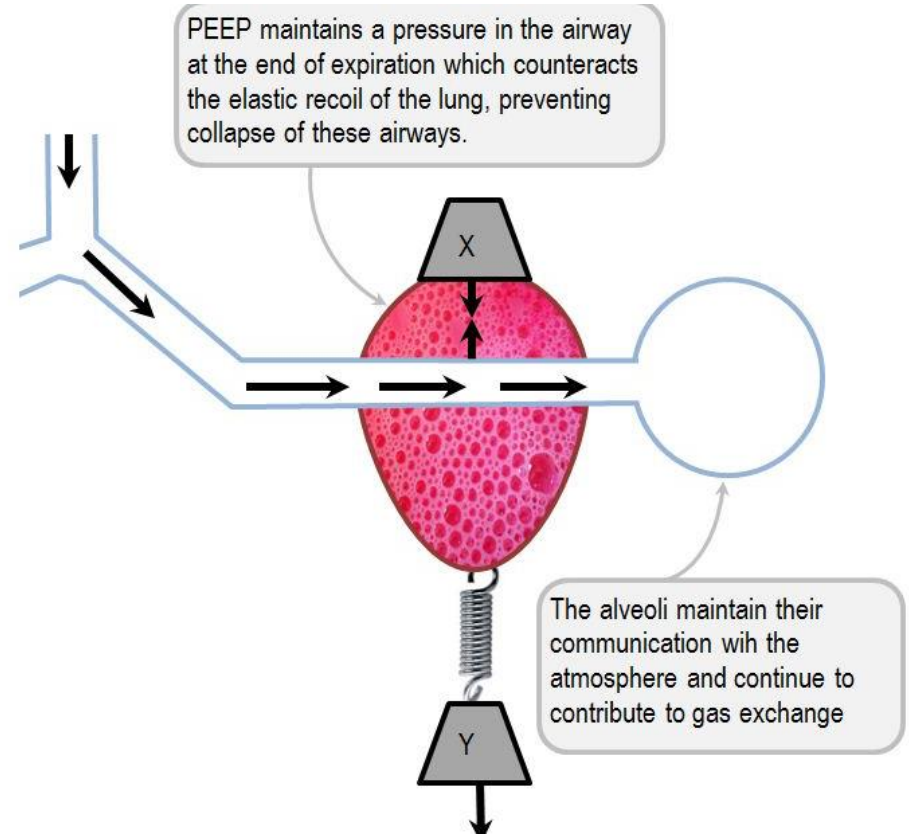
- More rapid acquisition of functional residual capacity
- Improved oxygenation and lung compliance
- Decreased lung injury

Effect of PEEP on Alveolar Volume

Without PEEP



With PEEP



www.derangedphysiology.com/php/Respiratory-failure-and-mechanical-ventilation

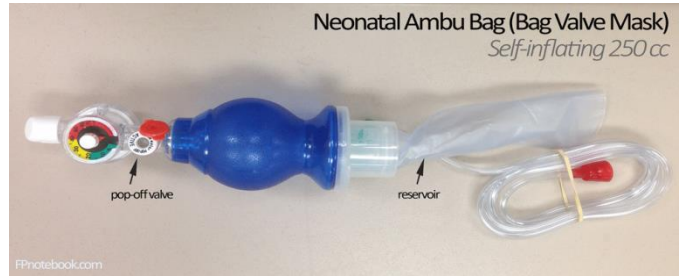
Use of Positive Pressure Support

- International guidelines state that PEEP is likely to be beneficial in stabilization of preterm neonates
  - 76% of units use PEEP

Resuscitation Devices

1. Anesthetic Rebreathing Bag
   (Current standard of care at UH)

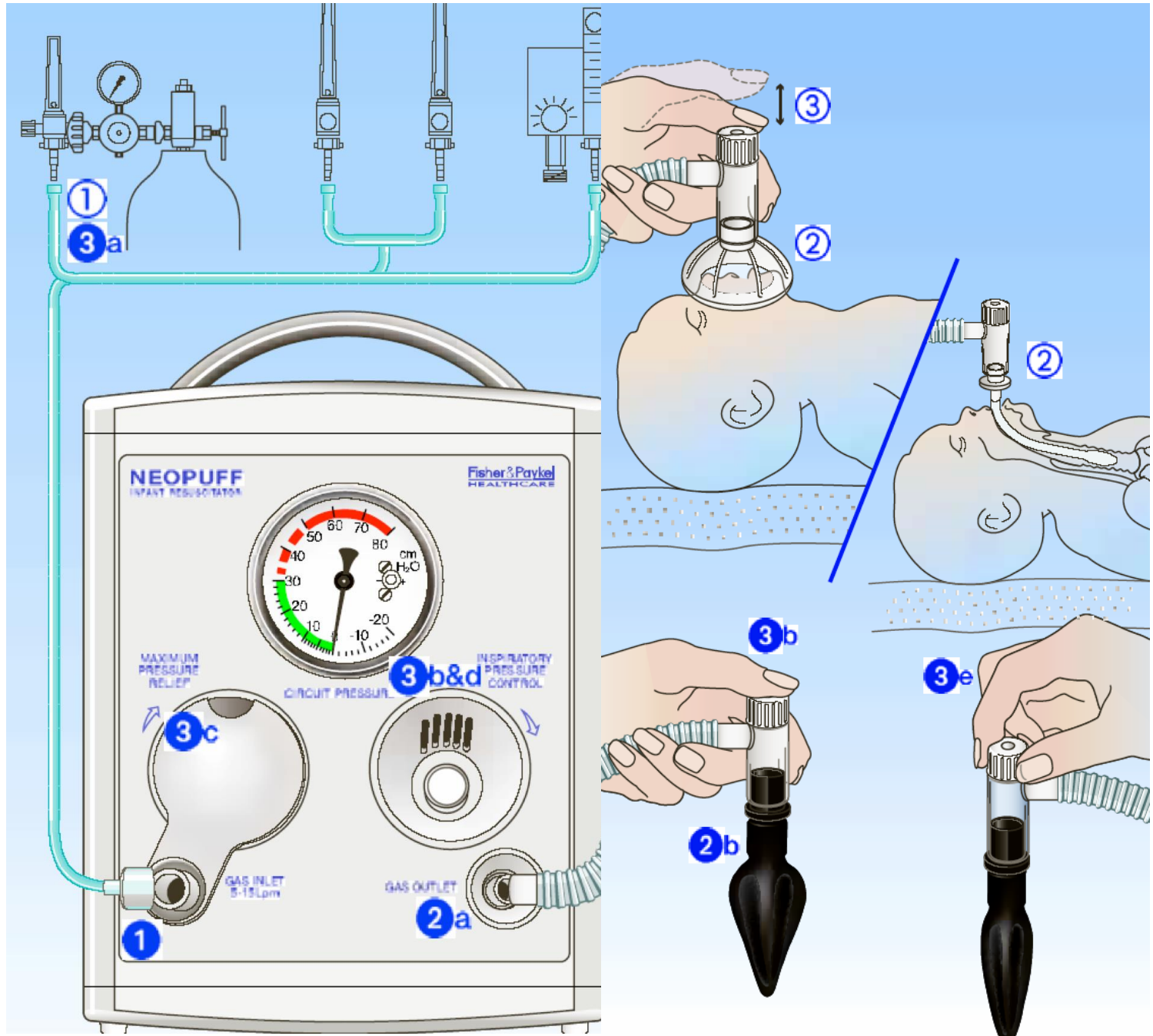
2. Self-Inflating Bag
   (Standard of care in some NICUs)



3. T-Piece Resuscitator (Neopuff)
   (Proposed standard of care at UH)

T-Piece Resuscitator (Neopuff)

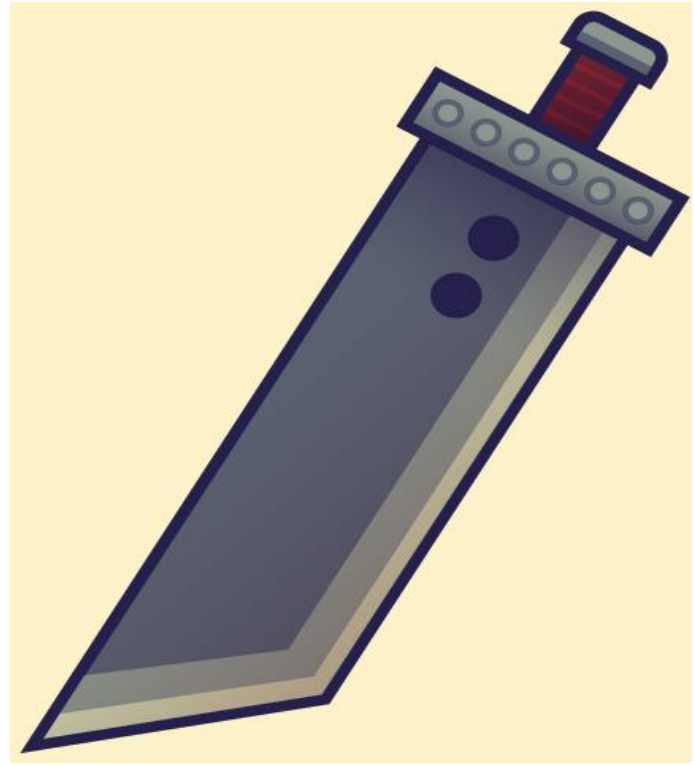
- Intrinsically provides PEEP
- Delivers more accurate and consistent PIP
- Produces more effective tidal exchange than bag-and-mask systems


NEOPUFF
INFANT RESUSCITATOR
Fisher & Paykel
HEALTHCARE
cm H2O
MAXIMUM PRESSURE RELIEF
CIRCUIT PRESSURE
INSPIRATORY PRESSURE CONTROL
GAS INLET
GAS OUTLET
1
2a
2b
2
3
3a
3b
3b&d
3c
3e

Does PPV affect subsequent neonatal outcomes?

PPV “Double Edge Sword”

- Too high of pressure
  - Over-distention
  - Increase risk of PTX & PIE
  - Histological injury to lungs
- Too low of pressure
  - Decrease HR
  - Chest compressions
  - Intubation



Recommendation by NRP

- According to the American Academy of Pediatrics / Neonatal Resuscitation Program (NRP) Guidelines
- The T-piece resuscitator should be used during DR neonatal resuscitation

Quality Improvement Cycle

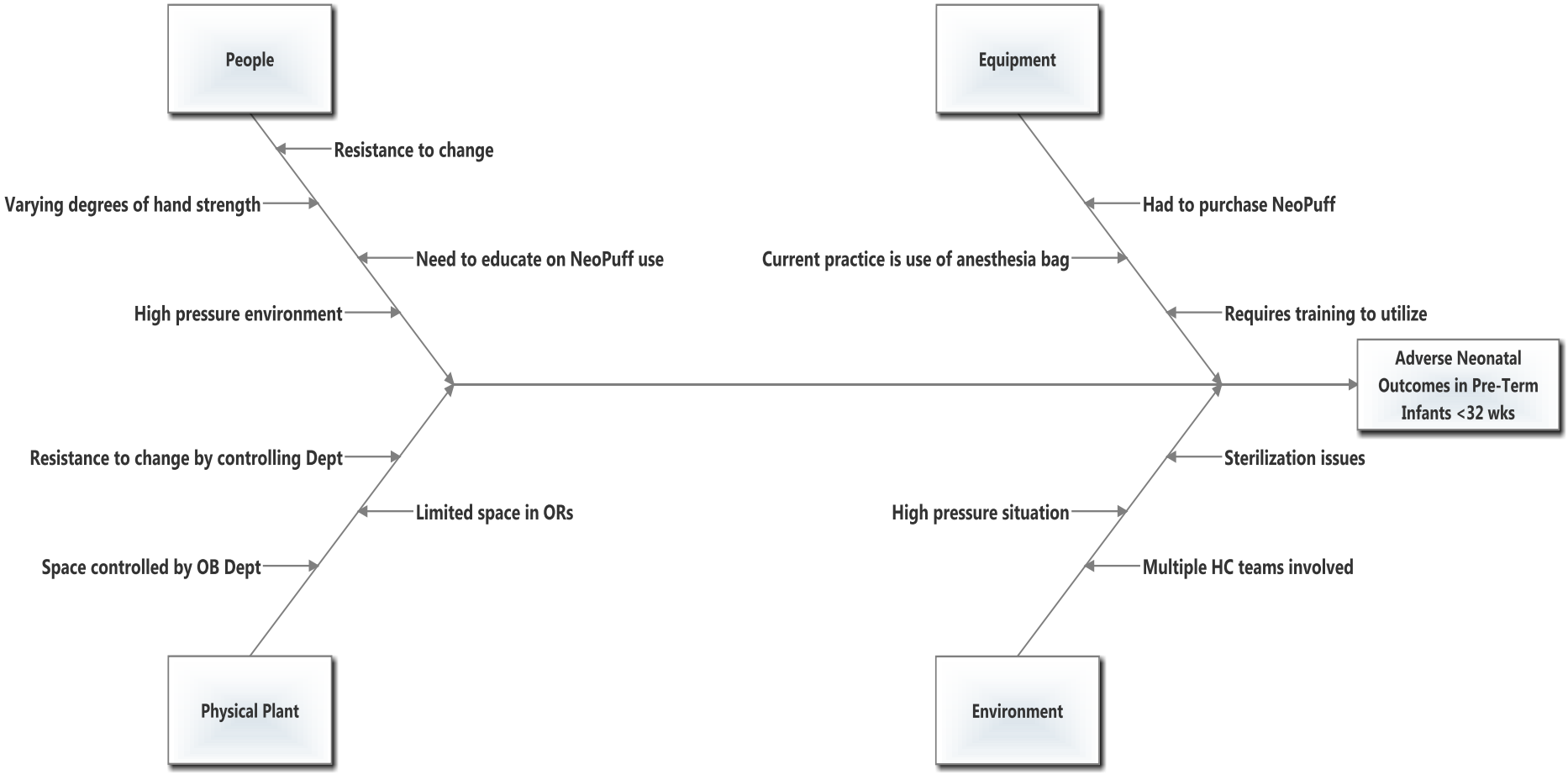
AIM Statement

To implement the use of Neopuff in the delivery room for resuscitation of preterm infants in NICU from 0 % to 50 % by May 20th, 2015

Project Milestones

• Team Created	January 2015
• AIM statement created	January 2015
• Weekly Team Meetings	Feb 2015
• Background Data, Brainstorm Sessions, Workflow and Fishbone Analyses	Feb 2015
• Interventions Implemented	March 2015
• Data Analysis	March-May 2015
• CS&E Presentation	June 5, 2015

Ishikawa Diagram



PLAN: Intervention

- Met with stakeholders and reviewed the literature about the use Neopuff; clarified the concerns of the providers
- 5 Neopuff machines were ordered by the department of Pediatrics, Neonatology division
- Planned on the use of Neopuff for PPV according to the neonatal resuscitation guidelines

PLAN: Intervention

Education of the health care providers:

- Developed the checklist and protocol for the use of Neopuff
- Respiratory therapist did in-service for all the nurses
  Organized hand on experience on the use of Neopuff for residents, NP's, fellows and attendings
- Had weekly NICU tours and answered the questions about the use of Neopuff
- Had meeting with OB-team and clarified their concerns

DO: Implementing the Change

Started the use of Neopuff on March 1st, 2015

Encountered problems:

- Missing patient supplies
- Reminders for HCP's
- Technical issues
- Follow up on overnight admissions
- Monthly meetings / Journal club discussion

CHECK: Results/Impact

- Reviewed all the charts of babies less than 32 weeks gestational age and required PPV in the DR
- Pre intervention group 28 patients
- Post intervention group 11 patients
- Relatively more premature babies in Neopuff group

CHECK: Results/Impact

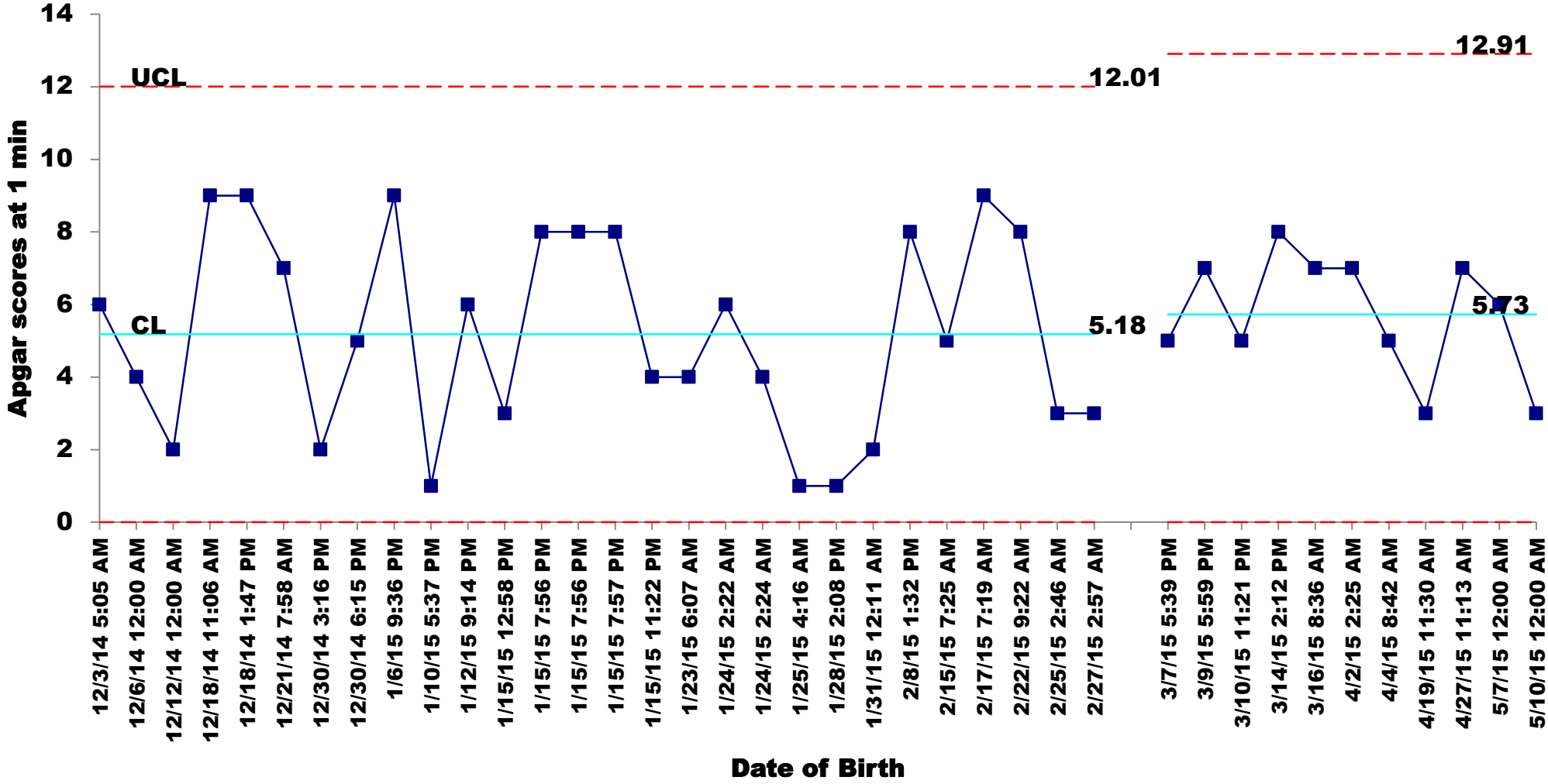
- Neonatal outcomes:

  Apgar scores at 1 & 5 mins, DR intubations,

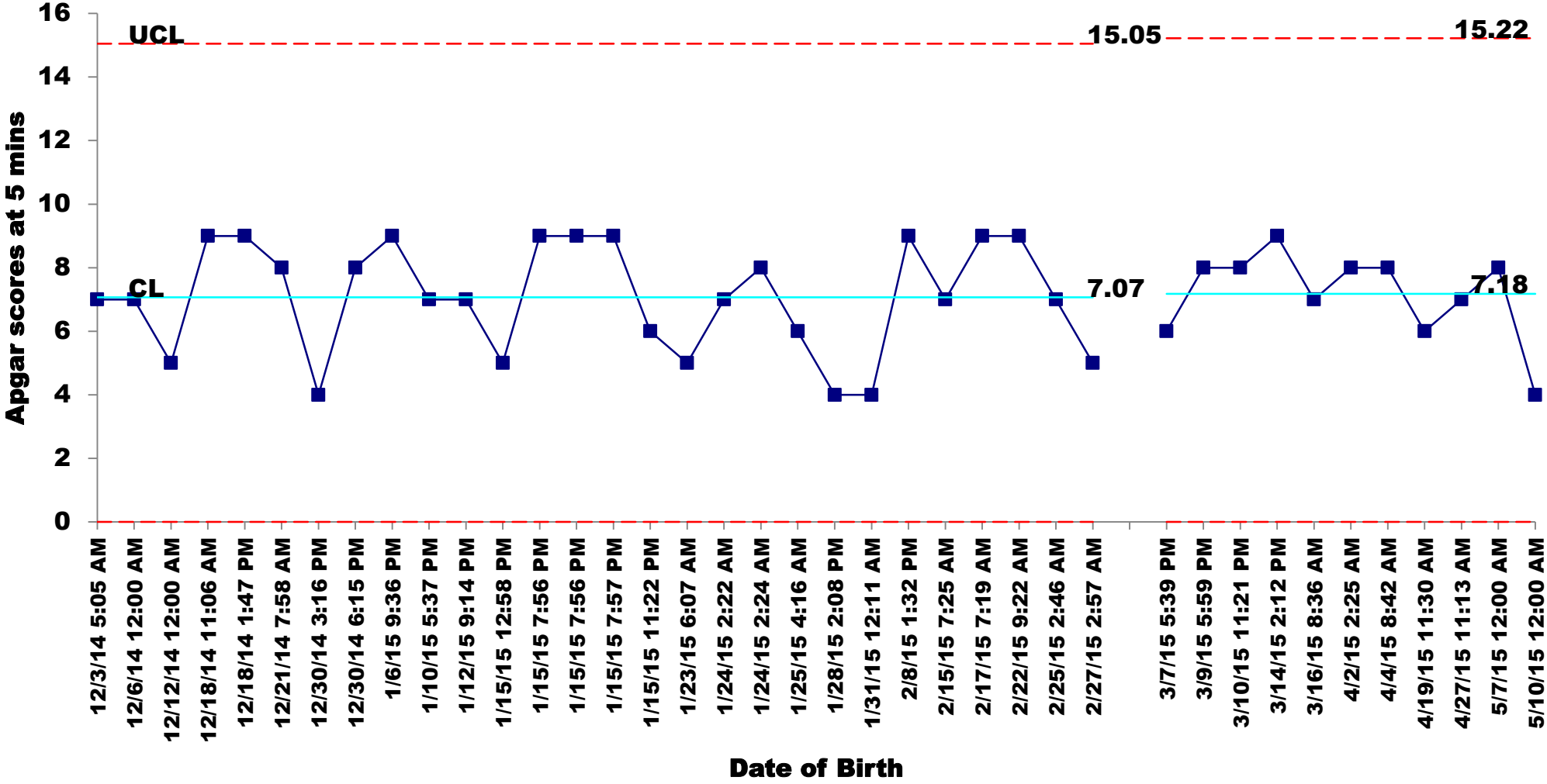
  RDS, pneumothorax, PIE, mechanical ventilation days in

  first week, IVH > grade 2, hydrocephalus
- Developed check list for data extraction
- Data were collected from chart reviews over a three month period: Dec, Jan and Feb 2015

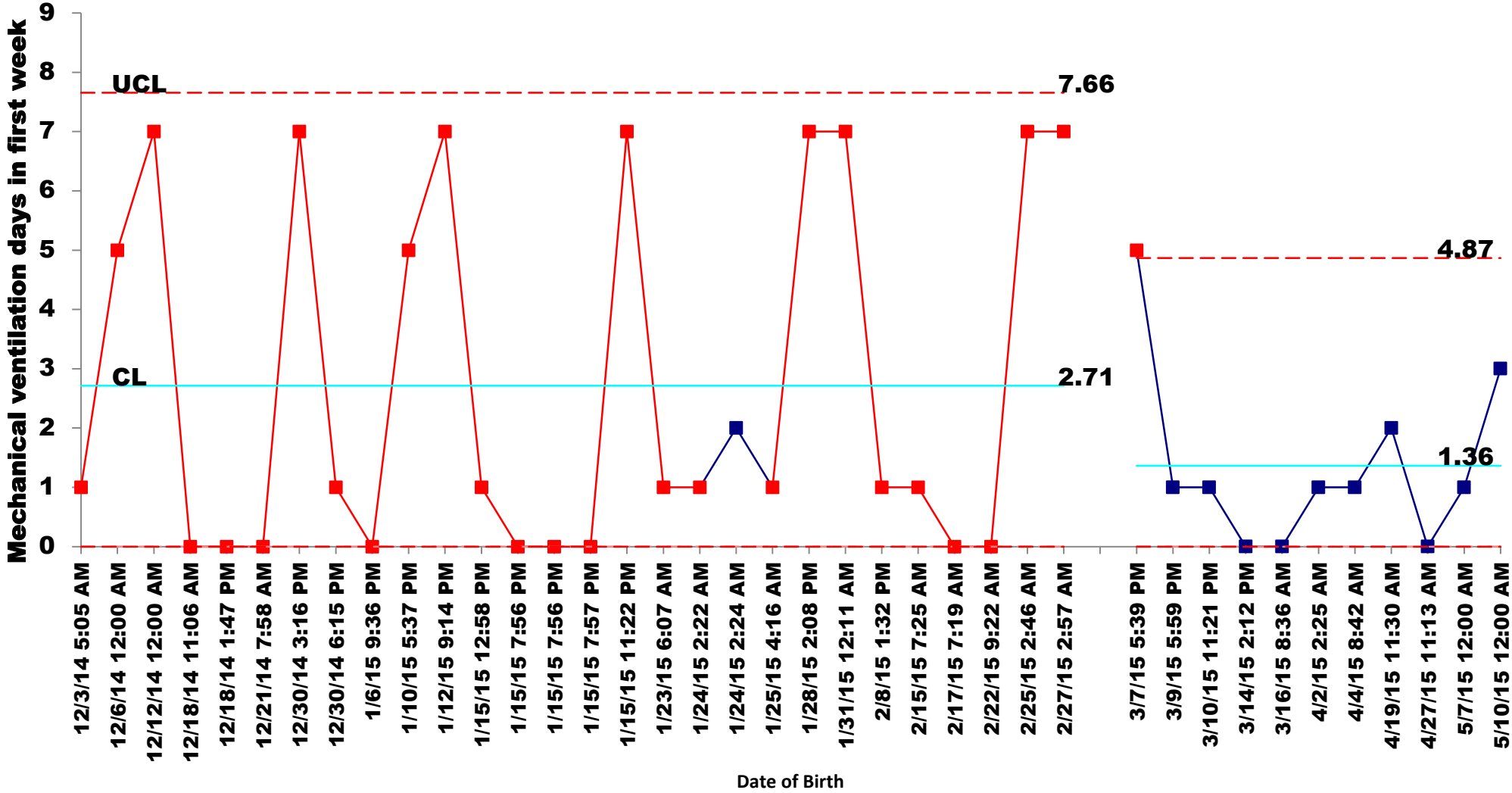
Apgar scores at 1 min
Pre and Post Neopuff



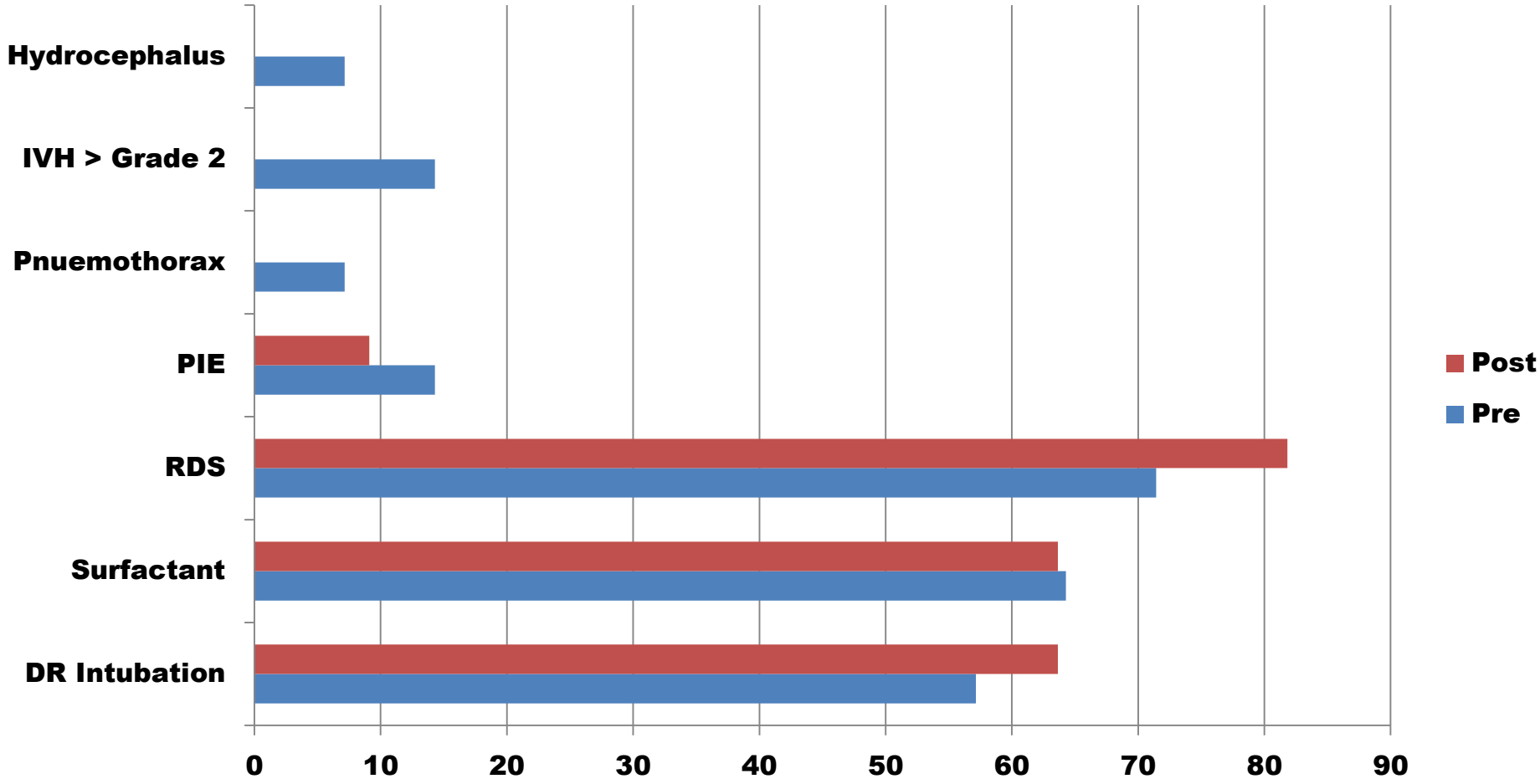
Apgar scores at 5 mins
Pre and Post Neopuff



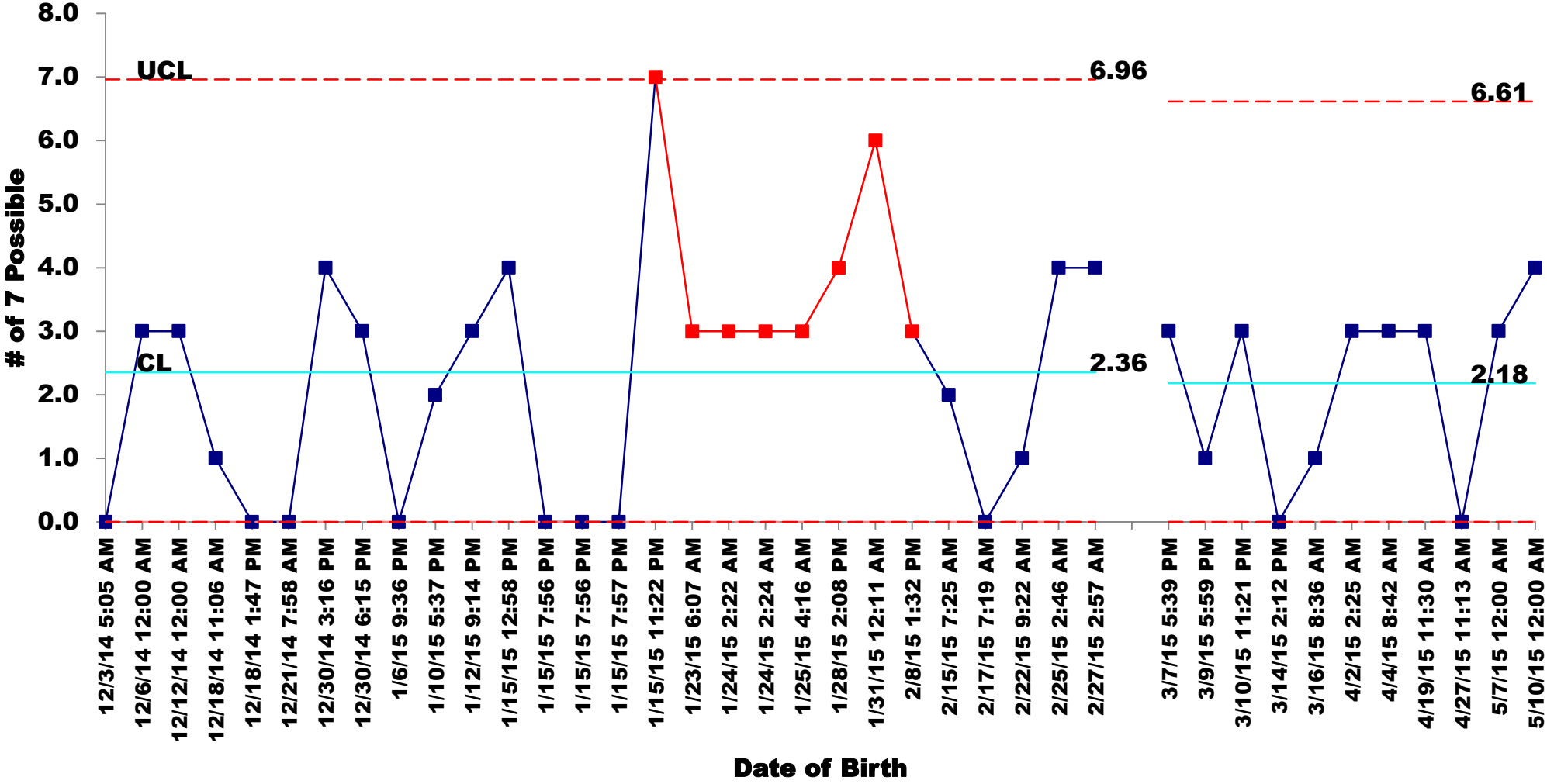
Mechanical ventilation days in first week
Pre and Post Neopuff



Neonatal Outcomes in Pre and Post Neopuff



Combined Neonatal Outcomes
Pre and Post Neopuff



ACT: Sustaining the Results

- The use of Neopuff was 100 % in the DR
- DR use of Neopuff guidelines, will be a part of NICU manual
- In-service will be provided to new employees (residents, NNP's and fellows during NICU orientation
- Respiratory therapist structured note will be embedded in the EMR which will help in the data extraction
- Every month the data will be analyzed and discussed in the NICU QI meeting

Return on Investment (ROI)

- In NICU we do “Bundle Billing” on the basis of the severity of illness and not on the basis of individual problems list like Pneumothorax, IVH etc. That is why it is difficult to determine ROI

- It will be interesting to look at the Length of stay (LOS) and will determine the ROI; but most of the babies in post-intervention group are still in-house

Return on Investment (ROI)

- What will be the LOS in babies with hydrocephalus and further neurodevelopmental outcomes ?

- Days on mechanical ventilation is associated with Bronchopulmonary Dysplasia (BPD); need to know how many babies develop BPD at the time of discharge ?

Conclusion/What's Next

We observed that in the post-intervention group

- The Apgar scores were improved or not worsened
- Babies stayed on the mechanical ventilator for less number of days
- Less number of babies developed PIE, Pneumothorax, IVH grade 2 and Hydrocephalus
- RDS and intubation rate were higher in those babies; that may be due to being more immature ?

The Team

- Syed Shah, MD
- Irene Sandate, NP
- Rachel Rivas, RN
- Rachael Farner, RN
- Eric Larson, RT
- Karen Aufdemorte, Facilitator
- Amy Quinn, MD
- Margarita Vasquez, MD
- Donald C McCurnin, MD
- Steven R Seidner, MD

Sponsor Department: Department of Pediatrics, Neonatology Division


Welcome to the
Neonatal Intensive
Care Unit
RN
RN
RN
RPh

Questions ? Comments….

Thank you!

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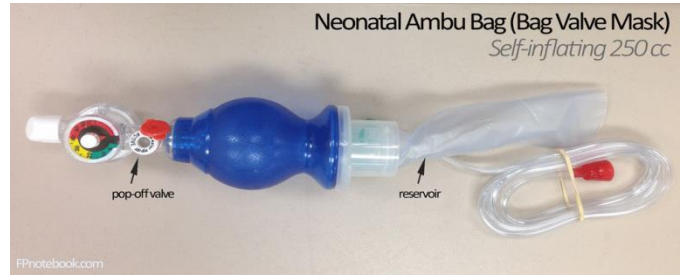
WE MAKE LIVES BETTER

Anesthetic Rebreathing Bag

- Delivered pressure and tidal volume depend on how hard bag is squeezed
  - Pressure-limiting valve
  - Manometer
- PEEP delivered by controlling rate of gas escaping from back of bag during expiration

Self-Inflating Bag (SIB)



- Depends on flow of air or O2
- Peak pressure dependent on operator
  - Valve limits maximum pressure delivered

T-Piece Resuscitator (TPR) (Neopuff)

- Requires continuous gas supply to generate set peak pressure and set PEEP

- Two ports attach to TPR
  - One port goes to oxygen (green tubing)
  - One port goes to patient (white tubing)

Literature Evidence

- Compared PPV during DR resuscitation in neonates with Neopuff (40 pts) and self-inflating bag (50 pts)
- The duration of PPV in delivery room was significantly less in Neopuff group ($p < 0.001$)
- A fewer neonates required DR intubation in Neopuff group ($p = 0.04$)
- In the Neopuff group, a higher proportion of neonates resuscitated with room air only ($p = 0.001$)

Anup Thakur et al, T-piece or self inflating bag for positive pressure ventilation during delivery room resuscitation: An RCT. Resuscitation 90 (2015) 21–24

Literature Evidence

- Studied 31 operators using a Neopuff, a self-inflating bag and a flow-inflating bag during 30 s of ventilation on a neonatal manikin
- Compared the delivery of consistent PIP of 20 or 40 cm of cm H2 O and a PEEP of 5 cmH2 O
- The Neopuff delivered the desired pressures more accurately than the two other devices

Stacie Bennett et al. A comparison of three neonatal resuscitation devices. Resuscitation 67 ; 2005