Using Nightingale to Identify Opportunities for Improvement

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As Director of Data Systems and Analytics at Vermont Oxford Network, Erika Edwards has developed content for and presented training programs on data and reporting resources for quality improvement. She oversees all member reporting and database research, and participates in development of data collection tools. In addition, she is a Research Assistant Professor of Mathematics and Statistics at the University of Vermont. Prior to joining Vermont Oxford Network she was a statistical analyst at the Vermont Department of Health, Boston University School of Public Health, and the Robert Wood Johnson Foundation. Erika has a M.P.H. and a Ph.D., both in Epidemiology, from Boston University.

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Dr. Soll is the H. Wallace Professor of Neonatology at the University of Vermont College of Medicine, the President of Vermont Oxford Network, and Director of Network Clinical Trials. Dr. Soll is an authority in evidence-based medicine and randomized clinical trials. He is the coordinating editor of the Cochrane Neonatal Review Group of the Cochrane Collaboration and author or co-author of the Cochrane Reviews of surfactant therapy. He is the author of numerous peer reviewed articles and book chapters on the subject of surfactant replacement therapy and evidence-based medicine. A native of New York City, Dr. Soll graduated from Cornell University with a degree in Genetics and History of Science in 1975. He received his MD degree from the University of Health Sciences/Chicago Medical School in 1978. He returned to New York City to complete his residency training in Pediatrics at Bellevue Hospital/New York University Medical Center in 1981. After 2 years with the Public Health Service, Dr. Soll returned to academic training. He completed the post graduate fellowship in Neonatal Perinatal Medicine at the University of Vermont in 1983 and has remained in Vermont ever since.

Annual Quality Congress Sunrise Session, Saturday, October 3, 2015
Using Nightingale to Identify Opportunities for Improvement
Objective: Demonstrate 3 strategies to use Nightingale data to identify data-driven opportunities for quality improvement at your center.
Using Nightingale to Identify Opportunities for Improvement: Retinopathy of Prematurity

Roger F. Soll MD / Erika M. Edwards PhD, MPH

DI SCLOSURES

Roger F. Soll MD is the President of Vermont Oxford Network and the Coordinating Editor of the Cochrane Neonatal Review Group

Erika M. Edwards PhD, MPH is the Director of Data Systems and Analytics, Vermont Oxford Network

No other relevant financial issues to disclose.
Using Nightingale to Identify Opportunities for Improvement: Retinopathy of Prematurity

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Overview

Key Performance Measures

Admissions and Discharges

Infant Characteristics

Initial Resuscitation

Respiratory Care

Respiratory Outcomes

Infection

Surgery

PIH and PVL

Retinopathy of Prematurity

Feeding at Discharge

Growth

Length of Stay

VERMONT OXFORD NETWORK: CENTER 999

Key Performance Measures

Sample figure: Concerning rate of retinopathy of prematurity

Sample figure: Concerning rate of retinopathy of prematurity

Sample figure: Concerning rate of retinopathy of prematurity

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Sample figure: Concerning rate of retinopathy of prematurity
Using Nightingale to Identify Opportunities for Improvement: Retinopathy of Prematurity

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**OXYGEN IN PRETERM INFANTS**

Retinopathy of Prematurity (Retrolental Fibroplasia)

First described in 1942:

“Grayish white opaque membrane behind each crystalline lens”

Terry 1942

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**RETINOPATHY OF PREMATURITY**

Pathogenesis

Phase 1: Relative retinal hyperoxia and interruption of normal vascularization

- retinal response to hyperoxia is vasoconstriction
- reduced vascular endothelial growth factor (VEGF)

Phase 2: Hypoxia-revascularization

- VEGF is upregulated in response to hypoxia
- Abnormal neovascularization can occur

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**EFFECT OF RESTRICTED OXYGEN ON RETROLENTAL FIBROPLASIA**

OVERVIEW OF 3 RANDOMIZED CONTROLLED TRIALS

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Typical Risk Difference</th>
<th>Decreased Risk</th>
<th>Increased Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTIVE RLF</td>
<td>-0.30 (-0.39, -0.21)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CICATRI(CIAL RLF</td>
<td>-0.13 (-0.20, 0.06)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEATH</td>
<td>0.03 (-0.02, 0.07)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEATH OR CICATRI(CIAL RLF</td>
<td>-0.07 (-0.16, 0.03)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Watts 1992

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**STAGES OF RETINOPATHY OF PREMATURITY**

STAGE 1

STAGE 2

STAGE 3

STAGE 4
Using Nightingale to Identify Opportunities for Improvement: Retinopathy of Prematurity

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October 3, 2015

Epidemic of ROP

Retinopathy of Prematurity

Vermont Oxford Network Annual Reports 2000-2012

Effect of Restricted Oxygen on Mortality

Mortality Before (1944-1948) and After (1954-1958)
Introduction of a Policy of Oxygen Restriction in Infants Birth Weight 1000-1499 Grams

Characteristics of randomized trials included in the NeoProM Collaboration

Targeting Higher vs. Lower Arterial Oxygen Saturations
Effect on Death

Targeting Higher vs. Lower Arterial Oxygen Saturations
Effect on Death or Disability at 18 to 24 Months

Studies

Relative Risk (95% CI)

Decreased • Risk • Increased

0.2 0.5 1.0 2.0 4.0

Studies

Relative Risk (95% CI)

Decreased • Risk • Increased

0.2 0.5 1.0 2.0 4.0

COT TRIAL 2013

0.86 (0.73 to 1.02)

COT TRIAL 2013

0.92 (0.71 to 1.20)

SUPPORT TRIAL 2010

0.81 (0.64 to 1.03)

TYPICAL ESTIMATE

0.86 (0.76 to 0.97)

I squared 0%

Cochrane Review unpublished 2014

COT 2013

0.96 (0.86 to 1.08)

SUPPORT 2010

0.92 (0.78 to 1.10)

TYPICAL ESTIMATE

0.95 (0.86 to 1.05)

I squared 0%

Cochrane Review unpublished 2013

Relative Risk and 95% CI
Using Nightingale to Identify Opportunities for Improvement: Retinopathy of Prematurity

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**Targeting Higher vs. Lower Arterial Oxygen Saturations Effect on Retinopathy of Prematurity**

<table>
<thead>
<tr>
<th>Studies</th>
<th>Relative risk (95% CI)</th>
<th>Decreased Risk</th>
<th>Increased Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOOST II 2013</td>
<td>1.37 (0.99 to 1.86)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COT 2013</td>
<td>0.97 (0.88 to 1.06)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TYPICAL ESTIMATE</td>
<td>1.04 (0.95 to 1.15)</td>
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</tbody>
</table>

I squared 81%

Cochrane Review unpublished 2014

**Targeting Higher vs. Lower Arterial Oxygen Saturations Effect on Severe Retinopathy of Prematurity**

<table>
<thead>
<tr>
<th>Studies</th>
<th>Relative risk (95% CI)</th>
<th>Decreased Risk</th>
<th>Increased Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>COT 2013</td>
<td>1.83 (0.74 to 1.41)</td>
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</tr>
<tr>
<td>SUPPORT 2010</td>
<td>2.07 (1.46 to 2.93)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TYPICAL ESTIMATE</td>
<td>1.44 (1.14 to 1.82)</td>
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</table>

I squared 88%

Cochrane Review unpublished 2014

**VON Day Oxygen Monitoring Audit**

**Spot Oxygen Saturation**

Infants on Oxygen and Respiratory Support (N = 697 Infants)

- Median spot saturation 94% (1st quartile 91%, 3rd quartile 97%)

**RETINOPATHY OF PREMATURITY**

**Prevention**

Effective: Oxygen Restriction (at what cost?)

Ineffective: Vitamin E, Superoxide dismutase, Light reduction

Jury still out: Vitamin A, Inositol, Continuous monitoring

**Identification**

Effective: Retinal exam at recommended postmenstrual age

**Treatment**

Effective: Retinal ablation surgery, Anti-VEGF

Ineffective: Supplemental oxygen

**ROP ON NIGHTINGALE:** Tracking and Improving Outcome

- ROP exams
- ROP incidence (over time and compared to other centers)
- Risk adjusted ROP and SROP for VLBW infants
- Respiratory care and outcomes
- Surgery
- Anti-VEGF
- Mortality

**Improvement Formula**

Generalizable Scientific Evidence + Particular Context → Measured Performance Improvement

Do What? Evidence Based Medicine

Do How? Evidence Based Practice

Batalden, PB, Davidoff F. Qual Saf Health Care 2007;16:2-3

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PDSA CYCLE

CAN CHANGES IN CLINICAL PRACTICE DECREASE THE INCIDENCE OF SEVERE ROP?

Oxygen Management Policy

- Improved saturation monitoring
- Initiation of monitoring from birth
- Avoiding repeated increases and decreases of FiO₂
- Minimization of “titration” of FiO₂
- Modification of alarm limits

Mean proportion of time in specified oxygen saturation range

Nurse:patient ratio and achievement of oxygen saturation goals in premature infants.
Trials have now shown us the appropriate range to maintain oxygen saturation.

Maintaining appropriate oxygen saturation is a complex task that includes oxygen targets, alarm settings and staff response and unit culture.

Tracking ROP identification, prevention, and treatment as well as balancing measures over time can help centers understand and improve ROP outcomes.