# What is the evidence supporting universal versus risk-based maternal screening to prevent group B streptococcal infection in newborns?

**Evidence Summary No. 14**

**Developed as part of the OHRI-Champlain LHIN Knowledge to Action research program For BORN Ontario**

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Disclaimer

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# What is known about universal versus risk-based maternal screening to prevent group B streptococcal infection in newborns?

The objective of this report is to summarize the evidence on the recommended prenatal screening strategy for group B streptococcal (GBS) infection. Its intention is to support efforts that seek to increase rates of universal GBS screening among pregnant women across Ontario.

**Key Messages**

- GBS disease is a leading cause of infant mortality in Canada. Screening pregnant women for GBS colonization has been shown to greatly reduce early-onset GBS disease in infants. Screening can be done by universal culture testing or by assessing maternal risk factors.

- Universal, culture-based GBS screening of women at 35–37 weeks' gestation is recommended as best practice by a range of North American bodies, including the Canadian Task Force on Preventive Health Care, Society of Obstetrician and Gynaecologists of Canada, Association of Ontario Midwives, British Columbia Reproductive Care Program, Center for Disease Control and Prevention, Institute for Clinical Systems Improvement, American College of Obstetricians and Gynecologists, American Academy of Pediatrics, American College of Nurse-Midwives, American Academy of Family Physicians, and American Society for Microbiology.

- In contrast, risk-based GBS screening is recommended by several non-North American agencies including the National Institute for Health and Clinical Excellence, Royal College of Obstetricians and Gynaecologists, New Zealand GBS Consensus Working Party, and New Zealand College of Midwives.

- According to a 2007 health technology assessment, until a GBS vaccine is developed, universal, culture-based GBS screening followed by intrapartum antibiotic prophylaxis for GBS positive women is considered to be the most cost effective strategy for women at low risk of GBS infection (i.e., membrane rupture $\geq$18 hours or no risk factors).

- While many guidelines have made recommendations on GBS screening, there is a dearth of scientific evidence on this subject (e.g., randomized controlled trials, systematic reviews). As of 2010, there were no randomized controlled trials comparing the two strategies.

### Who is this summary for?

This summary was undertaken for BORN Ontario and is intended for use by local health systems stakeholders, policy-makers and decision-makers within Ontario

### ☑ This summary includes:

- **Key findings** from a broad collection of recent literature and evidence sources.
- **Recommendations** from health agencies

### ☒ This summary does not include:

- **Additional information** not presented in the literature
- **Detailed descriptions of the interventions** presented in the studies.

Sections may conclude with a **"Bottom line"** subsection that provides a statement summarizing the studies or aims to provide some context. These statements are not meant to address all of the evidence in existence on the subject, rather, only that which is featured in this document.

All papers summarized in this document are available by request to kkonnyu@ohri.ca.

# I. Background

**Contents**



Group B streptococcus (GBS) is a bacterium which commonly infects pregnant women and poses the risk of being transmitted to infants during the perinatal period [Phares et al. 2008]. GBS transmission from mother to infant carries serious health risks to the newborn including sepsis, pneumonia, or meningitis [Baker et al. 1995, Davies et al. 2001, Verani et al. 2010]. In both Canada and the United States, GBS disease is a leading cause of infant morbidity and mortality [Verani et al. 2010, Darling and Saurette 2010, Money and Dobson 2004].

In Canada, almost one-fifth of pregnant women are colonized with GBS at 36 weeks' gestation [Darling and Saurette 2010]. If left untreated, approximately 50% of babies born to GBS positive mothers become colonized and 1 – 2% of colonized infants develop GBS disease [Darling and Saurette 2010]. Infections occurring within the first week of an infant's life are considered *early-onset* GBS and are acquired through vertical transmission from a GBS colonized mother to the infant. Infections occurring after the first week of life are considered *late-onset* and can be acquired through both vertical transmission from the mother to the infant and horizontal transmission from the hospital or community to the infant [CTFPHC 2002].

When maternal GBS infections are identified prenatally, early-onset GBS disease in the newborn can be prevented by administration of intrapartum antibiotic prophylaxis (IAP) to the mother [CTFPHC 2002, Verani et al. 2010]. The screening method that identifies the greatest number of GBS infected mothers should, therefore, result in the fewest number of infants with early-onset GBS disease. In 1996, the Centre for Disease Control and Prevention (CDC) issued recommendations for two screening strategies to prevent perinatal GBS transmission:

- Universal screening: All pregnant women are screened for GBS infection by culture testing at 35-37 weeks' gestation and decisions to administer IAP are based on a positive GBS culture.
- Risk-based screening: IAP is administered based on risk factors that increase likelihood of early-onset GBS infection (e.g., previous delivery of GBS-infected baby, premature delivery, maternal fever $\geq 38^{o}$C, rupture of membranes $\geq$18 hours [Verani et al. 2010]).

A large population-based study conducted in the late 90s found that universal screening identified a greater proportion of women at risk of transmitting GBS to their babies than risk-based screening. Based on this study, CDC's 2002 revised guidelines recommended universal screening exclusively [Verani et al. 2010]. Despite these recommendations, the issue of whether to employ a universal vs. risk-based approach to screening remains contentious. While universal screening is recommended in the United States, Canada, and Belgium, it is not currently recommended in the United Kingdom or New Zealand [Colbourn et al. 2007, CTFPHC 2002, Melin et al. 2004, Campbell et al. 2004]. Concerns remain about clinical effectiveness, cost-effectiveness, overuse of antibiotics, and medicalization of labour. [Gilbert et al. 2004, Cromwell 2007].

The objective of this review is to conduct a rapid summary of the evidence supporting the use of universal as opposed to risk-based screening for prenatal GBS infection. The intention is to support efforts aimed at increasing rates of universal GBS screening among pregnant women across Ontario.

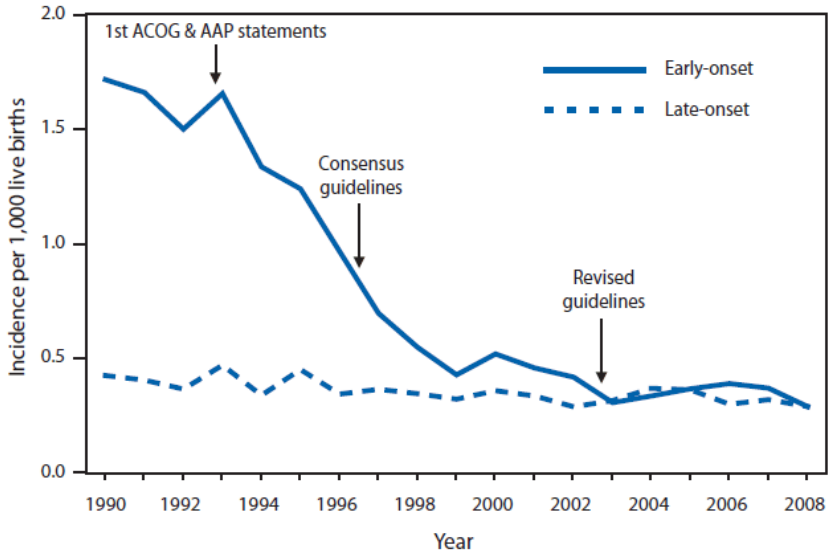
**Levels of evidence:**
Each piece of evidence presented in this summary is assigned a level (adapted from Cochrane MSK group, 2010):

- **Platinum**: Systematic reviews and meta-analyses
- **Gold**: Randomized controlled trials (RCTs)
- **Silver**: Observational studies (non-randomized trials, case-control, time-series, cohort studies, case series)
- **Bronze**: Expert committee guidelines, reports or opinions and/or clinical experience of respected authorities (e.g. commentary, editorial)
- O Level of evidence cannot be determined

# II. Evidence

***Note on the evidence relating to universal and risk-based screening:***
This evidence summary failed to identify high quality evidence from either RCTs or systematic reviews (of RCTs or other study designs) evaluating the effectiveness of universal vs. risk-based GBS screening. Based on our rapid assessment, North American practice appears to have been directed from one large observational study and reinforced by subsequent monitoring (e.g., Figure 1) [Verani et al. 2010, Darling and Saurette 2010, Money and Dobson 2004]. The lack of evidence for this particular practice is an interesting finding, and may warrant caution in interpreting the conclusions from the cost-effectiveness analysis and guidelines presented below.

**Figure 1.** Incidence of early- and late-onset invasive group B streptococcal (GBS) disease — Active Bacterial Core surveillance areas, 1990–2008, and activities for prevention of GBS disease.




This graph illustrates a drop in the incidence of early-onset GBS disease in the early 1990s, when implementation of IAP began [Verani et al. 2010]. A plateau of about 0.5 cases per 1,000 live births occurred between 1999 and 2001. Since 2002, when guidelines recommending the universal screening strategy were issued, incidence has ranged from 0.3 to 0.4 cases per 1,000 live births [Verani et al. 2010].

ACOG: American College of Obstetricians and Gynecologists; AAP: American Academy of Pediatrics.
Source: Adapted from Jordan HT, Farley MM, Craig A, et al. Revisiting the need for vaccine prevention of late-onset neonatal group B streptococcal disease. Pediatr Infect Dis J 2008;27:1057–64.* Incidence rates for 2008 are preliminary because the live birth denominator had not been finalized. *Source: Verani et al., 2011.*

5/11 O A 2007 health technology assessment (HTA) by Colbourn et al. looked at the cost-effectiveness of strategies to prevent GBS and other bacterial infections in the United Kingdom [Colbourn et al. 2007]. Researchers drew evidence from systematic reviews, primary studies, primary data sets, and expert opinion. A decision model was used to compare the cost-effectiveness of five

patient care strategies (in order of decreasing cost):
1. Prenatal testing for GBS followed by IAP for infected women;
2. Universal, culture-based screening for GBS followed by IAP for infected women;
3. IAP without GBS testing;
4. Vaccination against GBS during pregnancy*;
5. No intervention.

*cost unknown

Each patient care strategy was, in turn, evaluated for each of the following 12 maternal risk groups:

**Preterm delivery (<37 weeks):**
1. Planned Caesarean section
2. Previous baby with GBS disease
3. Positive GBS swab in current pregnancy
4. Fever ≥38°C during labour
5. Membrane rupture ≥2 hours before labour
6. Membrane rupture <2 hours before labour

**Term delivery (≥37 weeks):**
7. Planned Caesarean section
8. Previous baby with GBS disease
9. Positive GBS swab in current pregnancy
10. Fever ≥38°C during labour
11. Membrane rupture ≥18 hours
12. None of the above risk factors

Although IAP administration without testing for GBS (Strategy 3) was considered to be more cost-effective for higher risk groups (1-10), the most cost-effective option for the lower risk groups (11 and 12), was deemed to be either universal, culture-based GBS screening followed by IAP for GBS positive women (Strategy 2) or vaccination for all women upon development of a vaccine (Strategy 4).

**Bottom line:**
This section summarized evidence from one HTA of moderate quality (AMSTAR=5). It concluded that universal screening for GBS followed by IAP for GBS positive women is the most cost effective strategy for women at low risk of GBS infection (membrane rupture ≥18 hours or no risk factors). Vaccination against GBS infection was also noted as being cost effective, however only as a theoretical preventative strategy as a vaccine is not currently available. Screening for high risk women was deemed unnecessary as these women should be receiving IAP treatment regardless.

# III. Guidelines

**Center for Disease Control (US)**

In 2010, the CDC issued new guidelines for early-onset GBS screening, replacing those published in 2002 and 1996 [Verani et al. 2010]. The guidelines were developed by meetings of clinical and public health representatives and were endorsed by the American College of Obstetricians and Gynecologists, American Academy of Pediatrics, American College of Nurse-Midwives, American Academy of Family Physicians, and American Society for Microbiology.

The guideline recommends that "in the absence of a licensed GBS vaccine, universal screening and [IAP] continue to be the cornerstones of early-onset GBS disease prevention." Within the universal screening strategy, the guideline specifically recommends the following key components:

1. GBS screening (vaginal and rectal) for pregnant women at 35–37 weeks' gestation
2. IAP treatment for women identified as having GBS bacteriuria during their current pregnancy or a previous baby with GBS disease, regardless of GBS test result
3. Communication of GBS screening results and recommended interventions to women by their healthcare providers

**Society of Obstetricians and Gynaecologists of Canada (Canada)**

The Society of Obstetricians and Gynaecologists of Canada (SOGC) published guidelines in 2004 based on a review of the evidence, as well as a review of the CDC's 2002 guidelines [Money and Dobson 2004]. These guidelines replaced their 1997 guidelines which listed both universal and risk-based screening as acceptable. The revised guidelines made the following recommendation with respect to screening (1) and treatment (2-6):

1. Offer all women screening for group B streptococcal disease at 35-37 weeks' gestation with culture done from one swab first to the vagina then to the rectal area

2. Treat the following women during the intrapartum period at time of labour or rupture of membranes with IV antibiotics:
    - all women positive by GBS culture screening done at 35-37 weeks
    - any women with an infant previously infected with GBS
    - any women with documented GBS bacteriuria (regardless of level of colony-forming units per mL) in this pregnancy
3. Treat women at < 37 weeks' gestation with IV antibiotics unless there has been a negative GBS vaginal/rectal swab culture within 5 weeks
4. Treat women with intrapartum fever with IV antibiotics (i.e., chorioamnionitis must be treated, but broader spectrum antibiotics would be advised)
5. If a woman is GBS-positive by culture screening or by history of bacteriuria, with prelabour rupture of membranes at term, treat with GBS antibiotic prophylaxis and initiate induction of labour with IV oxytocin
6. If GBS culture result is unknown and the woman has ruptured membranes at term for >18 hours, treat with GBS antibiotic prophylaxis

**Canadian Task Force on Preventive Health Care (Canada)**

In 2002, the Canadian Task Force on Preventive Health Care issued a recommendation statement for the prevention of GBS infection in newborns [CTFPHC 2002]. The task force considered the evidence for three preventive strategies (Box 1)

**Box 1.**

1. Universal screening followed by IAP for *all* GBS colonized women
2. Universal screening followed by IAP for GBS colonized women who also have risk factors for GBS infection. (Risk factors included were preterm labour, prolonged rupture of membranes, maternal fever $\geq 38^{o}$C, GBS bacteriuria during pregnancy, and previous newborn with GBS disease)
3. IAP given based on risk factors only

Although the task force found fair evidence for both universal screening strategies (Strategies 1 and 2), it cautioned that IAP for all colonized women (Strategy 1) would result in many more women being exposed to antibiotics, which may increase the incidence of antibiotic-resistant bacteria. The report concluded that there was insufficient evidence to determine the effectiveness of IAP based on risk factors alone (Strategy 3).

**Association of Ontario Midwives (Canada)**

In 2010, the Association of Ontario Midwives (AOM) released clinical practice guidelines for GBS prevention and management targeting midwives [Darling and Saurette 2010]. The following recommendations were made:

1. Universal screening of all women at 35-37 weeks' gestation for GBS with culture done from one swab from vagina to rectal area
2. Women can swab themselves if given proper instruction
3. If delivery has not occurred and >5 weeks have passed since the previous swab, re-screening should be done

The AOM guidelines described the two possible treatment strategies (Box 1; Strategy 1 and 2) evaluated above by the Canadian Task Force on Preventive Health Care; both treatments follow universal screening. The guideline recommends that women should be informed about both treatment options, including the fact that treating all GBS positive women (Strategy 1) is the approach recommended by the CDC and SOGC, and that less research has focused on Strategy 2.

**Guidelines from other agencies**

The American College of Obstetricians and Gynecologists and the British Columbia Reproductive Care Program have both released their own guidelines endorsing those put out by the CDC, thereby recommending universal GBS screening [ACOG 2011, BCRCP 2003]. Guidelines from the Institute for Clinical Systems Improvement and from the Belgian Superior Health Council also recommend universal GBS screening for all women at 35-37 weeks' gestation [ICSI 2010, Melin 2007].

In the United Kingdom, the National Institute for Health and Clinical Excellence (NICE) and the Royal College of Obstetricians and Gynaecologists issued guidelines that recommend against universal screening for GBS because, as stated by NICE, "evidence of its clinical and cost effectiveness remains uncertain"[NICE 2008, RCOG 2003]. The New Zealand GBS Consensus Working Party and the New Zealand College of Midwives also recommend risk-based screening instead of universal screening because this is thought to expose fewer women to antibiotics [Campbell et al. 2004, NZCM 2004]. Both New Zealand reports cite concerns over allergic reactions to antibiotics and antibiotic resistance as reasons to minimize IAP use.

**Bottom line:**
This section summarized recommendations from 12 agencies. Eight agencies from three countries (Canada, US, Belgium) recommend universal screening of women at 35–37 weeks' gestation to provide the best prevention of GBS disease in newborns; four agencies from two countries (UK, New Zealand) recommend risk-based screening to avoid the overuse of antibiotics.

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## Methods

Detailed search strategies were developed by an experienced Information Specialist (specific search terms available upon request). Searching was limited to the following databases:

- The Cochrane Library on Wiley, including:
  - Cochrane Database of Systematic Reviews (CDSR);
  - Database of Abstracts of Reviews of Effects (DARE)
  - Cochrane Central Register of Controlled Trials (CENTRAL)
  - National Health Service Economic Evaluation Databases (NHS EED)
  - Health Technology Assessment (HTA) database
- OVID MEDLINE
- OVID EMBASE

Search concepts included Medical Subject Headings (MeSH) and non-thesaurus terms (i.e. text words). A 'grey literature' search was also conducted for potentially relevant studies by reviewing the web sites of relevant organizations (available upon request). Guidelines based on literature review were included. To be included, all citations had to have been published in English and be available in full text electronically.

Screening and extraction was conducted by one reviewer, and thus may have introduced a marginal amount of error. Risk of bias was only evaluated for the HTA in this report, using the AMSTAR instrument.

## Risk of Bias Assessment of Systematic Reviews

AMSTAR is an 11-item measurement tool created to assess the methodological quality of systematic reviews. Each question is scored according to 1 of 4 options (yes, no, cannot answer, not applicable) and the number of 'yes' answers tallied. A higher score indicates increased methodological quality.

The 11 assessment criteria are as follows:

1. Was an "a priori" design provided?
2. Was there duplicate study selection and data extraction?
3. Was a comprehensive literature search performed?
4. Was the status of publication (i.e. grey literature) used as an inclusion criterion?
5. Was a list of studies (included and excluded) provided?
6. Were the characteristics of the included studies provided?
7. Was the scientific quality of the included studies assessed and documented?
8. Was the scientific quality of the included studies used appropriately in formulating conclusions?
9. Were the methods used to combine the findings of studies appropriate?
10. Was the likelihood of publication bias assessed?
11. Was the conflict of interest stated?

The AMSTAR score (from 0 to 11) for the HTA in this evidence summary is reported in a box before the summary of the HTA.

# Additional Information

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**Conflict of Interest**
None declared

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