

# Initiating the use of non-invasive respiratory support following delivery of 27–30 week gestation infants in a Level III NICU



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## KEYWORDS

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Extremely premature infants;  
Respiratory distress syndrome (RDS);  
Neonatal intensive care unit (NICU);  
Quality improvement

**Abstract** Historically it has been common practice to intubate and give surfactant to extremely premature infants. The most recent evidence-based literature has shown this practice results in similar outcomes to infants treated with non-invasive respiratory support (NIRS) with selective surfactant administration following delivery. The need for an evidence-based practice change was identified at Integris Baptist Medical Center-Neonatal Intensive Care Unit (IBMC-NICU) and steps taken to implement new practice following the delivery of extremely premature infants. To date seventeen infants have been managed with the new practice in place. The new practice has resulted in a culture change in the unit leading to more evidence-based changes.

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## Introduction

In early 2014, the Committee on Fetus and Newborn released a policy statement on respiratory support in preterm infants following delivery. The committee found after reviewing multiple randomized controlled studies that the use of early nasal continuous positive airway pressure (NCPAP) with the use of early selective surfactant treatment in extremely premature infants resulted in decreased rates of bronchopulmonary dysplasia (BPD) or death when compared to historical practice of intubation with prophylactic surfactant administration at delivery. This evidence-based knowledge led to the introduction of a practice change at Integris Baptist Medical Center-Neonatal Intensive Care Unit (IBMC-NICU). The goals of the practice change were to reduce delivery room intubations, surfactant administration, days on mechanical ventilation, and the incidence of BPD or death in infants 27–30 weeks gestation. In infants between 27 to 30.6 weeks gestation delivered at IBMC (P), does initial management with non-invasive positive pressure ventilation (NIPPV) and treatment with rescue surfactant (I), as compared with historical practice of intubation and surfactant in the delivery room (C), decrease the number of mechanical ventilation (MV) days, and decrease the incidence of BPD (O)?

## Historical practice

At IBMC-NICU the practice was to intubate and administer surfactant in the delivery room to premature infants born between 27 to 30 weeks gestation. Neonatal respiratory distress syndrome (RDS) begins after birth and increases in severity over the first days of life. RDS is a disease of pulmonary insufficiency (Sweet et al., 2013, 27). Classic presentation of RDS is cyanosis, grunting, retractions, and tachypnea, if continues untreated the infant will likely die from respiratory failure. Surfactant deficiency has been identified as the primary cause of RDS in premature infants. The use of surfactant in the treatment of neonatal RDS has become the gold-standard for premature infants.

## Evidence-based literature

A review of literature reveals that application of early NIRS in the delivery room has comparable outcomes to prophylactic surfactant administration

in the delivery room, making it the preferred mode of respiratory management owing to its less invasive nature. Current research assessing the use of prophylactic surfactant in the delivery room and early NIRS has resulted in improved long-term outcomes in extremely low birth weight (ELBW) infants.

A study performed by Sandri et al. (2009) concluded that early management with NCPAP over early prophylactic surfactant resulted in improved outcomes in premature infants. Researchers stated the need for further study specifically regarding prophylactic intubation, surfactant, extubation method (InSurE) versus early selective InSurE. Sandri et al.'s (2009) research promotes the initial management of respiratory needs in the ELBW infants with NCPAP.

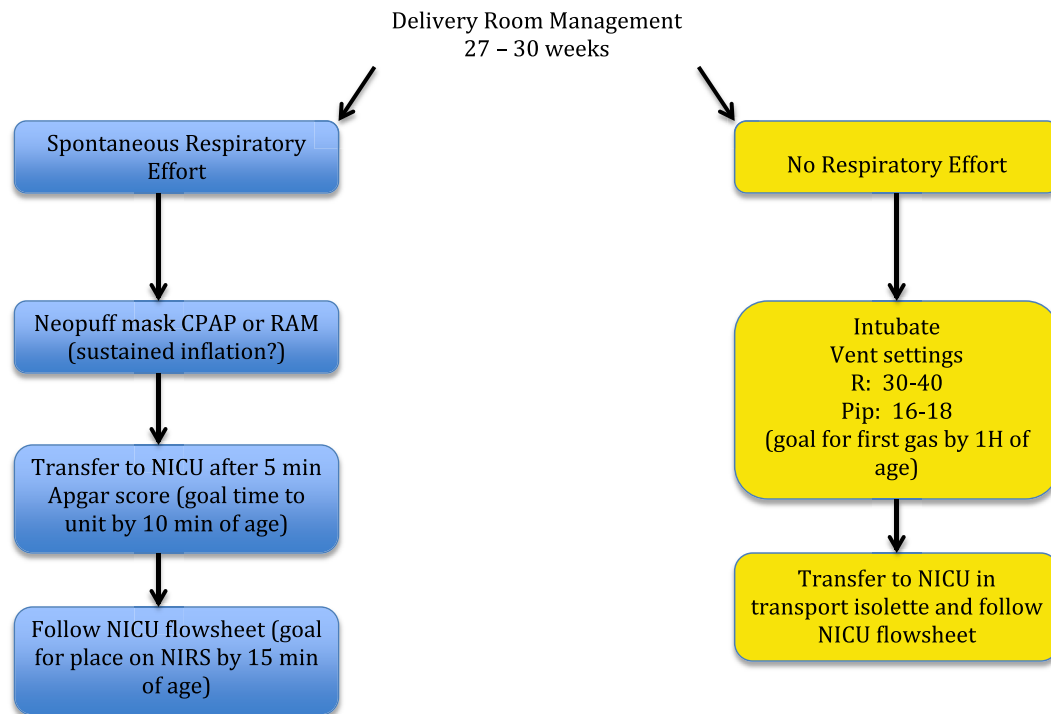
Rojas et al. (2009) investigated the implementation of the immediate use of NCPAP with early surfactant treatment for ELBW infants. Their research concluded that the need for subsequent MV was decreased in the group treated with early surfactant. The researchers did consider the need for additional research concerning trauma caused by intubation for surfactant administration.

Finer et al. (2010) observed no substantial outcome differences in ELBW infants managed with early NCPAP and limited exposure to MV versus early surfactant administration occurring in the first hour following birth; thus, supporting the idea that even 24–27 week infants may do as well with NIRS when compared to prophylactic surfactant and MV. The researchers discovered an increased need for intubation and surfactant administration in infants randomly treated with NCPAP, but this was an anticipated result due to the extremely premature nature of the infants involved.

With the current literature available it is evident there remains a need for additional research regarding the different treatment modalities to evaluate the long-term outcomes of ELBW infants. The need for change at IBMC-NICU was evident. Utilization of current evidence-based research was used to implement practice change.

## Implementation of practice change

All inborn infants between 27 to 30 weeks with spontaneous respiratory drive were managed with non-invasive respiratory support (NIRS) in the delivery room. In infants lacking a respiratory drive the existing practice was utilized. A flow chart (Fig. 1) was developed and used to define practices



Adapted from "Figure 9-1 Process flow chart," Geary, M. & Clanton, C. (2011a). Developing metrics that support projects and programs. In J. L. Harris, L. Roussel, S. E. Walters, & C. Dearman (Eds), *Project planning and management: A guide for CNLs, DNP's, and nurse executives* (p. 128). Sudbury, MA: Jones & Bartlett.

**Fig. 1** Flow charts designed to be used in delivery room and at bedside to give visual reference for non-invasive respiratory management (Dearmon and Davis, 2011).

for intubation with early surfactant after failed management with NIRS. Both intubation and surfactant administration logs (Fig. 2) were maintained and records gathered on all infants between 27 to 30 weeks gestation. The practice change outcomes focus on mortality, need for intubation, need for surfactant, days on MV, and BPD defined as the need for oxygen at 36 weeks corrected gestation.

## Subjects

This practice change included all infants born between 27 to 30 weeks gestation. Each infant included in the data collection was born at IBMC and not transferred in from other facilities. Both male and female infants were included. Data was collected on every infant born at IBMC between January of 2015 to April of 2015 meeting the inclusion criteria.

Exclusion criteria to the practice change included patients with significant facial anomalies, airway obstructions, tracheoesophageal fistulas, congenital diaphragmatic hernia, known genetic disorders, and potentially life-threatening disorders unrelated to prematurity. At this time there are approximately nine infants that met criteria and were managed with the practice change.

## Setting

IBMC-NICU is a level III NICU with six board certified neonatologists, seven full-time neonatal nurse practitioners, four part-time neonatal nurse practitioners, three advanced practice nurse interns, multiple nationally certified registered nurses, and respiratory therapists. The infants were enrolled in the project at the time of delivery. The delivery settings included patient

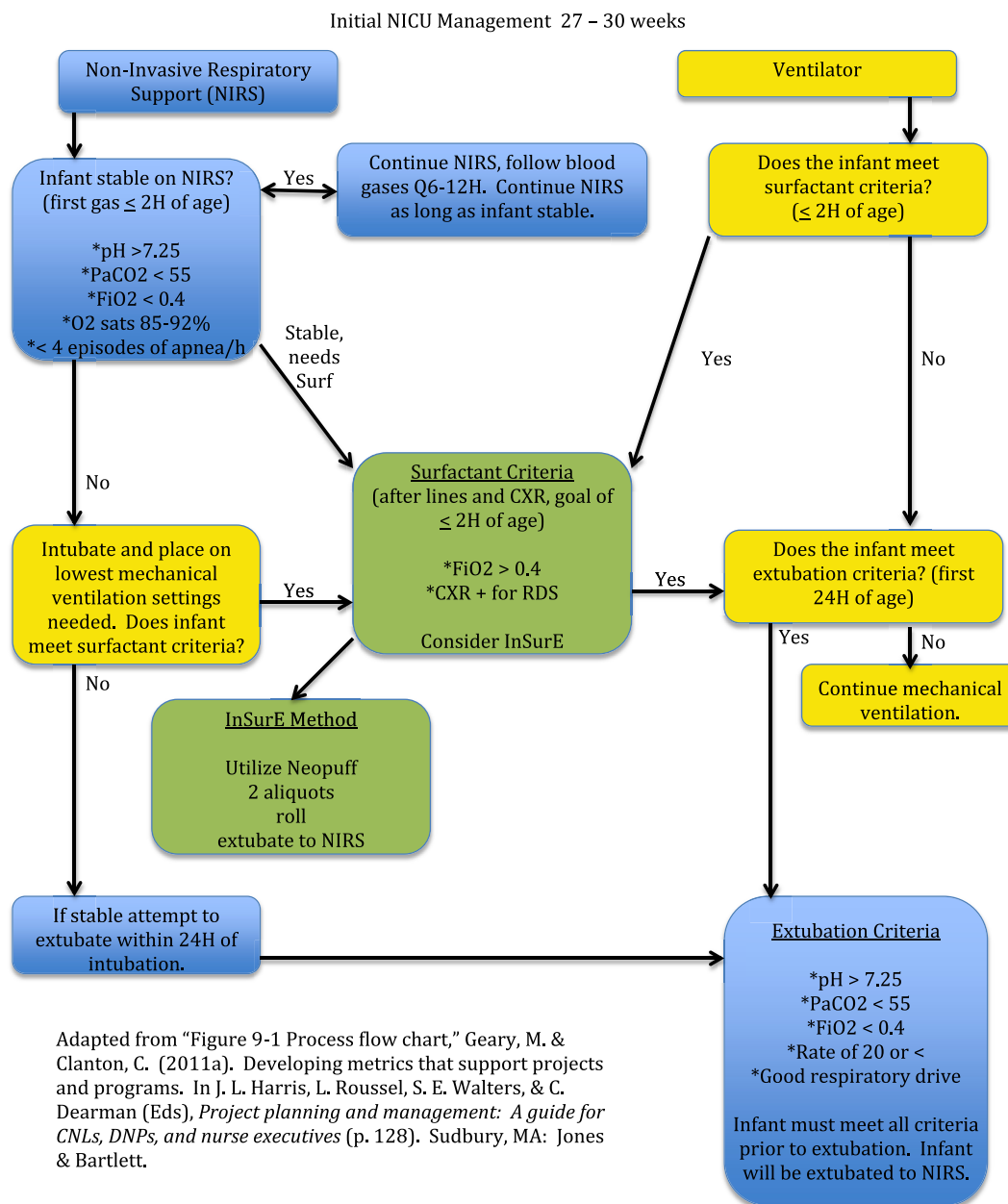


Fig. 1 Continued.

delivery rooms and also the cesarean suites. The delivery setting created the first issue impacting the practice change. The delivery room and cesarean suites are small and tightly cramped making it difficult to bring in extra equipment and personnel needed to begin implementing the change. Most of the radiant warmers used during delivery are equipped with the ability to provide positive pressure ventilation (PPV). It was necessary to configure the setting to result in the best outcomes. It was essential to identify each

person's role in the delivery room prior to the infant's delivery.

After stabilization in the delivery room or cesarean suite the infant was transported to the NICU on PPV and placed immediately on NIRS. Each infant meeting inclusion criteria for the practice change had a flow chart placed at the bedside (Fig. 1) as a visual reference for the bedside nurse and respiratory therapist. The flow chart was utilized to increase understanding and compliance.

## Individual Patient Log

Patient Name: \_\_\_\_\_ MRN: \_\_\_\_\_

DOB: \_\_\_\_\_ Gestation: \_\_\_\_\_

Intubated at delivery: \_\_\_\_\_ yes \_\_\_\_\_ no

1. Intubated: \_\_\_\_\_ yes \_\_\_\_\_ no Date/Time: \_\_\_\_\_

Surfactant #1: \_\_\_\_\_ yes \_\_\_\_\_ no Date/Time: \_\_\_\_\_

Surfactant #2: \_\_\_\_\_ yes \_\_\_\_\_ no Date/Time: \_\_\_\_\_

2. NIRS following delivery: \_\_\_\_\_ yes \_\_\_\_\_ no

\_\_\_\_\_ RAM \_\_\_\_\_ NCPAP

Surfactant #1: \_\_\_\_\_ yes \_\_\_\_\_ no Date/Time: \_\_\_\_\_

Surfactant #2: \_\_\_\_\_ yes \_\_\_\_\_ no Date/Time: \_\_\_\_\_

3. Extubated to:

\_\_\_\_\_ RAM \_\_\_\_\_ NCPAP \_\_\_\_\_ VT \_\_\_\_\_ RA Date/Time: \_\_\_\_\_

4. O2 at 36 weeks: \_\_\_\_\_ yes \_\_\_\_\_ no Type: \_\_\_\_\_

**Fig. 2** Individual log to keep in patient's chart throughout hospital stay.

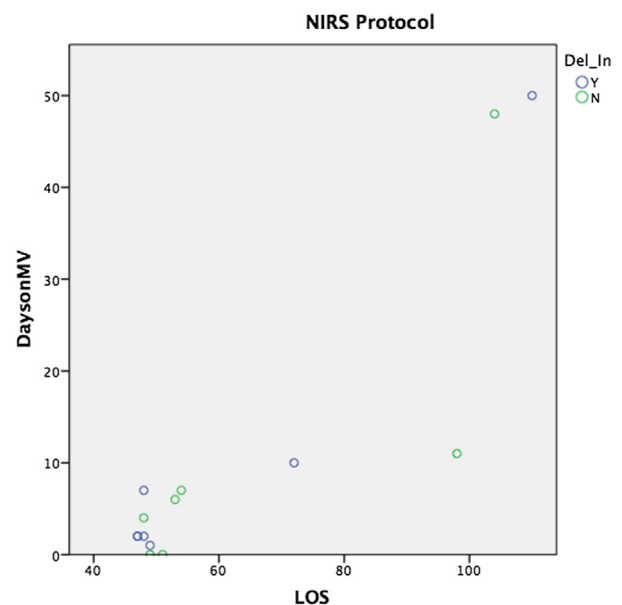
## Tools

Additional quality improvement tools were not needed for the practice change. Staff compliance is difficult to measure and assure. Staff was asked to follow the flow chart and the NNP or neonatologist made final decision on NIRS failure. Staff was educated on the flow chart, given a project summary, and granted access to the evidence-based literature that lead to the initiation of the practice change. A power point presentation was developed and presented at staff meetings for the bedside nurses.

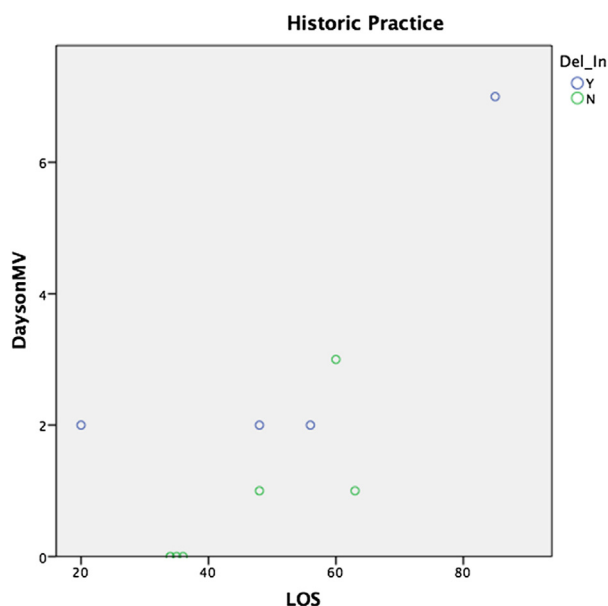
## Outcomes

The practice change was implemented on January 1, 2015. Between January 1, 2015 and April 30, 2015 there were fourteen infants born at IBMC meeting inclusion criteria. Infants ranged in age from 27.0 weeks gestation to 30.6 weeks gestation. The group included male and female patients. Seven infants were intubated at delivery due to poor respiratory effort. Ten of the fourteen infants required surfactant administration. The average gestational age

**Table 1** Depicts scatter plot comparing length of stay and days on mechanical ventilation of infants intubated in the delivery room.



**Table 2** Depicts scatter plot comparing length of stay and days on mechanical ventilation of infants intubated in the delivery room.



was 28.5 weeks gestation, the average birth weight was 1088 g, and the average number of days on MV was 10.7 days. A Pearson correlation coefficient was calculated for the relationship between participants days on MV and need for oxygen (O<sub>2</sub>) at 36 weeks gestation. A strong negative correlation was found ( $r(12) = -0.629$ ,  $p < 0.05$ ) indicating a significant linear relationship between the two variables. Infant with a >number of MV days have an increased need for O<sub>2</sub> at 36 weeks gestation. A scatter plot graph has been developed revealing days on MV and length of stay (LOS) in infants managed with NIRS or intubation at delivery (Table 1).

A retrospective comparison has been done on infants of similar gestation comparing results from historic practice to new practice. From January 2014 to April 2014 there were 10 infants born between 27 to 30.6 weeks gestation. Of those 10, four were intubated at delivery, four were treated with surfactant, none required oxygen at 36 weeks gestation, and one died. The average gestational age was 29 weeks gestation, the average birth weight was 1316 g, and the average number of days on MV was 1.8 days. A Pearson correlation coefficient was calculated for the relationship between participants days on MV and need for oxygen (O<sub>2</sub>) at 36 weeks gestation. A weak correlation that was not significant was found ( $r(8) = -0.034$ ,  $p > 0.05$ ). Indicating that increased MV days do not effect the need for O<sub>2</sub> at 36 weeks gestation. A scatter plot

graph has been developed revealing days on MV and length of stay (LOS) in infants managed with NIRS or intubation at delivery (Table 2).

## Conclusion

Implementation of this practice change has resulted in a culture change in the unit. It has resulted in a change in practice and continues to change the way the unit as a whole manages this extremely premature population. Initial non-compliance with the practice change has been eliminated and staff is excited to participate in the practice. The unit and patients have both benefitted from the change. Infants of a certain gestation are no longer automatically intubated based on gestational age, but each is individually assessed at the time of birth and respiratory support individualized to the patient's needs. As a result of the practice change it is still necessary to follow the outcomes of the infants treated and continue to expand to all gestational ages.

## Disclosure statement

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