



Optimizing Non-Invasive Respiratory Support: A Quality Improvement Project

CASSIE DEMARTINO & NOA FLEISS



Background



Background: BPD

- BPD is a major cause of mortality and morbidity in very preterm infants.
- Incidence of 45% in surviving ELBW infants (BW <1,000 g).
- Despite increased use of antenatal corticosteroids, surfactant, and improved ventilation techniques, the incidence has not decreased.
- Mechanical ventilation may damage lungs and it is hypothesized that avoidance of ventilation may lead to less BDP.

Research

Non-invasive versus invasive respiratory support in preterm infants at birth: systematic review and meta-analysis

BMJ 2013 ; 347 doi: <https://doi.org/10.1136/bmj.f5980> (Published 17 October 2013)

Cite this as: *BMJ* 2013;347:f5980

Conclusions:

- One additional infant could survive to 26 weeks without BPD for every 25 babies treated with nasal CPAP in the DR rather than being intubated.

Cochrane Database of Systematic Reviews | [Review - Intervention](#) [New search](#) [Conclusions changed](#)

Prophylactic or very early initiation of continuous positive airway pressure (CPAP) for preterm infants

✉ [Prema Subramaniam, Jacqueline J Ho, Peter G Davis](#) [Authors' declarations of interest](#)

Version published: 18 October 2021 [Version history](#)

<https://doi.org/10.1002/14651858.CD001243.pub4> [↗](#)

Conclusions:

- Nasal CPAP vs MV reduces the incidence of BPD and the combined outcome of death and BPD.
- Probably no difference in NDI.

Incidence and Outcome of CPAP Failure in Preterm Infants

Peter A Dargaville¹, Angela Gerber², Stefan Johansson³, Antonio G De Paoli²,
C Omar F Kamlin⁴, Francesca Orsini⁵, Peter G Davis⁴;
Australian and New Zealand Neonatal Network

TABLE 1

Early Respiratory Management by Gestational Age Range

	25–28 wk Gestation	29–32 wk Gestation	All Infants
Total	6771	12 332	19 103
Intubated	4782	2637	7419
CPAP	1989	9695	11 684
CPAP-S (% of all CPAP)	1126 (57)	7634 (79)	8760 (75)
CPAP-F (% of all CPAP)	863 (43)	2061 (21)	2924 (25)

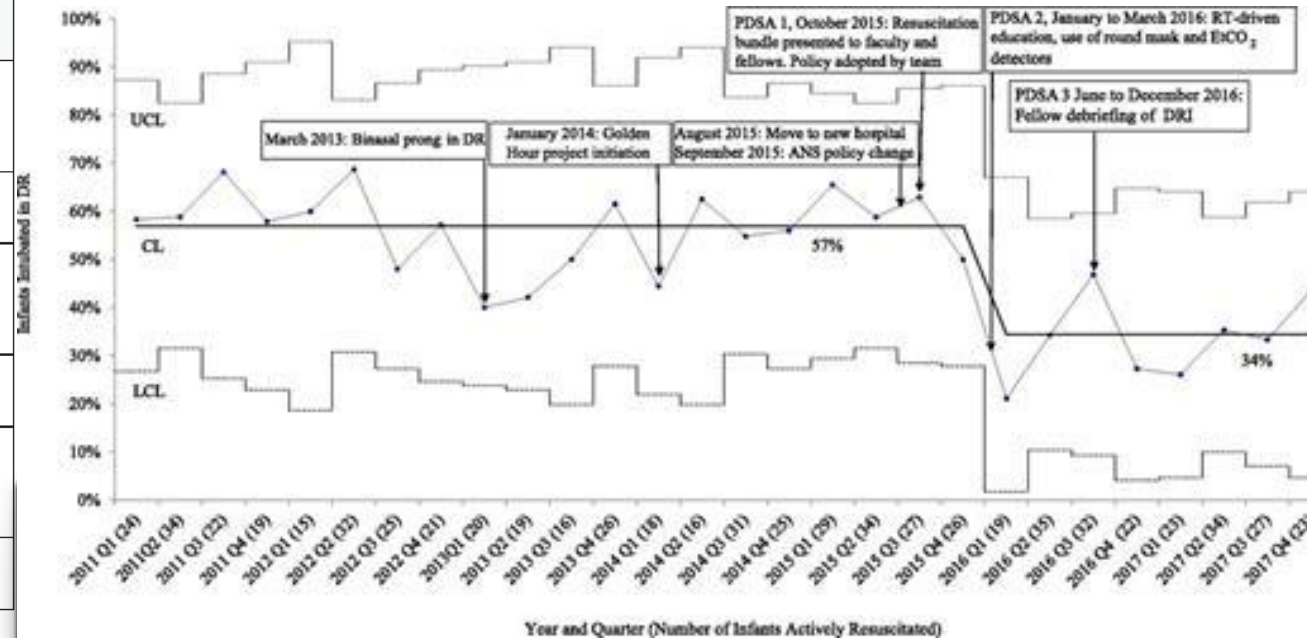
57% (1126) of 25-28 week infants were successfully managed on CPAP

Reducing DR Intubations

QI project to reduce intubations for infants ≤ 29 w
 Reduced DR intubations from **57% to 34%** over 3-year period

DR Resuscitation QI Bundle

Objective	Intervention
Improve Fm-PPV	Initiate PPV with PIP 25 and PEEP 5 if infant has bradycardia, apnea, or ineffective respiration; increase PIP to 30 as part of MRSOP steps before intubation attempt
	Increase T ₁ to 1 s if infant not responding to MRSOP steps
	Simulation-based training focused on MRSOP. Change to appropriate size round masks using size guide at the resuscitation cart. Use of ETCO ₂ detectors with Fm-PPV
	Document MRSOP
Improve documentation	Document indication for intubation. RT to double check the accuracy of documentation with the resuscitation nurse
Debriefing	Debrief after each intubation

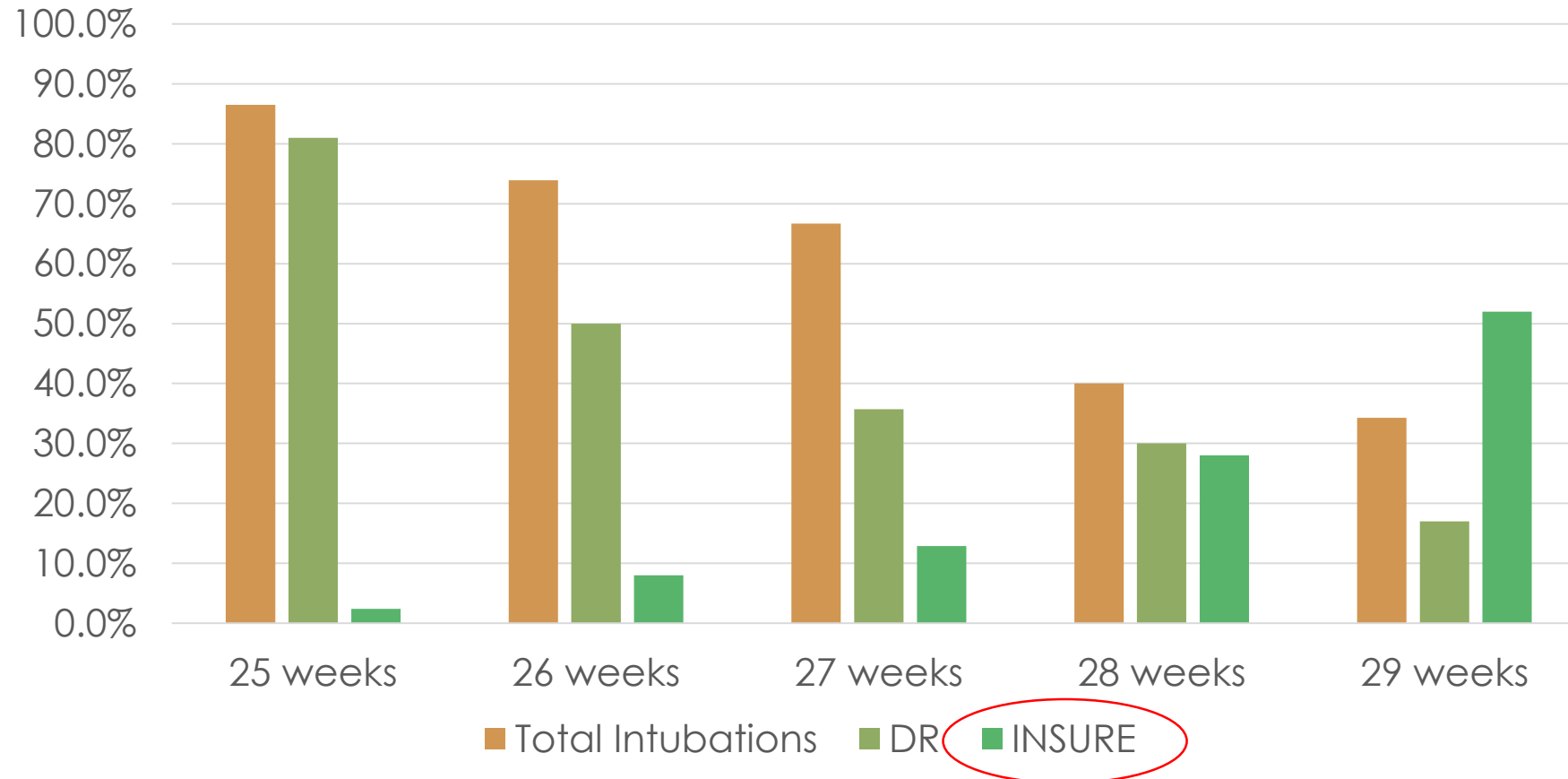


A light beige brushstroke background shape, resembling a paintbrush stroke, centered on a white background. The shape is roughly horizontal and has irregular, feathered edges.

QI Project

Yale Intubation Data: 25-29 weeks GA

1/2021-2/2023



Methods

- Retrospective chart review of all infants born between 25w0d to 29w6d was conducted from Jan 2020 to Oct 2022 to determine baseline respiratory data.
- Plan-do-study-act (PDSA) cycles planned.
- Data collected monthly from a structured data analysis report generated through the EMR.

Global Aim

Reduce long-term morbidities of mechanical ventilation, specifically BPD and IVH, in the neonatal population.

SMART Aim

Increase the percentage of infants maintained on non-invasive respiratory support from 39.5% to 60% in a 1-year period (10/1/2022-10/1/2023)

Population

Infants born between 25w0d and 29w6d gestation admitted to the Yale New-Haven York Street Campus NICU

Key Drivers

Alignment and engagement of NICU medical providers.

Optimizing non-invasive respiratory support.

Following evidenced-based delivery room management.

Utilization of the electronic health record to track and audit progress.

Interventions

Monthly multidisciplinary respiratory care meetings.

Education, training, and implementation of chin-straps for infants on CPAP or NIPPV.

Increase INSURE use.

Unit guidelines/algorithm for respiratory escalation, surfactant administration, and intubation.

Delivery room guidelines/algorithm for non-invasive respiratory support and intubation.

Optimizing caffeine administration.

Obtain and present data reports.

Legend

- Completed/Adopted/Abandoned intervention
- Potential intervention
- Active intervention



QI Measures

Primary outcome measures:

- % of intubations (total and DR)
- % of INSURE

Global aim:

- Reduce rates of BPD
- Reduce rates of IVH

Process measures:

- DR intubations
- Compliance with DR respiratory guidelines

Balancing measures:

- Pneumothorax
- ROP

Active Interventions: Monthly Multidisciplinary Respiratory Care Meetings

- Medical Leadership
- Attendings
- Fellow
- APPs
- Nurse Educations
- Nurse Leadership
- Respiratory Therapist



Active Interventions: Chin Strap Use

- NeoTech chin straps regularly used for all infants ≤ 29 weeks on non-invasive support.
- Encouraged use of chin straps in the DR:
 - Small Baby DR Guidelines
- No adverse events reported
 - One infant with gastric perforation Dec 2022 however, after discussion with team members, this was unlikely to be due to chin strap use.



Active Interventions: Small Baby DR Respiratory Guidelines

- Guidelines part of small baby DR bundle (<29 weeks) that went live April 2023.
- Includes recommendations for respiratory support and intubation criteria.

Delivery Room Respiratory Care

TPR Initial Settings:

- 25/6, FiO₂ 0.3 for infants <29 weeks
- 20/6, FiO₂ 0.21 for infants ≥29 weeks

Infants <29 weeks:

- Immediate mask CPAP if breathing
- Titrate PIP up to 30 if poor chest rise or bradycardia
- **Transition to nasal CPAP/NIPPV with INCA prongs as soon as possible**
- **Place chin strap if on CPAP/NIPPV**

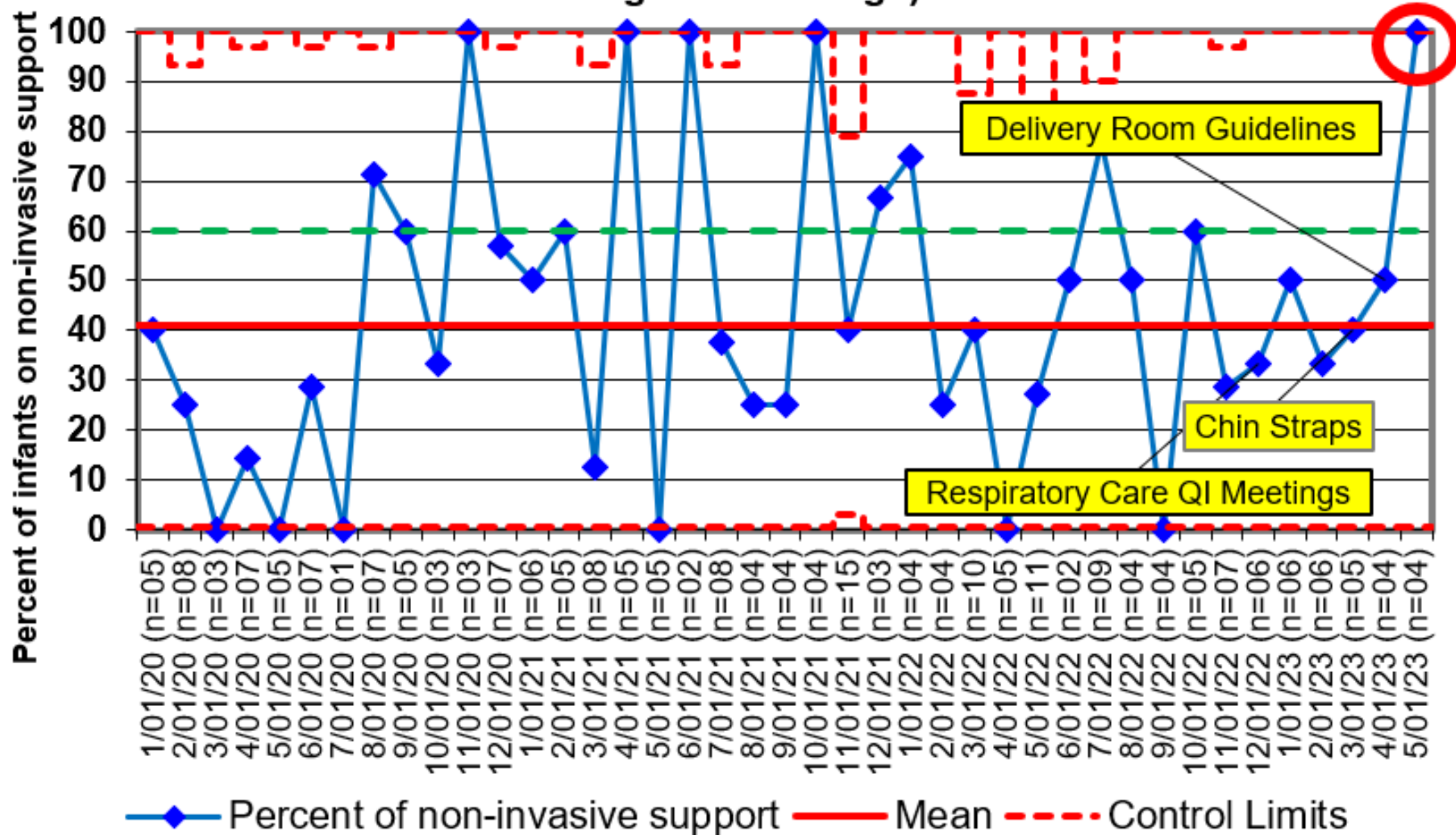
Intubation Criteria (for first hour of life only):

- Frequent apnea despite adequate trial of NIPPV
- Bradycardia (HR <100) despite effective PPV
- FiO₂ >0.60 despite adequate trial of nasal CPAP/NIPPV

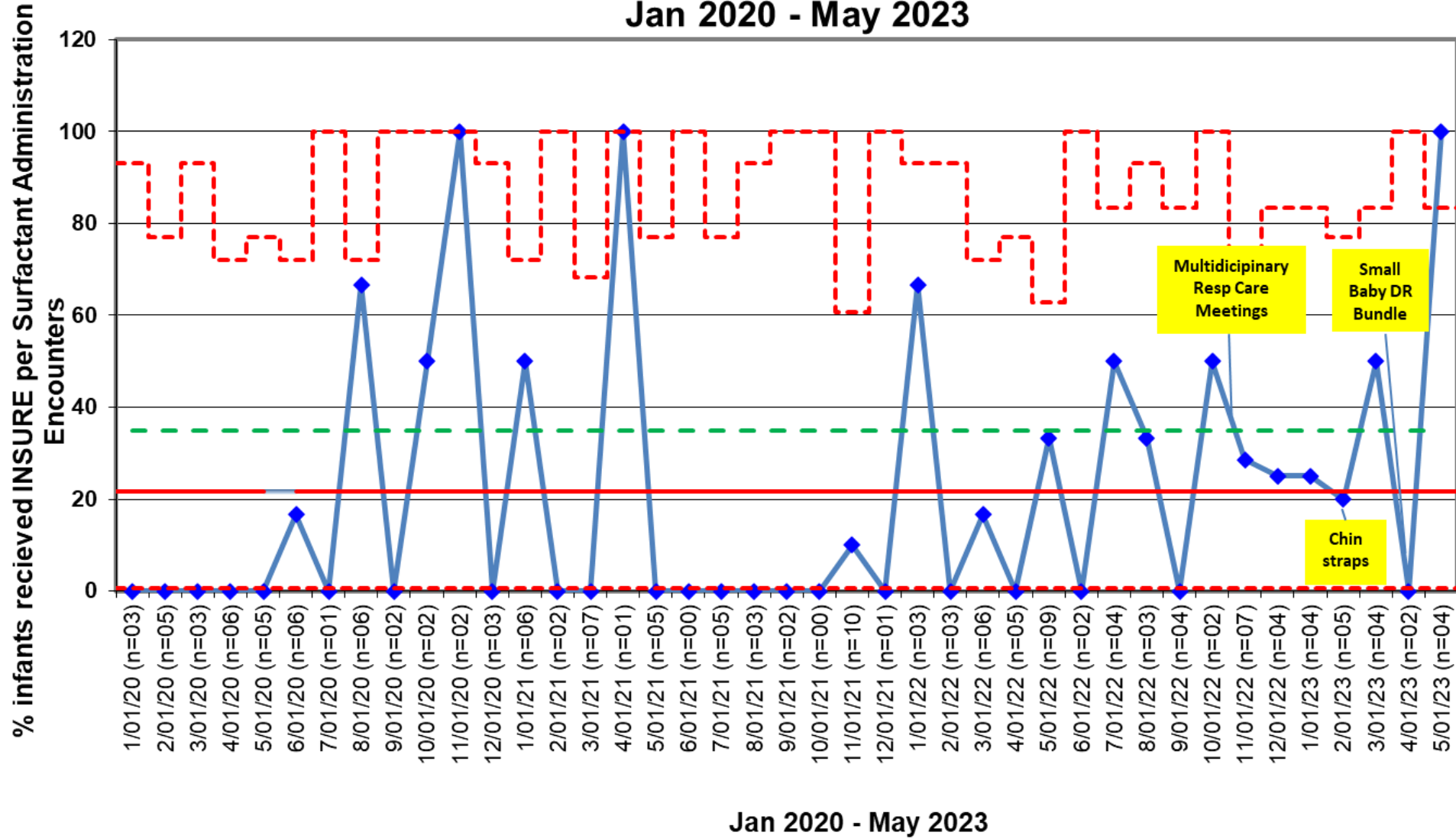
Active Interventions: Staff Engagement

- Shifting culture away from invasive to non-invasive
- Monthly QI data reports shared with the division
- Non-invasive “success” stories posted in the monthly nursing newsletters

Infants Maintained on Non-Invasive Support (25-29 weeks gestational age)

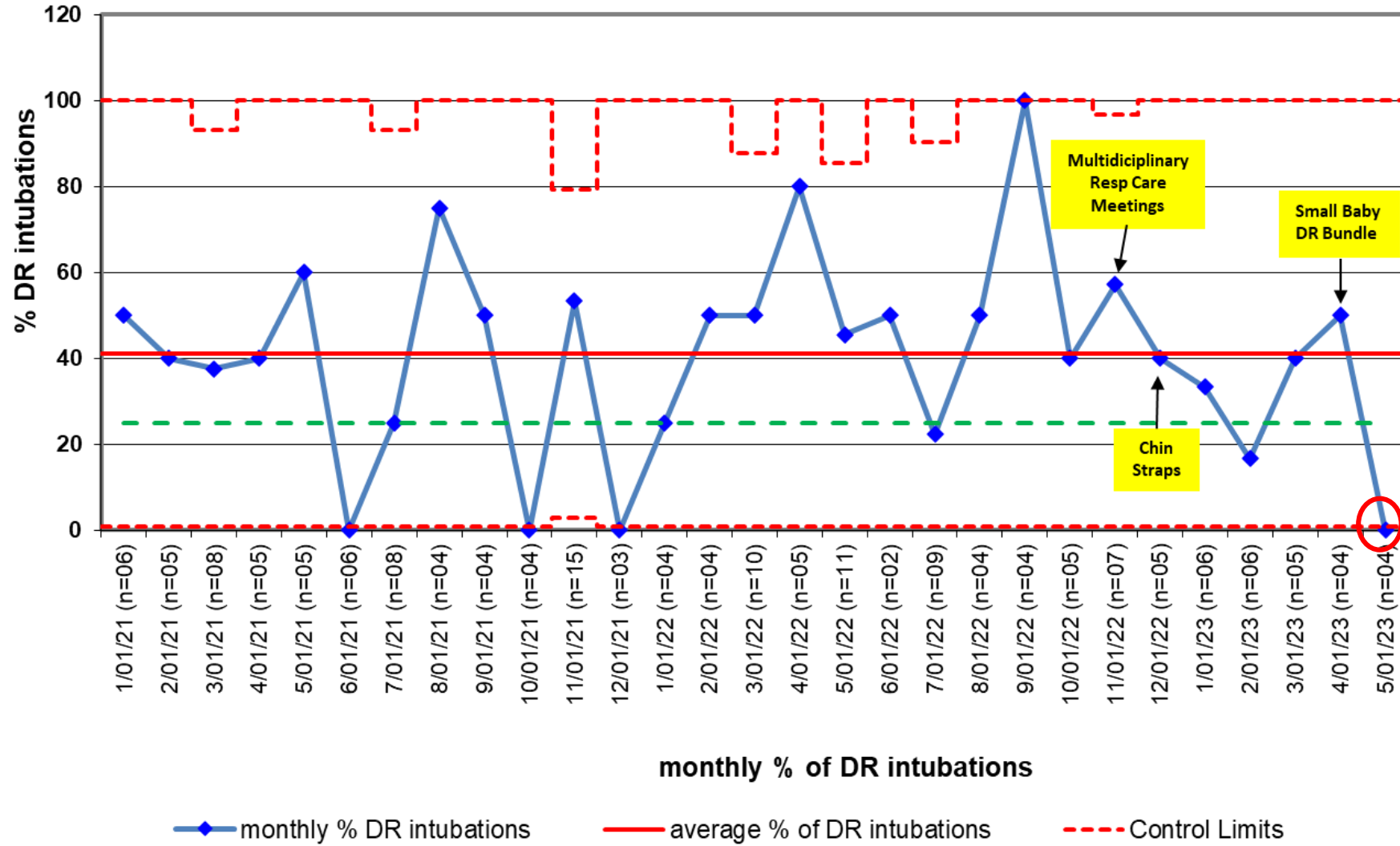


Infants 25-29 weeks who recieved INSURE Jan 2020 - May 2023



◆ Monthly % of infants who received INSURE
 — Average of infants who received INSURE
 - - - Control Limits

Delivery Room Intubations (Jan 2021-May 2023)



Next Steps:

- Update VLBW delivery room note to include respiratory section to track compliance with our DR guidelines
- Continue to increase staff engagement
- Administration of caffeine in the DR
- Increase INSURE use