

Vermont Oxford Network
NQF Measure 0303
Late Sepsis or Meningitis in Neonates (risk adjusted)

NQF Measure Number:

0303

Measure Description:

Late sepsis or meningitis in neonates is a measure of nosocomial bacterial infection for eligible infants whose birth weight is greater than 400 grams or whose gestational age is 22 weeks or greater. Coefficients are provided on request to hospitals that wish to determine observed and expected values based on case mix for a given period (usually a 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 any of the following 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.

Vermont Oxford Network
NQF Measure 0303
Late Sepsis or Meningitis in Neonates (risk adjusted)

3. Any infant whose birth weight is over 1500 grams and who is admitted to a Neonatal Intensive Care Unit (NICU) in the reporting hospital within the first 28 days of life without first having gone home should be included, regardless of gestational age. A NICU is any location within the hospital in which newborn infants receive continuous positive airway pressure (CPAP) or intermittent mandatory ventilation (IMV).
4. Any infant whose birth weight is over 1500 grams and who dies at any location in the reporting hospital within 28 days of birth without first having gone home should be included. This includes inborn and outborn infants.

Exclusions:

1. Infants who meet none of the above 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 reporting period (usually 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 'Calculation Instructions', 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.

Vermont Oxford Network
 NQF Measure 0303
 Late Sepsis or Meningitis in Neonates (risk adjusted)

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)
 - Indicator variables for maternal race or ethnicity (0 or 1)
 - Hispanic
 - Black
 - White
 - Asian
 - Other
 - 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).

$$SMR_{shrnk} = \frac{O + v^2}{E + v^2}$$

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

$$Rate_{shrnk} = \frac{SMR_{shrnk} \times E}{N}$$

with standard error ($SE_{Rate_{shrnk}}$) equal to $\frac{SE_{SMR_{shrnk}} \times E}{N}$.

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

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

Vermont Oxford Network
 NQF Measure 0303
 Late Sepsis or Meningitis in Neonates (risk adjusted)

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

$$Rate_{shrnk} = \frac{SMR_{shrnk} \times E}{N}$$

with standard error ($SE_{Rate_{shrnk}}$) equal to $\frac{SE_{SMR_{shrnk}} \times E}{N}$.

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

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

8. 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 limits¹ for $O-E_{shrnk}$.

$$O-E_{shrnk} = \frac{O}{SMR_{shrnk}} - E$$

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

9. Definitions:

Data item definitions are from the Vermont Oxford Network Manual of Operations, available on-line at www.vtoxford.org.

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 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.

Vermont Oxford Network
NQF Measure 0303
Late Sepsis or Meningitis in Neonates (risk adjusted)

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 caepicia* 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]
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

Vermont Oxford Network
NQF Measure 0303
Late Sepsis or Meningitis in Neonates (risk adjusted)

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,

Vermont Oxford Network
NQF Measure 0303
Late Sepsis or Meningitis in Neonates (risk adjusted)

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. Major Birth Defect:

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 NOT be coded as major birth defects:

- Cleft Lip without Cleft Palate
- Club Feet
- Congenital Dislocation of the Hips
- Congenital CMV

Vermont Oxford Network
NQF Measure 0303
Late Sepsis or Meningitis in Neonates (risk adjusted)

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

Vermont Oxford Network
NQF Measure 0303
Late Sepsis or Meningitis in Neonates (risk adjusted)

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

Vermont Oxford Network
NQF Measure 0303
Late Sepsis or Meningitis in Neonates (risk adjusted)

e. APGAR Score at 1 Minute:

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

f. Maternal Race/Ethnicity - White:

The response to this item should be obtained by personal interview with the mother or review of the birth certificate or medical record, in that order of preference.

"Hispanic" is indicated if the biological mother is a person of Cuban, Mexican, Puerto Rican, South or Central American or other Spanish culture or origin, regardless of race.

"Black" is indicated if the biological mother is a person having origins in any of the original peoples of Africa.

"White" is indicated if the biological mother is a person having origins in any of the original peoples of Europe, the Middle East, North Africa (Arabic origins) or Western Russia (including Afghanistan and South Russia).

"Asian" is indicated if the biological mother is a person having origins in the original peoples of the Far East, Southeast Asia, the Indian Subcontinent or the Pacific Islands. This includes Cambodia, China, Guam, Hawaii, India, Japan, Korea, Laos, Philippines, Samoa, Thailand, Vietnam or any Pacific Island.

"Other" is indicated if none of the race/ethnicity categories above applies to the biological mother.

g. 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.

h. 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"**.

Vermont Oxford Network
NQF Measure 0303
Late Sepsis or Meningitis in Neonates (risk adjusted)

i. Infant Gender:

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

j. Mode of Delivery :

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

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

Vermont Oxford Network Contact:

Joseph Carpenter, Director of Operations and Statistics, 802-865-4814, x 217;
joe@vtoxford.org.