California Perinatal Quality Care Collaborative
Antenatal Corticosteroid Therapy Tool Kit
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Introduction
How to use the CPQCC
ANTENATAL CORTICOSTEROID THERAPY
Toolkit

**EVIDENCE-BASED GUIDELINES**
(Left Hand Column)

*Read through the information on the left hand side of the table first.* The material on the left hand side of the table represents the most current available and authoritative Evidence-Based Guidelines of leading healthcare organizations.

**CONTROVERSIES AND COMMENTS**
(Right Hand Column)

*Read through the information on the right hand side of the table.* This section will describe the current controversies regarding administration of antenatal corticosteroids for fetal maturation, which are currently the subjects of considerable discussion, debate and investigation. While they are not currently included in the Evidence-Based Guidelines printed in the left hand column of this document, these issues are of critical importance to the care of women at risk for preterm delivery and their infants, and may well show up in future recommendations.

**REVIEW YOUR CENTER’S DATA**

Antenatal Steroids are administered to mothers of fetuses at risk for delivering preterm (i.e., 24 to 33 completed weeks of gestation). Corticosteroids include betamethasone, dexamethasone and hydrocortisone.

Review CPQCC data report, using multiple figures, charts and graphs - for example:
1. Small Baby data set (i.e., ≤1500 gm)
2. Big Baby data set (i.e., selected babies > 1500 gm)
3. Your unit compared to other units at same CCS-level
4. In-born infants vs. out-born infants
5. Risk adjusted ANS administration rates
6. Trend charts recording 11 years of data

Help with interpreting your CPQCC Data Web Report can be obtained by calling 650-723-4822.

The CPQCC benchmark for ANS Administration Rates is 85%.
Sample: All small babies in a unit compared to all other CPQCC hospitals in 2008

Sample: All big babies in a unit, compared to all other CPQCC hospitals in 2008

Sample: Small babies in a unit, compared to other CPQCC hospitals of the same CCS Level in 2008
Sample: In-born, small babies only, compared to other CPQCC hospitals of the same CCS Level in 2008

Sample: Risk-adjusted, standardized rates for ANS administration for small babies in a unit in 2008

Sample: Trend chart recording 11 years of ANS administration rates for a unit
BEGIN QI AT YOUR CENTER

1. Identify and analyze your center’s current Antenatal Corticosteroid administration rate.
2. Review L&D charts for miscommunication between the prenatal provider and the L&D staff about the mother’s ANS status utilizing Problem Identification Worksheet #1.
3. Drill down those charts with miscommunication and determine those factors contributing to the event utilizing Problem Identification Worksheet #2, and identify relevant stakeholders in formulating approaches to minimizing these factors.
4. Complete a case review of ANS opportunities missed.
5. Utilize the FOCUS-PDCA Process to address the identified problems and improve your data collection/reporting processes.

CONTINUE THE IMPROVEMENT PROCESS

1. Identify the process(es) to be improved.
2. Do the improvement, data collection and analysis
3. Check and study the results.
### Evidence Based Guidelines

"Recommendations for Use of Antenatal Corticosteroids\(^1\)

1. The benefits of antenatal administration of corticosteroids to fetuses at risk of preterm delivery vastly outweigh the potential risks. These benefits include not only a reduction in the risk of RDS but also a substantial reduction in mortality and IVH.

2. All fetuses between 24 and 34 weeks gestation at risk of preterm delivery should be considered candidates for antenatal treatment with corticosteroids.

In selected situations beyond 34 weeks gestational age with an indicated delivery (e.g., placenta previa, prior uterine rupture) in the presence of an immature fetal lung profile, treatment with antenatal corticosteroids can be effective. The same medication regimens would be utilized.

### Controversies & Comments

### Timing of Antenatal Corticosteroid Therapy

While the NIH Consensus Statement regarding the effect of antenatal corticosteroids for fetal maturation on perinatal outcomes recommends that only fetuses between 24 and 34 weeks gestation at risk of preterm delivery should be considered candidates for antenatal treatment with corticosteroids, clinicians and researchers have considered the risks and benefits of early treatment (i.e., prior to 24 weeks gestation) and late treatment (i.e., after 34 weeks gestation).

#### Early Administrations of Antenatal Corticosteroids (i.e., prior to 24 weeks gestation)

One study\(^2\) examined whether or not the use of antenatal corticosteroids would improve neonatal outcome in extremely low birth weight infants, using a retrospective case-control chart review over a ten-year period of all infants whose mothers were admitted prior to 24 weeks gestation and delivered by 26 weeks. The authors concluded that fetuses exposed to antenatal corticosteroids prior to 24 weeks gestation had decreased mortality and higher Apgar scores compared to those infants not exposed, with no differences in any of the other neonatal outcome measured (i.e., sepsis, RDS, IVH, NEC, PVL, and ROP). No recommendations concerning routine early treatment with antenatal corticosteroids were made, and the group suggested further prospective randomized study. This non-randomized study is subject to significant bias as mothers who receive antenatal corticosteroids would be more likely to have additional aggressive obstetric and neonatal treatments that may increase neonatal survival and reduce morbidity.

#### Late Administration of Antenatal Corticosteroids (i.e., after 34 weeks gestation)

Several studies have examined the effects of antenatal corticosteroids administered later than currently recommended. Shanks, et al\(^3\) looked at the effect of antenatal corticosteroid administration on fetal lung maturity in pregnancies with known fetal lung immaturity between the 34\(^{\text{th}}\) and 37\(^{\text{th}}\) weeks of gestation. The authors concluded “a single course of IM glucocorticoids even after 34
weeks in pregnancies with documented lung immaturity can significantly increase the TDx-FLM-II in one week. Patients with negative fetal lung maturity parameters between the 34th and 37th weeks can benefit from a single course of steroids.” This concept was also supported by ACOG in its 2002 Committee Opinion on Antenatal Corticosteroid Therapy for Fetal Maturation.

The frequency of respiratory distress syndrome diminishes markedly after 34 weeks gestation so many studies in the apst were under-powered to identify a difference. Stutchfield, et al used a very large sample size (998 women) to examine whether administration of antenatal corticosteroids would reduce respiratory distress in infants born by elective cesarean section at near term. The reduction was significant from 5.1% to 2.1% (RR=0.46; 95% CI: 0.23 to 0.93). They concluded that “antenatal betamethasone is effective in reducing admission to the special care unit with respiratory distress after elective cesarean section at term” and that “the likely benefits of antenatal corticosteroids should be compared with those of delaying delivery until 39 weeks when possible.”

3. “The decision to use antenatal corticosteroids should not be altered by fetal race or gender or by the availability of surfactant replacement therapy.

4. Patients eligible for therapy with tocolytics should also be considered for treatment with antenatal corticosteroids.

5. Treatment consists of two doses of 12 mg of betamethasone given intramuscularly 24 hours apart or four doses of 6 mg of dexamethasone given intramuscularly 12 hours apart.

### Betamethasone vs. Dexamethasone

While it is now well accepted that the administration of a single course of antenatal corticosteroids results in a decrease in neonatal morbidity and mortality, identification of the safest and most effective steroidal agent has some controversy. The preferred agents, betamethasone and dexamethasone are favored over other forms of steroids because they have both been studied extensively, seem to react in identical fashion and readily cross the placenta. The choice of which agent to use is currently based on ease of administration, cost effectiveness, drug availability and results from previous conflicting studies.

Elimian, et al conducted a randomized controlled trial (i.e., Betacode Trail) to “compare betamethasone with dexamethasone in terms of effectiveness in reducing perinatal morbidities and mortality among preterm infants.” They found that both drugs were largely comparable in reducing most morbidity and mortality in preterm infants. However, contrary to the finding of a higher rate of periventricular leukomalacia (PVL) in infants exposed to dexamethasone noted in earlier studies, this study found no such outcome, and in fact, found that PVL in the dexamethasone group was lower than in the betamethasone group. They concluded that both betamethasone and dexamethasone were
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appropriate for use in treating women at risk for preterm delivery, and found that dexamethasone was superior to betamethasone in reducing the rate of intraventricular hemorrhage.

A Cochrane review\textsuperscript{vii} completed in 2008 found that while the use of antenatal corticosteroid therapy in preventing neonatal morbidity is not in dispute, it is not yet clear which corticosteroid and which regimen performs best. The only definite finding reported was that intramuscular dexamethasone was noted to be superior to its oral form. Future controlled trials were recommended.

Current standard of care includes the use of either betamethasone or dexamethasone, but since the large majority of data is with betamethasone and it involves only two injections, betamethasone generally remains the first choice.

6. Because treatment with corticosteroids for less than 24 hours can be associated with significant reductions in neonatal mortality, RDS and IVH, antenatal corticosteroids should be given unless immediate delivery is anticipated.

7. In preterm premature rupture of membranes at less than 30 to 32 weeks’ gestation, in the absence of clinical chorioamnionitis, antenatal corticosteroid use is recommended because of the high risk of IVH at these early gestational ages.

Antenatal Corticosteroids and PROM

Antenatal steroids are equally effective in the setting of preterm rupture of membranes. The upper limit of gestational age for use of antenatal steroids in this population has some controversy. Some centers with higher rates of chorioamnionitis limit use to under 32 weeks of gestation while others use antenatal steroids up to the standard 34-week limit.

In their \textit{Guideline for the use of antenatal corticosteroids for fetal maturation}, Miracle et al\textsuperscript{viii} concluded that antenatal corticosteroid therapy is indicated in women with PROM from 24-32 weeks’ gestation not presenting clinical signs of chorioamnionitis. While administration of antenatal corticosteroids in this population involves some risk of infection for both mother and infant, the authors justified their recommendation based on 2 major meta-analyses:

- The 2006 Cochrane Review\textsuperscript{x} in which “ANS are shown to be beneficial in the subgroup of infants whose mothers have PROM. Neonatal death, RDS, IVH, NEC and duration of respiratory support are all reduced, without an increase in either maternal or neonatal infection”.
- Harding et al.’s\textsuperscript{2} 2001 meta-analysis which reported that “administration of corticosteroids to women with rupture of membranes substantially reduces the risks to their babies of respiratory distress syndrome, intraventricular hemorrhage, and necrotizing enterocolitis…may also reduce the risk of neonatal death…benefits do not appear to be accompanied by an increased risk of maternal or neonatal infection.” They further stated that, in their opinion, further trials to address the use of antenatal corticosteroids in PROM
8. In complicated pregnancies where delivery prior to 34 weeks’ gestation is likely, antenatal corticosteroid use is recommended unless there is evidence that corticosteroids will have an adverse effect on the mother or delivery is imminent.

9. Weekly repetitive courses of antenatal steroids are no longer recommended because of concerns for fetal head and somatic growth. However, in mothers likely to deliver beyond 2 weeks from the primary course and before 34 weeks gestation, a single “rescue” course of antenatal corticosteroids appears to provide additional benefit. The same medication regimens would be utilized.

**Repeat Courses**

The NIH Consensus Statement regarding the effect of antenatal corticosteroids for fetal maturation on perinatal outcomes states that the “optimal benefit begins 24 hours after initiation of therapy and last 7 days”, which prompted clinicians and researchers to question whether or not repeat courses of antenatal corticosteroid therapy should be administered.

The NIH organized a consensus conference August 17-18, 2000 to review the current research and address whether or not there was sufficient evidence on benefits and risks of repeated courses of antenatal corticosteroids to permit consensus recommendations. They determined that data assessing benefits and risks from the studies available at the time were inadequate to argue for or against the use of repeat or rescue courses of antenatal corticosteroids for fetal maturation. They reaffirmed the 1994 Consensus recommendations and further stated that repeat courses of corticosteroids should not be used routinely, but should be reserved for patients enrolled in randomized controlled trials. ACOG endorsed these recommendations in its 2002 Committee Opinion on Antenatal Corticosteroid Therapy for Fetal Maturation

In 2000, Wapner, et al initiated a randomized, double-masked, placebo-controlled, multicenter clinical trial performed by 18 centers of the NICHD MFMU Network to determine if weekly corticosteroids improved neonatal outcome without undue harm. The study was halted in April 2003 because of a concerns regarding decreased birth weight in the treatment group. The authors concluded that “repeat antenatal corticosteroids significantly reduce specific neonatal morbidities but do not improve composite neonatal outcome…accompanied by reduction in birth weight and increase in small for gestational age infants.”

A Cochrane review completed in 2007 found that “repeat dose(s) of prenatal corticosteroids reduce the occurrence and severity of neonatal lung disease and the risk of serious health problems in the first few weeks of life. These short-term benefits for babies support the use of repeat dose(s) of prenatal corticosteroids for women at risk of preterm birth. However, these benefits are associated with a reduction in some measures of weight, and head circumference at birth, and there is still insufficient evidence on the longer-term benefits and risks.”
Rescue Course

Previous studies using repetitive courses of antenatal corticosteroids have shown improved neonatal outcome with no apparent increase in short term risk, but unclear long-term risk. Ring, et al\textsuperscript{xv} looked at whether the neonatal benefit of a single complete course of antenatal corticosteroids diminishes when delivery is remote from administration (>14 days). They concluded that “a time interval of >14 days is associated with an increased risk for ventilatory support and surfactant use in neonates who deliver at >28 weeks gestation”, and recommended further investigation to assess the risk vs. benefit of a rescue course of corticosteroids for those fetuses remaining undelivered >14 days after the initial course of treatment.

Current research has focused on the impact of a single “rescue” course of antenatal corticosteroids. A recent, randomized multicenter trial\textsuperscript{xvi} looked at whether the use of rescue steroids reduces morbidity and/or mortality in patients who have been previously treated with antenatal corticosteroids, but who again threaten to deliver before 34 weeks. They demonstrated a benefit in composite morbidity and a decrease in the presence and severity of RDS, but not mortality or other morbidities at <34 weeks. They also looked at the difference between methods of rescue therapy (i.e., discretionary antenatal corticosteroid administration based on the clinician’s judgment of impending risk vs. giving repeated doses to all patients at risk). They found that with the discretionary method, as opposed to routine repetitive dosing, they appeared better able to correctly identify patients who would truly benefit by this treatment and avoid unnecessarily treating those who would not. They finally concluded that “choosing to administer a rescue course of antenatal corticosteroids in pregnant women treated initially >2 weeks prior, and who are judged by the clinician to be likely to deliver within the next week and before 34 weeks gestation, is a beneficial approach that significantly decreases respiratory complications of prematurity and is without apparent immediate or short-term adverse effects to the mother or infant.”

A second study\textsuperscript{xvii} compared pulmonary function in preterm infants randomized to a single rescue course of antenatal corticosteroids, as compared to placebo. The authors concluded that infants randomized to one rescue course of antenatal corticosteroids, delivering at ≤34 weeks, have a significantly increased respiratory compliance vs. those randomized to placebo, suggesting improved clinical respiratory outcome.

Potential for Adverse Maternal Outcomes

Currently, the benefit of a single course of antenatal corticosteroid therapy in the setting of anticipated preterm delivery is undisputed with 20-year follow-up studies demonstrating long-term safety, although concern over the possibility of fetal and maternal adverse effects persists in the case of repeated doses. Potential detrimental fetal effects include neurodevelopmental delay, growth...
delay and adrenal suppression, while studies of adverse maternal effects have focused on the potential for infection.

Early research focused on the potential for an increase in maternal osteoporosis related to a single course of antenatal corticosteroid and found no evidence to support this.\textsuperscript{xviii} Carroll MA et al.\textsuperscript{xx} compared markers of maternal bone metabolism between women who received single vs. multiple courses of antenatal corticosteroids. The authors concluded that “multiple courses of corticosteroids for fetal maturation are not associated with persistent or cumulative effects on bone metabolism as measured by PICP and ICTP.”

\textsuperscript{xi} Antenatal Corticosteroids Revisited: Repeat Courses. NIH Consensus Statement 2000; 17(2): 1-10.
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Benchmarking

CPQCC centers submit standardized data for very low birth weight infants (VLBW - ≤1500 gm; “Small Babies”) and selected low birth weight infants (LBW - >1500 gm; “Big Babies”) through an online data interface to the CPQCC Data Center, where they are reviewed for errors and omissions. These data contain information on 64 variables. Question 13 of both the CPQCC Admission/Discharge Form and Delivery Room Death Form records whether mothers of eligible infants received treatment with antenatal steroids or not. Instructions for completing forms are:

“Note: Corticosteroids include betamethasone, dexamethasone and hydrocortisone.

- Check Yes if corticosteroids were administered IM or IV to the mother during pregnancy at any time prior to delivery.
- Check No if no corticosteroids were administered IM or IV to the mother during pregnancy at any time prior to delivery.
- Check Unk if this information cannot be obtained.”

CPQCC aggregates data and computes indicators that reflect clinical procedures and outcomes. Each center receives its respective set of indicators, as well as the Network median and interquartile range for each indicator in the CPQCC real-time reports. Indicators are displayed in graphs to facilitate comparisons. Most of the tables/figures provided in this section of the Tool Kit may also be found in your center’s Annual Quality Management Webreport. The following sample tables/figures include:

**Figure 1:** Antenatal Steroid Administration Rates in all CPQCC NICUs in 2008

**Figure 2.1:** Percent Antenatal Steroids, 2000 to 2009; All Infants; Center 0000 Compared to All CPQCC Centers

**Figure 2.2:** Percent Antenatal Steroids, 2000 to 2009; All Infants; Center 0000 Compared to Same CCS Level Centers

**Figure 2.3:** Percent Antenatal Steroids, 2000 to 2009; All Infants; Center 0000 Compared to All Centers in the Same Region

**Figure 3.1:** Standardized Rates for Antenatal Steroids, Infants 401 to 1,500 grams or 22 to 29 weeks gestation, born between 1/1/1998 and 1/6/2009

**Figure 3.2:** Observed/Expected Ratios for Antenatal Steroids; Infants 401 to 1,500 grams or 22 to 29 weeks gestation, born between 1/1/1998 and 1/6/2009

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1 CPQCC Network Database, Manual of Definitions for Infants Born in 2009, Version 02.09, March 25, 2009
The indicator for antenatal steroid therapy is the rate of administration. CPQCC defines the rate of antenatal steroid administration for a given time period as:

\[
\frac{\text{Number of Mothers Treated}}{\text{Number of Eligible Infants Reported to CPQCC}}
\]

The numerator is defined as those mothers (of eligible infants) who received any antenatal corticosteroids at any time in pregnancy prior to delivery. The denominator is the number of eligible infants reported to CPQCC. This is not a perfect indicator. For example, the numerator is mothers, while the denominator is infants. When a mother of twins is treated and recorded, she will be counted once in the numerator but twice in the denominator. Thus, the denominator may be artificially inflated and the overall indicator deflated. In addition, the rates are not risk adjusted. Thus, comparing the rate at a given center to national or state figures without accounting for the unique patient population in that center can lead to inaccurate conclusions.

Over the last several years, the ANS administration rate as a quality measure of obstetrical care has gained considerable attention both locally and nationally. The importance of improving compliance with the national guidelines for utilizing antenatal steroids for mothers at risk of preterm birth has led to the development of several quality measures for this topic. Table 1 describes the similarities and differences in definition between four leading quality organizations, including the Leapfrog Group, CPQCC, the National Quality Forum (NQF) and the Joint Commission (JC).

### Table 1: Quality Measures of Antenatal Steroids (ANS) Utilization

*May 2009*

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Leapfrog Group (NICU-1) 2009</th>
<th>CPQCC 2009</th>
<th>NQF/JC 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birthweight</td>
<td>500-1499 gm</td>
<td>401-1500 gm</td>
<td>Not used “as this is not known prior to delivery”</td>
</tr>
<tr>
<td>Gestational Age</td>
<td>AND: 24+0 to 32+6</td>
<td>AND: 24+0 to 33+6</td>
<td>24+0 to 33+6 (if membranes intact) 24+0 to 31+6 (if PROM)</td>
</tr>
<tr>
<td>Exclusions</td>
<td>Maternal age &lt;18yr Transfers in/out Contraindications: Maternal Infection Chorioamnionitis Thyrotoxicosis Cardiomyopathy Fetal demise Maternal TB</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Base population</td>
<td>Mothers meeting criteria who received ANS</td>
<td>Infants meeting criteria whose mothers received ANS</td>
<td>Mothers meeting criteria who received ANS</td>
</tr>
<tr>
<td>ANS criteria</td>
<td>Any steroid used for lung maturation at any point prior to delivery (an earlier admission or outpatient use is acceptable). An incomplete course is also acceptable.</td>
<td>Any steroid used for lung maturation at any point prior to delivery (an earlier admission or outpatient use is acceptable). An incomplete course is also acceptable.</td>
<td>Any steroid used for lung maturation at any point prior to delivery (an earlier admission or outpatient use is acceptable). An incomplete course is also acceptable.</td>
</tr>
</tbody>
</table>
The Leapfrog group has brought their measure much closer to CPQCC/VON for the 2009 reporting year. They allow for a series of exclusions but are minimally different for the gestational age/birth weight criteria. NQF and the Joint Commission have defined their measure adhering to the ACOG guideline that all mothers who are at risk for delivery before 34 weeks should receive ANS. Hence, their inclusion criteria are much broader all the way up to 34 weeks and increase the number of mothers covered two to three fold. All measures require chart review, though case identification and some data collection can be done using an electronic database or EMR. At this point, it is not known how these different specifications affect a given hospital’s ranking, as they have not been done simultaneously in a sufficient sample size of hospitals. Until the differences in these measures can be reconciled, the use of the NQF definition is recommended for QI efforts to enhance the utilization of ANS. The CPQCC/VON definitions represent subsets of the NQF and will therefore fall into place.

In 1998, only 25 percent of CPQCC hospitals administered ANS at the recommended rate, which was determined by an expert panel of obstetricians and maternal-fetal medicine specialists to be 85%. Following CPQCC improvement strategies over the next five years, 75 percent of the hospitals were found to be administering ANS at or above the recommended rate. While many providers strive for ANS rates exceeding 90-95%, there are numerous barriers to achieving and sustaining ANS rates at this level. Subsequently, CPQCC’s expert OB/MFM panel has reaffirmed ANS rates of 85% as the CPQCC benchmark.

An important goal of this tool kit is to give your center the opportunity to look beyond the indicator and to better understand the actual patterns and practices that affect your rate. The Problem Identification Worksheets in the next section will facilitate this understanding.
**Figure 1:** Antenatal Steroid Administration Rates in all CPQCC NICUs in 2008

![Antenatal Steroids Chart]

The chart is preliminary as data collection is ongoing.

<table>
<thead>
<tr>
<th>CPQCC</th>
<th>N</th>
<th>Median</th>
<th>Q1</th>
<th>Q3</th>
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<tbody>
<tr>
<td>2007</td>
<td>127</td>
<td>37.0%</td>
<td>27.8%</td>
<td>48.9%</td>
</tr>
<tr>
<td>2008</td>
<td>127</td>
<td>38.1%</td>
<td>26.8%</td>
<td>50.0%</td>
</tr>
</tbody>
</table>
Figure 2.1: Percent Antenatal Steroids, 2000 to 2009; All Infants; Center 0000 Compared to All CPQCC Centers

The charts below display unadjusted trends over time for the variable you selected. Trend charts showing risk-adjusted results can be obtained by choosing the Standardized Table/Chart option to your left.

Percent Antenatal Steroids, 2000 to 2009

All CPQCC Infants
Center 0000 compared to all CPQCC Centers
The shaded area in the chart corresponds to years for which the data collection is on-going/ incomplete.

The number displayed next to each data point for Center 0000 is the total number of infants on which the percentage is based.

Figure 2.2: Percent Antenatal Steroids, 2000 to 2009; All Infants; Center 0000 Compared to Same CCS Level Centers

Percent Antenatal Steroids, 2000 to 2009

All CPQCC Infants
Center 0000 compared to same CCS Level Centers
The shaded area in the chart corresponds to years for which the data collection is on-going/ incomplete.

The number displayed next to each data point for Center 0000 is the total number of infants on which the percentage is based.
Figure 2.3: Percent Antenatal Steroids, 2000 to 2009; All Infants; Center 0000 Compared to All Centers in the Same Region.
Figure 3.1: Standardized Rates for Antenatal Steroids, Infants 401 to 1,500 grams or 22 to 29 weeks gestation, born between 1/1/1998 and 1/6/2009

<table>
<thead>
<tr>
<th>Year</th>
<th>Center</th>
<th>Infants</th>
<th>Observed</th>
<th>Observed %</th>
<th>Expected</th>
<th>Expected %</th>
<th>OE Ratio</th>
<th>95% Confidence Limits for OE Ratio</th>
<th>Unadjusted % for...</th>
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<td></td>
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<td></td>
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<tr>
<td>1998</td>
<td>5</td>
<td>2</td>
<td>40.0</td>
<td>84.6</td>
<td>0.47</td>
<td>0.35</td>
<td>1.11</td>
<td>45.4 - 44.0</td>
<td>69.1</td>
</tr>
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<td>3</td>
<td>1</td>
<td>33.3</td>
<td>66.7</td>
<td>0.50</td>
<td>0.62</td>
<td>2.04</td>
<td>56.1 - 55.2</td>
<td>72.6</td>
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<td>2000</td>
<td>6</td>
<td>7</td>
<td>77.0</td>
<td>66.0</td>
<td>0.30</td>
<td>0.50</td>
<td>1.89</td>
<td>56.9 - 60.9</td>
<td>63.9</td>
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<tr>
<td>2001</td>
<td>4</td>
<td>4</td>
<td>66.7</td>
<td>51.8</td>
<td>0.50</td>
<td>0.72</td>
<td>1.94</td>
<td>62.6 - 70.1</td>
<td>57.9</td>
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<tr>
<td>2002</td>
<td>21</td>
<td>18</td>
<td>45.5</td>
<td>84.9</td>
<td>1.01</td>
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<td>1.69</td>
<td>81.2 - 85.5</td>
<td>79.7</td>
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<td>2003</td>
<td>27</td>
<td>18</td>
<td>66.7</td>
<td>62.8</td>
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<td>0.49</td>
<td>1.27</td>
<td>62.7 - 80.0</td>
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<tr>
<td>2004</td>
<td>25</td>
<td>16</td>
<td>73.0</td>
<td>63.6</td>
<td>0.66</td>
<td>0.51</td>
<td>1.30</td>
<td>78.4 - 94.9</td>
<td>75.8</td>
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<td>2005</td>
<td>34</td>
<td>26</td>
<td>76.5</td>
<td>62.6</td>
<td>0.33</td>
<td>0.51</td>
<td>1.29</td>
<td>66.6 - 72.1</td>
<td>73.3</td>
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<td>2006</td>
<td>47</td>
<td>42</td>
<td>89.4</td>
<td>82.2</td>
<td>1.09</td>
<td>0.78</td>
<td>1.47</td>
<td>78.5 - 88.8</td>
<td>72.9</td>
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<tr>
<td>2007</td>
<td>50</td>
<td>47</td>
<td>78.5</td>
<td>81.7</td>
<td>0.36</td>
<td>0.70</td>
<td>1.27</td>
<td>82.0 - 86.0</td>
<td>81.1</td>
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<td>2008</td>
<td>47</td>
<td>35</td>
<td>74.5</td>
<td>81.0</td>
<td>0.31</td>
<td>0.63</td>
<td>1.26</td>
<td>83.5 - 86.0</td>
<td>81.4</td>
</tr>
<tr>
<td>2009</td>
<td>8</td>
<td>7</td>
<td>73.0</td>
<td>61.7</td>
<td>0.35</td>
<td>0.30</td>
<td>1.13</td>
<td>83.1 - 85.2</td>
<td>78.3</td>
</tr>
<tr>
<td>2005 to 2009 Aggregate</td>
<td>141</td>
<td>115</td>
<td>81.6</td>
<td>82.1</td>
<td>0.99</td>
<td>0.32</td>
<td>1.13</td>
<td>81.0 - 88.7</td>
<td>75.8</td>
</tr>
</tbody>
</table>

Figure 3.2: Observed/Expected Ratios for Antenatal Steroids; Infants 401 to 1,500 grams or 22 to 29 weeks gestation, born between 1/1/1998 and 1/6/2009
Antenatal Corticosteroid Therapy Form

INSTRUCTIONS

Center Number: Center Name: Date:

Name and Position/Title of Person Completing Form:

Telephone Number:

The rate of antenatal steroid administration for a given time period is defined as:

\[
\text{Number of Mothers Treated} \quad \text{Number of Eligible Infants Reported to CPQCC}
\]

The attached data tables address factors that influence this rate: These factors are:

- Accuracy in counting mothers who were treated.
- Failure to treat mothers for whom treatment was planned.
- Physician practice regarding eligibility, particularly with respect to certain conditions. These are preterm labor with tocolysis; preeclampsia/eclampsia/HELLP syndrome; premature preterm rupture of membranes (PPROM); gestational diabetes (GDM); vaginal bleeding/abruption/previa; and advanced cervical dilation.

Worksheet I addresses factors 1 and 2 above. Table I will help determine whether accuracy in counting treated mothers is a concern for your hospital. It will also provide information on failure to administer ordered steroids. To complete this table, you should review charts of mothers of infants listed in your CPQCC reports as not having received steroids. Please be sure to include review of those mothers whose infants might have been transferred or died.

Worksheet II addresses factor 3 above. To complete this table, you should review charts of mothers of infants listed in your CPQCC reports as not having received steroids. When completed, Table II provides insight into medical conditions negatively correlated with administration of steroids. You may also use Table II to identify physicians who administer steroids less frequently.
Patient #
Infant died in delivery room (yes/no)
Infant transferred (yes/no)
If yes, where?
Was there a prior admission? When? Where? Were steroids administered?
Were steroids indicated on this admission? (yes/no)
Were steroids ordered here according to charts, medication sheets, physician records? (yes/no) If yes, what is the source of this information?
Were steroids given here according to charts, medication sheets, physician records? (yes/no) If yes, what is the source of this information?
When was the initial course of steroids administered?
Was a rescue course of steroids administered? (yes/no) Was it ≥ 14 days from initial course? (yes/no) Was it at ≤ 34 weeks gestation? (yes/no)

1
No
Yes: home
No prior admit No steroids
Yes
No
No
N/A
N/A
2
No
Yes: CCH
?
Yes
?
No
N/A
N/A
3
No
No
Yes: 27 weeks
ANS given
No
No
No
2/12/09 at other hospital
N/A
4
No
No
No
Yes
Yes: MD orders
Yes: Discharge profile
7/5/09
No
5

No
No
No
Yes
Yes: MD orders
No
N/A
N/A
6

No
No
No
Yes
Yes: MD orders
No
N/A
N/A
7

No
No
No
Yes
No
No
N/A
N/A
8

No
No
No
No
No
N/A
N/A
N/A
9

No
No
No
Yes
Yes
Yes
Yes
Yes
8/1/09
N/A
10
<table>
<thead>
<tr>
<th>Case</th>
<th>Improved?</th>
<th>Weeks?</th>
<th>ANS?</th>
<th>Rescue Course?</th>
<th>Date 1st Dose</th>
<th>Days After 1st Dose</th>
<th>Weekly Dose</th>
<th>Gestational Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Yes</td>
<td>25</td>
<td>Yes</td>
<td>Yes</td>
<td>8/8/09</td>
<td>28</td>
<td>Yes</td>
<td>30</td>
</tr>
<tr>
<td>2</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>N/A</td>
<td>N/A</td>
<td>No</td>
<td>N/A</td>
</tr>
<tr>
<td>3</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>N/A</td>
<td>N/A</td>
<td>No</td>
<td>N/A</td>
</tr>
<tr>
<td>4</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>7/31/09</td>
<td>28</td>
<td>Yes; given 8/28/09</td>
<td>30</td>
</tr>
<tr>
<td>5</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>N/A</td>
<td>N/A</td>
<td>No</td>
<td>N/A</td>
</tr>
<tr>
<td>6</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>No</td>
<td>N/A</td>
</tr>
</tbody>
</table>

(Note: Shaded lines indicate cases with improvement potential)
**Worksheet II**

<table>
<thead>
<tr>
<th>Patient #</th>
<th>Reason for delivery</th>
<th>Approx. admit to delivery interval (hours)</th>
<th>G.A</th>
<th>Physician</th>
<th>Preterm labor with tocolysis (yes/no)</th>
<th>PPROM with no evidence of chorio (yes/no)</th>
<th>PPROM with no chorio or increased risk to mother (yes/no)</th>
<th>GDM (yes/no)</th>
<th>Vaginal bleeding (yes/no)</th>
<th>Cervical dilation (cm) at admission</th>
<th>PIH (yes/no)</th>
<th>Other relevant conditions/ justification for lack of ANS administration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Unknown</td>
<td>0</td>
<td>28</td>
<td>Dr. A</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>N/A</td>
<td>No</td>
<td>Home birth; no prenatal</td>
<td>Yes</td>
<td>Transport; no data</td>
</tr>
<tr>
<td>2</td>
<td>Unknown</td>
<td>0</td>
<td>28+2</td>
<td>Unknown</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Preterm labor</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Dr. R
Yes
No
No
No
No
4
No
Comfort measures only
4
Unknown
8
30+6
Dr. S
No
No
No
Yes
No
0
No
STEROIDS GIVEN
5
Preterm labor
5
31+6
Dr. N
Yes
No
No
No
No
0
No
Ordered, not given
6
PPROM, preterm labor
5
26+3
Dr. S
No
Yes
-
No
No
?
Yes
STEROIDS GIVEN
7
Prolapsed cord; emergency
C-section
12
27+4
<table>
<thead>
<tr>
<th>Dr. J</th>
<th>Yes</th>
<th>No</th>
<th>No</th>
<th>No</th>
<th>No</th>
<th>No</th>
<th>?</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prolapsed cord</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PPROM, preterm labor</td>
<td>24</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27+1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dr. R</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Severe Pre-eclampsia</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32+4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dr. S</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>N/A</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-viable infant; PPROM, preterm labor</td>
<td>16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23+3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dr. J</td>
<td>Yes</td>
<td>Yes (but under GA limit of 24-32 wks)</td>
<td>-</td>
<td>No</td>
<td>No</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infant died in del room</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preterm labor</td>
<td>48</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24+6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Dr. S
Yes
No
No
No
No
0
Yes
STEROIDS GIVEN
12
Placenta previa
15
34+5
Dr. S
No
No
No
Yes
0
No
G.A. > 34 weeks
13
Pre-eclampsia
8
33+2
Dr. M
No
No
No
No
No
0
Yes
Detected lung maturity
(Note: Shaded lines indicate cases with improvement potential)
ANTENATAL SYSTEMS ASSESSMENT
Appropriate Administration of Antenatal Corticosteroid Therapy

Circle the Factor on this Fishbone Diagram OR (if not present) Add the Factor to the Skeleton
Antenatal Corticosteroid Therapy Form

INSTRUCTIONS

Center Number: Center Name: Date:

Name and Position/Title of Person Completing Form:

Telephone Number:

The rate of antenatal steroid administration for a given time period is defined as:

\[
\text{Number of Mothers Treated} \div \text{Number of Eligible Infants Reported to CPQCC}
\]

The attached data tables address factors that influence this rate: These factors are:

- Accuracy in counting mothers who were treated.
- Failure to treat mothers for whom treatment was planned.
- Physician practice regarding eligibility, particularly with respect to certain conditions. These are preterm labor with tocolysis; preeclampsia/eclampsia/HELLP syndrome; premature preterm rupture of membranes (PPROM); gestational diabetes (GDM); vaginal bleeding/abruption/previa; and advanced cervical dilation.

Worksheet I addresses factors 1 and 2 above. Table I will help determine whether accuracy in counting treated mothers is a concern for your hospital. It will also provide information on failure to administer ordered steroids. To complete this table, you should review charts of mothers of infants listed in your CPQCC reports as not having received steroids. Please be sure to include review of those mothers whose infants might have been transferred or died.

Worksheet II addresses factor 3 above. To complete this table, you should review charts of mothers of infants listed in your CPQCC reports as not having received steroids. When completed, Table II provides insight into medical conditions negatively correlated with administration of steroids. You may also use Table II to identify physicians who administer steroids less frequently.
Worksheet I

Patient #
Infant died in delivery room (yes/no)
Infant transferred (yes/no)
If yes, where?
Was there a prior admission? When? Where? Were steroids administered?
Were steroids indicated on this admission? (yes/no)
Were steroids ordered here according to charts, medication sheets, physician records? (yes/no) If yes, what is the source of this information?
Were steroids given here according to charts, medication sheets, physician records? (yes/no) If yes, what is the source of this information?
When was the initial course of steroids administered?
Was a rescue course of steroids administered? (yes/no) Was it ≥ 14 days from initial course? (yes/no) Was it at ≤ 34 weeks gestation? (yes/no)
<table>
<thead>
<tr>
<th>Worksheet II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient #</td>
</tr>
<tr>
<td>Reason for delivery</td>
</tr>
<tr>
<td>Approx. admit to delivery interval (hours)</td>
</tr>
<tr>
<td>G.A</td>
</tr>
<tr>
<td>Physician</td>
</tr>
<tr>
<td>Preterm labor with tocolysis (yes/no)</td>
</tr>
<tr>
<td>PPROM with no evidence of chorio (yes/no)</td>
</tr>
<tr>
<td>PPROM with no chorio or increased risk to mother (yes/no)</td>
</tr>
<tr>
<td>GDM</td>
</tr>
<tr>
<td>(yes/no)</td>
</tr>
<tr>
<td>Vaginal bleeding</td>
</tr>
<tr>
<td>(yes/no)</td>
</tr>
<tr>
<td>Cervical dilation (cm) at admission</td>
</tr>
<tr>
<td>PIH</td>
</tr>
<tr>
<td>(yes/no)</td>
</tr>
<tr>
<td>Other relevant conditions/ justification for lack of ANS administration</td>
</tr>
</tbody>
</table>
FIND a Process to Improve

Use information from the completed Problem Identification Worksheets in the previous section to find a process that “constitutes an opportunity for improvement.” The last column of Worksheet IIA will in some cases “explain” why certain patients did not receive steroids (e.g., infants with gestational age greater than 34 weeks). In finding a process to improve, focus on infants without such an explanation.

Processes identified for improvement from Worksheet I:

1. **Undercounting of mothers treated with antenatal steroids.** Is the administration of antenatal corticosteroid therapy being reported to CPQCC accurately? Are maternal charts accurate and being read carefully for the purposes of CPQCC reporting? In reviewing Table One, do you find any infants to whom steroids were administered? If yes, your hospital’s rate of antenatal steroid administration according to CPQCC data may be depressed because some treated mothers are not being counted.

2. **Steroid administration as noted on various sources is not consistently being reviewed and/or reported to CPQCC.** Which sources of information about steroid treatment are not consistently being reviewed for CPQCC reporting purposes? In column 5 of Table One, what sources of information are listed? If “charts” are listed, it may be that information about steroid administration is not easily discerned from the chart and was missed when CPQCC reports were completed. If an alternate source of information is listed, meaning that you had to look at sources other than charts, it may be that information on steroid administration is not being recorded at all on the charts.

3. **Treated mothers of infants who died in the delivery room are less likely to be counted.** Of infants who die in the delivery room (yes in column 2), do you find evidence of steroid administration? If so, is there a problem in recording steroid administration to mothers of such infants?

4. **Treated mothers of infants who were transferred to/from another hospital are less likely to be counted.** Of infants who were transferred (yes to column 3), do you find evidence of steroid administration? You may have to search to find maternal charts from the hospital at which the mother was treated.

5. **The rate of antenatal steroid administration is low at hospitals that transfer infants to your hospital.** Your sample may reveal that mothers who deliver at particular hospitals are not being given steroids when it is appropriate to do so. Though not related to processes within your hospital, this problem once identified should be addressed through education, consultation and outreach.

6. **Women who were previously admitted and who received steroids at a prior admission are incorrectly counted.** Women who received antenatal corticosteroid treatment during a

---

prior admission may not have their previous medical record readily available when CPQCC data is collected and entered.

7. **Antenatal corticosteroids were ordered, but not administered.** If there is a discrepancy between columns 4 and 5, this should be a concern.
Processes identified for improvement from Worksheet II:

1. **Even in the absence of advanced cervical dilation, steroids are not consistently administered.** Lack of antenatal corticosteroid administration may be explained by relatively advanced cervical dilation at admission and inadequate time for antenatal corticosteroid administration. For patients without advanced cervical dilation and with, presumably, adequate time for steroid administration, other factors correlating with lack of antenatal corticosteroid administration should be pursued from the worksheet.

2. **Women who deliver less than 24 hours after admission to not receive antenatal corticosteroids.** There is evidence to support steroid administration for women who deliver less than 24 hours after receiving the first dose. Do you notice that the Admission/Delivery interval is less than 24 hours for many of the women who did not receive steroids? If so, this may be an area for improvement.

3. **Some obstetricians administered steroids less consistently than others.** In column 4, do some physicians appear more frequently than others? If so, there may be significant variation in corticosteroid administration based on the attending obstetrician.

4. **When tocolysis is administered for preterm labor, steroids are less consistently administered.** The information in column 5 might suggest that antenatal corticosteroids are not being administered to women in preterm labor with tocolysis. Examine the charts of patients listed in the worksheet. Was there adequate time for corticosteroid administration? If so, this may be an area for improvement.

5. **Antenatal corticosteroids are not consistently administered in the case of Premature Preterm Rupture of Membranes (PPROM).** The information in column 6 might suggest that corticosteroids are not being administered in the case of PPROM. Again, examine the charts of patients with PPROM listed in the worksheet. Was there adequate time for corticosteroid administration? If so, this may be an area for improvement.

6. **Antenatal corticosteroids are not consistently administered to women with Gestational diabetes, vaginal bleeding/abruption/previa, preeclampsia/eclampsia/HELLP, or “other” condition.** Based on the information in the worksheet, are any of these “other” conditions correlated with absence of antenatal corticosteroid administration? If so, this may be a problem to be addressed by your hospital.

---

ORGANIZE a Team that Knows the Process

Once a process has been targeted for improvement, the next step is to identify individuals who have “ownership” of the process, have insights into the process and/or play key roles in the process. Their participation in efforts to improve the process is critical. When identifying participants, consider both their current role, position and perspective within the hospital, and their appropriate role and position within the quality improvement effort.

There is no set formula for team composition. Depending on the process to be improved, a team might consist of one or two members or could require a larger, multidisciplinary group. The team will also depend on the factors unique to each hospital, such as schedules and priorities of staff. The following table provides examples of teams constructed to address the processes identified in the previous section. These examples are meant to be illustrative, not exhaustive, and should be adapted to the resources and constraints of your hospital.

Once appropriate team members have been identified, their participation should be secured. Individuals identified as potential team members may not be entirely enthusiastic about participating. Clearly stated hospital/department commitment to improving the process will encourage individual participation. Inclusion of well-reputed and/or neutral parties in teams will also serve to encourage those who might feel threatened or challenged by the activity.
Table I. Processes to be improved and corresponding sample teams

<table>
<thead>
<tr>
<th>Process To Be Improved</th>
<th>Example Of Team Members</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Undercounting of mothers treated with antenatal corticosteroids.</td>
<td>Person(s) responsible for CPQCC reporting; other senior data personnel; general obstetricians; perinatologists; OB nurses; pharmacy personnel.</td>
</tr>
<tr>
<td>2. Corticosteroid administration as noted on various sources is not consistently being reviewed and/or reported to CPQCC.</td>
<td></td>
</tr>
<tr>
<td>3. Treated mothers of infants who died in the delivery room are less likely to be counted.</td>
<td></td>
</tr>
<tr>
<td>4. Treated mothers of infants who were transferred to another hospital are less likely to be counted.</td>
<td>Physicians from your hospital and those hospitals either sending you or accepting your transported mothers/infants; representatives from other hospitals interested in outcomes/quality improvement; transport coordinator; others involved in transfer procedures; regional coordinator; outreach coordinator.</td>
</tr>
<tr>
<td>5. The rate of antenatal corticosteroid administration is low at hospitals that transfer infants to your hospital.</td>
<td></td>
</tr>
<tr>
<td>6. Women who were previously admitted and who received steroids at a prior admission are incorrectly counted.</td>
<td>Person(s) responsible for CPQCC reporting; other senior data personnel; general obstetricians; perinatologists; OB nurses.</td>
</tr>
<tr>
<td>7. Antenatal corticosteroids ordered, but not administered.</td>
<td>OB nurses, general obstetricians; perinatologists; pharmacy personnel.</td>
</tr>
<tr>
<td>8. Even in the absence of advanced cervical dilation, antenatal corticosteroids are not consistently ordered/administered.</td>
<td>General obstetricians; perinatologists; outcome/quality management personnel; OB nurses.</td>
</tr>
<tr>
<td>9. Women who deliver less than 24 hours after admission do not receive antenatal corticosteroids.</td>
<td></td>
</tr>
<tr>
<td>10. Some obstetricians administer antenatal corticosteroids less consistently than others.</td>
<td>Obstetricians who administer less and administer more antenatal corticosteroids; quality management personnel; well-reputed persons from within or outside hospital with depth of understanding of issue.</td>
</tr>
<tr>
<td>11. When tocolysis is administered for preterm labor, antenatal corticosteroids are less consistently administered.</td>
<td>Well-reputed persons from within or outside hospital with depth of understanding of issue; general obstetricians; perinatologists.</td>
</tr>
<tr>
<td>12. Antenatal corticosteroids are not consistently administered in the case of PPROM.</td>
<td></td>
</tr>
<tr>
<td>13. Steroids are not consistently administered to women with GDM, vaginal bleeding, preeclampsia or other conditions.</td>
<td></td>
</tr>
</tbody>
</table>
CLARIFY the Current Knowledge of the Process

Once a team has been constructed, several issues should be presented to the team members. These are:

- The rationale for the promotion of antenatal corticosteroid administration. Section 2 of the Tool Kit, *Rationale for Promotion of Antenatal Corticosteroid Therapy*, provides consensus statements from ACOG and the NIH about appropriate usage of antenatal corticosteroids. These statements and/or other background material should be made available to team members.

- Update on the current rate of antenatal corticosteroid administration within your center, along with comparative data such as national or state median rates. This information is presented in Section 3 of the Tool Kit, *Benchmarking*.

- The method by which your hospital identified a process to be improved, and the evidence that the process needs improvement. Provide team members with the completed Problem Identification Worksheets (with some information removed to ensure confidentiality) and the results that it provided. Demonstrate to the Team how the worksheet gave rise to the “process to be improved”.

- Details of the process as it currently stand. For example, if the Problem Identification Worksheets suggest that antenatal corticosteroids are being ordered but not administered, you will want to review and discuss current procedures and controls for ordering and/or administering antenatal corticosteroids, as well as all the steps in between related to procurement, delivery and so forth. A flowchart is a useful tool for describing the current process.

- In clarifying current knowledge, consider calling upon team members, other hospital staff and outside sources with appropriate expertise to assist. The mechanism chosen for clarifying knowledge will depend on the process to be improved, the team and its needs, and the resources available. You may wish to distribute articles in advance and then provide a venue for discussion and exchange, such as a team meeting. Alternately, it may be effective to review information together or to re-package the information. For example, summaries can be sent around via e-mail.
UNDERSTAND the Causes of Process Variation

Process variation should be discussed following the previous activity, clarification of current knowledge of the process. The key points related to process variation are:

- The possible range of process variation. For example, consider administration of antenatal corticosteroids to patients with preeclampsia, eclampsia or HELLP. In some hospitals, antenatal corticosteroids are consistently administered despite evidence of this pregnancy complication. In other hospitals, antenatal corticosteroids are rarely administered, even to patients with mild or uncertain preeclampsia. Between these extremes, antenatal corticosteroids could be administered regularly to all patients except those with severe preeclampsia.

- The acceptable range of process variation. Consider a scenario in which the process to be improved is documentation of antenatal corticosteroid administration. It may be difficult to obtain such documentation for mothers of infants who are not born at the hospital in question, and one could therefore expect documentation to be accurate less than 100% of the time.

- The apparent range of process variation within your hospital. You may find that antenatal corticosteroids are always administered, never administered, or sometimes administered to patients with certain conditions. Charts, histograms and diagrams will help the team assess process variation.

- An assessment of the probable reason for process variation within your hospital. Does the process vary according to severity of the condition? Does the process vary depending on the physician?

The extent to which process variation is justified. For example, antenatal corticosteroid administration is likely to correlate with the length of the admission/delivery interval. For patients who deliver immediately, lack of antenatal corticosteroid administration can be justified. However, antenatal corticosteroids should be given if delivery is not imminent, even if the
**SELECT the Process Improvement**

Restate the process to be improved as an actual improvement. This should be a team activity, with attention given to the methods used to select the process improvement. The following chart provides an example of an improvement for each previously identified process.

**Table II. Process to be Improved and Examples of Improvement**

<table>
<thead>
<tr>
<th>Process to be Improved</th>
<th>Examples of Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Undercounting of mothers treated with antenatal corticosteroids.</td>
<td>Designate staff member with clear responsibility for documenting and reporting antenatal corticosteroid administration.</td>
</tr>
<tr>
<td>2. Antenatal corticosteroid administration as noted on various sources is not consistently being reviewed and/or reported to CPQCC.</td>
<td>Revise patient report/chart format so that area for reporting antenatal corticosteroid administration is more obvious.</td>
</tr>
<tr>
<td>3. Treated mothers of infants who died in the delivery room are less likely to be counted.</td>
<td>Assure that CPQCC delivery room death forms (which have an antenatal corticosteroid question) are filled out at time of delivery; establish procedure whereby L&amp;D logs are reviewed for deaths; establish procedure whereby mother’s nurse completes CPQCC death form.</td>
</tr>
<tr>
<td>4. Treated mothers of infants who were transferred to/from another hospital are less likely to be counted.</td>
<td>Maintain regular contact between NICU data managers from different hospitals to ensure complete patient record is transferred; involve transport teams in data collection pertaining to antenatal corticosteroids; request complete copy of chart from referring hospital; include CPQCC data on sheet to be completed by referring hospital at time of transfer.</td>
</tr>
<tr>
<td>5. The rate of antenatal corticosteroid administration is low at hospitals that transfer infants to your hospital.</td>
<td>Establish inter-hospital dialogue on antenatal corticosteroid administration; review yearly data to demonstrate antenatal corticosteroid administration rates and rate variation to hospital staff at referring hospitals; encourage other hospitals to use the ANS Tool Kit; circulate Rationale section of Tool Kit to referring hospitals; review issue at Morbidity and Mortality conferences.</td>
</tr>
<tr>
<td>6. Women who were previously admitted and who received antenatal corticosteroids at a prior admission were incorrectly counted.</td>
<td>Write and circulate memorandum on timing of antenatal corticosteroid administration and on relevant CPQCC reporting guidelines.</td>
</tr>
<tr>
<td>7. Antenatal corticosteroids ordered but not administered.</td>
<td>Develop standards for treatment; establish procedures that promote physician follow-up on ordered medications to ensure that they are administered; standing orders; STAT orders.</td>
</tr>
<tr>
<td>8. Even in the absence of advanced cervical dilation, antenatal corticosteroids are not consistently ordered/administered.</td>
<td>Organize educational session about importance of antenatal corticosteroids, including delivering physicians and pediatricians/neonatologists; circulate consensus paper and other documents from Rationale section of</td>
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</tr>
<tr>
<td><strong>9. Women who deliver less than 24 hours after admission do not receive antenatal corticosteroids.</strong></td>
<td>Tool Kit to all delivering physicians. Organize education session about benefits of antenatal corticosteroids when administered within 24 hours of delivery; circulate <em>Rationale</em> section of Tool Kit to delivering physicians and OB nurses.</td>
</tr>
<tr>
<td><strong>10. Some obstetricians administer antenatal corticosteroids less consistently than others.</strong></td>
<td>Organize education session about the importance of antenatal corticosteroids; be sure that targeted physicians are able to attend; copy <em>Rationale</em> section of Tool Kit and distribute to physicians.</td>
</tr>
<tr>
<td><strong>11. When tocolysis is administered for preterm labor, antenatal corticosteroids are less consistently administered.</strong></td>
<td>Organize education session about benefits of antenatal corticosteroids regardless of whether tocolysis is administered for preterm labor; utilize standard order sheets; develop “care map” of protocol for preterm labor.</td>
</tr>
<tr>
<td><strong>12. Antenatal corticosteroids are not consistently administered in the case of PPROM.</strong></td>
<td>Organize educational session about benefits of antenatal corticosteroid regardless of incidence of PPROM.</td>
</tr>
<tr>
<td><strong>13. Antenatal corticosteroids are not consistently administered to women with GDM, vaginal bleeding, preeclampsia or “other” conditions.</strong></td>
<td>Organize educational session about benefits of antenatal corticosteroids irrespective of these conditions.</td>
</tr>
</tbody>
</table>
PLAN the Improvement and Continue Data Collection

This stage involves visualizing how the specified improvements will be made. The first column of the table below re-states “examples of improvements” from the previous table. The second column provides key steps toward realizing the specified improvement. Note that only the key steps are described. You may want to go into more detail, outlining intermediate steps. Be sure to include target dates for completing each step. Use the Implementation Worksheet at the end of this section to document the proposed improvement, key steps planned towards realizing the improvement, and actual steps taken (see next heading, Do the Improvement). Entries into the Implementation Worksheet are to be made on a regular basis, thereby charting the progress of quality improvement efforts.

Table III. Improvements and Key Steps Towards Making Improvements

<table>
<thead>
<tr>
<th>Example of Improvement</th>
<th>Examples of Key Steps Toward Realizing Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Designate staff member with clear responsibility for documenting and reporting antenatal corticosteroid administration.</td>
<td>Team nominates/agrees upon staff member(s) to take on responsibility; responsibilities clarified; relationship between team responsibilities and staff member responsibility clarified.</td>
</tr>
<tr>
<td>2. Revise patient report/chart format so that area for reporting antenatal corticosteroid administration is more obvious.</td>
<td>Team reviews current format and alternate models; revisions made.</td>
</tr>
<tr>
<td>3. Assure that CPQCC delivery room death forms (which have an antenatal corticosteroid question) are filled out at time of delivery.</td>
<td>Team reviews current process for completing delivery room death forms and reasons why data on antenatal corticosteroids administration is not complete. New procedures proposed and agreed upon.</td>
</tr>
<tr>
<td>4. Establish direct contact between NICU data managers from different hospitals.</td>
<td>Team researches current methods of communication and possible shortcomings/limitations to these methods. Enhanced methods proposed, agreed upon.</td>
</tr>
<tr>
<td>5. Establish inter-hospital dialogue on antenatal corticosteroid administration; encourage other hospitals to use the ANS Tool Kit.</td>
<td>Team considers current system of dialogue; propose and enact improved system. Devise strategy for promotion of Tool Kit in other hospitals.</td>
</tr>
<tr>
<td>6. Write and circulate memorandum on timing of antenatal corticosteroid administration and on relevant CPQCC reporting guidelines.</td>
<td>Team discusses NIH guidelines, specifically related to timing of doses. Team writes memorandum, establishes target audience, disseminates memorandum.</td>
</tr>
<tr>
<td>7. Establish procedures that promote physician follow-up on ordered medications to ensure that they are administered.</td>
<td>Team reviews current checks and balances for administration of ordered medication; propose and enact improved procedures.</td>
</tr>
<tr>
<td>8. Organize educational session about importance of antenatal corticosteroids.</td>
<td>Team adapts a consensus statement on importance of ANS; discusses best way of reaching physicians with this statement; outline plan for outreach.</td>
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<tr>
<td>9. Organize education session about benefits of</td>
<td>Team discusses literature related to this issue; forms</td>
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<tr>
<td>antenatal corticosteroids when administered within 24 hours of delivery.</td>
<td>consensus about appropriate treatment; discusses best way of reaching physicians; outline plan for outreach.</td>
</tr>
<tr>
<td>10. Organize education session about the importance of antenatal corticosteroids. Be sure that targeted physicians are able to attend.</td>
<td>Team meets for open forum discussion where different opinions can be voiced; literature discussed; consensus reached by Team; method of reaching physicians adapted; outline plan for outreach.</td>
</tr>
<tr>
<td>11. Organize education session about benefits of antenatal corticosteroids regardless of whether tocolysis is administered for preterm labor.</td>
<td>Team discusses issue – pros/cons of ANS administration with tocolysis; relevant literature/studies reviewed; consensus reached; outline plan for outreach.</td>
</tr>
<tr>
<td>12. Organize educational session about benefits of antenatal corticosteroid regardless of incidence of PPROM.</td>
<td>Team discusses issue – pros/cons of ANS administration with PPROM; relevant literature/studies reviewed; consensus reached; outline plan for outreach.</td>
</tr>
<tr>
<td>13. Organize educational session about benefits of antenatal corticosteroids irrespective of these (GDM, vaginal bleeding, preeclampsia, or “other”) conditions.</td>
<td>Team discusses issue; relevant literature/studies reviewed; outline plan for outreach.</td>
</tr>
</tbody>
</table>
DO the Improvement, Data Collection and Analysis

The planning is complete and the next step is implementation. Fundamental to CQI is timely feedback on the progress and success of improvement efforts. Thus, implementation is accompanied by ongoing data collection, analysis and planning. Important activities during this stage are to:

- Revisit lessons learned from the Problem Identification Worksheets (PIWs). Regularly collect data using the PIWs. This allows the team to chart progress towards achieving the stated improvement, to determine whether the strategy in place is working, and to identify new or evolving areas for improvement.

- Describe planned steps toward realizing the proposed improvement. This should be repeated at regular intervals. Based on changes and/or new information from the PIW, the Team may decide to adjust the Proposed Improvement and to update, revise and refine the plan (see next two headings, Check and Study the Results and Act to Hold the Gain and to Continue to Improve the Process).

- Update and document actual steps taken. Note what has been accomplished including Team meetings, agreements reached, new procedures and so forth. Use the Implementation Worksheet or similar tool to keep track of progress.

Depending on the improvement and on the resources at hand, the Team may decide to update the Implementation Worksheet weekly, monthly or quarterly.
CHECK and Study the Results

The completed Implementation Worksheet serves as a one-page results summary. This summary should be copied and distributed to team members. When discussing and analyzing results, the team should consider:

- Changes over time in process identified for improvement.

- What caused the change? That is, which elements of the plan were effective?

- If no change over time, why not? Which elements of the plan were not effective or were not effectively carried out?

- Change over time in other process. Have the steps taken toward improving a process helped or hindered other processes?

- The lessons learned for each component of the FOCUS-PDCA activity. Reflect on what was done well, and what can be improved. Write down the most important lessons learned.
ACT to Hold the Gain…

Now that improvements have been made, how will the Team ensure that new systems and behaviors become permanent? One way to accomplish this is to continue to complete the Problem Identification Worksheets and Implementation Worksheet. Though worksheets should be completed regularly, the Team may decide that for monitoring/maintenance purposes, worksheets can be filled out less frequently.

and to Continue to Improve the Process

Using lessons learned from the previous section, revise your plan to improve the process at hand. Activities that proved useful may be enhanced, while others that were less useful may be deemphasized. The Team should work together, coming to a consensus if possible, to make revisions. These revisions should be documented in the Implementation Worksheet, under Key Planned Steps.
HOSPITAL WIDE QUALITY IMPROVEMENT PROCESS
STRATEGY FOR IMPROVEMENT

FOCUS-PDCA

Find a process to improve

Organize a team that knows the process

Clarify the current knowledge of the process

Understand the causes of process variation

Select the process improvement

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Antenatal Corticosteroid Therapy Implementation Worksheet

Use this Implementation Worksheet to document FOCUS-PDCA decisions and activities. Update at regular intervals in conjunction with the Problem Identification Worksheets (PIWs) as improvements are planned and implemented. In Column One, mark the date when the form is being completed. In Column Two, describe relevant data from the most recently completed PIW. In Column Three, indicate the proposed improvement. In Column Four, outline the key planned steps toward the improvement. In Column Five, document the actual steps taken to date.

<table>
<thead>
<tr>
<th>Date</th>
<th>Evidence of Need for Improvement from PIW</th>
<th>Proposed Improvement</th>
<th>Key Planned Steps</th>
<th>Actual Steps Taken</th>
</tr>
</thead>
<tbody>
<tr>
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</table>
Quality Improvement
Examples & References
Best Practice Ideas for Improving Antenatal Steroid Administration Rates

1. OB Department education by Neonatology
2. OB Department leadership: “Do the Right Thing”
3. Standard Order Set
4. Protocol for who is a candidate
5. Post information on Unit: “Wanted” Posters
6. Betamethasone or Dexamethasone readily available on Unit (PYXIS)
7. Neonatal involvement (consultation) ASAP on preterm patients
8. Prospectively track: Yes – No – Why?
9. Monthly rates – Post on Unit
10. Yearly rates per physician
11. QAI Committee involvement
Antenatal corticosteroid therapy for fetal maturation reduces mortality, respiratory distress syndrome and intraventricular hemorrhage in preterm infants. These benefits extend to a broad range of gestational ages (24-24 weeks) and are not limited to gender or race.

| NURSING | Please:  
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<td></td>
<td>Complete the form in its entirety on every case that meets candidate criteria.</td>
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<td>Please:</td>
<td>Addressograph and place in the designated box to ensure delivery to the Performance Improvement Department.</td>
</tr>
<tr>
<td></td>
<td>Do not place in the medical record and do not copy.</td>
</tr>
<tr>
<td>Comments</td>
<td></td>
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</tbody>
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<th>NURSING</th>
<th>Please check if any of the following applies:</th>
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<tbody>
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<td>Too immature (&lt;24 weeks)</td>
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<td>Gestational age &gt;34 weeks</td>
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<td></td>
<td>Already received</td>
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<td>Physician did not order</td>
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<td>Maternal contraindications</td>
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<td>Suspected rapid delivery</td>
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<td>No threatened labor</td>
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<tr>
<td></td>
<td>Other:</td>
</tr>
<tr>
<td></td>
<td>Steroids given</td>
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</tbody>
</table>

ADDRESSOGRAPH
Patient Identification

Date: ______________ Time: ______________

Allergies: ____________________________________________________________

Steroid therapy for fetal lung maturity enhancement.
☐ Betamethasone suspension (Celestone soluspan) 12 mg IM every 24 hours for a total of 2 doses.

Antibiotics regimen for Group B streptococcus prophylaxis or treatment. Discontinue if GBS culture is negative. Continue for 7 days if GBS culture is positive or not available.
☐ Penicillin G. 5 million units IV PB loading dose, then 2.5 million units IV PB every 4 hours, OR
☐ Ampicillin 2 grams IV PB loading dose, then 1 gram IV PB every 4 hours, OR

For GBS positive patient with PENICILLIN ALLERGY:
• If GBS culture is sensitive to erythromycin or clindamycin:
  ☐ Erythromycin 250 mg IV Q 6 hours.
  ☐ Clindamycin 900 mg IV Q 8 hours.

• If GBS culture NOT sensitive to erythromycin or clindamycin:
  ☐ Cefazolin 2gm IV initially, then 1 gm IV Q 8 hours.
    (for NON-SIGNIFICANT penicillin allergy)
  ☐ Vancomycin 1gm IV Q 12 hours
    (for SIGNIFICANT penicillin allergy)

Antibiotics to prolong latency period in preterm PROM at fetal age of viability. Do not discontinue with negative GBS culture.
☐ Ampicillin 2 grams IV PB 6 hours for 48 hours, then amoxicillin 250 mg PO TID for 5 days and erythromycin 250 mg IV PB every 6 hours for 48 hours then erythromycin base 333 mg PO TID for 5 days, OR
☐ For intolerance to erythromycin side effects, ampicillin 2 grams IV PB every 6 hours for 48 hours, then amoxicillin 250 mg PO TID for 5 days and azithromycin 500 mg PO, then azithromycin 250 mg daily for 4 days, OR
☐ For penicillin allergy, clindamycin 900 mg IV PB every 8 hours for 72 hours, then 300 mg PO BID for 7 days, AND
☐ Erythromycin 250 mg IV PB every 6 hours for 48 hours, then erythromycin base 333 mg PO TID for 5 days, OR
☐ Azithromycin 500 mg PO, then azithromycin 250 mg daily for 4 days.

Physician Signature ______________________________________________________

Authorization for therapeutic substitution is given unless checked here ☐
REFERENCES


