Measuring Term Baby Outcomes: PC-06: Unexpected Newborn Complications

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Unexpected Newborn Complications
(term neonatal composite outcome measure)

This measure simply asks: of babies without preexisting conditions (no preemies, multiple gestations, birth defects or other fetal conditions) and who are normally grown and were not exposed to maternal drug use, How many had severe or moderate neonatal complications?
Unexpected Newborn Complications
(term neonatal composite outcome measure)

- First developed and and initial testing in 2010
  - California Maternal Quality Care Collaborative (Obstetrics) in conjunction with the California Perinatal Quality Collab (Neonatology)

- Extensively field-tested over the next 7 years
  - Used in state QI projects in California, Washington, Oregon and Florida, and NPIC (totaling over 750,000 annual births)

- NQF endorsed in 2012 and re-endorsed in 2016

- Chosen by TJC as PC-06 in early 2018
  - Reporting starting with January 2019 births
What is the Most Important Pregnancy Outcome for Mothers and their Families?

“A Good ‘Take-Home’ Baby…”

Avoiding Cesarean or Episiotomy or moderate Maternal Morbidities are clearly secondary
If Baby Outcomes Are So Important, Why Were We Not Measuring Them?

Some of the historical issues…

- Which babies?
- What outcomes?
- Low rates of poor outcomes
- Which of the poor outcomes are related to care?
Which Babies?

- All Babies versus Term Babies?
  - Preterm infants have a wide range of outcomes related to gestational age, birth weight—Not a homogeneous group
  - Rates of prematurity and congenital malformations vary greatly among hospitals
  - Important principle: Some populations (e.g., premies and malformations) are not expected to have perfect outcomes
Survey of Prior Attempts to Measure Term Baby Outcomes

- Rate of Term Baby NICU admissions (or Term baby NICU LOS)
  - NICUs vary in their admission criteria, even internally by shift or census
  - Observation versus Confirmed Diagnoses
  - NICU Admission is not an external code

- AHRQ PSI 17: Birth Trauma Rate (injury to the infant)
AHRQ PSI 17: Birth Trauma

Figure 1. Distribution of all neonatal birth trauma and birth trauma considered to be a Patient Safety Indicator by AHRQ, 2004-2005.

Rates (per 1,000)
All Trauma: 25.9
PSI 17: 2.45
CS v. Vag (OR)
All Trauma: 0.55
PSI 17: 1.71


1Denominator is total singleton live births with neonatal birth trauma in 2004-2005. However, percentages total 102.37 because some neonates had more than one type of neonatal birth trauma
2Excluding infants weighing <2500g or EGA earlier than 37 weeks when using AHRQ guidelines for PSI #17
3Excluding infants with diagnosis Osteogenesis Imperfecta when using AHRQ guidelines.
AHRQ PSI 17: Birth Trauma

Critique:

- Small subset of all birth traumas
- Very low rate: 2 per thousand births
- Dominated by non-specific codes
- Easy to “show improvement” by adjusting coding practices for “other birth trauma”
- Narrow view of birth outcomes…
- Not NQF endorsed

But it is easy to calculate!
UNC Denominator: Inclusions / Exclusions

- Include: Singleton live births (ICD10)
- BWt ≥2.5kg and GA≥37 weeks
  - for PC-06, using ICD-10 codes for preterm and SGA
- Exclusions (ICD-10)-“Pre-existing Conditions”:
  - Congenital malformations (most Q codes)
  - Congenital disorders (from E and G codes)
  - Fetal-placental Conditions, Infections, IUGR, Hydrops, Rh sensitization (from A and P codes)
  - Maternal Drug Use and withdrawal symptoms (from P codes)
All newborns with a discharge date between 1/1/2016 to 8/31/2016, and with linked birth certificate, newborn PDD, and mom PDD records in CMQCC California active tract data

N = 233,816

Singleton livebirths (ICD-10 diagnoses codes Z38.00 & Z38.01)
N = 227,189

Birth weight >= 2,500 g on birth certificate
N = 215,235

Gestational age between 37 and 46+6 weeks (if GAGE is missing, birth weight >= 3,000 g or >= 8,165 g) on birth certificate
N = 207,088

Qualified newborns without congenital malformations
N = 200,373

Exclude non-singletons
N = 6,627 (2.8%)

Exclude birth weight < 2,500 g on birth certificate
N = 11,954 (5.1%)

Exclude gestational age < 37 weeks (If GAGE is missing, exclude birth weight < 3,000 g or >= 8,165 g) on birth certificate
N = 8,147 (3.5%)

Exclude newborns with congenital malformations (Group 2A dx)
N = 6,715 (2.9%)

Exclude newborns with other fetal conditions (Group 2B dx)
N = 3,087 (1.3%)

Exclude newborns which were affected by maternal drug use (Group 2C dx)
N = 1,501 (0.6%)

Qualified newborns without congenital malformations and other fetal conditions
N = 197,286

Final UNC denominator
N = 195,785 (83.7%)
Complications are Categorized from the Viewpoint of the Family:

Frame 1 (Severe): “Would I be fearful of my baby’s survival or long term outcome if my baby had…”

Frame 2 (Moderate): “Would I be upset if my baby had….”

Note that the concept of preventability is not used.
The Devil is always in the Details…

- Use administrative data to minimize data burden
  - Allows for 100% survey--no sampling!
- Provide safeguards for over-coding and under-coding
- Separate out Severe from Moderate complications
  - Critical for Face Validity
- Identify diagnosis categories ("buckets")
  - To understand the areas for improvement and facilitate QI projects
UNC: Coding Strategies

- After examining coding practices for hospitals around the state, “special needs” appeared:
  - **Over-coding Protection:**
    - Sepsis vs. “R/O Sepsis”—Added a requirement for a prolonged newborn LOS: LOS >4 days
  - **Under-coding Protection:**
    - Diagnoses are not always recorded (e.g. a systematic exclusion of hypoxia codes) however procedure codes are almost always coded as they tie to billing.
    - Utilize both diagnosis and procedure codes for a “complication bucket” whenever appropriate (e.g nitric oxide, EEG, ventilator, ECMO)
UNC: Coding Strategies-2

- **Over-coding Protection:**
  - A number of moderate complication diagnoses required a longer LOS than usual to indicate that it was consequential—Added a requirement for a prolonged newborn LOS: LOS >4 days for a Cesarean and >2 days for a vaginal birth
  - Examples: clavicle facture,

- **Under-coding Protection:**
  - Some cases had very few codes but very long LOS…suspicious for a morbidity
  - Screened these cases first for neonatal jaundice, phototherapy, and a series of codes for social problems (e.g. homelessness, child welfare custody, residential institution)
  - If none of these codes, these cases were considered moderate morbidity
Examples of “Severe UNC”

- Neurologic/Birth Injury
  - ICH, HIE, Asphyxia, Erb’s Paralysis, EEG

- Shock/Resuscitation
  - Arterial Line, CPR

- Respiratory
  - Pulm Hem, Vent, Chest tube, Nitric Oxide

- Infection
  - Septic shock, Sepsis with identified bacteria
Examples of “Moderate UNC”

- **Neurologic/Birth Injury** (with LOS requirement)
  - Fx. Clavicle, “affect. by” forceps, CT or MRI

- **Respiratory**
  - CPAP, RDS, Pneumothorax
  - with LOS: TTP, Mec Aspiration

- **Infection**
  - Sepsis with identified bacteria but short LOS
Do Hospitals Caring for Higher Risk Mothers Have Higher Rates of UNC?

<table>
<thead>
<tr>
<th>NICU Level</th>
<th>Severe UNC</th>
<th>Total UNC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level III-IV (117)</td>
<td>1.7%</td>
<td>3.0%</td>
</tr>
<tr>
<td>Level II (58)</td>
<td>2.4%</td>
<td>3.4%</td>
</tr>
<tr>
<td>Level I (74)</td>
<td>2.4%</td>
<td>3.0%</td>
</tr>
<tr>
<td>Critical Access (14)</td>
<td>2.5%</td>
<td>3.4%</td>
</tr>
<tr>
<td>University (6)</td>
<td>2.3%</td>
<td>4.6%</td>
</tr>
</tbody>
</table>

Mean rates among California hospitals for full-year 2017
UNC Analysis: What is Driving My Rate?

Total UNC: Example University Hospital
Full Year: 2017

Percentage of all Term Newborns without preexisting conditions

- Hospital Severe
- Hospital Moderate
- CA Statewide Severe
- CA Statewide Moderate
UNC: Additional NQF Validation Studies

- **Face Validity:**
  - In a comparison trial for neonatal morbidity by gestational age, UNC tracked very closely to NPIC (major East Coast perinatal data set) analysis using NICU admissions and major complications.

- **Formal Reliability Testing**
  - NQF requirement using RAND statistical tools for Reliability.
  - Tests ability to discriminate among hospitals (variation and frequency).
  - Good is $\geq 0.8$, excellent is $\geq 0.9$.
  - Mean UNC Reliability among 220 California hospitals = 0.92.

- **Stability within a hospital over time**
  - Tested for 3x 6-month baseline periods with minimal variation noted in >90% of California hospitals.
UNC Analysis: What is Driving My Rate?

UNC Category Analysis: Example University Hospital Full Year: 2017

Percentage of all Term Newborns without preexisting conditions

- Neurologic or Birth Injury: 0.42% (Hospital Severe), 0.55% (Hospital Moderate), 0.58% (CA Statewide Severe), 1.03% (CA Statewide Moderate)
- Infection: 0.55% (Hospital Severe), 0.58% (Hospital Moderate), 0.58% (CA Statewide Severe), 0.58% (CA Statewide Moderate)
- Respiratory: 1.16% (Hospital Severe), 1.75% (Hospital Moderate), 1.16% (CA Statewide Severe), 1.16% (CA Statewide Moderate)
- Shock: 0.09% (Hospital Severe), 0.04% (Hospital Moderate), 0% (CA Statewide Severe), 0% (CA Statewide Moderate)
- Transfer: 0% (Hospital Severe), 0.88% (Hospital Moderate), 0.88% (CA Statewide Severe), 0.88% (CA Statewide Moderate)
- Long LOS (No Jaundice or Social Issue): 0.09% (Hospital Severe), 0.08% (Hospital Moderate), 0.08% (CA Statewide Severe), 0.08% (CA Statewide Moderate)
"Post-market Surveillance"

- After an expert panel picks ICD codes that “make sense”, it is critical to examine data from large numbers of hospitals to see how codes are assigned in the “real world”

- Example:
  ICD9 Procedure Code 93.90: Non-invasive mechanical ventilation <24hrs (e.g. CPAP) is used by some hospitals for bag and mask resuscitation in the delivery room so bills can be created for a pediatrician in attendance…

- TWEAK: add a LOS modifier
2016-2017 Projects

- Translate to ICD-10 codes
  - Examine individual code frequencies
  - Review again with expert panel
  - ICD-9 v. ICD-10: within 0.1% point

- Eliminated Birth Certificate linkage, allow for PDD alone:
  - No Low Apgar--no change in rates
  - No BWt and GA--slight rise in Moderate UNC due to more 35-36 wk’ers

- Focus on **Severe** v. Moderate v. Total UNC
On case review, these 3 hospitals had multiple cases of 5' Apgar charted as 0 when it was missing and 1' Apgar was ≥7.
In each pilot hospital, after successful intervention to reduce NTSV Cesarean births (decreased 15-22%), Unexpected Newborn Complications measure was either unchanged or reduced, reassuring the medical staff.

Unexpected Newborn Complications (UNC) as a Balancing Measure for Cesarean reduction projects.
Examples of UNC QI Projects

- Benchmarking for UNC categories leads to better understanding of where to work
- Revision of infection work-up protocols
- Education for forceps best practices
- Improved resuscitation protocols
- Second Stage Labor management protocols
- Identification of cases for in-depth review
- Most important use is as balancing measure for OB intervention studies
UNC Conclusions

- Reflects a patient/family viewpoint but also resonates with physicians
- More variation than expected
- More improvement opportunities than expected
- Sensitive to both obstetric practice and neonatal care
UNC Summary

- Validated term baby outcome measure
- Able to drill-down and examine reasons for higher levels / improvement opportunities
- Suitable for use as a balancing measure for primary or NTSV Cesarean rate QI projects
UNC FAQs

1. What proportion of a hospital’s births are included?
   80-85% will meet inclusion criteria, generating a sufficient volume

2. Do certain hospital types have significantly different rates (and hence inherently disadvantaged)?
   While there is large variation among hospitals of the same type or category, the means and ranges between the categories are quite similar, indicating that risk adjustment is not required.

3. How much variation is there among hospitals?
   Total UNC showed significant variation. In 2016, the 50\(^{th}\)\%tile was 27.4 per 1,000 while 25\(^{th}\)\%tile was 19.2 and the 75\(^{th}\)\%tile was 37.7. Similar variation was seen for Severe UNC.

4. What are the diagnosis categories that drive UNC?
   In California, the most frequent category is Respiratory at 10.9 per 1,000 births, followed by Transfer to Another Hospital (8.0), Infection (6.2), Neurologic/Birth Injury (3.9) and Long LOS (0.9 per 1,000 births)
5. Why are hospital transfers included?
   A. Transfer case are included as Severe because they usually represent serious neonatal issues, and the transfer results in major disruption and concern for the family.
   B. Neonatal coding in the birth hospital is often quite limited so the underlying diagnosis(es) are usually unclear
   C. Only transfers to higher levels of care should be included

6. What about infants transferred who later are found to have a congenital anomaly?
   An unrecognized neonatal anomaly requiring transfer is often a perinatal quality care opportunity.

7. What happens if the long LOS is due to the mother?
   Some mothers have prolonged PP LOS due to conditions like Preeclampsia, but if the baby is normal, most insurances require that the baby be discharged and either stay as rooming-in or go home with family.
Thank You

Questions?