Vermont Oxford Network
National Quality Forum Measure 0304
Late Sepsis or Meningitis in Very Low Birth Weight (VLBW) Neonates (risk adjusted)

Measure Description:

Late sepsis or meningitis in VLBW neonates is a measure of nosocomial bacterial infection for eligible infants whose birth weight is between 401 and 1500 grams or whose gestational age is between 22 and 29 weeks. Coefficients are provided on request to hospitals that wish to calculate observed and expected values based on case mix for a given birth year. The observed and expected values may be used to calculate hospital performance measures such as the standardized morbidity ratio (SMR), the standardized rate, or observed minus expected values. The coefficients are based on a multivariable logistic regression model which includes birth location and factors present at birth that may be associated with infection.

A measure of systematic variation among hospitals in the Vermont Oxford Network is also available on request to provide a means to adjust for random variation using a process referred to as shrinkage. Shrinkage formulas are described below in the section labeled "Calculation Instructions." When the shrinkage formulas are applied, the hospital performance measure values are moved closer to the population mean in proportion to the imprecision of the estimate, i.e., in inverse proportion to the number of cases. Shrunken estimates are a weighted average of the hospital value and the population (Vermont Oxford Network) mean value. In small hospitals shrunken estimates will weight the population mean value more heavily, whereas the calculated performance measure value will be weighted more heavily in larger hospitals.   Shrunken estimates are more stable over time than if the correction were not applied, because they adjust for imprecision by filtering random variation.

Population:

Infants in the reporting hospital after day 3 of life or readmitted after day three of life should be included if they meet either of the following two criteria:

1. Any infant who is born at the reporting hospital and whose birth weight is between 401 and 1500 grams OR whose gestational age is between 22 weeks 0 days and 29 weeks 6 days (inclusive) should be included, regardless of where in the hospital the infant receives care.

2. Any outborn infant who is admitted to any location in the reporting hospital within 28 days of birth, without first having gone home, and whose birth weight is between 401 and 1500 grams OR whose gestational age is between 22 weeks 0 days and 29 weeks 6 days (inclusive) should be included, regardless of where in the hospital the infant receives care.

Exclusions:
1. Infants who meet neither of the above two criteria.
2. Outborn infants admitted more than 28 days after birth.
3. Outborn infants who have been home prior to admission.
4. Infants discharged home on or before day 3 of life.
5. Infants who die on or before day 3 of life.
6. Infants who transfer to another hospital on or before day 3 of life and who are not readmitted to the reporting hospital.

Measure Stratification:

Covariates associated with predicting the expected value are included in the multivariable model.

Calculation Instructions

1. Determine the number of infants for a birth year who meet the population criteria described above. Be sure that all eligible infants during the reporting period are identified. This number is termed N.

2. Using the definitions in the section below labeled "Definitions," determine the number of infants who had nosocomial bacterial infection after day 3 of life and prior to discharge home for each of the N infants. The number identified as having nosocomial bacterial infection is termed the "observed number with infection" or O for short.

3. For each of the N infants, calculate the expected value of infection by multiplying the coefficient times its covariate value for each covariate (coefficients provided on request). The covariates include:
   Gestational Age in completed weeks (GA)
   GA squared
   Small for Gestational Age (data table provided on request)
   Major birth defect (0=No, 1=Yes)
   APGAR score at 1 minute (0 to 10)
   Birth location (0=Inborn, 1=Outborn)
   Multiple gestation (0=No, 1=Yes)
   Infant gender (0=Female, 1=Male)
   Mode of delivery (0=C-Section, 1=Vaginal)

4. Add the expected values for each of the N infants to calculate the number of expected cases of nosocomial bacterial infection. This number is termed the "expected number with infection" or E for short.

5. Calculate the standardized morbidity ratio (SMR_{shrnk}) for nosocomial bacterial infection using the values for O and E and applying the estimate for systematic variation (v^2), determined from Vermont Oxford Network analyses (provided on request).

$$SMR_{shrnk} = (O + v^2) / (E + v^2)$$

with standard error $SESMR_{shrnk} = sqrt(1/(E+(1/v^2)))$;

6. Calculate the shrunken, adjusted nosocomial bacterial infection rate ($Rate_{shrnk}$) and its 95% confidence interval.

$$Rate_{shrnk} = (SMR_{shrnk} \times E) / N$$

with standard error ($SE_{Rateshrnk}$) equal to $SESMR_{shrnk} \times E) / N$.

and 95% confidence interval for $Rate_{shrnk}$ equal to

$$Rate_{shrnk} \pm 1.96 \times SE_{Rateshrnk}.$$

7. Calculate the number of observed minus expected cases of nosocomial bacterial infection, adjusting for case mix and systematic variation (O–E$_{shrnk}$), and calculate the 95% control limits[1] for O–E$_{shrnk}$.

$$O–E_{shrnk} = E \,/\, SMR_{shrnk}$$

with 95% control limits equal to $O–E_{shrnk} \pm 1.96 \times SE_{SMRshrnk} \times E$.

8. Definitions:

Data item definitions are from the Vermont Oxford Network Manual of Operations, available on-line at: https://public.vtoxford.org/manuals-forms/

a. Nosocomial Bacterial Infection

Either coagulase negative staphylococcus and/or an identified bacterial pathogen after day 3 of life. In determining the date of day 3, the date of birth counts as day 1 regardless of the time of birth. For an infant born at 11:59 PM on September 1, day 3 is September 3rd. Infants who are discharged home or who die prior to day 3 should not be considered when calculating rates. Infants who transfer to another hospital should only be considered if they are readmitted to your hospital following transfer and prior to discharge home.

An infant is considered to have a bacterial pathogen after day 3 of life if one or more of the following bacterial pathogens is recovered from a blood and/or cerebral spinal fluid culture obtained after day 3.

1. Achromobacter species [including Achromobacter xylosoxidans (also known as Alcaligenes xylosoxidans) and others]

2. Acinetobacter species

3. Aeromonas species

4. Alcaligenes species [Alcaligenes xylosoxidans and others]

5. Bacteroides species

6. Burkholderia species [Burkholderia capecia and others]

7. Campylobacter species [Campylobacter fetus, C. jejuni and others]

8. Chryseobacterium species

9. Citrobacter species [Citrobacter diversus, C. freundii, C. koseri and others]

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[1] Note O-E values above or below the control limits are indication of a "true" signal that the value for O-E is less or greater than expected.

10. Clostridium species

11. Enterobacter species [Enterobacter aerogenes, E. cloacae, and others]

12. Enterococcus species [Enterococcus faecalis (also known as Streptococcus faecalis), E.   faecium, and other Enterococcus species]

13. Escherichia coli

14. Flavobacterium species

15. Haemophilus species [Haemophilus influenzae and others]

16. Klebsiella species [Klebsiella oxytoca, K. pneumoniae and others]

17. Listeria monocytogenes

18. Moraxella species [Moraxella catarrhalis (also known as Branhamella catarrhalis) and others]

19. Neisseria species [Neisseria meningitidis, N. gonorrhoeae and others]

20. Pasteurella species

21. Prevotella species

22. Proteus species [Proteus mirabilis, P. vulgaris and others]

23. Providencia species [Providencia rettgeri, and others]

24. Pseudomonas species [Pseudomonas aeruginosa and others]

25. Ralstonia species

26. Salmonella species

27. Serratia species [Serratia liquefaciens, S. marcescens and others]

28. Staphylococcus coagulase positive [aureus]

29. Stenotrophomonas maltophilia

30. Streptococcus species [including Streptococcus Group A, Streptococcus Group B, Streptococcus Group D, Streptococcus pneumoniae, Strep milleri and others]

An infant is considered to have coagulase negative staph after day 3 of life if all three of the following conditions are met.

1. Coagulase negative staphylococcus is recovered after day 3 of life from a blood culture obtained from either a central line or peripheral blood sample and/or is recovered from cerebrospinal fluid obtained by lumbar puncture, ventricular tap or ventricular drain.
2. There are one or more signs of generalized infection (such as apnea, temperature instability, feeding intolerance, worsening respiratory distress or hemodynamic instability) after day 3 of life.
3. The infant is treated with five or more days of intravenous antibiotics after the above cultures were obtained. If the infant died, was discharged, or transferred prior to the completion of five days of intravenous antibiotics, this condition would still be met if the intention were to treat for five or more days.

b. Gestational Age:

Note: only the number of completed weeks is used in the measure calculations.

Record the best estimate of gestational age in weeks and days using the following hierarchy:

1. Obstetrical measures based on last menstrual period, obstetrical parameters, and prenatal ultrasound as recorded in the maternal chart.
2. Neonatologist's estimate based on physical criteria, neurologic examination, combined physical and gestational age exam (Ballard or Dubowitz), or examination of the lens.

The best estimate should be recorded in weeks and days. In instances when the best estimate of gestational age is an exact number of weeks, enter the number of weeks in the space provided for weeks and enter "0" in the space provided for days. Do not leave the number of days blank.

c. Small for Gestational Age (SGA):

An infant is considered SGA if the birth weight is in the 10th percentile for birth weight, given the infant's gestational age in completed weeks, maternal race (Black, Hispanic, White, Asian or Other), gender and whether the gestation was singleton or multiple. The United States Natality Datasets are used for SGA determinations. Use the table below to determine the 10th percentile value based on the infant's gestational age, gender, maternal race and multiple birth. If the infant's birth weight is less than the tabulated birth weight, the infant is classified as SGA. If gender, maternal race or multiple birth is unknown, the 10th percentile

values may still be determined from the table. A table of SGA values is provided on request.

d. <u>Major Birth Defect</u>:

Check **"Yes"** if the infant had one or more of the birth defects listed below. In the spaces provided, you may enter as many as five 3-digit code numbers of birth defects from the list.

Check **"Yes"** if the infant had birth defects, not listed below, which were lethal, or life threatening. In this case use the defect code of "100" (in addition to any other applicable code) and describe the defects in detail in the space provided for description. Be specific. Do not use general descriptions such as "multiple congenital anomalies" or "complex congenital heart disease". To be considered as lethal or life threatening a birth defect must either; 1) be the primary cause of death, or 2) be treated prior to discharge with specific surgical or medical therapy to correct a major anatomic defect or a life threatening physiologic dysfunction.

Check **"No"** if an infant was not diagnosed as having one or more of the birth defects listed below and did not have an unlisted birth defect which was lethal or life threatening.

The following conditions should <u>NOT</u> be coded as major birth defects:

   Cleft Lip without Cleft Palate
   Club Feet
   Congenital Dislocation of the Hips
   Congenital CMV
   Cystic Fibrosis
   Extreme Prematurity
   Fetal Alcohol Syndrome
   Hypospadias
   Hypothyroidism
   Intrauterine Growth Retardation
   Intrauterine Infection
   Limb Abnormalities
   Patent Ductus Arteriosus
   Persistent Pulmonary Hypertension (PPHN)
   Polydactyly
   Pulmonary Hypoplasia
   Small Size for Gestational Age
   Syndactyly

The following conditions are considered major birth defects :
   Anencephaly
   Atresia of large Bowel or Rectum

Bilateral Polycystic, Multicystic, or Dyplastic Kidneys
Bilateral Renal Agenesis
Biliary Atresia
Cleft Palate
Complete Atrio-Ventricular Canal
Congenital Cystic Adenomatoid Malformation of the Lung
Congenital Diaphragmatic Hernia
Congenital Hydrocephalus
Conjoined Twins
Double Outlet right Ventricle
Duodenal Atresia
Esophageal Atresia
Exstrophy of the Urinary Bladder
Gastroschisis
Hemoglobin Barts
Holoprosencephaly
Hydranencephaly
Hydrops Fetalis w/anasarca
Hypoplastic Left Heart Syndrome
Ileal Atresia
Imperforate Anus
Inborn Error of Metabolism
Interrupted Aortic Arch
Jejunal Atresia
Meningomyelocele
Myotonic Dystrophy
Obstructive Uropathy w/Congenital Hydronephrosis
Oligohydramnios sequence
Omphalocele
Penatalogy of Cantrell (Thoraco-Abdominal Ectopia Cordis)
Pulmonary Atresia
Single Ventricle
Skeletal Dysplasia
Tetralogy of Fallot
Thanatophoric Dysplasia Types 1 and 2
Total Anomalous Pulmonary Venous Return
Tracheal Agenesis or Atresia
Tracheo-Esophageal Fistula
Transposition of the Great Vessels
Tricuspid Atresia
Triploidy

Trisomy 13
Trisomy 18
Trisomy 21
Truncus Arteriosus
Other Chromosomal Abnormality
Other Lethal or Life Threatening Birth Defect

e. APGAR Score at 1 Minute:

Enter the APGAR score at 1 minute as noted in the labor and delivery record.

f. Location of Birth:

Check **"Inborn"** if the infant was delivered at your center.

Check "**Outborn**" if the infant was delivered outside your center. Any infant requiring ambulance transfer will be considered outborn. When completing Network data forms for outborn infants, use all information available from the hospital that transferred the infant to your center as well as from your own hospital.

g. Multiple Gestation:

Check **"Yes"** if two or more live fetuses were documented at any time during the pregnancy which resulted in the birth of the infant.
Otherwise check **"No"**.

h. Infant Gender:

Check **"Male"** or **"Female"**.

i. Mode of Delivery :

Check **"Vaginal"** for any vaginal delivery (spontaneous or induced).

Check **"Cesarean Section"** for any cesarean delivery (elective or emergent).

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