**Overview**

**Premise:** There has long been a demand for a composite measure to identify the most important outcome for families having a birth--taking home a healthy baby. While there are several measures looking at specific clinical practices and outcomes in preterm infants, there are no other measures for outcomes in term babies (who represent 90% of all births). Criteria for Neonatal Intensive Care Unit admission of term babies varies greatly from unit to unit and region to region so it has not been useful for quality comparisons.

This measure simply asks: of babies without preexisting conditions (no premies, 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 complications? A combination of ICD-9 diagnosis and procedure codes and neonatal Length of Stay (LOS) is used to categorize complications. This measure is a key balance to other NQF endorsed measures that examine obstetric care in this population such as cesarean section and episiotomy rates. Most families would value having a low chance of unexpected newborn complications and low-medium rates of obstetric procedures.

**Denominator:** Babies without preexisting conditions are identified using a combination of Patient Discharge Diagnosis data and either Birth Certificate or Medical Record data to add/confirm a few additional elements. The Denominator is comprised of singleton live born babies who by best Obstetric Estimate are at least 37.0 weeks of gestation, over 2500gms in birthweight (normally grown), do not have any congenital malformations or fetal conditions, are not exposed to maternal drug use or to selected maternal conditions (see Flow Chart and Appendix 2 for a list of ICD-9 codes and descriptions). This is a group who are expected to do well and go home routinely with the mother.

**Numerator:** The numerator is divided into two categories: Severe complications and moderate complications. **Severe complications** include neonatal death, transfer to another hospital for higher level of care, extremely low Apgar Score (≤3 at either 5 or 10 minutes of life), severe birth injuries such as intracranial hemorrhage or nerve injury, neurologic damage, severe respiratory, neurologic or infectious complications. Parents of such babies may often worry about short or long term infant outcomes. **Moderate complications** include diagnoses or procedures that raise concern but at a lower level than the list for severe (e.g. use of CPAP or bone fracture). Most require an infant LOS that exceeds that of the mother, validating that these are indeed significant complications. Examples include less severe respiratory complications (e.g. Transient Tachypnea of the Newborn), or infections with a longer LOS but not sepsis. As a “safety net” to capture cases who were under-coded, the numerator also includes cases from these seemingly normal infants who had a LOS >5 days with neither any form of jaundice nor a social reason for staying in the hospital (e.g. family disruption or adoption). (see Flow Chart and Appendix 3-5 for lists of ICD-9 codes and descriptions).

**Measure Calculation:** The measure is reported as Total Unexpected Newborn Complications per 1,000 births and has subdivisions of Serious and Moderate Complications (further details are in the Flow Chart and Appendices).
Summary of Measure Updates
Since the initial NQF endorsement there has been useful discussion and feedback by Obstetric and Neonatal leaders around the nation about how to tweak and make this measure more useful for quality improvement. Likewise we have had feedback from patient user groups as to how to make it more understandable from their perspective. A summary of our subsequent changes and updates is presented below.

(1) **Change in Name:** The initial name, Healthy Term Newborn, was chosen to represent a positive health status but many women had a hard time understanding what we were measuring. We chose to invert the measure to Unexpected Newborn Complications for that reason and because it was easier to interpret the typical range from 1 to 6% than from 94 to 99%.

(2) **Adding two sub-measures (Severe and Moderate):** A number of experts were concerned that the scope of the composite measure was too broad, covering conditions of varying severity that may not normally go together. After several user groups and expert panels we broke the ICD-9 codes into the two categories to allow analysis by severity but to also allow roll-up for summary assessment.

(3) **Identification of Term Infants:** As the measure was put into production, it was surprisingly hard to identify term infants using Patient Discharge Diagnosis (PDD) data alone as called for in the initial specifications. Available ICD-9 codes for gestational age and birthweight are significantly under-utilized in practice. However, the use of a linked PDD to Birth Certificate data files has solved this issue as the Birth Certificate data fields for Best Obstetric Gestational Age and Birthweight have high degrees of completeness and accuracy. The Birth Certificate also allows the addition of extremely low Apgar scores as an additional numerator item.

(4) **Additional Codes for Denominator Exclusions:** After feedback was received on additional potential congenital anomaly ICD-9 codes, we added a wider panel of codes so that now essentially any congenital malformation is excluded. (see Appendix 2)

(5) **Coding Practices: Checks and balances:** We learned that coding practices do vary for some of these codes with some hospitals being “over exuberant” in their coding and others clearly under-coding existing complications. The new specifications attempt to balance this issue by requiring that many codes for Moderate Complications additionally have an infant LOS that exceeds the typical maternal postpartum LOS (>2 days for a vaginal birth and >4 days for a cesarean birth). This requirement significantly reduces the number of infants identified but validates that these babies had significant morbidity. Conversely, some babies had very long neonatal LOS without any codes to account for it, suggesting the possibility of under-coding. Our expert panel identified two categories of prolonged neonatal LOS that were not medically serious and could be excluded from this consideration: neonatal jaundice typically treated with Billi-Lites, and social disruption for homelessness or foster care. (see Appendices 4 and 5)

(6) **Septicemia Code:** We found that a number of babies with septicemia (771.81) had short LOS indicating that it was not likely severe, therefore we added a requirement for a LOS of at least 5 days to be included among Severe Complications.
Frequently Asked Questions (FAQ’s)

Now that we have several years of results with over a million patients, we can address some common FAQ’s:

(1) What proportion of a hospital’s births is included in this measure? Typically >80% of a hospital's births are covered with 15-18% meeting one or another of the exclusion criteria (see Flow Chart).

(2) What is the distribution of rates among hospitals and how much variation is there? The mean hospital rate for Total Unexpected Newborn Complications (California 2 years reviewed) is 39.3 per 1,000 births (Severe Complications-23.1 per 1,000 and Moderate Complications-16.2). 95 percentiles for Total Unexpected Newborn Complications ranged from approximately 10 to 80 per 1,000.

(3) What are the common diagnosis categories that drive this measure? The codes from both Severe and Moderate Complications can be combined into 6 categories for further analysis. The most frequent category is Respiratory followed by Infection, Transfer to another hospital, Neurologic/Birth Injury, Shock/Resuscitation and lastly by Long LOS—without clear diagnosis (see Table 2). Examining hospitals with high rates, we find significant variation among diagnostic categories—some hospitals have high rates of infection while others have high rates of respiratory issues suggesting improvement opportunities.

(4) Do certain hospital types or categories have significantly different rates (and therefore inherently disadvantaged)? We have noted that there is significant variation within low and high volume hospitals; within hospitals with high-level Neonatal Intensive Care Units and within hospitals with basic-level facilities; and among Public/County facilities and among Private facilities. No one grouping as a whole is favored over another.

(5) How can this measure drive Quality Improvement? While we originally envisioned this measure to be a balancing measure for Obstetric services, on further analysis we have found it very helpful for driving quality improvement. The key is to provide the sub-analyses of the diagnostic categories described in question (3) above. Being able to identify that you have a high rate overall and that your issues are with infection or respiratory issues provides good direction.

Contact Elliott Main, MD at California Maternal Quality Collaborative for further information: phone: (650) 725-6108 or (415) 750-6003; email: main@cmqcc.org
Revised Specifications v2.3  
NQF #716: Unexpected Newborn Complications  
(aka Healthy Term Newborn)  
**Figure 1: Denominator Inclusions**

Hospital Discharge Diagnosis File

- Singleton Livebirth?
  - Yes
  - BWt ≥2.5kg?
    - Yes
    - Use Birth Certificate or Medical Record: Birthweight
  - No
    - GA ≥37wks?
      - Yes
      - GA Unknown
        - Use Birth Certificate or Medical Record: Best Obstetric Estimate of Gestational Age
    - No
      - GA Unknown
        - Use Birth Certificate or Medical Record: LMP-based Gestational Age
  - Unknown
    - Use Birth Certificate or Medical Record: Birthweight

- Not in Measure Population
- Starting Denominator

**Note:** ICD9 and DRG codes alone are very poor at identifying term infants. Therefore, the GA from BC is used.

These represent back-up criteria. Birth Certificate Obstetric Estimate of GA usually is present for >99% of cases, and then these two steps may be omitted.

Use Birth Certificate or Medical Record: Birthweight
Revised Specifications v2.3
NQF #716: Unexpected Newborn Complications
(aka Healthy Term Newborn)

Figure 2: Denominator Exclusions

In summary, the Final Denominator excludes most serious fetal conditions that are “preexisting” (present before labor), including: prematurity, multiple gestations, poor fetal growth, congenital malformations and genetic disorders, other specified fetal and maternal conditions and maternal drug use.
**Revised Specifications v2.3**  
**NQF #716: Unexpected Newborn Complications**  
(aka Healthy Term Newborn)  

**Figure 3: Numerator Inclusions: Severe Complications**

- **Final Denominator**
  - Yes: **Neonatal Death?**  
    - Yes: Use Patient Discharge Diagnosis Data: Disposition Code for Death  
    - No: Use Patient Discharge Diagnosis Data: Disposition Code for Transfer to Higher Level of Care  
  - No: **Neonatal Transfer?**  
    - Yes: Use Birth Certificate or Medical Record: Apgar Score at 5 minutes or 10 minutes ≤3  
    - No: **S’ or 10’ Apgar ≤3?**  
      - Yes: Use Patient Discharge Diagnosis Data, examining both Primary and Other Diagnosis fields for specific ICD-9 Codes defining a array of specific Severe Complications, included selected codes from the categories of: Birth Injuries, Hypoxia/Asphyxia, Shock/Complications, Respiratory Complications/Procedures, Infections, Neurologic Complications. (see Appendix 3, Groups 3A thru 3I)  
      - No: **Severe ICD-9 Code?**  
        - Yes: Use Patient Discharge Diagnosis Data, examining both Primary and Other Diagnosis fields for the specific ICD-9 Code defining sepsis but also requiring a neonatal Length of Stay >4 days. (see Appendix 3, Group 3J)  
        - No: **Sepsis and LOS >4 days?**  
          - Yes: **Numerator: Severe Complications**  
          - No: **Starting Population for Moderate Complications Analysis**

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March 2013
Figure 4: Numerator Inclusions: Moderate Complications

Starting Population for Moderate Complications Analysis

- Moderate Comps (No LOS)?
  - Yes
  - No
- LOS >4d CS or LOS >2d Vag?
  - Yes
  - No
- Moderate Comps (with LOS)?
  - Yes
  - No
- LOS >5d?
  - Yes
  - No
- Jaundice or Social codes?
  - Yes
  - No

Numerator: Moderate Complications

Not in Numerator

Use Patient Discharge Diagnosis Data, examining both Primary and Other Diagnosis and Procedure fields for specific ICD-9 Code defining a specific Moderate Complication, that do not require a prolonged LOS (see Appendix 4, Groups A thru C)

Use Patient Discharge Diagnosis Data for LOS and for ICD-9 Diagnosis Codes V3000 (vaginal birth) or V3001 (Cesarean birth)

Use Patient Discharge Diagnosis Data, examining both Primary and Other Diagnosis and Procedure fields for specific ICD-9 Codes defining a array of specific Moderate Complications, included selected codes from the categories of: Birth Injuries, Hypoxia/Asphyxia, Shock/Resuscitation, Respiratory Complications/Procedures, Infections, Neurologic Complications. (see Appendix 4, Groups D thru H)

Use Patient Discharge Diagnosis Data to determine LOS

Use Patient Discharge Diagnosis Data, examining both Primary and Other Diagnosis and Procedure fields for the specific ICD-9 Code defining Neonatal Jaundice or Social Indications for prolonged hospitalization. (see Appendix 5, Groups A thru C)
NQF #716: Unexpected Newborn Complications
(aka Healthy Term Newborn, Revised Specifications)

Table 1: Final Measure Calculations

- **Unexpected Newborn Complications (Total):** (rate per 1,000 livebirths)
  
  \[(\text{Severe Complications Numerator} + \text{Moderate Complications Numerator}) \times 1,000\]
  
  Final Denominator
  
  California state-wide rate in 2011: **39.3 per 1,000 births**

- **Unexpected Newborn Complications (Severe):** (rate per 1,000 livebirths)
  
  \[(\text{Severe Complications Numerator}) \times 1,000\]
  
  Final Denominator
  
  California state-wide rate in 2011: **23.1 per 1,000 births**

- **Unexpected Newborn Complications (Moderate):** (rate per 1,000 livebirths)
  
  \[(\text{Moderate Complications Numerator}) \times 1,000\]
  
  Final Denominator
  
  California state-wide rate in 2011: **16.2 per 1,000 births**
Fig. 5: Frequency Distribution of UNC Measure In California Hospitals (2011-2012)

Total Unexpected Newborn Complications

California Mean = 36.0/1,000 (3.6%)

Significant variation noted in both large and small hospitals
Revised Specifications
NQF #716: Unexpected Newborn Complications
(aka Healthy Term Newborn)

Table 2: Sub-Measure Calculations

An additional feature is the ability to calculate several sub-measures to direct Quality Improvement efforts. These “buckets” include like-diagnoses from both severe and moderate categories. Hospital level comparisons show significant variation in these categories. This Sub-measure analysis allows hospitals to focus on specific care practices to drive QI. See Appendix 6 for details on the Sub-Category groupings.

<table>
<thead>
<tr>
<th>Neonatal Complication Sub-Categories</th>
<th>Proportion of Total Complications (California 2011-12)</th>
<th>Rate of each Complication Category (per 1,000 births)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory</td>
<td>41.9%</td>
<td>14.9</td>
</tr>
<tr>
<td>Infection</td>
<td>21.1%</td>
<td>7.5</td>
</tr>
<tr>
<td>Transfer to Higher Level of Care</td>
<td>16.6%</td>
<td>5.9</td>
</tr>
<tr>
<td>Neurologic/Birth Injury</td>
<td>12.9%</td>
<td>4.6</td>
</tr>
<tr>
<td>Shock/Resuscitation</td>
<td>3.1%</td>
<td>1.1</td>
</tr>
<tr>
<td>Long LOS (without clear diagnosis)</td>
<td>3.9%</td>
<td>1.4</td>
</tr>
</tbody>
</table>
Unexpected Newborn Complications: Validation Studies

• Face Validity:
  – In a comparison trial for neonatal morbidity by gestational age tracked very closely to NPIC (major East Coast perinatal data set) analysis using NICU admissions and major complications (in press)

• Formal Reliability Testing
  – NQF requirement using RAND statistical tools
  – Tests ability to discriminate among hospitals
  – Good is 0.8, excellent is 0.9
  – Mean Reliability among 220 California hospitals =0.92

• Stability within a hospital over time
  – Tested for 3 6-month periods with minimal variation noted in >90% of California hospitals
Appendices for Unexpected Newborn Complications (NQF #716)

Denominator Specifications

Appendix 1: Denominator Inclusions (ICD-9 Codes)
Singleton Inborn (Diagnosis Codes)
V30.00 Single liveborn, born in hospital, delivered without mention of cesarean section
V30.01 Single liveborn, born in hospital, delivered by cesarean section

Appendix 2: Denominator Exclusions (ICD-9 Codes)
There are 3 "groups" of diagnoses that lead to exclusion: fetal congenital anomalies, other chronic fetal conditions that are not anomalies, and maternal drug use. A wide array of ICD-9 diagnosis codes are used (each of which is infrequent) with the goal to ensure that the remaining denominator infants are expected to do well.

Group 2A: Congenital Malformations (Diagnosis Codes)
255.2 Adrenogenital disorders
259.4 Dwarfism, not elsewhere classified
478.74 Stenosis of larynx
740.0 Anencephalus
740.1 Craniorachischisis
740.2 Iniencephaly
741.00 Spina bifida with hydrocephalus, unspecified region
741.01 Spina bifida with hydrocephalus, cervical region
741.02 Spina bifida with hydrocephalus, dorsal (thoracic) region
741.03 Spina bifida with hydrocephalus, lumbar region
741.90 Spina bifida without mention of hydrocephalus, unspecified region
741.91 Spina bifida without mention of hydrocephalus, cervical region
741.92 Spina bifida without mention of hydrocephalus, dorsal (thoracic) region
741.93 Spina bifida without mention of hydrocephalus, lumbar region
742.0 Encephalocele
742.1 Microcephalus
742.2  Congenital reduction deformities of brain
742.3  Congenital hydrocephalus
742.4  Other specified congenital anomalies of brain
742.51 Diastematomyelia
742.53 Hydromyelia
742.59 Other specified congenital anomalies of spinal cord
742.8  Other specified congenital anomalies of nervous system
742.9  Unspecified congenital anomaly of brain, spinal cord, and nervous system
743.00 Clinical anophthalmos, unspecified
743.03 Cystic eyeball, congenital
743.06 Cryptophthalmos
743.10 Microphthalmos, unspecified
743.11 Simple microphthalmos
743.12 Microphthalmos associated with other anomalies of eye and adnexa
743.20 Buphthalmos, unspecified
743.21 Simple buphthalmos
743.22 Buphthalmos associated with other ocular anomalies
743.30 Congenital cataract, unspecified
743.31 Congenital capsular and subcapsular cataract
743.32 Congenital cortical and zonular cataract
743.33 Congenital nuclear cataract
743.34 Total and subtotal cataract, congenital
743.35 Congenital aphakia
743.36 Congenital anomalies of lens shape
743.37 Congenital ectopic lens
743.39 Other congenital cataract and lens anomalies
743.41 Congenital anomalies of corneal size and shape
743.42 Corneal opacities, interfering with vision, congenital
743.43 Other corneal opacities, congenital
743.44 Specified congenital anomalies of anterior chamber, chamber angle, and related structures
743.45 Aniridia
743.46 Other specified congenital anomalies of iris and ciliary body
743.47 Specified congenital anomalies of sclera
743.48 Multiple and combined congenital anomalies of anterior segment
743.49 Other congenital anomalies of anterior segment
743.51 Vitreous anomalies
743.52 Fundus coloboma
743.53 Chorioretinal degeneration, congenital
743.54 Congenital folds and cysts of posterior segment
743.55 Congenital macular changes
743.56 Other retinal changes, congenital
743.57 Specified congenital anomalies of optic disc
743.58 Vascular anomalies
743.59 Other congenital anomalies of posterior segment
743.61 Congenital ptosis
743.62 Congenital deformities of eyelids
743.63 Other specified congenital anomalies of eyelid
743.64 Specified congenital anomalies of lacrimal gland
743.65 Specified congenital anomalies of lacrimal passages
743.66 Specified congenital anomalies of orbit
743.69 Other congenital anomalies of eyelids, lacrimal system, and orbit
743.8 Other specified anomalies of eye
743.9 Unspecified anomaly of eye
745.0 Common truncus
745.10 Complete transposition of great vessels
745.11 Double outlet right ventricle
745.12 Corrected transposition of great vessels
745.19 Other transposition of great vessels
745.2 Tetralogy of fallot
745.3 Common ventricle
745.4 Ventricular septal defect
745.5 Ostium secundum type atrial septal defect
745.60 Endocardial cushion defect, unspecified type
745.61 Ostium primum defect
745.69 Other endocardial cushion defects
745.7 Cor biloculare
745.8 Other bulbus cordis anomalies and anomalies of cardiac septal closure
745.9 Unspecified defect of septal closure
746.00 Congenital pulmonary valve anomaly, unspecified
746.01 Atresia of pulmonary valve, congenital
746.02 Stenosis of pulmonary valve, congenital
746.09 Other congenital anomalies of pulmonary valve
746.1 Tricuspid atresia and stenosis, congenital
746.2 Ebstein's anomaly
746.3 Congenital stenosis of aortic valve
746.4 Congenital insufficiency of aortic valve
746.5 Congenital mitral stenosis
746.6 Congenital mitral insufficiency
746.7 Hypoplastic left heart syndrome
746.81 Subaortic stenosis
746.82 Cor triatriatum
746.83 Infundibular pulmonic stenosis
746.84 Obstructive anomalies of heart, not elsewhere classified
746.85 Coronary artery anomaly
746.86 Congenital heart block
746.87 Malposition of heart and cardiac apex
746.89 Other specified congenital anomalies of heart
746.9 Unspecified congenital anomaly of heart
747.0 Patent ductus arteriosus
747.10 Coarctation of aorta (preductal) (postductal)
747.11 Interruption of aortic arch
747.20 Anomaly of aorta, unspecified
747.21 Anomalies of aortic arch
747.22 Atresia and stenosis of aorta
747.29 Other anomalies of aorta
747.31 Pulmonary artery coarctation and atresia
747.32 Pulmonary arteriovenous malformation
747.39 Other anomalies of pulmonary artery and pulmonary circulation
747.40 Anomaly of great veins, unspecified
747.41 Total anomalous pulmonary venous connection
747.42 Partial anomalous pulmonary venous connection
747.49 Other anomalies of great veins
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
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<td>747.62</td>
<td>Renal vessel anomaly</td>
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<td>Upper limb vessel anomaly</td>
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<td>747.64</td>
<td>Lower limb vessel anomaly</td>
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<td>Anomalies of other specified sites of peripheral vascular system</td>
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<td>Congenital anomalies of cerebrovascular system</td>
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<td>747.82</td>
<td>Spinal vessel anomaes</td>
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<td>Persistent fetal circulation</td>
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<td>Other combinations of cleft palate with cleft lip</td>
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<td>Other specified anomalies of upper alimentary tract</td>
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<td>Other anomalies of intestine</td>
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<td>751.60</td>
<td>Unspecified anomaly of gallbladder, bile ducts, and liver</td>
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<td>Biliary atresia</td>
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<td>751.62</td>
<td>Congenital cystic disease of liver</td>
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<td>Renal agenesis and dysgenesis</td>
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<td>Congenital single renal cyst</td>
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<tr>
<td>753.14</td>
<td>Polycystic kidney, autosomal recessive</td>
</tr>
<tr>
<td>753.15</td>
<td>Renal dysplasia</td>
</tr>
<tr>
<td>753.16</td>
<td>Medullary cystic kidney</td>
</tr>
<tr>
<td>753.17</td>
<td>Medullary sponge kidney</td>
</tr>
<tr>
<td>753.19</td>
<td>Other specified cystic kidney disease</td>
</tr>
</tbody>
</table>
753.20  Unspecified obstructive defect of renal pelvis and ureter
753.21  Congenital obstruction of ureteropelvic junction
753.22  Congenital obstruction of ureterovesical junction
753.23  Congenital ureterocele
753.29  Other obstructive defects of renal pelvis and ureter
753.3  Other specified anomalies of kidney
753.5  Exstrophy of urinary bladder
753.6  Atresia and stenosis of urethra and bladder neck
753.8  Other specified anomalies of bladder and urethra
753.9  Unspecified anomaly of urinary system
754.0  Congenital musculoskeletal deformities of skull, face, and jaw
754.1  Congenital musculoskeletal deformities of sternocleidomastoid muscle
754.2  Congenital musculoskeletal deformities of spine
754.30  Congenital dislocation of hip, unilateral
754.31  Congenital dislocation of hip, bilateral
754.32  Congenital subluxation of hip, unilateral
754.33  Congenital subluxation of hip, bilateral
754.35  Congenital dislocation of one hip with subluxation of other hip
754.40  Genu recurvatum
754.41  Congenital dislocation of knee (with genu recurvatum)
754.42  Congenital bowing of femur
754.43  Congenital bowing of tibia and fibula
754.44  Congenital bowing of unspecified long bones of leg
754.50  Talipes varus
754.51  Talipes equinovarus
754.52  Metatarsus primus varus
754.53  Metatarsus varus
754.59  Other varus deformities of feet
754.60  Talipes valgus
754.61  Congenital pes planus
754.62  Talipes calcaneovalgus
754.69  Other valgus deformities of feet
754.70  Talipes, unspecified
754.71  Talipes cavus
754.79 Other deformities of feet
754.81 Pectus excavatum
754.82 Pectus carinatum
754.89 Other specified nonteratogenic anomalies
755.20 Unspecified reduction deformity of upper limb
755.21 Transverse deficiency of upper limb
755.22 Longitudinal deficiency of upper limb, not elsewhere classified
755.23 Longitudinal deficiency, combined, involving humerus, radius, and ulna (complete or incomplete)
755.24 Longitudinal deficiency, humeral, complete or partial (with or without distal deficiencies, incomplete)
755.25 Longitudinal deficiency, radioulnar, complete or partial (with or without distal deficiencies, incomplete)
755.26 Longitudinal deficiency, radial, complete or partial (with or without distal deficiencies, incomplete)
755.27 Longitudinal deficiency, ulnar, complete or partial (with or without distal deficiencies, incomplete)
755.28 Longitudinal deficiency, carpals or metacarpals, complete or partial (with or without incomplete phalangeal deficiency)
755.29 Longitudinal deficiency, phalanges, complete or partial
755.30 Unspecified reduction deformity of lower limb
755.31 Transverse deficiency of lower limb
755.32 Longitudinal deficiency of lower limb, not elsewhere classified
755.33 Longitudinal deficiency, combined, involving femur, tibia, and fibula (complete or incomplete)
755.34 Longitudinal deficiency, femoral, complete or partial (with or without distal deficiencies, incomplete)
755.35 Longitudinal deficiency, tibiofibular, complete or partial (with or without distal deficiencies, incomplete)
755.36 Longitudinal deficiency, tibia, complete or partial (with or without distal deficiencies, incomplete)
755.37 Longitudinal deficiency, fibular, complete or partial (with or without distal deficiencies, incomplete)
755.38 Longitudinal deficiency, tarsals or metatarsals, complete or partial (with or without incomplete phalangeal deficiency)
755.39 Longitudinal deficiency, phalanges, complete or partial
755.4 Reduction deformities, unspecified limb
755.50 Unspecified anomaly of upper limb
755.51 Congenital deformity of clavicle
755.52 Congenital elevation of scapula
755.53 Radioulnar synostosis
755.54 Madelung's deformity
755.55 Acrocephalosyndactyly
755.56 Accessory carpal bones
755.57 Macroactyelia (fingers)
755.58 Cleft hand, congenital
755.59 Other anomalies of upper limb, including shoulder girdle
755.60 Unspecified anomaly of lower limb
755.61 Coxa valga, congenital
755.62 Coxa vara, congenital
755.63 Other congenital deformity of hip (joint)
755.64 Congenital deformity of knee (joint)
755.65 Macrodactyly of toes
755.66 Other anomalies of toes
755.67 Anomalies of foot, not elsewhere classified
755.69 Other anomalies of lower limb, including pelvic girdle
755.8 Other specified anomalies of unspecified limb
755.9 Unspecified anomaly of unspecified limb
756.0 Anomalies of skull and face bones
756.10 Anomaly of spine, unspecified
756.11 Spondylolysis, lumbosacral region
756.12 Spondylolisthesis
756.13 Absence of vertebra, congenital
756.14 Hemivertebra
756.15 Fusion of spine (vertebra), congenital
756.16 Klippel-Feil syndrome
756.17 Spina bifida occulta
756.19 Other anomalies of spine
756.2 Cervical rib
756.3 Other anomalies of ribs and sternum
756.4 Chondrodystrophy
756.50 Congenital osteodystrophy, unspecified
756.51 Osteogenesis imperfecta
756.52 Osteopetrosis
756.53 Osteopoikilosis
756.54 Polyostotic fibrous dysplasia of bone
756.55 Chondroectodermal dysplasia
756.56 Multiple epiphyseal dysplasia
756.59 Other osteodystrophies
756.6 Anomalies of diaphragm
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>756.70</td>
<td>Anomaly of abdominal wall, unspecified</td>
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<tr>
<td>756.71</td>
<td>Prune belly syndrome</td>
</tr>
<tr>
<td>756.79</td>
<td>Other congenital anomalies of abdominal wall</td>
</tr>
<tr>
<td>756.81</td>
<td>Absence of muscle and tendon</td>
</tr>
<tr>
<td>756.82</td>
<td>Accessory muscle</td>
</tr>
<tr>
<td>756.83</td>
<td>Ehlers-Danlos syndrome</td>
</tr>
<tr>
<td>756.89</td>
<td>Other specified anomalies of muscle, tendon, fascia, and connective tissue</td>
</tr>
<tr>
<td>756.9</td>
<td>Other and unspecified anomalies of musculoskeletal system</td>
</tr>
<tr>
<td>757.1</td>
<td>Ichthyosis congenita</td>
</tr>
<tr>
<td>758.0</td>
<td>Down's syndrome</td>
</tr>
<tr>
<td>758.1</td>
<td>Patau's syndrome</td>
</tr>
<tr>
<td>758.2</td>
<td>Edwards' syndrome</td>
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<tr>
<td>758.31</td>
<td>Cri-du-chat syndrome</td>
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<tr>
<td>758.32</td>
<td>Velo-cardio-facial syndrome</td>
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<tr>
<td>758.33</td>
<td>Other microdeletions</td>
</tr>
<tr>
<td>758.39</td>
<td>Other autosomal deletions</td>
</tr>
<tr>
<td>758.5</td>
<td>Other conditions due to autosomal anomalies</td>
</tr>
<tr>
<td>758.6</td>
<td>Gonadal dysgenesis</td>
</tr>
<tr>
<td>758.81</td>
<td>Other conditions due to sex chromosome anomalies</td>
</tr>
<tr>
<td>758.89</td>
<td>Other conditions due to chromosome anomalies</td>
</tr>
<tr>
<td>758.9</td>
<td>Conditions due to anomaly of unspecified chromosome</td>
</tr>
<tr>
<td>759.5</td>
<td>Tuberous sclerosis</td>
</tr>
<tr>
<td>759.6</td>
<td>Other hamartoses, not elsewhere classified</td>
</tr>
<tr>
<td>759.7</td>
<td>Multiple congenital anomalies, so described</td>
</tr>
<tr>
<td>759.81</td>
<td>Prader-Willi syndrome</td>
</tr>
<tr>
<td>759.82</td>
<td>Marfan syndrome</td>
</tr>
<tr>
<td>759.83</td>
<td>Fragile X syndrome</td>
</tr>
<tr>
<td>759.89</td>
<td>Other specified congenital anomalies</td>
</tr>
</tbody>
</table>

**Group 2B: Other Fetal Placental Conditions (Diagnosis Codes)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>762.0</td>
<td>Placenta previa affecting fetus or newborn</td>
</tr>
<tr>
<td>762.1</td>
<td>Other forms of placental separation and hemorrhage affecting fetus or newborn</td>
</tr>
<tr>
<td>762.6</td>
<td>Other and unspecified conditions of umbilical cord affecting fetus or newborn</td>
</tr>
<tr>
<td>764.00</td>
<td>Light-for-dates without mention of fetal malnutrition, unspecified [weight]</td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
</tr>
<tr>
<td>-------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>764.01</td>
<td>Light-for-dates without mention of fetal malnutrition, less than 500 grams</td>
</tr>
<tr>
<td>764.02</td>
<td>Light-for-dates without mention of fetal malnutrition, 500-749 grams</td>
</tr>
<tr>
<td>764.03</td>
<td>Light-for-dates without mention of fetal malnutrition, 750-999 grams</td>
</tr>
<tr>
<td>764.04</td>
<td>Light-for-dates without mention of fetal malnutrition, 1,000-1,249 grams</td>
</tr>
<tr>
<td>764.05</td>
<td>Light-for-dates without mention of fetal malnutrition, 1,250-1,499 grams</td>
</tr>
<tr>
<td>764.06</td>
<td>Light-for-dates without mention of fetal malnutrition, 1,500-1,749 grams</td>
</tr>
<tr>
<td>764.07</td>
<td>Light-for-dates without mention of fetal malnutrition, 1,750-1,999 grams</td>
</tr>
<tr>
<td>764.08</td>
<td>Light-for-dates without mention of fetal malnutrition, 2,000-2,499 grams</td>
</tr>
<tr>
<td>764.09</td>
<td>Light-for-dates without mention of fetal malnutrition, 2,500 grams and over</td>
</tr>
<tr>
<td>764.10</td>
<td>Light-for-dates with signs of fetal malnutrition, unspecified [weight]</td>
</tr>
<tr>
<td>764.11</td>
<td>Light-for-dates with signs of fetal malnutrition, less than 500 grams</td>
</tr>
<tr>
<td>764.12</td>
<td>Light-for-dates with signs of fetal malnutrition, 500-749 grams</td>
</tr>
<tr>
<td>764.13</td>
<td>Light-for-dates with signs of fetal malnutrition, 750-999 grams</td>
</tr>
<tr>
<td>764.14</td>
<td>Light-for-dates with signs of fetal malnutrition, 1,000-1,249 grams</td>
</tr>
<tr>
<td>764.15</td>
<td>Light-for-dates with signs of fetal malnutrition, 1,250-1,499 grams</td>
</tr>
<tr>
<td>764.16</td>
<td>Light-for-dates with signs of fetal malnutrition, 1,500-1,749 grams</td>
</tr>
<tr>
<td>764.17</td>
<td>Light-for-dates with signs of fetal malnutrition, 1,750-1,999 grams</td>
</tr>
<tr>
<td>764.18</td>
<td>Light-for-dates with signs of fetal malnutrition, 2,000-2,499 grams</td>
</tr>
<tr>
<td>764.19</td>
<td>Light-for-dates with signs of fetal malnutrition, 2,500 grams and over</td>
</tr>
<tr>
<td>764.90</td>
<td>Fetal growth retardation, unspecified, unspecified [weight]</td>
</tr>
<tr>
<td>764.91</td>
<td>Fetal growth retardation, unspecified, less than 500 grams</td>
</tr>
<tr>
<td>764.92</td>
<td>Fetal growth retardation, unspecified, 500-749 grams</td>
</tr>
<tr>
<td>764.93</td>
<td>Fetal growth retardation, unspecified, 750-999 grams</td>
</tr>
<tr>
<td>764.94</td>
<td>Fetal growth retardation, unspecified, 1,000-1,249 grams</td>
</tr>
<tr>
<td>764.95</td>
<td>Fetal growth retardation, unspecified, 1,250-1,499 grams</td>
</tr>
<tr>
<td>764.96</td>
<td>Fetal growth retardation, unspecified, 1,500-1,749 grams</td>
</tr>
<tr>
<td>764.97</td>
<td>Fetal growth retardation, unspecified, 1,750-1,999 grams</td>
</tr>
<tr>
<td>764.98</td>
<td>Fetal growth retardation, unspecified, 2,000-2,499 grams</td>
</tr>
<tr>
<td>764.99</td>
<td>Fetal growth retardation, unspecified, 2,500 grams and over</td>
</tr>
<tr>
<td>773.0</td>
<td>Hemolytic disease of fetus or newborn due to Rh isoimmunization</td>
</tr>
<tr>
<td>773.2</td>
<td>Hemolytic disease of fetus or newborn due to other and unspecified isoimmunization</td>
</tr>
<tr>
<td>773.3</td>
<td>Hydrops fetalis due to isoimmunization</td>
</tr>
<tr>
<td>778.0</td>
<td>Hydrops fetalis not due to isoimmunization</td>
</tr>
</tbody>
</table>
Group 2C: Maternal Drug Use (Diagnosis Codes)
760.70  Unspecified noxious substance affecting fetus or newborn via placenta or breast milk
760.71  Alcohol affecting fetus or newborn via placenta or breast milk
760.72  Narcotics affecting fetus or newborn via placenta or breast milk
760.73  Hallucinogenic agents affecting fetus or newborn via placenta or breast milk
760.74  Anti-infectives affecting fetus or newborn via placenta or breast milk
760.75  Cocaine affecting fetus or newborn via placenta or breast milk
760.76  Diethylstilbestrol [DES] affecting fetus or newborn via placenta or breast milk
760.77  Anticonvulsants affecting fetus or newborn via placenta or breast milk
760.78  Antimetabolic agents affecting fetus or newborn via placenta or breast milk
760.79  Other noxious influences affecting fetus or newborn via placenta or breast milk
779.5  Drug withdrawal syndrome in newborn

Numerator Specifications
Appendix 3: Severe Complications Numerator (ICD-9 Codes)

Group 3A: Severe Birth Trauma (Diagnosis Codes)
767.0  Subdural and cerebral hemorrhage
767.11 Epicranial subaponeurotic hemorrhage (massive)
767.3  Other injuries to skeleton due to birth trauma
767.4  Injury to spine and spinal cord due to birth trauma
767.6  Injury to brachial plexus due to birth trauma
767.7  Other cranial and peripheral nerve injuries due to birth trauma

Group 3B: Severe Hypoxia Asphyxia (Diagnosis Codes)
768.5  Severe birth asphyxia
768.6  Mild or moderate birth asphyxia
768.70 Hypoxic-ischemic encephalopathy, unspecified
768.71 Mild hypoxic-ischemic encephalopathy
768.72 Moderate hypoxic-ischemic encephalopathy
768.73 Severe hypoxic-ischemic encephalopathy
Unspecified severity of birth asphyxia in liveborn infant

Congenital diplegia

Congenital hemiplegia

Congenital quadriplegia

Congenital monoplegia

Infantile hemiplegia

Other specified infantile cerebral palsy

Infantile cerebral palsy, unspecified

**Group 3C:** Severe Shock and Resuscitation (Diagnosis Codes)

Disseminated intravascular coagulation in newborn

Necrotizing enterocolitis in newborn, unspecified

Stage I necrotizing enterocolitis in newborn

Stage II necrotizing enterocolitis in newborn

Stage III necrotizing enterocolitis in newborn

Shock, unspecified

Cardiogenic shock

Septic shock

Other shock without mention of trauma

Acute kidney failure with lesion of tubular necrosis

**Group 3D:** Severe Respiratory Complications (Diagnosis Codes)

Persistent fetal circulation

Meconium aspiration with respiratory symptoms

Pulmonary hemorrhage

**Group 3E:** Severe Infection (Diagnosis Codes)

Congenital pneumonia

Bacteremia of newborn

Severe sepsis
## Group 3F: Severe Neurological Complication (Diagnosis Codes)

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>772.10</td>
<td>Intraventricular hemorrhage unspecified grade</td>
</tr>
<tr>
<td>772.11</td>
<td>Intraventricular hemorrhage, grade I</td>
</tr>
<tr>
<td>772.12</td>
<td>Intraventricular hemorrhage, grade II</td>
</tr>
<tr>
<td>772.13</td>
<td>Intraventricular hemorrhage, grade III</td>
</tr>
<tr>
<td>772.14</td>
<td>Intraventricular hemorrhage, grade IV</td>
</tr>
<tr>
<td>772.2</td>
<td>Subarachnoid hemorrhage of fetus or newborn</td>
</tr>
<tr>
<td>779.0</td>
<td>Convulsions in newborn</td>
</tr>
<tr>
<td>345.3</td>
<td>Grand mal status</td>
</tr>
<tr>
<td>779.2</td>
<td>Cerebral depression, coma, and other abnormal cerebral signs in fetus or newborn</td>
</tr>
<tr>
<td>779.7</td>
<td>Periventricular leukomalacia</td>
</tr>
<tr>
<td>779.85</td>
<td>Cardiac arrest of newborn</td>
</tr>
<tr>
<td>427.5</td>
<td>Cardiac arrest</td>
</tr>
<tr>
<td>348.30</td>
<td>Encephalopathy, unspecified</td>
</tr>
<tr>
<td>348.31</td>
<td>Metabolic encephalopathy</td>
</tr>
<tr>
<td>348.39</td>
<td>Other encephalopathy</td>
</tr>
<tr>
<td>348.5</td>
<td>Cerebral edema</td>
</tr>
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</table>

## Group 3G: Severe Shock/Resuscitation (Procedure Codes)

<table>
<thead>
<tr>
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<th>Description</th>
</tr>
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<tbody>
<tr>
<td>38.91</td>
<td>Arterial catheterization</td>
</tr>
<tr>
<td>99.60</td>
<td>Cardiopulmonary resuscitation, not otherwise specified</td>
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</table>

## Group 3H: Severe Respiratory (Procedure Codes)

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>96.70</td>
<td>Continuous invasive mechanical ventilation of unspecified duration</td>
</tr>
<tr>
<td>96.71</td>
<td>Continuous invasive mechanical ventilation for less than 96 consecutive hours</td>
</tr>
<tr>
<td>96.72</td>
<td>Continuous invasive mechanical ventilation for 96 consecutive hours or more</td>
</tr>
<tr>
<td>00.12</td>
<td>Administration of inhaled nitric oxide</td>
</tr>
<tr>
<td>34.04</td>
<td>Insertion of intercostal catheter for drainage</td>
</tr>
</tbody>
</table>

## Group 3I: Severe Neurological (Procedure Codes)

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>89.14</td>
<td>Electroencephalogram</td>
</tr>
<tr>
<td>43.1</td>
<td>Gastrostomy</td>
</tr>
</tbody>
</table>
Group 3J:  **Severe Septicemia (Diagnosis Codes)**

This code requires a minimum infant hospital Length of Stay of >4 days to ensure that it represents a truly serious diagnosis.

771.81  Septicemia [sepsis] of newborn

**Appendix 4: Moderate Complications Numerator (ICD-9 Codes)**

Groups A thru C do not require any neonatal LOS length to validate their severity.

**Group 4A: Moderate Birth Trauma (Diagnosis Codes)**

767.2  Fracture of clavicle due to birth trauma

767.5  Facial nerve injury due to birth trauma

**Group 4B: Moderate Respiratory Complication (Diagnosis Codes)**

769.  Respiratory distress syndrome in newborn

770.2  Interstitial emphysema and related conditions

**Group 4C: Moderate Respiratory Complication (Procedure Codes)**

93.90  Non-invasive mechanical ventilation (e.g. CPAP)

Groups D thru H additionally require an infant LOS to be >2 days for a vaginal birth and >4 days for a Cesarean birth to validate their severity.

**Group 4D: Moderate Birth Trauma with specific LOS requirement (Diagnosis Codes)**

763.0  Breech delivery and extraction affecting fetus or newborn

Other malpresentation, malposition, and disproportion during labor and delivery affecting fetus or newborn

763.1  Forceps delivery affecting fetus or newborn

763.3  Delivery by vacuum extractor affecting fetus or newborn

763.4  Cesarean delivery affecting fetus or newborn

763.5  Maternal anesthesia and analgesia affecting fetus or newborn

767.8  Other specified birth trauma
**Group 4E: Moderate Respiratory Complications with specific LOS requirement (Diagnosis Codes)**

- 770.14 Aspiration of clear amniotic fluid with respiratory symptoms
- 770.4 Primary atelectasis
- 770.5 Other and unspecified atelectasis
- 770.6 Transitory tachypnea of newborn
- 770.81 Primary apnea of newborn
- 770.82 Other apnea of newborn
- 770.83 Cyanotic attacks of newborn
- 770.84 Respiratory failure of newborn
- 770.86 Aspiration of postnatal stomach contents with respiratory symptoms
- 770.87 Respiratory arrest of newborn
- 770.88 Hypoxemia of newborn
- 770.89 Other respiratory problems after birth

**Group 4F: Moderate Neurological Complication with specific LOS requirement (Procedure Codes)**

- 87.03 Computerized axial tomography of head
- 87.04 Other tomography of head
- 88.91 Magnetic resonance imaging of brain and brain stem

**Group 4G: Moderate Respiratory Complications with specific LOS requirement (Procedure Codes)**

- 93.91 Intermittent positive pressure breathing [IPPB]
- 93.93 Nonmechanical methods of resuscitation
- 93.94 Respiratory medication administered by nebulizer
- 93.95 Hyperbaric oxygenation
- 93.96 Other oxygen enrichment
- 93.98 Other control of atmospheric pressure and composition
- 93.99 Other respiratory procedures

**Group 4H: Moderate Infection with specific LOS requirement (Diagnosis Code)**

- 771.81 Septicemia of the newborn

This group includes babies with this code that have a shorter LOS than those in Appendix 3, Group G where the LOS has to be >4 days.
Appendix 5: Moderate Complications Numerator—Long LOS (ICD-9 Codes)

After an infant LOS >5 days has been identified, the codes in Groups A thru C are used to exclude cases for jaundice or social reasons for their prolonged LOS.

**Group 5A: Jaundice (Diagnosis Codes)**

- 773.1 Hemolytic disease of fetus or newborn due to ABO isoimmunization
- 774.0 Perinatal jaundice from hereditary hemolytic anemias
- 774.1 Perinatal jaundice from other excessive hemolysis
- 774.2 Neonatal jaundice associated with preterm delivery
- 774.30 Neonatal jaundice due to delayed conjugation, cause unspecified
- 774.31 Neonatal jaundice due to delayed conjugation in diseases classified elsewhere
- 774.39 Other neonatal jaundice due to delayed conjugation from other causes
- 774.4 Perinatal jaundice due to hepatocellular damage
- 774.5 Perinatal jaundice from other causes
- 774.6 Unspecified fetal and neonatal jaundice
- 774.7 Kernicterus of fetus or newborn not due to isoimmunization

**Group 5B: Jaundice (Procedure Code)**

- 99.83 Other phototherapy

**Group 5C: Social Problems (Diagnosis Codes)**

- V60.0 Lack of housing
- V60.1 Inadequate housing
- V60.2 Inadequate material resources
- V60.3 Person living alone
- V60.4 No other household member able to render care
- V60.6 Person living in residential institution
- V60.81 Foster care (status)
- V60.89 Other specified housing or economic circumstances
- V60.9 Unspecified housing or economic circumstance
- V61.05 Family disruption due to child in welfare custody
- V61.06 Family disruption due to child in foster care or in care of non-parental family member
Sub-Category ("Bucket") Specifications

Appendix 6: Sub-Category Groupings

The categories below represent a re-sorting of the groupings above into diagnosis-related "buckets"

**Respiratory Sub-Category**
Group 3D: Severe Respiratory Complications (Diagnosis Codes)
Group 3H: Respiratory (Procedure Codes)
Group 4B: Moderate Respiratory Complication Diagnosis Codes)
Group 4C: Moderate Respiratory Complication (Procedure Codes)
Group 4E: Moderate Respiratory Complications with specific LOS requirement (Diagnosis Codes)
Group 4G: Moderate Respiratory Complications with specific LOS requirement (Procedure Codes)

**Infection Sub-Category**
Group 3E: Severe Infection (Diagnosis Codes)
Group 3J: Severe Septicemia (Diagnosis Codes)
Group 4H: Moderate Infection with specific LOS requirement (Diagnosis Code)

**Transfer to Higher Care Sub-Category**
Transferred Disposition Code

**Neurologic / Birth Injury Sub-Category**
Group 3A: Severe Birth Trauma (Diagnosis Codes)
Group 3B: Hypoxia Asphyxia (Diagnosis Codes)
Group 3F: Severe Neurological Complication (Diagnosis Codes)
Group 3I: Neurological (Procedure Codes)
Group 4A: Moderate Birth Trauma (Diagnosis Code)
Group 4D: Moderate Birth Trauma with specific LOS requirement (Diagnosis Codes)
Group 4F: Moderate Neurological Complication with specific LOS requirement (Procedure Codes)
From the Birth Certificate: 5' or 10' Apgar ≤3
**Shock/Resuscitation Sub-Category**
Group 3C: Shock and Resuscitation (Diagnosis Codes)
Group 3G: Shock/Resuscitation (Procedure Codes)

**Long Neonatal Length of Stay (LOS) Sub-Category**
Those with neonatal LOS>5d not in above categories and excluding cases from:
Group 5A: Jaundice (Diagnosis Codes)
Group 5B: Jaundice (Procedure Code)
Group 5C: Social Problems (Diagnosis Codes)