

Early Onset Neonatal Sepsis

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Note:

This guideline provides advice of a general nature. This statewide guideline has been prepared to promote and facilitate standardisation and consistency of practice, using a multidisciplinary approach. The guideline is based on a review of published evidence and expert opinion.

Information in this statewide guideline is current at the time of publication.

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Health practitioners in the South Australian public health sector are expected to review specific details of each patient and professionally assess the applicability of the relevant guideline to that clinical situation.

If for good clinical reasons, a decision is made to depart from the guideline, the responsible clinician must document in the patient's medical record, the decision made, by whom, and detailed reasons for the departure from the guideline.

This statewide guideline does not address all the elements of clinical practice and assumes that the individual clinicians are responsible for discussing care with consumers in an environment that is culturally appropriate, and which enables respectful confidential discussion. This includes:

- The use of interpreter services where necessary,
- Advising consumers of their choice and ensuring informed consent is obtained,
- Providing care within scope of practice, meeting all legislative requirements and maintaining standards of professional conduct, and
- Documenting all care in accordance with mandatory and local requirements

Note: The words woman/women/mother/she/her have been used throughout this guideline as most pregnant and birthing people identify with their birth sex. However, for the purpose of this guideline, these terms include people who do not identify as women or mothers, including those with a non-binary identity. All clinicians should ask the pregnant person what their preferred term is and ensure this is communicated to the healthcare team.

“Aboriginal and Torres Strait Islander recognition statement: We use the term ‘Aboriginal’ to refer to people who identify as Aboriginal, Torres Strait Islander, or both Aboriginal and Torres Strait Islander. We do this because the people indigenous to South Australia are Aboriginal and we respect that many Aboriginal people prefer the term ‘Aboriginal’. We also acknowledge and respect that many Aboriginal South Australians prefer to be known by their specific language group(s).”



Australian Aboriginal Culture is the oldest living culture in the world, yet Aboriginal people continue to experience the poorest health outcomes when compared to non-Aboriginal Australians. In South Australia, Aboriginal women are 2–5 times more likely to die in childbirth and their babies are 2–3 times more likely to be of low birth weight. The accumulative effects of stress, low socio-economic status, exposure to violence, historical trauma, culturally unsafe and discriminatory health services, and health systems are all major contributors to the disparities in Aboriginal maternal and birthing outcomes. Despite these unacceptable statistics, the birth of an Aboriginal baby is a celebration of life and an important cultural event bringing family together in celebration, obligation, and responsibility. The diversity between Aboriginal cultures, language and practices differ greatly and so it is imperative that perinatal services prepare to respectfully manage Aboriginal protocol and provide a culturally positive health care experience for Aboriginal people to ensure the best maternal, neonatal and child health outcomes.

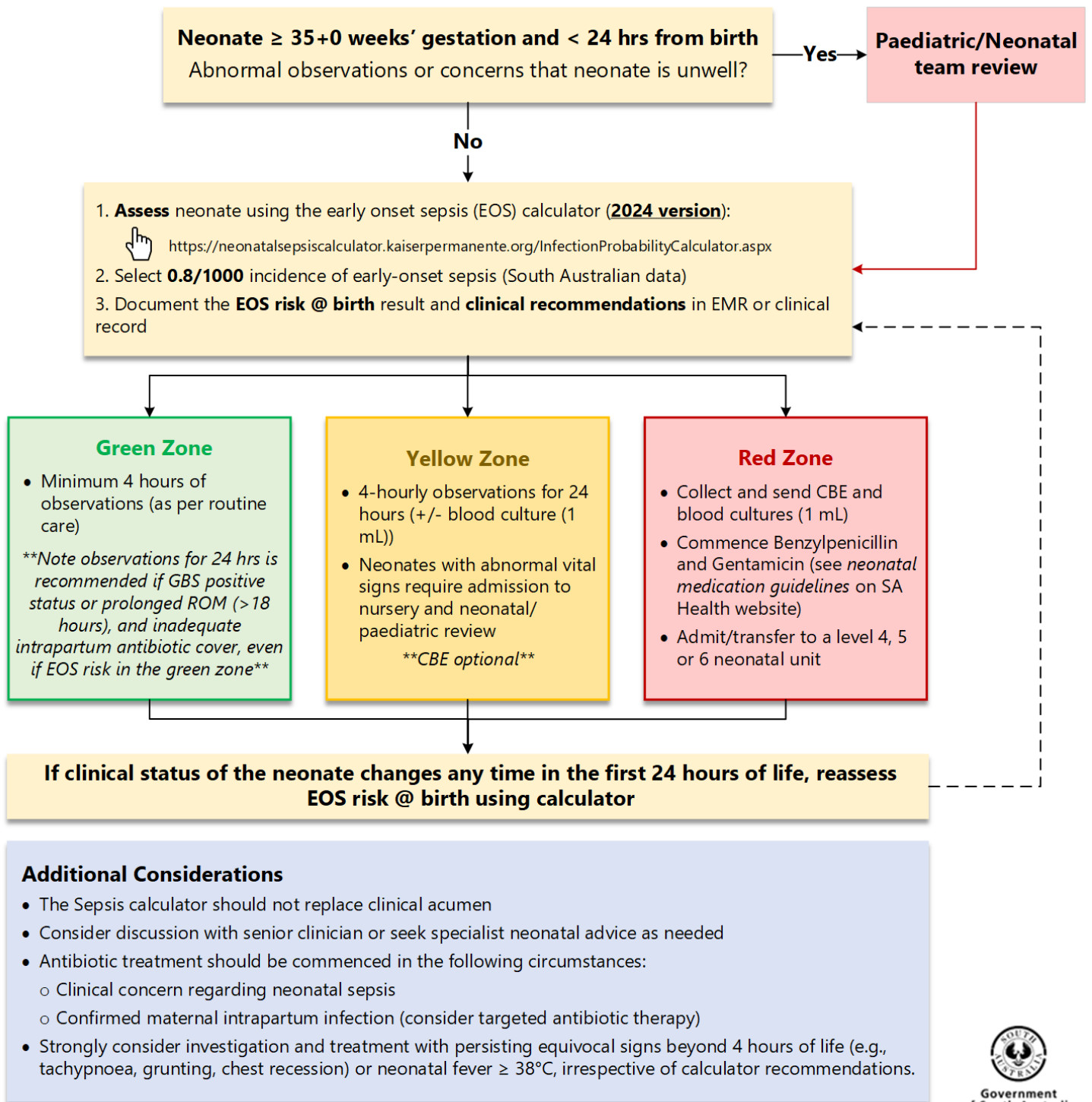
Explanation of the Aboriginal artwork: The Aboriginal artwork used symbolises the connection to country and the circle shape shows the strong relationships amongst families and the Aboriginal culture. The horseshoe shape design shown in front of the generic statement symbolises a woman and those enclosing a smaller horseshoe shape depicts a pregnant woman. The smaller horseshoe shape in this instance represents the unborn child. The artwork shown before the specific statements within the document symbolises a footprint and demonstrates the need to move forward together in unison.

Purpose and Scope of PPG

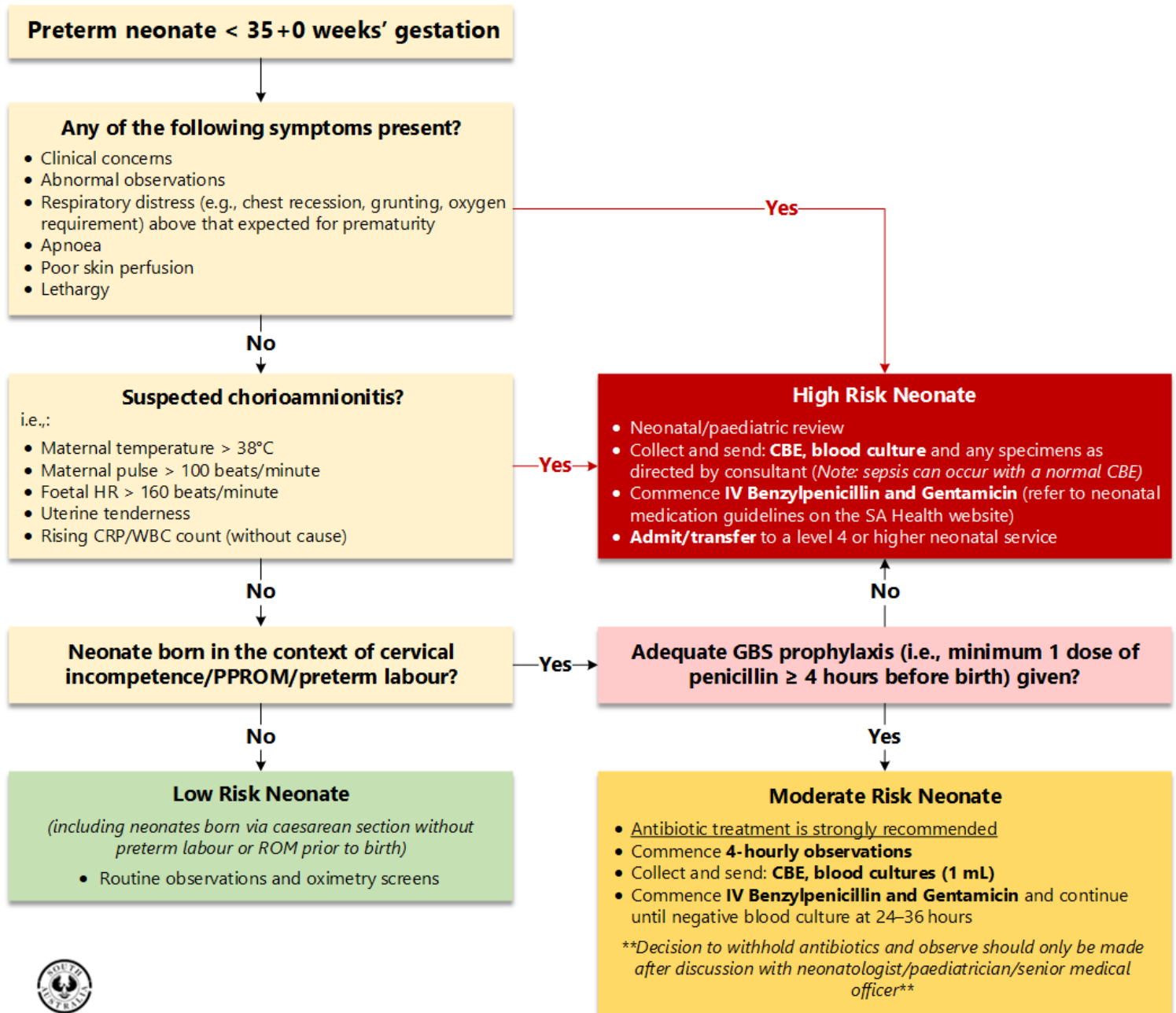
The purpose of this guideline is to give clinicians information on the prevention and treatment of neonatal early onset sepsis (EOS).



Flowchart 1| Management of Early Onset Sepsis in Infants Born $\geq 35^{+0}$ Weeks' Gestation



Flowchart 2| Management of Early Onset Sepsis in the Preterm Infant Born < 35⁺⁰ Weeks' Gestation



Early Onset Neonatal Sepsis

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Summary of Practice Recommendations

[Screening for Group B Streptococcus](#) (GBS) and giving intrapartum antibiotic prophylaxis to carrier mothers is the most effective means of preventing early onset GBS.

Careful [observation and examination](#) are key to the early detection of sepsis.

The [risk](#) of sepsis in a term infant with respiratory distress not settling by 4 hours of age should be carefully considered.

For [infants born \$\geq 35^{+0}\$ weeks' gestation](#) and < 24 hours old, the risk of sepsis can be assessed using the [EOS calculator](#) (2024 version).

For [infants born < 35⁺⁰ weeks' gestation](#), careful consideration of the circumstances of preterm birth and current clinical status is required.

Clinicians should have a lower threshold to treat preterm infants for EOS.

Routine [investigations](#) include blood cultures (volume ideally 1mL), and complete blood examination (CBE) with immature/total neutrophil ratio (I:T ratio).

Empirical [treatment](#) is with intravenous (IV) benzylpenicillin and gentamicin.

Duration of treatment depends on clinical circumstances but is at least 24–36 hours.

Where symptomatic EOS is suspected, consult a paediatrician or neonatologist and [admit/transfer](#) to a level 4 or higher neonatal service.

The [period of observation required](#) for term infants will depend on the individual risk assessment by the EOS sepsis calculator.

Approximately 95% of EOS cases are diagnosed < 48 hours after birth.^{1, 3} [Parental observation at home](#) after this period is likely to be safe if parents are aware of symptoms that require immediate medical review.

Parents should be informed of what is considered normal, and where to seek help when they recognise any abnormal signs.

Abbreviations

>	Greater than
\geq	Equal to or greater than
<	Less than
\leq	Equal to or less than
g	Gram(s)
CBE	Complete blood examination
CRP	C-reactive protein
EMR	Electronic Medical Record
EOS	Early Onset Sepsis
GBS	Group B <i>Streptococcus</i>
I:T ratio	Immature: total neutrophil ratio
IV	Intravenous
PPROM	Premature pre-labour rupture of the membranes
ROM	Rupture of membranes



Definitions

Adequate GBS Intrapartum Antibiotic Prophylaxis	At least 1 dose of penicillin or other GBS specific antibiotic given 4 or more hours prior to birth.
Chorioamnionitis	Indicates an infection of the amniotic fluid, membranes, placenta, and/or decidua.
Early Onset Neonatal Sepsis	The presence of systemic bacterial or fungal sepsis with initial symptoms occurring \leq 72 hours after birth. ¹⁻³
GBS Positive	Positive GBS screen < 5 weeks before labour.
Late Onset Neonatal Sepsis	The presence of systemic bacterial or fungal sepsis that occurs > 72 hours of age. ¹⁻³ Late onset GBS disease can occur in infants up to 90 days of age.
Systemic Sepsis	A clinical picture consistent with sepsis and either a positive bacterial or fungal culture of blood and/or cerebrospinal fluid.

Respectful Maternity Care and Shared Decision-Making Statement

The South Australian Perinatal Practice Guidelines (SAPPG) are committed to **safe, respectful and culturally responsive** maternity care for all women and newborns.

Women have the **right to dignity, informed choice and autonomy**. Clinicians support decision-making with clear, unbiased information and compassionate, non-coercive care. Care is provided in partnership with women and families, honouring their values, cultural needs, and preferences across the maternity journey.

Clinicians are encouraged to use Safer Care Victoria's RESPECT principles to guide clinical practice, see [Respectful Maternity and Newborn Care Framework | Safer Care Victoria](#).

R E S P E C T

Recognise the woman's right to decide
 Enlist appropriate interpreters when needed
 Share balanced information
 Provide time and space
 Enable questions
 Check understanding
 Trust and document

Pathophysiology of Early Sepsis

Early-onset sepsis (EOS) results from transplacental or genital tract bacterial transmission, leading to a neonatal infection with a positive blood or cerebrospinal fluid culture within the first 72 hours of life.¹⁻³ It is associated with significant morbidity and mortality, which is increased at lower gestations.^{1, 2, 4} The incidence of GBS EOS has declined to 0.3–0.8 per 1000 live births.^{2, 5} This is largely due to the introduction of antenatal GBS screening and intrapartum antibiotic prophylaxis (IAP).^{3, 6, 7}

Most infections are due to GBS or *Escherichia coli*, with other organisms seen less frequently. These include bacteria that are part of the normal vaginal flora such as *Streptococcus pneumoniae*, *Haemophilus influenza*, *Staphylococcus aureus*, *Clostridia sp.*, and other *Enterobacteriaceae* such as *Klebsiella*.^{1, 2, 4}



Early Onset Neonatal Sepsis

GBS Screening and Intrapartum Antibiotic Prophylaxis

The principal risk factor for GBS EOS is maternal colonisation of the genitourinary and gastrointestinal tract. Without intrapartum antibiotic prophylaxis (IAP), 50% of GBS positive women will transmit bacteria to their baby and 1–2% will go on to develop GBS EOS.⁸ Universal GBS screening and IAP is the most effective means of preventing GBS EOS.^{3, 6, 7}

GBS positive is defined as:⁸

- maternal GBS vaginal colonisation in the current pregnancy based on a low-vaginal swab taken less than 5 weeks before labour
- maternal GBS bacteriuria in the current pregnancy
- early onset neonatal GBS sepsis in a previous child.

Individual GBS colonisation can fluctuate over time and relies on accurate swab collection methods. Studies have shown 61.4% of swabs in term infants with GBS EOS had falsely negative antenatal GBS screening results.⁹ This emphasises the importance of not relying solely on a negative maternal swab. False negative rates for GBS PCR are less well defined.

Where another organism is known to be a part of the ambient vaginal flora, specific prophylaxis may be considered. See *Antibiotics in the Peripartum Period PPG* in the A-Z index at www.sahealth.sa.gov.au/perinatal.

Note: GBS prophylaxis has no effect on late onset neonatal GBS sepsis or other causative pathogens, and there is currently no evidence-based recommendations for IAP against the other pathogens.³

Whilst intrapartum antibiotic prophylaxis given 2–4 hours prior to birth has some efficacy, antibiotics given 4 or more hours before birth is most effective at preventing early onset GBS disease.⁴ For infants < 35 weeks, adequate intrapartum prophylaxis is defined as GBS specific antibiotics given 4 or more hours before birth.

Note: When using the neonatal EOS calculator, 2 hours is specified as adequate GBS specific antibiotic prophylaxis.

Risk Factors for Early Onset Neonatal Sepsis

An infant is considered at risk for EOS if any of the following apply:

- evidence of maternal chorioamnionitis
- GBS positive mother (see [Definitions](#))
- preterm labour at less than 37⁺⁰ weeks' gestation
- premature prelabour rupture of membranes (PPROM)
- prolonged rupture of membranes greater than 18 hours with or without labour, irrespective of GBS status.

Symptoms of Early Onset Neonatal Sepsis



The recognition of symptoms and treatment on clinical grounds is critical.

- Clinical symptoms and signs that should raise the suspicion of sepsis include:
 - need for positive pressure ventilation during birth resuscitation
 - respiratory distress (any signs of tachypnoea, grunting, increased effort of breathing with subcostal/intercostal recession and/or nasal flaring)
 - unexplained temperature instability (hypothermia < 36.4°C or fever ≥ 38°C)
 - poor skin perfusion/pallor
 - lethargy causing abnormal feeding



- apnoea
- seizures
- elevated lactate level.

There is a narrow window for withholding antibiotics in babies with respiratory distress in the first 4 hours of life and clinicians must exercise judgement to distinguish between transitional instability from signs of clinical illness.³

Note: Respiratory distress due to congenital pneumonia is the most common presentation of EOS. Any persisting signs should be treated as possible sepsis.

Assessment of Early Onset Sepsis in Infants \geq 35 Weeks' Gestation

The **neonatal EOS calculator** is a multivariate risk assessment tool developed from a large infant cohort analysis.^{5, 10, 11} It uses stratified risk ratios attributable to intrapartum factors to calculate the risk of EOS at birth. A subsequent composite risk is generated after infant clinical assessment which recommends a management pathway including routine care, serial observation, investigation with a blood culture or empiric antibiotic treatment.¹¹ See [Table 1](#).

All babies born \geq 35⁺⁰ weeks' gestation should have their risk of sepsis and clinical recommendation using the EOS calculator performed and documented after birth. This is practically done at 1 hour of life with the first newborn examination and observations. If the baby's clinical status changes within the first 24 hours of life, the clinical recommendation is re-evaluated.

Note: The calculator should not be used if the infant is over 24 hours of age.

Access the EOS calculator via:

- <https://neonatalesepsiscalculator.kaiserpermanente.org/InfectionProbabilityCalculator.aspx>¹²
- select the **2024 version**
- [Sepsis Calc](#) ('copy to clipboard' function available for EMR)
- See [Flowchart 1](#) for summarised assessment and management pathways.

Information Parameters Required for the EOS Calculator:

- South Australian EOS incidence: 0.8 per 1000 live births.
- Gestational age
- Highest recorded maternal antepartum temperature.
 - The first available post-partum temperature may be used in cases where there has been no maternal temperature recorded before birth or where there is a maternal fever within 1 hour of birth.
- Rupture of membranes duration (hours)
- GBS status
- Maternal intrapartum antibiotic type and timing prior to birth

Classification of the Infant's Clinical Presentation

Infants can be classified as well, equivocal, or clinical illness (see [Table 1](#)). Clinical judgement is required when categorising an infant's clinical presentation. Some symptoms of sepsis (e.g., apnoea, poor skin perfusion, lethargy) are not included in the calculator's defined categories.



Table 1: Classification of the infant's clinical presentation¹²

Classification	Signs and symptoms	
Well	No persistent physiological abnormalities	
Equivocal	Clinical Parameter: <ul style="list-style-type: none"> Tachycardia (Heart Rate > 160 bpm) Tachypnoea (Respiratory Rate > 60 breaths/minute) Temperature instability ($\geq 38^{\circ}\text{C}$ or $< 36.4^{\circ}\text{C}$) Respiratory distress not requiring supplemental oxygen 	Equivocal Signs: <ul style="list-style-type: none"> 2 x clinical parameters abnormal for > 2 hours, or <ul style="list-style-type: none"> 1 x clinical parameter abnormal for > 4 hours Note: Abnormality can be intermittent.
Clinical Illness	<ul style="list-style-type: none"> Persistent need for NCPAP/HFNC/mechanical ventilation Hemodynamic instability requiring vasoactive medication Neonatal encephalopathy/Perinatal depression Seizure Apgar Score @ 5 minutes < 5 Need for supplemental oxygen > 2 hours to maintain oxygen saturations > 90% 	

Early Onset Sepsis Calculator Clinical Recommendations and Observations

- There are 4 possible clinical recommendation pathways (see [Table 2](#)).¹²

Table 2: Clinical Recommendation Pathways

Zone	Clinical Recommendation	Observations
Green	No culture, No antibiotics	Routine
Yellow	No culture, No antibiotics	Every 4 hours for 24 hours
Yellow	Blood culture	Every 4 hours for 24 hours
Red	Empiric antibiotics	Observations in a neonatal nursery

- If the baby is well, observations may occur in the birth suite or postnatal ward.
- Any baby with abnormal observations should be monitored in a level 4, 5, or 6 nursery.
- See [treatment](#) regarding empirical antibiotic choice.

Safety Caveats When Using the Early Onset Sepsis Calculator



The sepsis calculator is a tool only and should not replace clinical acumen. Clinician discretion may be required in certain situations.

- Investigation and antibiotic treatment should be commenced in the following circumstances:
 - all unwell appearing infants or where there is a strong suspicion of sepsis
 - confirmed maternal intrapartum infection
 - discuss specific antibiotic choice.
- Clinicians should strongly consider treating infants with persisting equivocal signs (tachypnoea/grunting/chest recession) that do not resolve within 4 hours or where there is a neonatal fever $\geq 38^{\circ}\text{C}$. Consider discussion with a senior clinician or seek specialist neonatal advice.

Assessment of Early Onset Sepsis in Preterm Infants < 35⁺⁰ Weeks' Gestation

Key Points

See [Flowchart 2](#) for summarised assessment and management pathways.

- The EOS calculator is not validated for use in infants < 35⁺⁰ weeks' gestation. Categorical assessment based on the circumstances of preterm birth provides the best current approach to neonatal management.³
- All preterm infants < 35⁺⁰ weeks' gestation require admission to a neonatal nursery for observation.
- Investigation and antibiotic treatment are indicated for all preterm infants who are:
 - symptomatic or unwell appearing
 - asymptomatic, but born mothers with signs of chorioamnionitis
 - asymptomatic but born in the context of cervical incompetence/PPROM/preterm labour where there has been inadequate IAP < 4 hours before birth.
- Antibiotic treatment is strongly recommended for asymptomatic preterm infants who are born in the context of PPRM/preterm labour where there has been adequate IAP ≥ 4 hours before birth.
 - Decision to withhold antibiotics in this group should only be made after discussion with a senior medical officer.

Note: Clinicians should have a lower threshold to commence antibiotics with lower gestations.

- Asymptomatic preterm infants born via a caesarean section, in the absence of preterm labour or rupture of membranes (ROM) prior to birth are at a lower risk for EOS.⁴ If well, routine monitoring and observation is appropriate.

Investigations

- All infants with symptoms of sepsis should be treated irrespective of initial investigation results.
- Inflammatory markers have poor positive predictive accuracy (high false positive rate) for detecting sepsis and are not routinely recommended as screening tools in asymptomatic infants.^{1, 13, 14} Whilst a CBE can be performed, results must be interpreted with caution.

Table 3: Investigation Considerations

Aspect	Considerations
Minimum investigations	<ul style="list-style-type: none"> ● CBE: <ul style="list-style-type: none"> ▪ A raised immature: total neutrophils (I:T ratio > 0.2) and neutropenia are the most sensitive indicators of sepsis.^{3, 4, 14} ▪ The CBE is more sensitive if taken 6–12 hours after birth. A normal CBE (at 6–12 hours) has high negative predictivity for sepsis in a well-baby.^{1, 14} ● Blood culture: <ul style="list-style-type: none"> ▪ Collect 1 mL for blood culture as this is sensitive for detecting low grade bacteraemia. ▪ 0.5 mL is sensitive at detecting moderate/high grade bacteraemia only.¹³
Optional investigations	<ul style="list-style-type: none"> ● C-reactive protein (CRP) <ul style="list-style-type: none"> ▪ Single values may give false positive or false negative values.¹³ ▪ Serial CRP levels may be useful to guide duration of antibiotic treatment.
Lumbar puncture	<p>Recommended in all infants where there is:</p> <ul style="list-style-type: none"> ● clinical concern regarding meningitis/neurological symptoms, or ● positive blood culture, or ● insufficient improvement in response to antibiotic therapy
Other investigations	<ul style="list-style-type: none"> ● Chest X-ray if respiratory signs present. ● Endotracheal aspirate for culture if intubated. ● Gastric aspirate/surface swabs can identify colonising flora if taken soon after birth, but have a poor correlation with invasive sepsis.¹⁵

Antibiotic Treatment

- Treatment of suspected EOS must include both gram-positive and gram-negative antibiotic coverage.
 - Empirically treat with IV benzylpenicillin and gentamicin. See *Benzylpenicillin* and *Gentamicin Neonatal Medication Guides* found in the A-to-Z index at www.sahealth.sa.gov.au/neonatal.
- Timely administration of antibiotics in sepsis is imperative and reduces morbidity and mortality.¹⁵
- Consider intramuscular administration if venous access is delayed.
- Some situations require specific antibiotic considerations:
 - neurological signs (unexplained apnoea or seizures) or clinical concern for meningitis
 - risk factors or clinical symptoms of herpes simplex virus infection
 - known maternal colonisation or infection with pathogenic organisms.
- Discuss with a specialist regarding preferred antibiotic regime.

Antibiotic Duration and Cessation

- Antibiotics can safely be stopped at 24–36 hours, if the baby is asymptomatic, CBE is normal, and the blood culture remains negative.
- The sensitivity for culturing pathogenic organisms in neonatal blood cultures at 36 hours is between 96–100%.^{13, 16}
- Seek specialist advice regarding antibiotic treatment duration in cases where the baby remains unwell, there are elevated inflammatory markers or blood culture positive.

Admission, Observation and Retrieval/Transfer

- Careful observation and examination are key to the early detection of sepsis.
- All infants with abnormal observations should be admitted to a level 4, 5 or 6 neonatal nursery.
- Infants who are unwell with symptomatic EOS should be discussed with a level 5 or 6 neonatal service for transfer consideration.
 - Seek specialist advice regarding need for retrieval via **MedSTAR** on **13 78 27**.

Discharge

Eligibility for Discharge

- The period of observation required for term infants will depend on the individual risk assessment by the [EOS sepsis calculator](#).
- Asymptomatic infants who are assessed as having a [low risk of sepsis \(green\)](#) should have a minimum of 4 hours of observation. However specific circumstances may mean a longer period of observation in hospital is required.

Discharge Education

- Approximately 95% of EOS cases are diagnosed < 48 hours after birth.^{1,3} Parental observation at home after this period is likely to be safe if parents are aware of symptoms that require immediate medical review.
- Parents should be informed of what is considered normal, and where to seek help when they recognise any abnormal signs.
- See *Neonatal Sepsis Presenting from the Community Paediatric Clinical Practice Guideline* found in the A-to-Z index at www.sahealth.sa.gov.au/paediatric and *Postnatal Care PPG* in the A-Z index at www.sahealth.sa.gov.au/perinatal.



Resources

Resource	Purpose	Website	Intended Audience
Australian Charter of Healthcare Rights	Support informed consent and shared decision-making	See 'Australian Charter of Healthcare Rights' at www.safetyandquality.gov.au	Consumers/ Clinicians
Australian Government Pregnancy, Birth and Baby	Preconception, pregnancy and postnatal information	www.pregnancybirthbaby.org.au	Consumers
Australian Therapeutic Guidelines	Evidence based guidance on medication prescribing and treatment, including antibiotics	Select 'Antibiotic' guideline at www.tg.org.au	Clinicians
Centre for Disease Control and Prevention (CDC): Group B Strep Disease	Information on prevention, screening, and management of Group B Streptococcus	Search 'group b strep disease' at www.cdc.gov	Consumers/ Clinicians
Group B Streptococcus (RANZCOG)	Overview of GBS infection, risks, and management in pregnancy	ranzocg.edu.au/wp-content/uploads/Group-B-Streptococcus.pdf	Consumers
Maternal Group B Streptococcus in Pregnancy: Screening and Management (RANZCOG)	Evidence based guidance for clinicians on screening, risk assessment, and management of GBS in pregnancy	https://ranzocg.edu.au/wp-content/uploads/2022/05/Maternal-Group-B-Streptococcus-in-Pregnancy-Screening-and-Management.pdf	Clinicians
Medicines Information	Medication safety in pregnancy	See 'Medicines' at www.sahealthlibrary.sa.gov.au	Clinicians
Newborn Sepsis Calculator	Estimate risk of early-onset sepsis in newborns to guide clinical management	www.sepsiscalc.org	Clinicians
Neonatal Early Onset Sepsis Calculator	Individualised risk assessment for early-onset neonatal sepsis	https://neonatalsepsiscalculator.kaisermanente.org/InfectionProbabilityCalculator.aspx	Clinicians
Pathology Tests Explained	Understanding pathology and screening tests	www.pathologytestsexplained.org.au	Consumers/ Clinicians
SA Health Pregnancy	Pregnancy information for South Australia	Search 'Pregnancy' at www.sahealth.sa.gov.au	Consumers
SAPPGs Web-based App	Access to SAPPGs	https://extapps2.sahealth.sa.gov.au/PracticeGuidelines/	Clinicians



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OFFICE USE ONLY

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13/04/2026	V10.1	Clinical Guidelines Domain Custodian	Updated guidance to use the 2024 version of the EOS calculator.
09/09/2025	V10	Clinical Guidelines Domain Custodian	Formally reviewed in line with 1–5 yearly scheduled timeline for review.
21/12/2017	V9.1	SA Health Safety & Quality Strategic Governance Committee	Amendment.
20/06/2017	V9	SA Health Safety & Quality Strategic Governance Committee	Minor changes to formatting.
17/06/2014	V8	SA Health Safety & Quality Strategic Governance Committee	Reviewed.
18/19/2012	V7	SA Health Safety & Quality Strategic Governance Committee	Reviewed.
24/05/2010	V6	SA Maternal & Neonatal Clinical Network	Reviewed.
25/01/2010	V5	SA Maternal & Neonatal Clinical Network	Reviewed.
24/11/2009	V4	SA Maternal & Neonatal Clinical Network	Reviewed.
20/10/2009	V3	SA Maternal & Neonatal Clinical Network	Reviewed.
30/04/2007	V2	SA Maternal & Neonatal Clinical Network	Reviewed.
04/08/2004	V1	SA Maternal & Neonatal Clinical Network	Original approved version.