Driving Quality in Maternal Newborn Care: 
*The Effect of Implementation of the Maternal Newborn Dashboard in Ontario*

BORN Conference  
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BORN Ontario
Objectives

• Present
  – An overview of the BORN Ontario Maternal Newborn Dashboard (MND)
  – The results of the MND study:
    • ITS analysis for 6 KPIs
    • Provincial survey
BORN is a Registry under PHIPA

- BORN was granted registry Status under the *Personal Health Information Privacy Act (PHIPA)* in Nov 2009

- Registry status affords BORN authority to collect, use and disclose personal health information *without consent* “for the purpose of *facilitating or improving the provision of health care*”.

This special authority requires BORN to develop and adhere to rigorous privacy policies – and have them reviewed and *approved* by the Ontario Information and Privacy Commissioner.
Facilitation of Care

- Performance improvement first requires healthcare professionals to be aware of evidence-practice gaps and to agree about the need for and direction of change.


- Evidence suggests audit and feedback can be used to drive quality improvement in healthcare by helping users to identify areas where practice is good or there is room for improvement.
Cochrane Systematic Review (Ivers et al., 2012)

- 140 RCTs – Evidence that audit and feedback leads to small-moderate improvements in practice (effect size range - 0.5-16%)

- Audit and feedback is more effective when:
  - Baseline performance is low
  - Provided more than once
  - Explicit targets and an action plan are included
Maternal Newborn Dashboard (MND)

- Reports on selected KPIs (feedback)
- Compares performance to established ideal (benchmarks)
- Provides alerts (signals) to trigger action when performance is sub-optimal

MND launched Nov 19, 2012

Allows these users to better meet their quality mandate as set out in the Excellent Care for All Act (2010).

• Rigorous dashboard development process

• Key stakeholders – SMEs
  – Clinical practice, KT, performance measurement, analysis, research, policy)

• Key Performance Indicator (KPI) selection
  – Clinically meaningful
  – Feasible to measure
  – Amenable to change

• Evidence-based benchmarks & evidence summaries

• Multi-functional design features to present data and facilitate audits

• Communication and Implementation plan

# Maternal Newborn Dashboard

<table>
<thead>
<tr>
<th>Key Performance Indicators</th>
<th>Rate (%)</th>
<th>Status</th>
<th>Benchmark values (%)</th>
<th>Comparator values (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Proportion of newborn screening samples that were unsatisfactory for testing</td>
<td>1.2</td>
<td>✔️</td>
<td>&lt;2.0</td>
<td>1.1</td>
</tr>
<tr>
<td>2 Rate of episiotomy in women who had a spontaneous vaginal birth</td>
<td>12.3</td>
<td>✔️</td>
<td>&lt;13.0</td>
<td>15.6</td>
</tr>
<tr>
<td>3 Rate of formula supplementation at discharge in term infants whose mothers intended to</td>
<td>35.6</td>
<td>🟡</td>
<td>&lt;20.0</td>
<td>34.0</td>
</tr>
<tr>
<td>4 Proportion of women with a cesarean section performed from ≥37 to &lt;39 weeks' gestation</td>
<td>42.3</td>
<td>🟡</td>
<td>&lt;11.0</td>
<td>45.8</td>
</tr>
<tr>
<td>5 Proportion of women who delivered at term and had Group B Streptococcus (GBS) screening</td>
<td>90.2</td>
<td>✔️</td>
<td>&gt;94.0</td>
<td>92.3</td>
</tr>
<tr>
<td>6 Proportion of women who were induced with an indication of post-dates and were less than</td>
<td>17.2</td>
<td>✔️</td>
<td>&lt;5.0</td>
<td>22.6</td>
</tr>
</tbody>
</table>

Other Neonatal Level IIC hospitals Other 1001-2499 birth volume hospitals Ontario
Evidence Summaries

- Evidence summaries developed for each KPI in the Dashboard
- Posted on the BORN website http://www.bornontario.ca/reports/dashboard
- Critical appraisal and synthesis of the evidence an essential step to:
  - Inform selection of the final KPIs
  - Inform benchmark setting process
  - A resource for users

MND – A Knowledge-to-Action Strategy for Quality Improvement

Knowledge Gap

• What is not understood about audit and feedback:
  – What factors increase the effectiveness of audit and feedback
  – Why performance improves in some settings and not in others, and
  – What resources are needed to support the use of an electronic audit and feedback system such as the MND

• Received funding (2014-2017) for a multi-phase, mixed methods study to evaluate the effect of an electronic audit and feedback system to improve maternal newborn care in Ontario
  • CIHR Operating Grant
  • MOHLTC HSRF Capacity Award
Maternal Newborn Dashboard Study

• **Purpose:**
  – To evaluate the effect of an electronic audit and feedback system on six key performance indicators (KPIs) in Ontario

• **By Exploring:**
  – Attributes of the dashboard
  – Organizational factors
  – Facilitation/resource factors

• **Multi-phased, mixed methods design**
  – Interrupted time series
  – Provincial survey
MND Study Objectives

- **Interrupted Time Series Analysis**
- **Key Informant Interviews**
- **Provincial Survey**
- **Data Quality Assessment**
- **Case Study Comparison**
- **Regression: Predictors of Differential Effectiveness of the MND**
- **Validation Projects:**
  - OR4KT Tool
  - HEAT Tool
- **Evaluation Projects:**
  - KTA Evidence summaries
  - Dashboard Development Roadmap
- **Development:**
  - Dashboardv2

Funding:
- CIHR Funding
- HSRF Funding
Interrupted Time Series Analysis
Methods

• **Study datasets**
  – BORN registry datasets covering 2009-2015 were used, for the primary analysis with 6 KPIs, and for analysis with two internal control indicators.
  – Analysis also carried out on four indicators from an external control dataset, from the province of British Columbia which covered 2009-2015.

• **Study time period**
  – Includes 3 years pre-MND implementation and 2 years post-implementation.
  – 5 month implementation time period was censored from the analysis.

• **Design**
  – Interrupted time series (ITS).

• **Analysis**
  – Segmented regression (accounting for serial autocorrelation).
  – Effect of the MND was assessed at 30 months post-implementation.
  – Measured as both the absolute and relative differences between observed KPI rates, and KPI rates predicted based on pre-implementation trends.
  – Primary analyses were carried out using 6 KPIs in BORN registry datasets, secondary analyses were carried out using 2 internal control indicators, and 4 indicators from the external control dataset (from BC).
Results

• A statistically significant effect of the MND was found for 4 out of 6 KPIs

• No significant effects were identified for the internal control indicators or in the external control dataset.
KPI 1: *Proportion of newborn screening samples that were unsatisfactory for testing*

**Why important?**

- Painful procedure requiring pain relief measures for the newborn (skin-to-skin, breastfeeding or sucrose)
- Family required to return for extra visit to hospital or HCP for repeat testing
- Higher costs
- Delays in potentially important findings
KPI 1 - Rate of unsatisfactory NSO samples

- Raw data
- Observed trend
- Predicted secular trend
**KPI 1 - Proportion of Unsatisfactory Newborn Screening Samples**

**Ontario - Apr-Jun 2012 to Jul-Sept 2016**

**New benchmarks set for KPI 1 – Fall 2016**

Data Source: BORN Ontario – 2017-04-19
KPI 2: Rate of episiotomy in women having a spontaneous vaginal birth

• Why important?

  – Restrictive use of episiotomies compared to routine use of episiotomies improves maternal outcomes:

    • less severe perineal trauma
    • less need for suturing
    • higher probability of intact perineum, and
    • higher likelihood of resuming intercourse earlier.¹
KPI 2 - Rate of episiotomy

Rate per 100

Month

Raw data
Observed trend
Predicted secular trend
KPI 2 - Rate of Episiotomy in Women who had Spontaneous Vaginal Birth
Ontario - Apr-Jun 2012 to Jul-Sept 2016

Data Source: BORN Ontario – 2017-04-19
KPI 3: Rate of formula supplementation from birth to discharge in term infants whose mothers intended to breastfeed

• Why important?

  – Most women state they intend to breastfeed\(^2\) but at the time of discharge from hospital many infants have been supplemented with formula.\(^3\)

  – Supplementation with formula reduces the exclusivity and duration of breastfeeding.\(^4\)

  – Fewer women and babies benefit from the protective effects of breastfeeding, resulting in:
    • Increased primary care visits, hospital visits, and prescriptions.
KPI 3 - Rate of Formula Supplementation from Birth to Discharge in Term Infants whose Mothers Intended to Exclusively BF
Ontario - Apr-Jun 2012 to Jul-Sept 2016

Data Source: BORN Ontario – 2017-04-19
KPI 4: Proportion of women with a cesarean section performed prior to 39 weeks’ gestation among low-risk women having a repeat cesarean section at term

- Why important?
  - Early-term birth by <39 weeks is associated with increased morbidity in the neonate:
    - respiratory distress syndrome
    - transient tachypnea of the newborn
    - higher rates of admission to neonatal intensive care units (NICU).
  - Decreasing the proportion of cesarean sections performed at <39 weeks’ gestation among low-risk women not in labour would improve:
    - health outcomes for the infant and
    - decrease costs associated with neonatal morbidity and NICU admissions.
KPI 4- Repeat c-section in low risk women 37-39 weeks

Rate per 100

Month


Raw data  Observed trend  Predicted secular trend
KPI 4 - Rate of Elective Repeat CS < 39 Weeks' GA for Low Risk Women not in Labour
Ontario - Apr-Jun 2012 to Jul-Sept 2016

Data Source: BORN Ontario – 2017-04-19
KPI 5: Proportion of women delivering at term who had Group B Streptococcus (GBS) screening at 35-37 weeks' gestation

• Why important?
  
  – GBS disease is a leading cause of infant mortality in Canada.

  – Screening pregnant women for GBS colonization has been shown to greatly reduce early-onset GBS disease in infants.

  – Universal, culture-based GBS screening followed by intrapartum antibiotic prophylaxis for GBS positive women is considered to be the most cost effective strategy for women at low risk of GBS infection.

  – Increasing the proportion of women screened for Group B Streptococcus (GBS) would improve
    • health outcomes for the infant and
    • decrease costs associated with neonatal morbidity and NICU admissions.
KPI 5 - GBS screening 35 to 37 weeks

Rate per 100

Month


Raw data  Observed trend  Predicted secular trend

BORN Ontario
KPI 5 - Rate of GBS Screening at 35-37 Weeks' GA for Women who Delivered at Term
Ontario - Apr-Jun 2012 to Jul-Sept 2016

Data Source: BORN Ontario – 2017-04-19
KPI 6: Proportion of women induced with an indication of post-dates who are less than 41 weeks' gestation at delivery

• Why important?

– Reduction in the proportion of women induced with an indication of post-dates who were less than 41 weeks’ gestation at delivery has the potential to:
  • improve health outcomes for infants and
  • reduce unnecessary cesarean delivery.
KPI 6- Rate of induction for post-dates in women less than 41 weeks

![Graph showing the rate of induction for post-dates in women less than 41 weeks from November 2009 to March 2015, with data points, an observed trend line, and a predicted secular trend line.]
KPI 6 - Proportion of Women Induced with an Indication of Post-dates but were < 41 Weeks' GA at Delivery
Ontario - Apr-Jun 2012 to Jul-Sept 2016

Data Source: BORN Ontario – 2017-04-19
### Table 1. Effect of MND on rates of KPIs, in BORN and BC datasets

<table>
<thead>
<tr>
<th>Key Performance Indicator</th>
<th>Absolute change from predicted† (95% CI)</th>
<th>Relative change from predicted‡ (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>KPI1: Unsatisfactory NSO rates</strong></td>
<td>0.40 (-2.17 to 2.97)</td>
<td>17% (-185% to 220%)</td>
</tr>
<tr>
<td><strong>KPI2: Episiotomy</strong></td>
<td>-1.51 (-2.39 to -0.64)*</td>
<td>-14% (-28% to -1%)*</td>
</tr>
<tr>
<td><strong>KPI3: Supplementation</strong></td>
<td>0.29 (-1.01 to 1.08)</td>
<td>0% (-6% to 7%)</td>
</tr>
<tr>
<td><strong>KPI4: Elective repeat C/S prior to 39 wks</strong></td>
<td>21.29 (-11.30 to 6.92)</td>
<td>6% (-41% to 29%)</td>
</tr>
<tr>
<td><strong>KPI5: GBS screening</strong></td>
<td>2.84 (2.16 to 3.51)*</td>
<td>3% (1% to 4%)*</td>
</tr>
<tr>
<td><strong>KPI6: Post-dates induction prior to 41 wks</strong></td>
<td>3.22 (2.49 to 3.96)*</td>
<td>27% (13% to 42%)*</td>
</tr>
</tbody>
</table>

*p<0.05. Statistical significance when confidence interval does not include 0.

†Absolute change in the rate per hundred. For example, for KPI 2, indicates a decrease of 1.51 episiotomies per 100 (2.39 to 0.64) at 30 months post-MND implementation.

‡Percent relative change. For example, for KPI 2, indicates a relative decrease of 14% in the rate of episiotomies at 30 months post-MND implementation.
Conclusions

- In terms of absolute effect of the MND at 30 months post-implementation, this corresponds to:
  
  - **1.5 fewer women per hundred** having an episiotomy
  
  - **10 fewer women per hundred** having an elective repeat cesarean section prior to 39 weeks
  
  - **3 additional women per hundred** having GBS screening at the appropriate time.
  
  - **11 fewer women per hundred** being induced for post-dates prior to 41 weeks

- These results demonstrate that an A&F program implemented in maternal-newborn hospitals was associated with improvements at the provincial level in the majority of targeted behaviors.

- Research is underway to examine hospital-level differences in responses to the MND.
Provincial Survey
<table>
<thead>
<tr>
<th>Health Region</th>
<th>Responding Hospitals (N=57)</th>
<th>All of Ontario (N=94)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-4 – SW and Central</td>
<td>17 (29.8)</td>
<td>27 (28.7)</td>
</tr>
<tr>
<td>5-9 – Greater Toronto Area</td>
<td>17 (29.8)</td>
<td>28 (29.8)</td>
</tr>
<tr>
<td>10-11 – East and SE</td>
<td>11 (19.3)</td>
<td>13 (13.8)</td>
</tr>
<tr>
<td>12-14 – North</td>
<td>12 (21.1)</td>
<td>26 (27.7)</td>
</tr>
<tr>
<td>Level of Care</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>29 (50.9)</td>
<td>47 (50.0)</td>
</tr>
<tr>
<td>2</td>
<td>25 (43.9)</td>
<td>41 (43.6)</td>
</tr>
<tr>
<td>3</td>
<td>3 (5.3)</td>
<td>6 (6.4)</td>
</tr>
<tr>
<td>Birth Volume/year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤100</td>
<td>6 (10.5)</td>
<td>11 (11.7)</td>
</tr>
<tr>
<td>101-500</td>
<td>17 (29.8)</td>
<td>27 (28.7)</td>
</tr>
<tr>
<td>501-2499</td>
<td>21 (36.8)</td>
<td>33 (35.1)</td>
</tr>
<tr>
<td>≥2500</td>
<td>13 (22.8)</td>
<td>23 (24.5)</td>
</tr>
<tr>
<td>Method of Data Entry into BORN Information System (BIS)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manual</td>
<td>45 (79.0)</td>
<td>73 (77.7)</td>
</tr>
<tr>
<td>Upload from Electronic Health Record System</td>
<td>12 (21.0)</td>
<td>21 (22.3)</td>
</tr>
</tbody>
</table>
Useful Attributes of the MND

- KTA evidence summaries
- KPI definitions
- Dashboard audit features
- Dashboard reports and sub-reports
- Dashboard visual data displays

![Bar Chart]

- Not at all useful
- Slightly useful
- Somewhat useful
- Very useful
- N/A - we don't use this feature
Suggestions for New Dashboard Display

Features

- Customizable reports
- Ability to create graphs
- Trend displays
- Automatically generated standardized reports, with alerts through BIS messaging

Practitioner level statistics and trends

- Unsure
- Not very important
- Somewhat important
- Moderately important
- Important
- Extremely important
KPIs Targeted
Influencing Factors for KPI Prioritization

- Degree of difficulty or ease of the practice change issue
  - Not at all
  - To a small extent
  - To a moderate extent
  - To a great extent
  - Unsure

- Directives from the Chief of OB or other administrator
  - Not at all
  - To a small extent
  - To a moderate extent
  - To a great extent
  - Unsure

- Organizational or provincial priorities
  - Not at all
  - To a small extent
  - To a moderate extent
  - To a great extent
  - Unsure
Facilitators to Using the MND

- Local health Integration Network (LHIN) mandates
- Hospital mandates
- Availability of resources (e.g., computers, decision...)
- Relevance of the BORN dashboard data
- Familiarity with the dashboard
- Having an electronic medical record
- Team buy-in

Legend:
- Not at all
- To a small extent
- To a moderate extent
- To a great extent
- Unsure
Challenges to Using the MND

- System issues with network access to BIS
- Lack of resources to enter data
- Lack of knowledge or misunderstandings about system
- Limited availability of staff to enter data and run reports
- Negative staff attitudes, resistant to use of MND, or perceptions about lack of...
- Other competing priorities
- BORN dashboard not perceived as relevant

- Not at all
- To a small extent
- To a moderate extent
- To a great extent
- Unsure
Barriers to Clinical Practice Change

- Limited staff buy-in: 23 sites
- Competing priorities: 33 sites
- Limited time: 28 sites
- Limited resources: 31 sites
- Change fatigue: 27 sites
KTA Evidence Summaries Accessed

KPI 2: Episiotomy
KPI 3: Formula supp
KPI 4: Repeat caesarean section
KPI 5: GBS screening
KPI 6: Elective inductions
Unsure

<table>
<thead>
<tr>
<th>KPI</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>KPI 2</td>
<td>35.1</td>
</tr>
<tr>
<td>KPI 3</td>
<td>75.7</td>
</tr>
<tr>
<td>KPI 4</td>
<td>70.3</td>
</tr>
<tr>
<td>KPI 5</td>
<td>51.4</td>
</tr>
<tr>
<td>KPI 6</td>
<td>59.5</td>
</tr>
<tr>
<td>Unsure</td>
<td>8.1</td>
</tr>
</tbody>
</table>
What We’ve Learned!

- The findings of study have demonstrated the effectiveness of an A & F intervention to trigger improvement in 4 of 6 KPIs in the MND in Ontario

- Current features of the dashboard perceived to be very useful
  - Recommendations for improvements were received

- Factors that influenced KPI prioritization
  - Organizational or provincial priorities
  - Hospital directives
  - Degree of difficulty of the practice issue

- Facilitators included:
  - Regional or hospital mandates
  - Availability of resources
  - Perceived relevance of the data
  - Familiarity with the dashboard
  - Team buy-in

- Barriers to use included:
  - Competing priorities
  - System issues with the BIS
  - Resources available to enter data and run reports
Implications

• Design standards for audit and feedback
  – BORN
  – International A & F Collaborative

• Features to improve functionality and user experience with dashboards

• Aligning KPI selection with regional and provincial priorities
  – Increase momentum for clinical practice change in Ontario maternal newborn hospitals
Acknowledgements

MND Study:
• The Effect of an Electronic Audit and Feedback System on Six Key Performance Indicators in Ontario: The BORN Maternal Newborn Dashboard

Funding support:
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