

Using Quality Improvement Tools to Reduce Chronic Lung Disease



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KEYWORDS

- Chronic lung disease • Respiratory care • Potentially better practices
- Key driver diagram • Quality improvement

KEY POINTS

- Overall chronic lung disease (CLD) rates have not decreased appreciably in the past 20 years when compared to other neonatal morbidities and new approaches may need to be taken.
- Studies have demonstrated reduction in CLD by use of following strategies: avoidance of intubation by application of early CPAP/non-invasive ventilation, selective use of surfactant, initiation of caffeine, gentle ventilation and extubation strategies for intubated infants.
- Development of a local quality improvement initiative using the best available evidence, along with multidisciplinary involvement of team members can lead to success in reducing CLD rates.

INTRODUCTION

Despite the increased use of exogenous surfactant administration, increased access to antenatal steroids for mothers threatening preterm delivery, and substantial advancements in respiratory care, the overall incidence of chronic lung disease (CLD) has remained stubbornly elevated in the very low birthweight (VLBW) population over the past two decades.¹ During this time period, other improvements in medical care have led to substantial decreases in the incidence of other morbidities of VLBW infants, such as hospital-acquired bloodstream infections, necrotizing enterocolitis (NEC), severe interventricular hemorrhage, and severe retinopathy of prematurity.

CLD was first described by Northway and colleagues² in 1967, and these early cases were usually seen in premature infants with severe respiratory distress syndrome (RDS) who received positive pressure ventilation and oxygen administration. This chronic

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pulmonary disease was descriptively named bronchopulmonary dysplasia (BPD) because of the pathologic changes of injury and cellular repair of the parenchyma of the lung tissue, coupled with alterations in growth of the developing lung. Before the advent of mechanical ventilation, infants with RDS had high mortality rates because it was the leading cause of death in live-born premature infants; after the introduction of mechanical ventilation in neonatal care, BPD was seen primarily as a disease of mechanically ventilated late preterm infants. In modern times, because of advancements in neonatal care, infants at this gestation now rarely have severe pulmonary-related morbidity, and CLD is primarily seen in smaller preterm infants.

CLD is currently defined as need for supplemental oxygen for infants at 36 weeks corrected postmenstrual age,³ although there remains a spectrum of severity of illness for infants with this diagnosis. Newer definitions have been proposed to reflect this reality with the following classification: mild CLD is need for supplemental oxygen at 28 days, but not at 36 weeks post-menstrual age (PMA); moderate BPD is need for supplemental oxygen at 28 days and less than 30% oxygen at 36 weeks PMA; and severe BPD is need for supplemental oxygen at 28 days and greater than 30% oxygen at 36 weeks PMA and/or positive pressure ventilation at 36 weeks PMA.⁴

Quality improvement (QI) projects have become a mainstay of neonatal care over the past decade, with an increasing number of publications devoted to this topic. Neonatal intensive care units (NICUs) are well positioned for QI projects because of a long-standing history of participation in data collection, data benchmarking, and collaborative learning opportunities that exist throughout neonatology.⁵

Borrowing liberally from manufacturing and other industries, medicine has started to embrace the theory and methodology of QI science and how to apply that science to their daily work in improving the care of infants and families in their respective NICUs.

There have been several single-center and multicenter publications that have demonstrated QI projects leading to a reduction in CLD,^{6–8} but there has been no sustained overall decrease in CLD rates in VLBW infants in large national data sets.^{1,9,10} Many interventions that are described at the unit-level have either not been translatable or have not been successful in a broad application across a multitude of NICUs. This disparity between successful local initiatives and lack of widespread improvement likely highlights the importance of local context. Although any QI effort needs to structure its measures and interventions to the local environment, this may be particularly true for neonatal respiratory care, where the complex nature of CLD requires specific interventions and culture change that may not be easily translated from one NICU to another.¹¹

This article examines several strategies to reduce CLD in premature infants. It is hoped that the information provided is useful to neonatal providers seeking to evaluate or improve respiratory care practices in their NICU with a goal of reducing the burden of CLD in their patients and their families.

QUALITY IMPROVEMENT FOR CHRONIC LUNG DISEASE: GENERAL CONSIDERATIONS

A broad and expansive description of QI science and methods has been discussed extensively in other articles and is not included here. However, several common principles are important to apply when focusing on QI for CLD reduction. A specific QI project for CLD, similar to other projects, must be based on best available evidence in the medical literature, expert recommendations, or based on work by previous QI initiatives. Clinical practices that have the potential to improve the outcomes of neonatal care are known as potentially better practices (PBPs).¹²

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