

# NEONATOLOGY TODAY

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 c/o Mitchell Goldstein, MD  
 11175 Campus Street, Suite #11121  
 Loma Linda, CA 92354  
 Tel: +1 (302) 313-9984  
[LomaLindaPublishingCompany@gmail.com](mailto:LomaLindaPublishingCompany@gmail.com)

# Advancing Neonatal Respiratory Care with AI-Driven Clinical Intelligence: The Emerging Value of Etiometry in the NICU

Evan Butler

*“Respiratory instability remains one of the most prevalent and complex challenges in neonatal intensive care, particularly among preterm infants and those requiring mechanical ventilation. Despite continuous monitoring technologies such as pulse oximetry and ventilator-derived parameters, clinicians often lack integrated tools to synthesize these data streams and support review of oxygenation trends within hospital-defined workflows.”*

## Introduction:

Respiratory instability remains one of the most prevalent and complex challenges in neonatal intensive care, particularly among preterm infants and those requiring mechanical ventilation. Despite continuous monitoring technologies such as pulse oximetry and ventilator-derived parameters, clinicians often lack integrated tools to synthesize these data streams and support review of oxygenation trends within hospital-defined workflows. In parallel, key aspects of respiratory management, particularly carbon dioxide monitoring, still rely on intermittent measurements and indirect indicators to guide clinical decision-making. These limitations can contribute to variability in care and increase the risk of complications, including bronchopulmonary dysplasia (BPD), retinopathy of prematurity (ROP), prolonged mechanical ventilation, and repeated invasive procedures.

Recent advances in clinical intelligence platforms have introduced the potential to transform continuously collected physiologic data into actionable insights. [Etiometry's Clinical Intelligence Platform](#) integrates high-frequency bedside monitoring data with advanced analytics and AI-based risk algorithms to support real-time clinical decision-making. A growing body of clinical evidence suggests that this approach may enhance the precision, safety, and efficiency of neonatal respiratory care.

This article reviews recent studies and clinical data highlighting the emerging value of Etiometry in neonatal care, with a focus on oxygen management, ventilation strategies, and non-invasive tracking of hypercapnia.

## Optimizing Oxygen Therapy and Clinical Outcomes:

Maintaining oxygen saturation within a defined target range is a

*“This article reviews recent studies and clinical data highlighting the emerging value of Etiometry in neonatal care, with a focus on oxygen management, ventilation strategies, and non-invasive tracking of hypercapnia.”*

cornerstone of neonatal care, yet achieving consistent compliance remains difficult. Both hyperoxia and hypoxia are associated with adverse outcomes. Hyperoxia has been linked to the development of ROP, while fluctuations in oxygenation contribute to the pathogenesis of BPD. (1, 2)

A retrospective study utilizing Etiometry-derived data evaluated oxygen saturation (SpO<sub>2</sub>) compliance in 879 preterm infants receiving oxygen therapy. The study found that mean compliance with target SpO<sub>2</sub> ranges was only 44.7%, highlighting the challenge of maintaining optimal oxygenation in routine practice. Hyperoxic events occurred more frequently than hypoxic events, and the number of clinically intervenable events increased with decreasing gestational age. Importantly, lower compliance with target ranges was associated with a higher incidence of both ROP and BPD, with odds ratios demonstrating significantly increased risk among infants with poor compliance. (3)

These findings underscore the importance of continuous, high-resolution monitoring of oxygenation beyond simple threshold alarms. By capturing SpO<sub>2</sub> and FiO<sub>2</sub> data continuously and identifying periods of deviation from target ranges, the Etiometry platform enables clinicians to recognize actionable patterns and intervene more effectively. This capability represents a shift toward proactive oxygen management, with potential implications for reducing long-term morbidity. (1)

## Adjunctive CO<sub>2</sub> Risk Information to Support Clinician Review:

Continuous assessment of carbon dioxide levels remains a significant limitation in neonatal care. While pulse oximetry provides reliable oxygenation data, no equivalent non-invasive continuous standard exists for pSpO<sub>2</sub>. Blood gas sampling, therefore, remains the primary method for assessment but is invasive, intermittent, and resource-intensive.

The IVCO<sub>2</sub> Index provides additional information on the risk of inadequate carbon dioxide ventilation, using physiologic and laboratory inputs, supporting clinician review alongside primary clinical data. A recent retrospective cohort study in a Level IV NICU evaluated outcomes before and after implementation of this algorithm in 614 infants.

Following implementation, there was a statistically significant reduction in blood gas measurements per day (0.44 vs 0.40 per day, p=0.02), despite the post-implementation cohort

demonstrating higher acuity, including increased ventilator days and higher respiratory severity scores. Importantly, hypercapnia ( $p\text{SpO}_2 > 60$  mmHg) was detected unchanged. (4)

### **Enhancing Ventilation Management and Extubation Decisions:**

Mechanical ventilation is essential in the management of neonatal respiratory failure but is associated with risks including ventilator-induced lung injury and prolonged hospitalization. Determining the appropriate timing for extubation is a critical and complex decision that requires careful assessment of respiratory readiness and the risk of failure.

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*“Recent studies have explored the role of Etiometry in optimizing ventilation strategies. A study conducted at Children’s of Alabama and the University of Alabama at Birmingham demonstrated an association between the use of Etiometry’s Clinical Intelligence Platform and a 30% reduction in mechanical ventilation duration in pediatric and neonatal patients undergoing automated spontaneous breathing trials. (5)*

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*In addition, a multicenter study from Boston Children’s Hospital evaluated Etiometry’s risk analytics algorithms in patients undergoing congenital cardiac surgery. The study evaluated relationships between risk analytics outputs and extubation-failure outcomes, providing additional information for clinician review. (6)”*

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In addition, a multicenter [study](#) from Boston Children’s Hospital evaluated Etiometry’s risk analytics algorithms in patients undergoing congenital cardiac surgery. The study evaluated relationships between risk analytics outputs and extubation-failure outcomes, providing additional information for clinician review. (6)

Together, these findings highlight how time-aligned physiologic data may support clinician review of respiratory trajectory during extubation-readiness workflows and their evaluations of reducing both premature extubation and unnecessary prolongation of mechanical ventilation. The platform provides adjunctive information to help clinicians evaluate SBT/ERT performance alongside other clinical data.

### **Advancing SpO<sub>2</sub> Risk Review in Neonatal Care:**

Routinely collected physiologic data can provide useful context for reviewing carbon dioxide ventilation risk in neonatal care. A recent [study](#) published in the Journal of Perinatology <sup>7</sup> evaluated the use of Etiometry’s platform to support the review of hypercapnia risk in neonates, demonstrating how physiologic data can help clinicians assess respiratory status alongside other clinical information.

This capability has been further supported by regulatory advancements, including U.S. Food and Drug Administration clearance of an adjunctive index that indicates an increasing risk of inadequate carbon dioxide ventilation in neonatal patients. The index is intended to bring the patient to the clinician’s attention for review and should be interpreted alongside other clinical data when clinically appropriate.

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*“The integration of adjunctive respiratory-risk information into NICU workflows represents an important step toward broader adoption of AI-enabled clinical decision support. These tools may help care teams review patient status, support timely clinical awareness, and evaluate respiratory trends within existing hospital workflows.”*

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### **Discussion:**

The growing body of evidence supporting Etiometry’s Clinical Intelligence Platform suggests that it offers meaningful benefits across several domains of neonatal care. First, in oxygen management, the platform supports visualization of adherence to hospital-defined SpO<sub>2</sub> targets for clinician review. Associations between oxygenation patterns and ROP/BPD were reported in the literature and were observational.

Second, in ventilation management, the platform supports more precise and individualized decision-making by integrating continuous physiologic data with predictive analytics. This has been associated with reductions in mechanical ventilation duration

and improved assessment of extubation readiness.

Third, in carbon dioxide monitoring, the ability to predict hypercapnia non-invasively addresses a longstanding clinical challenge. In one retrospective cohort, blood gas measurement frequency was lower, whereas hypercapnia detection on blood gas analysis remained unchanged. The IVCO<sub>2</sub> Index is an adjunct and not a substitute for blood samples.

Importantly, these benefits have been observed even in higher-acuity populations, suggesting that the platform is robust and adaptable across a range of clinical scenarios. Rather than replacing clinical judgment, Etiometry enhances it by providing a continuous, data-driven perspective that complements traditional monitoring approaches.

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***“Etiometry’s Clinical Intelligence Platform represents a significant advancement in the application of artificial intelligence and data analytics in neonatal care. By transforming continuous physiologic data into actionable insights, it enables clinicians to deliver more precise, proactive, and patient-centered care.”***

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**Conclusion:**

Etiometry’s Clinical Intelligence Platform represents a significant advancement in the application of artificial intelligence and data analytics in neonatal care. By transforming continuous physiologic data into actionable insights, it enables clinicians to deliver more precise, proactive, and patient-centered care.

Current observational evidence suggests that platform-supported workflows may support clinician review of oxygenation trends, ventilation-related data, and adjunctive respiratory-risk information. As further studies are conducted and adoption expands, such technologies are likely to play an increasingly central role in the evolution of neonatal intensive care.

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**Disclosures:** The author is the Chief Operating Officer and Co-Founder of Etiometry

**NT**

Corresponding Author



Evan Butler  
Chief Operating Officer and Co-Founder  
Etiometry  
Email: [samantha@bellmontpartners.com](mailto:samantha@bellmontpartners.com)

Evan Butler is an engineer and entrepreneur who co-founded Etiometry in 2010. Previously, he worked at Boston Children’s Hospital in the Pediatric Cardiac Bioengineering Laboratory, where he designed, built, and tested novel surgical robots and tools. Evan was also a NASA GSRP Fellow at the Dryden Flight Research Center and developed intelligent flight control systems. He received his bachelor’s degree in Physics and Aerospace Engineering and his master’s degree in Dynamics and Control Engineering from Boston University. Evan has published conference papers, journal articles, and a book chapter in the fields of medical predictive analytics, concentric tube robots and tools for minimally invasive beating-heart surgery, and intelligent flight control systems. Evan has received multiple awards, including the 2010 IEEE Transactions on Robotics Best Paper Award.