Queensland Clinical Guidelines

Translating evidence into best clinical practice

Maternity and Neonatal **Clinical Guideline**

Early onset Group B Streptococcal disease (EOGBSD)

Queensland Government

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Cultural acknowledgement

We acknowledge the Traditional Custodians of the land on which we work and pay our respect to the Aboriginal and Torres Strait Islander Elders past, present and emerging.

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- Applying standard precautions, and additional precautions as necessary, when delivering care
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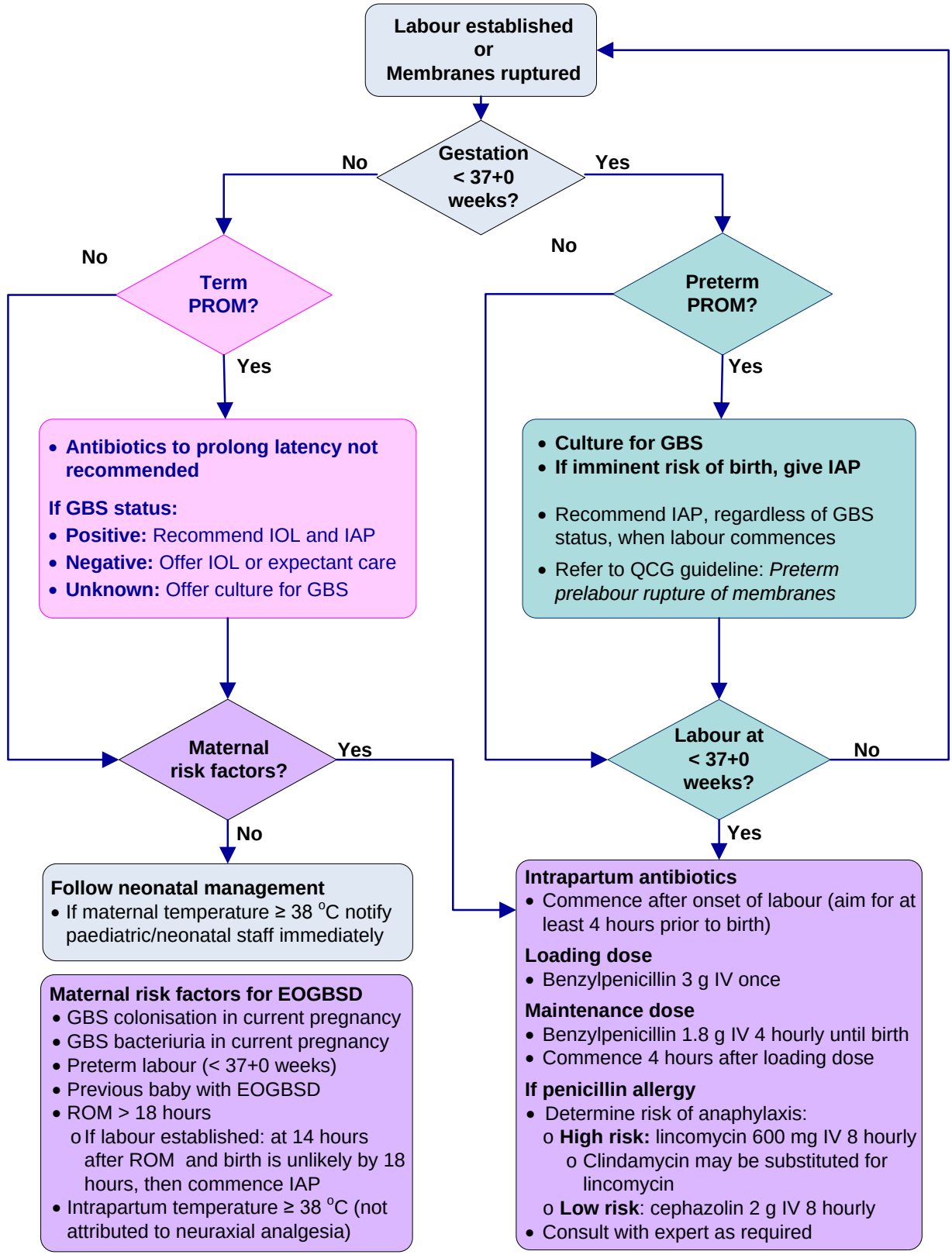
Flow Chart: Maternal management of early onset Group B Streptococcal disease (EOGBSD)

Administration of IAP to women with risk factors, reduces the risk of neonatal EOGBSD

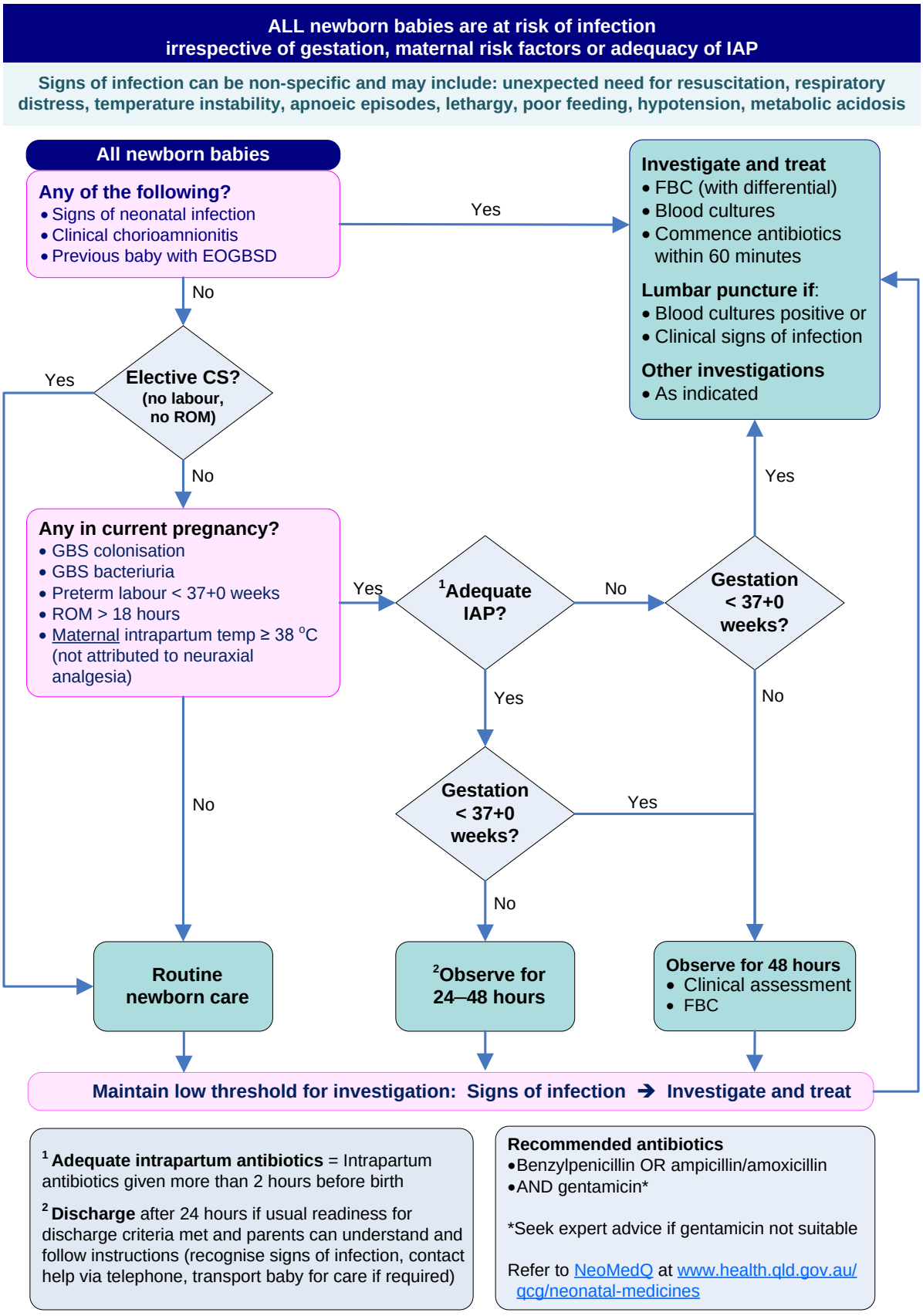
If CS with no labour and no ROM, IAP is not required (even if risk factors). Give routine surgical prophylaxis



CS: caesarean section, EOGBSD: early onset Group B Streptococcal disease, **GBS:** Group B Streptococcus, **IAP:** intrapartum antibiotic prophylaxis, **IV:** intravenous, **IOL:** induction of labour, **PROM:** prelabour rupture of membranes **ROM:** rupture of membranes, **>:** greater than, **<:** less than

Queensland Clinical Guidelines: EOGBSD Flowchart version F22.20-1-V4-R27

Flow Chart: Neonatal management of early onset sepsis



[1] **Adequate intrapartum antibiotics** = Intrapartum antibiotics given more than 2 hours before birth

[2] **Discharge** after 24 hours if usual readiness for discharge criteria met and parents can understand and follow instructions (recognise signs of infection, contact help via telephone, transport baby for care if required)

Recommended antibiotics
- Benzylpenicillin OR ampicillin/amoxicillin
- AND gentamicin*

*Seek expert advice if gentamicin not suitable

Refer to NeoMedQ at www.health.qld.gov.au/qcg/neonatal-medicines

CS: caesarean section, **EOGBSD:** early onset Group B Streptococcal disease, **EOS:** early onset sepsis, **FBC:** full blood count, **GBS**: Group B Streptococcus, **GDM**: gestational diabetes mellitus, **IAP:** intrapartum antibiotic prophylaxis, **IV:** intravenous, **LOD:** late onset disease, **ROM:** rupture of membranes, **T:** temperature, **>:** greater than, **<:** less than, **≥:** greater than or equal to

Queensland Clinical Guidelines: EOGBSD Flowchart F22.20-2-V6-R27

Table of Contents

List of Tables

Abbreviations

CS	Caesarean section
CRP	C-reactive protein
EOGBSD	Early onset Group B Streptococcus disease
EOS	Early onset sepsis
FBC	Full blood count
GBS	Group B Streptococcus
HHS	Hospital and Health Service
IAP	Intrapartum antibiotic prophylaxis
IOL	Induction of labour
LOD	Late onset disease
PMC	Primary maternity carer
PPROM	Preterm prelabour rupture of membranes
PROM	Prelabour rupture of membranes
PTL	Preterm labour
RANZCOG	Royal Australian and New Zealand College of Obstetricians and Gynaecologists
RDS	Respiratory distress syndrome
ROM	Rupture of membranes

Definition of terms

Chorioamnionitis	Indicates an infection of the amniotic fluid, membranes, placenta, and/or decidua.[1]
Colonised	The presence of microorganisms at levels that provoke neither symptoms nor immune response.
Early onset Group B Streptococcus (EOGBS)	Occurs within the first week of life. Most commonly within 72 hours of birth[2]. Typically due to vertical transmission to the newborn by ascending contaminated amniotic fluid or during vaginal delivery from the woman's lower genital tract.[3]
Expectant management	Non-intervention at any particular point in the pregnancy, allowing progress to a future gestational age. Intervention occurs only when clinically indicated.[4]
Imminent risk of preterm birth	Substantial risk of birth within 24 hours as clinically determined by the woman's health care provider.
Late onset GBS	Occurring after the first seven days of life. Typically acquired from vertical transmission at birth that later evolves into infection or horizontal transmission from contact with care providers or environmental sources.[3]
Latency	Time from prelabour rupture of membranes (PROM) to birth.
Neuraxial analgesia	Refers to the administration of medication into the subarachnoid or epidural space to produce anaesthesia and analgesia.
Threatened preterm labour	Preterm contractions without dilatation of the cervix and without substantial risk of imminent birth (within 24 hours) as clinically determined by the woman's health care provider.

1 Introduction

Streptococcus *agalactiae* or Group B Streptococcus (GBS) is the most frequent cause of early onset neonatal sepsis.[2,5-7] Maternal colonisation of the lower genital tract with GBS during pregnancy increases the risk of neonatal infection by vertical transmission.[8] Administration of intrapartum antibiotic prophylaxis (IAP) to women at risk of transmitting GBS to their baby can reduce the rate of early onset GBS disease (EOGBSD) by 80%.[7] IAP does not prevent late onset GBS disease.[7]

1.1 Universal screening versus risk factor approach

There is limited high quality scientific evidence and a lack of expert consensus on whether a risk based, or a universal screening approach should be used. However both are acceptable strategies for the reduction of EOGBS.[7,9-11] Queensland recommends a risk based approach for the identification of women for whom IAP is indicated. This is based on an assessment of the rate of EOGBSD in Queensland (in the context of a risk based approach), the likely cost effectiveness of both strategies, and the quality of the evidence in support of both approaches.[12] In the absence of compelling new evidence, this guideline continues to advocate such an approach (i.e. decision to treat based on identification of maternal risk factors). The Queensland Maternity and Neonatal Clinical Network and the Clinical Excellence Division, Queensland Health, have endorsed the risk factor approach for use in Queensland. For further details of rationale, refer to Appendix A: Rationale for risk factor approach in Queensland.

1.2 Burden of disease

Table 1. Burden of illness

Aspect	Considerations
Incidence of EOGBSD	• Incidence has declined worldwide since the introduction of IAP[13] o 2002–2011: 0.43 cases/1000 live births (North Queensland)[14] o 2005–2008: 0.38 cases/1000 live births (Australia)[15] o 2009–2011: 0.26 cases/1000 live births (New Zealand)[16] o 2005–2014: 0.32 cases/1000 live births (Queensland)[12]
Maternal colonisation	• Colonisation rates vary, estimated prevalence 7–29%[11] • Colonisation may be transient, intermittent or persistent[17] • Detection of GBS is dependent on valid and reliable sampling and culture techniques • The intensity of maternal colonisation is directly related to the risk of transmission to the baby[17] • Babies born to women with GBS bacteriuria (any colony count) during pregnancy are more frequently and more heavily colonised with GBS, increasing the risk of EOGBSD[13] • There is an increased prevalence of GBS colonisation amongst women giving birth preterm[18,19]
Early onset Group B Streptococcus disease	• The majority of EOGBSD cases occur in the first 48 hours after birth[20] • GBS can cause septicaemia, pneumonia, meningitis and death in up to 2% of babies born to colonised women untreated with IAP[21] • 40–50% of babies born to GBS positive mothers will become colonised with GBS in the absence of IAP[22] • 1.1% of babies born to GBS colonised women develop EOGBSD[23] o Preterm babies (less than, or equal to, 37+0 weeks gestation at birth) are four times more likely to develop EOGBSD than term babies[2] • Mortality from EOGBSD is highest amongst newborns with a birthweight equal to or less than 1000 g[20]
Antibiotic considerations	• The use of antibiotics in newborns is associated with an[24-26]: o Alteration to the microbiome and gut colonisation o Increase in the risk of necrotizing enterocolitis o Overall delay in breastfeeding initiation through maternal-infant separation and formula supplementation o Impact on long term health including obesity, autoimmune diseases and antimicrobial resistance

1.3 Clinical standards

Table 2. Clinical standards

Aspect	Considerations
Standard care	• Refer to Queensland Clinical Guideline: *Standard care*[27] for care considered 'usual' or 'standard' • Includes, for example, privacy, consent, decision making, sensitive communication, medication administration, staff education and support, culturally appropriate care
Routine screening for GBS	• Queensland Health recommends a risk factor based approach for the identification of women for IAP, therefore in this context routine screening for antenatal GBS carriage is not recommended in Queensland • GBS screening at 35–37 weeks gestation may be appropriate for individual women[7] o Offer information about the implications of the GBS screening test o If GBS negative and risk factors are present at the onset of labour, then recommend IAP [refer to section 3 Intrapartum antibiotic prophylaxis]
Future developments	• Screening and IAP are unable to prevent all maternal or neonatal disease • Although not yet common in clinical practice, there is potential for development of a vaccine[28] for pregnant women against serotypes Ia, III and V in the antenatal period[7] • Rapid testing is a new technology and may be useful in screening for GBS in the future[21] o Currently available assays do not have the performance characteristics required and should only be used in an evaluation or research setting in Queensland
Health care systems for risk reduction	• Increased adherence to a single approach is likely to achieve a greater reduction in the incidence of EOGBSD than either using both approaches together or changing the approach • Systematically promote adherence to recommended clinical practices through clinician education, local policy and audit • Establish and promote systematic processes to identify women for whom IAP is recommended (e.g. incorporate into routine antenatal and early labour assessments and into health care record documentation) • Collect GBS specimens according to recommended technique • Audit care so opportunities for further risk reduction can be identified • Establish systematic data collection regarding EOGBSD incidence in Queensland (and Australia) to evaluate effectiveness of prevention strategies
GBS isolates	• GBS isolates are characterised according to capsular polysaccharide (CPS) serotype[29], of which 10 are recognised: Ia, Ib, II–IX[30,31] • The distribution and predominance of certain serotypes is susceptible to variations and can change overtime, including distribution across multiple countries[31] • An increase of disease caused by serotype IV isolates and concurrent emergence of lincomycin resistance within this serotype has been reported[31] o Large proportions of type IV isolates reported among GBS isolates in United Arab Emirates, Turkey and Zimbabwe • If penicillin, ampicillin or cephazolin contraindicated (e.g. due to penicillin hypersensitivity), consider testing GBS isolates for inducible lincomycin resistance and antimicrobial drug-resistant isolates of all serotypes[13] • Acceptable alternatives to pencillin include clindamycin and vancomycin, depending on the nature of previous adverse reaction to pencillin and the antibiotic resistance[7] o Seek expert advice o Refer to section 3 Intrapartum antibiotic prophylaxis

2 Risk factors

Risk factors for EOGBSD include[7,32]:

- Preterm labour (PTL) at less than 37+0 weeks (spontaneous or induced)
- Rupture of membranes (ROM) greater than or equal to 18 hours prior to birth
- Intrapartum maternal temperature greater than or equal to 38 ^{o}C[33] if there is suspected or confirmed bacterial infection[32]
- GBS colonisation in the current pregnancy or known carriage of GBS (any colony count)
- Previous baby with EOGBSD
- Clinical diagnosis of chorioamnionitis
- Other baby of multiple with early onset sepsis (EOS)

2.1 Risk reduction

Reliable and systematic identification of women for whom IAP is indicated, is an important opportunity for risk reduction. In Queensland, the proportion of women with risk factors who do not receive IAP is unknown. One study reported that in the period between 2013 to 2016, 31% of pregnancies were not screened or were not given IAP despite the woman being colonised with GBS.[10,34]

Table 3. Risk reduction

Aspect	Considerations
Information	• Use the principles of informed decision making to discuss GBS and EOS • Routinely provide written information about GBS and EOGBSD
History	• Assess for risk factors during pregnancy and review history to determine indications for IAP • If there is a history of penicillin allergy, document in the health record
Early onset sepsis risk calculator	• Clinical risk stratification tools: o Increasingly used worldwide[35] to guide the use of antibiotics for newborn babies at 34+0 weeks gestation or greater[36-38] o Is associated with a reduction in the use of antibiotics[35] • Systematic reviews suggests that these tools, whilst effective, may miss cases of asymptomatic infection[39,40] o Close clinical observation of the newborn baby in conjunction with other risk reduction strategies remains vital[38] • If implemented at a local HHS level develop local policy to guide use
Measures not recommended	• Vaginal disinfection with chlorhexidine in labour for the prevention of EOGBS morbidity in preterm or term babies does not reduce vertical transmission or the risk of EOGBSD[7,9,41] • Antenatal treatment of GBS carriage is not recommended as it does not reduce the likelihood of GBS colonisation at the time of birth[2]

2.2 Specimen collection

Table 4. Specimen collection

Aspect	Considerations
Context	• Detection of GBS is increased by up to 25% by collecting an anorectal swab *in addition* to a low vaginal swab[13] • Detection of GBS from vaginal-perianal swab is not significantly different from the detection rate from vaginal-rectal swab[42,43] • Women report experiencing less discomfort from vaginal-perianal than from vaginal–rectal collection methods[42]
Specimen collection technique	• Swabs may be self-collected by the woman[44] • When specimen collection for GBS is clinically indicated, recommend either a vaginal-rectal swab OR a vaginal-perianal swab: • Use one single dry swab stick, insert into vaginal introitus and then[44]: o **For vaginal-anorectal:** insert into anus (through the anal sphincter) o **For vaginal-perianal:** swab the perianal surface without penetration through the anal sphincter o Place into standard bacterial transport medium (e.g. Amies or Stuart's)

3 Intrapartum antibiotic prophylaxis

Recommend IAP to women with one or more risk factors who are in active labour.

Table 5. Intrapartum antibiotic prophylaxis

Aspect	Consideration
Context	• IAP is recommended for women in active labour with one or more risk factors o Refer to section 2 Risk factors • Good quality evidence is lacking to identify the lowest dose IAP regimen required to exceed the minimum inhibitory concentration for GBS *and* achieve a clinically relevant reduction in EOGBSD
Drug of choice	• Benzylpenicillin intravenous (IV) is the antibiotic of choice for IAP[13,45] • Erythromycin is not recommended for IAP due to increasing rates of resistance (up to 45% or more for invasive isolates) • Oral antibiotics are not recommended and are insufficient for IAP[46]
Regimen	• Queensland Health and Therapeutic Guidelines support the following regimen[13,45] o Benzylpenicillin 3 g IV loading dose at the onset of labour o Benzylpenicillin 1.8 g IV every 4 hours thereafter until birth
Timing	• Due to the rapidity of some labours, especially in multiparous women, it can be difficult to confidently estimate the time-to-birth interval • In order to maximise the window for administration of IAP aim for administration at least four hours prior[45] to birth while recognising administration two hours prior to birth as adequate prophylaxis in determining neonatal management[22] • If birth is anticipated in less than two hours, administer IAP as benefit may still occur[22]
Effectiveness	• In a case control analysis of women with obstetric risk factors, adjusted effectiveness of IAP in preventing the incidence of EOGBSD was significantly reduced (RR 0.17, 95% CI, 0.04 to 0.74%)[9,21,47] • Overall effectiveness of IAP for the prevention of EOGBS is 89% (95% CI, 0.66 to 0.94)[9,48] • When the first dose of IAP was given two or more hours before birth, the effectiveness was 89% (95% CI, 0.70 to 0.96)[9,48] • Effectiveness was lowest if there was intrapartum fever (72%, 95% CI, 0.09 to 0.93) or if administration occurred less than two hours before birth (71%, 95% CI, 0.08 to 0.93)[9,48]
Penicillin hypersensitivity[45]	• For women with **immediate severe** or **delayed severe** penicillin anaphylaxis consider: o #Lincomycin (or clindamycin) 600 mg IV every 8 hours until birth • For women with **immediate non-severe** or **delayed non-severe** penicillin anaphylaxis consider: o Cefazolin 2 g IV every 8 hours until birth • If history of penicillin and/or clindamycin hypersensitivity refer to an infectious diseases clinician and the *Therapeutic Guidelines approach to preventing neonatal GBS disease[45]* • Consider isolate susceptibility testing as appropriate to the clinical circumstances

Lincomycin is listed on the Queensland Health List of Approved Medicines (LAM) and is the accepted alternative to clindamycin

*Refer to an Australian pharmacopeia for full details of all drugs

3.1 IAP not required

IAP is not required in the following circumstances[2,7]:

- Elective caesarean section (no labour, no rupture of membranes) irrespective of GBS carriage
- Routine surgical antibiotic prophylaxis for CS is indicated
- GBS carriage detected in a previous pregnancy (even if GBS status is unknown in the current pregnancy)
- Threatened preterm labour with intact membranes where the risk of imminent birth is low

4 Specific condition management

Table 6. Specific conditions

Aspect	Considerations
GBS positive in the current pregnancy	• A finding during pregnancy of vaginal and/or anorectal GBS does not require treatment in the antenatal period[2] • Specimen collection *before* 35 weeks is less predictive of GBS status at term[7] than collection between 35–37 weeks gestation[2] • If GBS is detected at any gestation of pregnancy in an incidentally collected vaginal swab, recommend IAP o Repeat swab is not required
GBS bacteriuria	• If there is GBS urinary tract infection (UTI) at any gestation in the current pregnancy (usually where quantitative count is greater than or equal to 10^5 cfu/m) recommend treatment at the time of diagnosis *and* IAP[2,49] • If there is GBS bacteriuria, a GBS vaginal swab is not required as the woman is presumed to be GBS colonised
Preterm labour (intact or ruptured membranes)	• The incidence of preterm labour (PTL) is significantly higher in GBS positive women compared to GBS negative women[19] o Before 34 weeks (6.6% vs 0.5%, p=0.001) o Before 37 weeks (9.8% vs 4.3%, p=0.047) • If there is imminent risk of preterm birth, with or without ruptured membranes, give IAP • If PTL ensues, continue IAP irrespective of GBS or membrane status • If PTL does not establish and membranes intact, cease IAP • If PTL does not establish and membranes ruptured, refer to section 4.1 Prelabour rupture of membranes
Intrapartum temperature 38 ^oC or more	• Markedly elevated maternal temperatures are most likely due to infection while transient lower temperature elevations may be due to spurious or non-infectious factors (e.g. dehydration, medications or neuraxial analgesia)[33,50-54] o Perform clinical assessment o Notify medical (paediatric/neonatal) staff of maternal pyrexia as it may have implications for neonatal management o Use clinical judgement and maintain high index of suspicion for infection • Replace GBS specific antibiotic prophylaxis with broad spectrum antibiotic therapy that includes an agent active against GBS[2] • If maternal temperature is greater than or equal to 38 ^oC within 24 hours of birth advise woman to seek advice from health care professionals (especially if discharged within 24 hours of birth) • If there is prelabour rupture of membranes (PROM) or preterm prelabour rupture of membranes (PPROM) refer to section 4.1 • Prelabour rupture of membranes
Chorioamnionitis	• Do not inhibit labour, but consider hastening birth under broad spectrum intravenous antibiotic cover o Collect low and high vaginal swabs for culture o Recommend induction of labour (IOL) • Refer to Queensland Clinical Guidelines: *Preterm labour and birth*[55] and *Induction of labour*[56] • Request placental histology to inform review of extent/severity of infection and for quality assurance purposes
Obstetric procedures if GBS positive	• Provided women with GBS risk factors are treated with IAP, there is insufficient evidence to recommend either avoidance of, or alterations of technique, in obstetric procedures (e.g. vaginal examinations, membrane sweeping, amniotomy, fetal scalp blood sampling or fetal scalp electrode) on the basis of positive GBS status[7,46]

4.1 Prelabour rupture of membranes

Individualise recommendations according to gestational age, fetal wellbeing, maternal wellbeing, maternal preferences and the ability to provide ongoing surveillance.

4.1.1 Term prelabour rupture of membranes

Table 7. Term prelabour rupture of membranes

Aspect	Consideration
Context	• GBS colonisation in pregnancy is not associated with increased risk of PROM[2,17] • There is no difference in incidence of early onset neonatal sepsis, maternal or neonatal infectious morbidity, mortality or stillbirth when routine use of antibiotics is compared with placebo or no antibiotics (n= 2639, 4 studies) for PROM at or near term[57] • Reduced infectious morbidity has been reported when labour is established and IAP is administered for term PROM greater than 12 hours duration[58]
IAP for term PROM	• Irrespective of GBS status commence when labour establishes (not before) if: o Duration of ROM is greater than or equal to 18 hours at the onset of established labour o During established labour, the duration of ROM reaches or exceeds 14 hours and birth is assessed as unlikely before duration of ROM equals 18 hours (e.g. do not wait for duration of ROM to equal 18 hours to commence IAP)
Expectant management versus immediate birth	• If known positive GBS status or there are other risk factors, recommend induction of labour (IOL) and IAP[2,22] • If known negative GBS status and no other risk factors, offer expectant management or IOL[2] • If unknown GBS status offer swabbing for GBS culture
Antibiotics prior to the onset of labour	• Routine antibiotic administration is not recommended for women with PROM at or near term prior to the onset of labour[41,57]
Care decisions	• Refer to Queensland Clinical Guideline: *Term prelabour rupture of membranes*[59] • Refer to Queensland Clinical Guideline: *Induction of labour*[56]

4.1.2 Preterm prelabour rupture of membranes

Table 8. Preterm prelabour rupture of membranes

Aspect	Consideration
Context	• Women with suspected or confirmed PPROM a rectovaginal swab is recommended for GBS culture[7,60] • Where possible, manage women at less than 34 weeks with PPROM as per guidelines as the risk of prematurity outweighs the risk of GBS infection[7]
IAP for PPROM	• When labour ensues (or CS), recommend IAP regardless of GBS status o Refer to section 3 Intrapartum antibiotic prophylaxis
Antibiotics prior to the onset of labour	• Known to prolong latency and reduce maternal and fetal infection following PPROM[22] • Optimal regimen and management is unclear[61,62] • Oral antibiotics alone are not adequate for IAP[13,22]
Care decisions	• Refer to Queensland Clinical Guideline: *Antenatal corticosteroids*[63] • Refer to Queensland Clinical Guideline: *Preterm labour and birth*[55] • Refer to Queensland Clinical Guideline: *Preterm prelabour rupture of membranes*[55]

5 Newborn care

All newborn babies are at risk of infection irrespective of gestational age, maternal risk factors or intrapartum antibiotic treatment.

Table 9. Early onset sepsis

Aspect	Consideration
Context	• Diagnosis of EOS is an ongoing challenge[26] • EOGBSD presents within seven days after birth[22] with most babies symptomatic by 12 to 24 hours of age[28,47] o Babies may be asymptomatic in the presence of confirmed EOGBSD • GBS is the most common causative pathogen of neonatal bacterial meningitis[22,28]
Clinical surveillance	• Clinical signs of sepsis can be non-specific and subtle, and a high index of suspicion is required o Delay in initiating treatment may significantly increase neonatal mortality and morbidity • Clinical judgment and serial monitoring are essential for early diagnosis[36] • Consider increased clinical surveillance and maintain a low threshold for starting antibiotic treatment[24] o Refer to section 5.2 Criteria for investigation of sepsis o Refer to section 5.4 Antibiotic therapy • If discharge before12 hours, advise of EOS signs
Risk assessment	• Preterm babies (less than 37+0 weeks) are at increased risk of EOGBSD compared to term babies[18] • Adequacy of IAP is an important protective factor for babies born to women with risk factors[46] • An early onset sepsis calculator may assist with reduction in unnecessary antibiotics o Refer to section 2.1 Risk reduction

5.1 Signs of sepsis

Clinical signs of sepsis can be non-specific and subtle, and a high index of suspicion is required.

Table 10. Signs of sepsis

Aspect	Considerations
Context	• 90% EOGBSD occurs during the first 24 hours of life, usually evident as[47]: o Respiratory disease (54%) o Generalised sepsis (27%) o Meningitis (15%)
General features	• Pallor • Jaundice • Hypothermia, fever, or temperature instability • Poor tolerance to handling • Hypoglycaemia or hyperglycaemia • Metabolic and/or respiratory acidosis
Respiratory	• Unexpected need for resuscitation • Respiratory distress: o Tachypnoea o Apnoeic episodes o Grunting o Cyanosis o Nasal flaring o Chest recession
Cardiovascular	• Tachycardia • Bradycardic episodes • Poor perfusion • Hypotension
Gastrointestinal	• Poor feeding • Vomiting • Abdominal distension • Feed intolerance • Bilious aspirates/vomits • Loose stools
Central nervous system	• Lethargy • Irritability • Meningeal inflammation • Seizures

5.2 Criteria for investigation of sepsis

Table 11. Criteria for investigation of sepsis

Surveillance	Criteria
Investigate and treat	• Baby with any of the following: o Clinical signs of neonatal infection o Clinical chorioamnionitis o Previous EOGBSD (sibling) • Baby less than 37 weeks gestation AND **inadequate** IAP with any of: o GBS colonisation in current pregnancy o GBS bacteriuria in current pregnancy o Preterm labour at less than 37+0 weeks o ROM more than 18 hours o Maternal intrapartum temperature more than 38 °C (not attributed to neuraxial analgesia)
Increased surveillance and FBC	• Baby 37+ 0 weeks or more gestation AND **inadequate** IAP with any of the following: o GBS colonisation in current pregnancy o GBS bacteriuria in current pregnancy o Preterm labour at less than 37+0 weeks o ROM more than 18 hours o Maternal temperature more than 38 °C (not attributed to neuraxial analgesia)
Increased observation	• Baby 37+ 0 weeks or more gestation AND **adequate** IAP with any of the following: o GBS colonisation in current pregnancy o GBS bacteriuria in current pregnancy o ROM more than 18 hours o Maternal temperature more than 38 °C (not attributed to neuraxial analgesia • If GBS infection present in a baby who is a multiple observe for signs of infection and treat if required[28]
Routine care	• Baby (any gestation) born by elective CS (no labour no ROM) without risk factors for EOGBSD or signs of infection • Baby born to woman without risk factors for EOGBSD or signs of infection

5.3 Investigations for sepsis

Any baby with clinical signs of sepsis requires a full diagnostic evaluation and commencement of empirical antibiotic therapy started[28] (within one hour)[32] regardless of adequacy of IAP, other obstetric risk factors or maternal GBS status.[3]

Table 12. Investigation of sepsis

Aspect	Considerations
Minimum investigations	• Perform routine vital signs of all babies at birth for signs of neonatal infection including EOS[32] • Prior to antibiotics: o Full blood count (FBC) with differential and platelet count[3] ▪ Decreased white cell count and neutrophils are associated with significant disease progression o Refer to Appendix B: Normal laboratory reference ranges for a term baby o Blood cultures—if possible collect at least 1 mL of blood[32,64]
Lumbar puncture	• Recommended (where local capabilities permit) where there is[3]: o Positive blood culture ***or*** o Clinical signs suggestive of sepsis (as babies with meningitis may have sterile blood cultures) ***or*** o Insufficient improvement in response to antimicrobial therapy • Collect a serum glucose concomitantly
Other investigations	• Consider chest x-ray if respiratory signs present[3] • Pulmonary infection may be radiographically indistinguishable from respiratory distress syndrome (RDS) o Presence of neutropenia, unexplained severe apnoea, poor peripheral vascular perfusion and shock, and lower peak inspiratory pressures on a ventilator than are usually present with RDS, may aid differentiation
Optional investigations	• C-reactive protein (CRP) and/or procalcitonin levels (PCT)[3,32,65] o Single values may give false positive or negative results o Serial CRP and/or PTC levels may be useful to guide duration of antibiotic treatment
Routine use not recommended	• Due to suboptimal sensitivity and specificity and poor predictive value for infection, routine use of urine antigen, cultures of mucous membranes, gastric aspirate and surface swabs not recommended[3,65]

5.4 Antibiotic therapy

Commence antibiotic therapy within 1 hour where a baby has clinical signs of sepsis.

Table 13. Antibiotic therapy

Aspect	Considerations
Context	• Use broad-spectrum antibiotics which provide cover against EOGBSD as well as other common pathogens • The type and duration of antibiotic treatment is determined by the clinical indications and may be modified by results of the investigations
Administration	• If peripheral IV access cannot be established, consider antibiotic administration via umbilical vein catheter • The intramuscular route may be used as an interim measure if other routes unavailable o Administer all recommended antibiotics at the same dose o Seek further expert advice but do not delay initiation of treatment
Empirical antibiotic therapy	• Recommended empirical antibiotic therapy is[66]: o Benzylpenicillin or ampicillin o **PLUS** gentamicin • Refer to NeoMedQ neonatal medicine monographs: o Gentamicin[67] o Benzylpenicillin[68] o Ampicillin[69] • Seek expert advice if gentamicin not suitable
GBS sepsis	• If GBS infection confirmed by culture and meningitis is excluded, use a narrower spectrum penicillin and discontinue aminoglycoside
GBS meningitis	• If GBS meningitis is **suspected**[70,71] o Cefotaxime o **PLUS** Ampicillin o Refer to NeoMedQ neonatal medicine monograph Cefotaxime[72] and Ampicillin[69] for dosing and frequency according to gestational age • Gentamicin not recommended when GBS meningitis is suspected
	• If GBS meningitis is **diagnosed** o Benzylpenicillin IV for 14–21 days • Refer to NeoMedQ neonatal medicine monograph Benzylpenicillin[68] for dosing and frequency according to gestational age
Duration of therapy	• Varies depending on results of cultures and clinical course; discuss with a paediatrician/neonatologist or infectious diseases physician • If GBS sepsis is proven or suspected, continue IV antibiotics for 7–10 days or longer as indicated o Review the baby at least once every 24 hours • If blood cultures are negative, white count normal, symptoms resolve, and baby is known to be well, then discontinue antibiotics after 36 hours[32,73]
Gentamicin monitoring	• Serum concentration monitoring avoids both excessive and sub-therapeutic concentrations thus preventing toxicity and ensuring efficacy • Therapeutic drug monitoring is recommended • Refer to NeoMedQ neonatal medicine monograph Gentamicin[67]

6 Postnatal care for asymptomatic well baby

Undertake newborn observations according to clinical assessment, rather than protocol alone. Determine care location (postnatal ward or neonatal unit) based on clinical indications and the service capabilities of the facility.

Table 14. Asymptomatic well baby

Well baby	Recommendation
All **(irrespective of maternal risk factors)**	• Routine newborn care that includes clinical surveillance for signs of sepsis (e.g. observation of colour, temperature, heart rate, respiratory rate) as appropriate to the clinical circumstances
Elective CS **(no labour no ROM)**	• As for all well babies • Term babies do not require routine investigation or monitoring regardless of maternal GBS status • In the absence of other clinical indications, admission to neonatal unit not required
Term **with maternal risk factors, and** adequate IAP	• As for all well babies and: o Clinical surveillance for 48 hours • Discharge may occur from 24 hours after birth, if the home care is suitable and baby is well o Refer to section 7 Discharge • In the absence of other clinical indications, admission to neonatal unit not required
Term **with maternal risk factors and** inadequate IAP	• As for all well babies and: o Clinical surveillance for signs of sepsis for 48 hours (discharge before 48 hours not recommended) o Full blood count • In the absence of other clinical indications, admission to neonatal unit not usually required
Preterm **with** adequate IAP	• As for all well babies and: o Clinical surveillance for signs of sepsis for 48 hours *and* o Full blood count • Maintain a high index of awareness that preterm babies are more susceptible to infection • If baby is well, there are no other clinical indications, and there are sufficient experienced staff to provide clinical surveillance, admission to a neonatal unit may not be required
Preterm **with** inadequate IAP	• Investigate [refer to Table 12. Investigation of sepsis] • Treat with antibiotics [refer to Table 13. Antibiotic therapy] • Admission to newborn unit usually required due to prematurity

7 Discharge

Table 15. Discharge

Aspect	Considerations
Criteria	• Consider usual discharge criteria to inform readiness for discharge • Inform parents about: o Recognising and responding appropriately to signs of infection in the baby o Transporting the baby promptly to an appropriate healthcare facility if required
Breastfeeding	• Breastfeeding/breast milk is safe in women who are GBS positive and has not been reported in association with EOGBSD[2] • In rare circumstances, GBS has been cultured from breast milk and reported in association with late onset disease and recurrent neonatal infections with GBS[74] o Refer to section 7.1 Late onset GBS disease • Refer to Queensland Clinical Guideline: *Establishing breastfeeding*[75]
Future pregnancy advice	• If this baby has had EOGBSD, advise the woman[32]: o IAP is recommended during the next labour o The next baby has an increased risk of EOGBSD o To inform health care providers in the next pregnancy that a previous baby has had EOGBSD • If the woman has had GBS colonisation in this pregnancy but without infection in the baby, birth management is not affected in the next pregnancy
Follow-up	• Inform the woman's primary maternity carer (PMC) and general practitioner (if not PMC) in writing, that there is a risk of recurrence of GBS in the baby and of GBS infection in babies in future pregnancies[32]

7.1 Late onset GBS disease

Table 16. Late onset Group B Streptococcal disease

Aspect	Consideration
Context	• Late onset disease (LOD) typically presents between seven days after birth to 2–3 months of age[22,31] • Sepsis from LOD constitutes up to 6 per 1000 live births[76] • The use of IAP for EOGBSD has had no notable effects on the occurrence of LOD[28,31] however may delay the time of onset or reduce severity of symptoms[77]
Risk factors	• LOD more common in babies with low birth weight and in the early preterm, postulated to be related to[77]: o Immature immune systems o Longer inpatient status with exposure to repeated antibiotic courses • Common risk factors for LOD may include[77]: o Young maternal age o Exposure to the human immunodeficiency virus (HIV) o Multiple pregnancy
Clinical presentation	• Most common clinical presentation of LOD are[22,31]: o Sepsis o Meningitis o Bacteraemia o Enlarged parotid gland or lymph nodes o Fever o Lethargy o Less commonly organ or soft tissue infection • The earlier LOD presents, the higher the risk for meningitis and death
Information for parents	• At discharge, offer parents of babies at increased risk of LOD, advice about: o Signs of sepsis in the newborn o Importance of seeking medical assistance if baby unwell

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Appendix A: Rationale for risk factor approach in Queensland

Refer to *References* for works cited in this Appendix. Uniform adherence with a single approach is an appropriate strategy to reduce the incidence and impact of EOGBSD.[7]

Aspect	Comment
Approach description	**Screening approach** • Universal antenatal screening for GBS carriage at 35–37 weeks gestation and treat all women with positive cultures, women with a preterm birth where GBS carriage status is unknown or previous infant with EOGBSD with intrapartum antibiotics **Risk factor approach** • No universal antenatal screening, treat all women with risk factors for EOGBSD with intrapartum antibiotics
Rate of EOGBSD in Queensland	• The overall rate of EOGBSD in Queensland has declined from 0.34/1000 live births in 2000–2004 to 0.32/1000 live births during 2005–2014[12] • A risk based approach has been advocated in Queensland throughout this time
Evidence by approach	**Universal screening** • Largely based on one retrospective study[78] that reported antenatal culture-based strategy when compared to risk factors based policy, was 50% more effective in preventing EOGBSD (0.33/1000 versus 0.59/1000 live births). This study reported: o 30–40% of women colonized with Group B Streptococci without obstetric factors who were identified by screening were ignored by the risk-based approach o Women with a prenatal screening culture positive for GBS were more likely to receive IAP than women with obstetric risk factors o Obstetric risk factors were also present in non-colonised women, so the risk factor-based approach lacked specificity and unnecessarily exposed many women to intrapartum chemoprophylaxis
	Risk based approach • There is a lack of a well-designed randomised control trial or systematic reviews (of RCTs or other study designs) evaluating the effectiveness of universal versus risk-based GBS screening. [79] The available evidence includes significant bias and confounds limiting their applicability[80] • An association between the introduction of universal screening guidelines and a decline in the EOGBSD rate[47] does not imply cause and effect[80] o The decline in USA EOGBSD rates antedated implementation of widespread screening o A decline in EOGBSD rates has occurred in New Zealand under a risk factor based approach[16] (0.24 per 1000 live births is lower than target rate of 0.25 per 1000 live births set by Centre for Disease Control USA)
Number needed to treat (NNT)	• Utilising a risk factor screening process a UK study reported that[81]: o 1675–1854 women need to receive penicillin IAP to prevent a single case of EOGBS o 24,065–32,087 women need to receive penicillin IAP to prevent a death due to EOGBS • An Australian study reports that if Queensland introduced universal GBS screening to reduce the current incidence from 0.33 to 0.25 per 1000 live births, a rate comparable to countries such as the USA, the NNT are an additional 12,500 women screening positive for GBS to prevent one further case of EOGBSD[12]
Cost-effectiveness	• Attempts to evaluate the cost-effectiveness of the strategies have produced differing results • A 2013 economic analysis 'Cost-effectiveness of strategies to prevent infection of Group B Streptococcus in neonates from maternal colonisation' commissioned by the Australia's Commonwealth Department of Health and Ageing, reported*:* *"Economic analysis of screening (in some cases in conjunction with providing intrapartum antibiotic prophylaxis) to prevent early onset Group B Streptococcus disease does not provide support for broad based intervention measures….Of the three strategies examined, routine screening (and to a lesser extent screening and treatment for risk factors) appears to be most cost effective, however, the result is not necessarily definitive enough to guide clinical choice"*

Limitations by approach

Aspect	Consideration
Limitations of universal screening approach	• A universal approach may miss identification of GBS risk for preterm babies[9] • 7% of women GBS negative at screening were GBS positive during labour[2] • 17–25% of women GBS positive at screening were GBS negative during labour[2] • In women who do not receive IAP due to false negative results, and the transient nature of GBS colonisation, an adverse neonatal outcome (e.g. infection, death) may occur • Women with a positive result may be excluded from some models of care (e.g. homebirth, midwifery led) and the impact compounded by timing which is usually in the last weeks of pregnancy[80] • May lead to further medicalisation of labour and require more counselling and a higher level of care for many more women, increasing costs and the risk of obstetrical intervention[80] • Positive culture (known GBS colonisers or false positive result) may lead to maternal anxiety and stress during pregnancy • Increases the chances of anaphylaxis with exposure to IAP • Women and babies exposed to IAP has doubled in the USA from 12% to 30% since the introduction of universal screening[34] o There is increasing recognition of the importance of antenatal colonisation of the neonatal gut microbiome with exposure to IAP and adverse health effects in later life[34]
Limitations of risk factor based approach	• 25–30% of EOGBSD cases are born to women without risk factors[13] • In women without risk factors (who do not receive IAP), an adverse neonatal outcome (e.g. infection, death) may occur • Requires accurate identification of risk and timely administration of IAP which can be problematic if adherence not maintained[9,12]

Approach by organisation

		Approach Type			
Organisation	**Year**	**Risk factor**	**Universal screening**	**Either**	**Not stated**
Royal College of Obstetricians and Gynaecologists	2017	✓			
National Institute for Clinical Excellence	2021	✓			
New Zealand GBS Consensus Working Party	2014	✓			
Northern Ireland	2020	✓			
American Society for Microbiology	2021		✓		
The Society of Obstetricians and Gynaecologists of Canada	2018		✓		
European Consensus Conference	2012		✓		
The American College of Obstetricians and Gynaecologists	2020		✓		
Australian Health Ministers' Advisory Council 2014, Clinical Practice Guidelines: Antenatal Care – Module II	2014			✓	
Royal Australian and New Zealand College of Obstetricians and Gynaecologists	2019			✓	
Australasian Society for Infectious Diseases	2014			✓	
Queensland (Qld Health)	2019			✓	
South Australia (SA Health)	2017		✓		
*Western Australia (KEMH)	2021		✓		
*Australian Capital Territory (ACT Health Shared Care Guidelines)	2010		✓		
*New South Wales (NSW Health)	2017			✓	
Safer Care Victoria	2019			✓	
*Tasmania	-				No guideline
*Northern Territory					No guideline

*Source: Homer CS, Scarf V, Catling C, Davis D. Culture-based versus risk-based screening for the prevention of Group B Streptococcal disease in newborns: a review of national guidelines. Women Birth. 2014; 27(1):46-51.

Appendix B: Normal laboratory reference ranges for a term baby

- Consider results in the context of the entire clinical picture
- Laboratory tests are only useful if they guide management
- Normal values for preterm may differ—seek expert advice
- Where possible, use local laboratory reference ranges
- Consider laboratory error if spurious results are returned for a well-baby

Cerebral Spinal Fluid (CSF)

CSF	Unit of measure	Age		With bacterial meningitis
Leucocytes	x10^6/L	≤ 25 (predominately mononuclear)		Elevated
Protein	mg/L	**< 1 week** 200–1700	**1 week–3 months** 200–1000	Elevated
Glucose	mmol/L	**0–12 years** 3.3–4.5		Decreased (but may be normal)
Glucose **(CSF: blood ratio)**	ratio	≥ 0.6 (normally 2/3 of plasma glucose)		Decreased (but may be normal)

Haematology

		Age				
Full Blood Count (venous)	Unit of measure	< 1 day	1day– < 3 days	3 days– < 1 week	1 week – < 2 weeks	With bacterial infection
Hb	g/L	135–222	145–225	135–225	125–205	
Hct	%	0.42–0.67	0.50–0.67	0.42–0.67	0.39–0.63	
MCV	fL	95–121	95–121	88–126	86–126	
MCH	pg	31–37	31–37	28–37	28–40	
MCHC	g/L	290–370	290–370	290–380	280–380	
Platelets	10^9/L	150–400	150–400	150–400	150–400	Decreased
WBC	x10^9/L	9.0–34.0	10.0–26.0	7.0–23.0	5.0–21.0	Elevated or decreased (decrease associated with worse prognosis)
Neutrophil	x10^9/L	5.0–21.0	4.0–14.0	1.5–10.0	1.0–10.0	Elevated or decreased (decrease associated with higher degree of illness)
Band (immature)	x10^9/L	<1.2	<1.2x	<1.2x	<1.2	Elevated
I:T ratio [Band/total neutrophils] < 0.2						
I:M ratio [immature/mature] < 0.25						
Eosinophil	x10^9/L	< 0.8	0.1–1.0	0.1–2.0	0.1–2.0	
Basophil	x10^9/L	< 0.1	< 0.1	< 0.1	< 0.1	
Lymphocyte	x10^9/L	2.0–11.0	3.0–8.0	2.0–17.0	2.0–17.0	
Monocytes	x10^9/L	< 1.9	0.5–2.0	0.1–1.7	0.1–1.7	
CRP	mg/L	< 5	< 5	< 5	< 5	Elevated Serial rise more significant Single result may not exclude or confirm infection

Hb: haemoglobin, **Hct:** haematocrit, **MCV:** mean corpuscular volume, **MCH:** mean corpuscular haemoglobin, **MCHC:** mean corpuscular haemoglobin concentration, **WBC:** white blood cell, **CRP:** C reactive protein

Source: Reference ranges from Pathology Queensland 2021

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