The Village Midwife, LLC
Jennifer L. Rector, LM, CPM
321 Main Street, Suite C
Newport News, VA 23601
P 757-472-2936
F 757-257-0086

GROUP B STREP INFORMED CONSENT

Midwives globally continue to debate the issue of how to effectively handle the testing and treatment of Group Beta Strep (GBS). Opinions and protocols vary widely among healthcare providers.

Inherent in the *Midwifery Model of Care* is that you maintain full responsibility for your care and you make your own informed decisions about your course of care, including whether or not you wish to be tested for GBS (as with all other laboratory tests & screenings) and whether or not to be treated if your test result returns Positive (+).

GBS colonization can be transient, chronic, or intermittent and a positive culture result means that the pregnant person carries GBS - not that they or the baby will definitely become ill. (cdc.gov)

We strongly believe that quality nutrition, nutrient supplementation, and a holistic, prevention regimen can significantly reduce GBS colonization.

We give pregnant people a choice of whether they want a routine culture at around 36 weeks or to be treated on an at-risk basis, or not at all.

We feel that in choosing home delivery and midwifery care you are accepting full responsibility for your care and in so doing you are able to decide if you want to test and what you want to do about it.

If you choose to have a culture and it returns positive, you will be advised that the standard medical protocol in our area is to administer antibiotics.

Whether or not you decide to be cultured for GBS or decide to take intravenous antibiotics during labor is a matter of informed consent.

This midwifery practice cannot give IV antibiotics during labor, if such treatment is desired, it is suggested the parents discuss such options with a physician.

It is vital that you understand that the only CDC approved regimen for GBS disease prevention is Penicillin every 4 hours until delivery, GBS is a serious disease which may lead to death of the newborn. Natural protocols or Hibiclens protocols are not CDC approved, and your midwife may not provide antibiotics to you while you are laboring.

What is Group B Strep?
Group B Streptococcus (GBS) is a type of bacteria that can cause illness in people of all ages. In newborns, GBS is a major cause of meningitis (infection of the lining of the brain and spinal cord), pneumonia (infection of the lungs), and sepsis (infection of the blood) (CDC 1996; CDC 2005; CDC 2009).

Group B strep lives in the intestines and migrates down to the rectum, vagina, and urinary tract. All around the world, anywhere from 10-30% of pregnant people are “colonized” with or carry GBS in their bodies (Johri et al. 2006). Using a swab of the rectum and vagina, people can test positive for GBS temporarily, on-and-off, or persistently (CDC 2010).

Being colonized with GBS does not mean that someone will develop a GBS infection. Most people with GBS do not have any GBS infections or symptoms. However, GBS can cause urinary tract infections and GBS infections in the newborn (CDC 2010), and people who have preterm births are 1.7 times more likely to be colonized with GBS during labor than people who do not have preterm births (Valkenburg-van den Berg et al. 2009).

This article focuses on Group B Strep in pregnancy in the United States, along with some information about other countries.

Are some people more likely to carry GBS?
Researchers have looked at the risk factors for GBS in young, non-pregnant women (Feigin, Cherry et al. 2009). People with these factors may be more likely to carry GBS:

- Multiple sexual partners
- Male-to-female oral sex
- Frequent or recent sex
- Tampon use
- Infrequent handwashing
- Less than 20 years old

In pregnant people, researchers have found that the presence of any amount of GBS in the urine makes it more likely that someone will be colonized at 35-37 weeks pregnancy (Perez-Moreno et al. 2017).

How often do newborns become infected with GBS?
There are 2 main types of GBS infection in newborns: early infection and late infection. In this article we will focus on early infection, which occurs in the first 7 days after birth. When a baby has an early GBS infection, symptoms usually appear within the first 12 hours, and almost all babies will have symptoms within 24-48 hours (CDC 2010). In a study of 148,000 infants born between 2000 and 2008, almost all of the 94 infants who developed early GBS infection were diagnosed within an hour after birth—suggesting that early GBS infection probably begins before birth (Tudela et al. 2012).

Early infection is caused by direct transfer of GBS from the mother to the baby, usually after the water breaks. The bacteria travel up from the vagina into the amniotic fluid, and the fetus may swallow some of the bacteria into the lungs—leading to an early GBS infection. Babies can also get GBS on their body (skin and mucous membranes) as they travel down the birth canal. However, most of these "colonized" infants stay healthy (CDC 2010).

In 1993-1994, the American Congress of Obstetricians and Gynecologists and the American Academy of Pediatrics recommended screening all pregnant women for GBS and treating GBS-positive women with intravenous (IV) antibiotics during labor. Since that time, we have seen a remarkable drop in early GBS infection rates in the U.S.—from 1.7 cases per 1,000 births in the early 1990's, to 0.25 cases per 1,000 births today (CDC 2012).

If someone who carries GBS is not treated with antibiotics during labor, the baby's risk of becoming colonized with GBS is approximately 50% and the risk of developing a serious, life-threatening GBS infection is 1 to 2% (Boyer & Gotoff 1985; CDC 2010; Feigin, Cherry et al. 2009). As I noted earlier, being colonized is not the same thing as having an early GBS infection– most colonized babies stay healthy.

On the other hand, if someone with GBS is treated with antibiotics during labor, the risk of their infant developing an early GBS infection drops by 80%. So, for example, the risk could drop from 1% down to 0.2%. (Ohlsson 2013)

What is the risk of death if the baby has an early GBS infection?
Researchers have estimated that the death rate from early GBS infection is 2 to 3% for full-term infants. This means of 100 babies who have an actual early GBS infection, 2-3 will die. Death rates from GBS are much higher (20-30%) in infants who are born at less than 33 weeks gestation (CDC 2010).

Although the death rate of GBS is relatively low, infants with early GBS infections can have long, expensive stays in the intensive care unit. Researchers have also found that up to 44% of infants who survive GBS with meningitis end up with long-term health problems, including developmental disabilities, paralysis, seizure disorder, hearing loss, vision loss, and small brains. Very little is known about the long-term health risks of infants who have GBS without meningitis, but some may have long-term developmental problems (Feigin, Cherry et al. 2009; Libster et al. 2012).

Are some newborns more likely to get early GBS disease?
The primary risk factor for early GBS infection is when the pregnant parent carries GBS. However, there are some things that increase the risk of early GBS infection:

- Being born at less than 37 weeks (Boyer &Gotoff 1985; Velaphi et al. 2003; Heath et al. 2009)
- A long period between water breaking and giving birth (Boyer &Gotoff 1985; Velaphi et al. 2003; Heath et al. 2009)
- Water broke before going into labor (premature rupture of membranes) (Adair et al. 2003)
- High temperature during labor (> 99.5 F or 37.5 C) (Boyer & Gotoff 1985; Adair et al. 2003; Velaphi et al. 2003; Heath et al. 2009)
- Infection of the uterus (aka "chorioamnionitis") (Adair et al. 2003)
- Parent previously gave birth to an infant who had an early GBS infection (CDC 2010)
- Intrauterine monitoring during labor (Adair et al. 2003)
- GBS in the urine during pregnancy (Carroll et al. 2016)
- Giving birth for the first time (Carroll et al. 2016)

How accurate is testing for GBS?
The CDC recommends measuring GBS with a culture test at 35-37 weeks of pregnancy. This is done by swabbing the rectum and vagina with a Q-tip, and then waiting to see if GBS grows. It takes about 48 hours to get the results back. The goal is to get the results back before labor begins (CDC, 2010).

A culture test during labor is considered the "gold standard," but this method is not used in practice because it takes too long to get results back. In a recent, high-quality study, researchers did the culture test twice– once at 35-36 weeks and once during labor. They compared the 35-36 week test to the gold standard.

Of pregnant people who screened negative for GBS at 35-36 weeks, 91% were still GBS-negative when the gold standard test was done during labor. The other 9% became GBS positive. These 9% were "missed" GBS cases, meaning that these people had GBS, but most (41 out of 42) did not receive antibiotics.

Of the pregnant people who screened positive for GBS at 35-36 weeks, 84% were still GBS positive when the gold standard test was done during labor. However, 16% of the GBS-positive people became GBS-negative by the time they went into labor. These 16% received unnecessary antibiotics (Young et al. 2011).

Is there a faster test that could be used in labor?
It's possible that a rapid-test for GBS during labor may be a better option for some people, and this has been a hot topic for research over the past few years. In the same study mentioned above, researchers compared the 35-36 week culture test and the in-labor rapid test to the gold-standard test (culture during labor).

The researchers found that the 35-36 week culture test only identified 69% of the pregnant people who actually had GBS during labor. Meanwhile, the in-labor rapid test was much more sensitive—it identified 91% of those with GBS during labor (Young et al, 2011).

Since the Young study, at least two other studies have found that the rapid test identified 100% of people with GBS during labor. (Helmig et al., 2017; Wolheim et al., 2017). However, one "real life" study (with obstetricians and midwives doing the testing) found that the sensitivity of the rapid test was only 86%, and on average, 24% of test swabs were invalid, meaning that a result was not given 24% of the time. More than half (59%) of these invalid results were due to improper handling of the test. An additional 2-hour training of hospital staff lowered the invalid rate from an initial high of 55% down to 13%. (Mueller et al., 2014).

In a 2012 study in France, researchers followed a hospital as it switched from prenatal testing to in-labor testing for GBS. With the in-labor rapid GBS test, more mothers with GBS were identified (17% vs. 12%), there were fewer cases of early GBS infection in newborns (0.5% vs. 0.9%), and the financial cost was the same (El Helali et al. 2012). In another study, researchers estimated that switching from the conventional prenatal test to the rapid test reduced the percentage of people unnecessarily treated with antibiotics from 14% down to 5%. They state that the rapid test strategy does generate extra costs for the hospital, but that these costs could be offset somewhat by decreasing nursing time spent administering unnecessary IV antibiotics or observing uninfected newborns (Poncelet-Jasserand et al. 2013).

One drawback of rapid-testing is that it can still take up to an hour or more to get the results back, and people would have to wait to get antibiotics until the results came in (Honest et al. 2006; Young et al. 2011). In one study, researchers found that the average time it took to receive a result was 75 minutes when the test was conducted by laboratory staff, and 165 minutes when the test was conducted by midwives and obstetricians (Mueller et al. 2014). The CDC says that the ideal rapid test for GBS could be done at the bedside in less than 30 minutes (CDC, 2010).

What is the evidence for antibiotics during labor to prevent early GBS infection?
To answer this question, I will walk you through the most important studies that led to how we most commonly try to prevent early GBS infections in the U.S. today.

GBS emerged as a widespread threat to newborns in the early 1970's. At that time, 1.7 of every 1,000 infants had early GBS infection (CDC 2010). In 1973, a researcher proposed giving pregnant women penicillin to stop early GBS infections in infants (Franciosi et al. 1973).

First, researchers tried giving penicillin to women before labor, but this didn't work. Although penicillin temporarily lowered GBS levels, by the time women went into labor the GBS levels were back up again (Gardner et al. 1979).

Next, researchers tried giving antibiotics to those with GBS during labor. In the late 1980's, three groups of researchers in the U.S., Spain, and Finland randomly assigned women with GBS to either receive IV antibiotics during labor (penicillin or ampicillin) or no antibiotics (Boyer & Gotoff 1985; Tuppurainen and Hallman 1989; Matorras et al. 1991).

In a recent Cochrane review, researchers combined the results of these 3 studies, with a total of 500 pregnant women. They found that when women with GBS had antibiotics during labor, their infants risk of catching early GBS infection dropped by 83% (Ohlsson & Shah 2013).

As the Cochrane reviewers noted, there were quite a few limitations to these 3 studies. In their summary, the reviewers said "There is no valid information from these three small, old, and biased trials to inform

clinical practice." However, an alternative perspective would be that there is some valid information from these studies, along with some limitations to the evidence.

Was the Cochrane review correct in saying that there was no valid information from these studies to inform practice?
The Cochrane Collaboration is a highly respected organization that conducts meta-analyses on different topics related to healthcare. A meta-analysis is a type of research study when researchers pool statistics from previous studies into one large study and look at the results.

The Cochrane Pregnancy and Childbirth Group has a policy that they only do meta-analyses on randomized, controlled trials. So the Cochrane review on GBS (published in 2009 and "updated" but essentially unchanged in 2013 and 2014) only includes three small randomized, controlled trials, and does not look at other types of evidence, such as evidence from large observational studies where some people received antibiotics and others did not.

Are the results from the Cochrane review concerning?
The researchers who wrote the Cochrane review on Group B Strep came to strong conclusions against the use of antibiotics for Group B Strep. After reviewing the three existing randomized, controlled trials on Group B Strep, they stated "There is no valid information from these three small, old, and biased trials to inform clinical practice…It is remarkable that in North America the commonly implemented practice of intrapartum antibiotic prophylaxis to GBS colonized women has been so poorly studied."

It is true that these three studies had some major limitations. In fact, most studies published before 1996 suffered from less than optimal written reports of their findings.

In the mid-1990's, researchers became very concerned about the widespread quality problem with clinical trial reports. So, in 1996, researchers from Canada and the U.S. came together and published the CONSORT guidelines for clinical trials.

CONSORT stands for the Consolidated Standards of Reporting Trials, and it is basically an evidence-based checklist of items that researchers must disclose in their article before they can report the results of their studies in most medical journals. Publishing of the CONSORT guidelines forced researchers to be transparent about their methods, and it greatly improved our ability to evaluate the quality of a clinical trial.

The three studies that the Cochrane reviewers critique as being "invalid" were done in 1986, 1989, and 1990, before the CONSORT guidelines were developed. So this partially explains why the written reports of these three studies are not up to today's standards.

What about their critique of the three randomized trials on antibiotics for Group B Strep?
To help you understand this issue, I would like to present two different ways that you could look at these three clinical trials: the concerns raised by the Cochrane reviewers, and an alternative point of view.

Table: Cochrane Perspective vs. Alternative Perspective

Cochrane Perspective	Alternative Perspective
None of the studies had a placebo treatment. The antibiotics were compared to no treatment.	This would not have changed the findings. The diagnosis of GBS in infants is not subjective or symptom-based, but it is based on culture (lab test) results.

Patients, care providers, and researchers were not blinded to the group assignments.	Likewise, this would not have changed the results. Blinding is much more important when the outcome of interest is subjective, like pain or quality of life.
The researchers did not do an up-front "power analysis" to determine the appropriate sample size.	It is possible that the researchers conducted a power analysis but did not report it, since power analyses were not required information for medical journals before 1996. Also, the meta-analysis did show a difference in GBS infection rates, so it appears that the studies were adequately powered to observe differences between the groups.
The sample sizes were likely too small to detect differences in early GBS infection and mortality.	But the studies did show a difference in early GBS infection rates. True, larger studies may have been better able to detect a difference in mortality rates, but it would take a very large sample, and such a study may not be practical or ethical given that the researchers found a decrease in GBS infection rates.
Only one of the three studies specifically looked at mortality.	Yes, this is a limitation, but we are interested in GBS infections, because they are a big deal. Infants are in the ICU for many weeks. This is traumatic, can have long term health effects, and also costs a lot of money.
Boyd et al. published their results and then announced that they only needed one more event in the control group to achieve statistical significance. After this one event happened, they re-published the study with the new "significant" finding. This indicates a high level of bias and possible manipulation of the study findings.	This is not ideal, but it is not uncommon for researchers to do a preliminary data analysis, find that there is a "trend" towards statistical significance, and then continue collecting more data. A trend towards significant results often indicates that the study needs only a slightly larger sample size in order to determine differences between groups.
Boyd et al. improperly tweaked their statistics (switched from a 2-tailed test to a 1-tailed test) so that the results were changed from "not significant" to "statistically significant."	In current times, researchers would have handled this differently by doing something called a "sensitivity analysis" and appropriately explained what they were doing.
Boyd et al. excluded all women who developed a fever from their statistics, which is incredible considering the fact that fever is a risk factor for early GBS infection.	The researchers excluded women with fever because all these women needed to receive antibiotics—they ethically could not stay in an untreated group. Therefore they were not eligible to be in this 'preventive trial'. This was an appropriate thing to do.
They were missing final results for 11% of women and infants in the study.	Yes, but it is unlikely that any of these missing individuals had GBS infections or were septic. Nowadays, there is a different type of analysis that we could have done to account for the missing data.

In summary, although these three studies had limitations (not uncommon for research published before 1996), there was also some valid information that we can use.

Although it would be best if we had modern, larger, randomized, controlled trials on antibiotics for Group B Strep, such trials would be very impractical and highly unlikely to be carried out, given that antibiotics are already in routine use. Furthermore, we have newer evidence from large observational studies that we can use to look at the potential benefits and risks of antibiotics for Group B Strep.

Based on information from the 3 original randomized, controlled trials, in 1996, the CDC initially recommended 2 ways to prevent early GBS infections:

1. The "universal approach." Screen all pregnant people at 35-37 weeks and treat everyone who is positive with antibiotics during labor (this is the method that is currently used in the U.S.)

2. The "risk-based approach." Treat laboring people with antibiotics if they have one or more of these risk factors: GBS in the urine at any point in pregnancy, previously gave birth to an infant with early GBS infection, goes into labor at less than 37 weeks, has a fever during labor, or water has been broken for more than 18 hours (this is the method that is currently used in the United Kingdom)

In 2002, the CDC revised their guidelines to recommend the universal approach.
This decision was based on an important study published in the New England Journal of Medicine (Schrag et al. 2002). In this study, researchers used CDC lab results and chart reviews to look at 629,912 live births that took place in the U.S. between the years 1998-1999.The researchers randomly selected 5,144 of these births to study, plus all 314 infants who were born with early GBS. They used hospital records to label people as receiving the universal approach (52%) or the risk-based approach (48%).

The results? There were 0.5 infants born with GBS per every 1,000 pregnant parents. People in both groups received antibiotics about a third of the time. But people whose care providers used the universal approach had a 54% reduction in the risk of early GBS infection compared to people whose care providers used the risk-based approach. This means that the universal approach worked better than the risk-based approach.

In 2002-2003, the same group of researchers looked at 819,528 births in the U.S. to see whether the revised guidelines had been put into practice. Like the previous study, the researchers picked a random sample of birthing people and infants to analyze, along with the 254 infants who had early GBS infection. Between 1999 and 2002, use of the universal approach rose from about 50% to 85%, and use of antibiotics during labor rose from 27% to 32%.

This time around, there were 0.32 infants born with early GBS per every 1,000 birthing people (down from 0.5 cases per 1,000 only four years earlier). When researchers looked at the infants born at 37 weeks or later who had early GBS, only 18.0% were born to pregnant parents who were not screened. Most of the cases of GBS in term infants (61%) happened in pregnant parents who had been screened but tested negative for GBS. The researchers concluded that universal screening and antibiotic use cannot be expected to prevent 100% of early GBS infections, and that if we want to further lower GBS infection rates, then we will need access to rapid testing and vaccines against GBS (Van Dyke et al. 2009).

What is the best time to receive antibiotics for GBS?
The CDC recommends that antibiotics be given every 4 hours, starting more than 4 hours before birth. Recent evidence supports these recommendation:

In 2013, researchers looked at 7,691 live births that took place during 2003-2004 in the U.S. (randomly selected out of >600,000 births), along with 254 infants who had early GBS infection (Fairlie et al., 2013). About 1 in 3 birthing people had antibiotics during labor (31%), and 59% of those received antibiotics more than 4 hours before birth.

When penicillin or ampicillin was given more than 4 hours before birth, it was effective 89% of the time. In contrast, giving antibiotics 2-4 hours before birth was effective 38% of the time. Antibiotics given less than 2 hours before birth were effective 47% of the time. When Clindamycin (another antibiotic) was used in place of penicillin, it worked very poorly (only 22% effective). There was no statistical difference

between the 2-4 hour window and the 2-0 hour window, so even though the percentages look different, they are not statistically significant.

In another study published in 2013, researchers reviewed the medical records of 4,756 birthing people who received antibiotics during labor for GBS– 1,149 received antibiotics for less than 4 hours, and 3,633 receiving antibiotics for 4 or more hours. More infants whose mothers received less than 4 hours of antibiotics had a discharge diagnosis of sepsis when compared to infants whose mothers received 4 hours or more of antibiotics (1.4% versus 0.4%.) (Turrentine et al., 2013).

Finally, a study carried out in Uruguay in 2015 followed 60 carriers of GBS at term who came to the hospital in early labor. They swabbed each person for GBS before antibiotics were started, and then again 2 and 4 hours after the first dose of penicillin was given. The researchers found that 72% of the participants were GBS positive before antibiotics were started, 47% were positive 2 hours after the first dose, and only 12% were positive for GBS 4 hours after the first dose. In all 60 newborns, the cord blood and amniotic fluid reached therapeutic levels of penicillin, even though 28% of the women gave birth before 4 hours. The maximum effect of the antibiotics was reached at 4 hours, just before the next dose was due (Scasso et al. 2015).

How will antibiotics during labor affect a newborn's microbiome?
When this Evidence Based Birth® article was first published in early 2014, I could not find any evidence on the effects of in-labor antibiotics for GBS on the newborn's microbiome. However, since that time, I have found 8 studies in which researchers have looked at the microbiota consequences of IV antibiotics during labor for Group B Strep.

In these studies (Table 1), researchers enrolled infants whose mothers had IV antibiotics during labor (typically for GBS) and compared them to infants whose mothers did not have IV antibiotics during labor. Most researchers studied the infant microbiome by collecting and analyzing stool samples at time points ranging from 3 days of life to 1 year of age.

Overall, researchers found that receiving IV antibiotics during labor does impact the infant's microbiome, at least temporarily. Seven of eight studies found that IV antibiotics during labor had at least a short-term effect on reducing beneficial bacteria and/or increasing levels of non-beneficial bacteria. Of the four studies that followed the infant microbiome over time, two found that the infant's microbiome had either recovered or mostly recovered by 4-8 weeks, while two other studies found important differences that persisted up to 3 months or a year later in some infants.

Perhaps the most important study on this topic, and the only study to follow infants for a year, was conducted by researchers in Canada. In 2016, Azad et al. studied 198 mother-infant pairs from a large Canadian cohort study. Infants could be included in the microbiome study if they had stool samples collected at 3 months and 1 year, and if they had complete information about antibiotic exposure during labor and infancy.

Infants were separated into 4 groups: no antibiotic exposure during labor with vaginal birth (57%), antibiotic exposure with vaginal birth (21%), antibiotic exposure with elective Cesarean (9%), and antibiotic exposure with unplanned Cesarean (13%). Cefazolin was the antibiotic that was typically used during Cesareans, and penicillin was the antibiotic of choice for vaginal births. Researchers also measured the presence and duration of exclusive breastfeeding.

The results showed that the infant microbiome was influenced by antibiotic exposure during labor, birth route (Cesarean or vaginal birth), and breastfeeding. At 3 months, infants exposed to antibiotics during labor or birth had a decreased level of Bacteroidetes (a beneficial bacteria), as well as a decrease in the "richness" of their microbiome, regardless of whether they were exclusively breastfed or not. The most

severe deficiencies happened among infants born by Cesarean. Infants born by Cesarean also had higher levels of Clostridium, Enterococcus, and Streptococcus—potentially harmful bacteria. At one year of age, most of these differences were gone, showing that the effect on the microbiome was short-term. However, some negative effects on the microbiome still persisted in infants born by unplanned Cesarean who had not been breastfed for at least 3 months.

The changes in the microbiome seen in all of these studies are consistent with what one would expect after administering IV antibiotics, like ampicillin, that mainly act against gram-positive bacteria. Killing off gram-positive bacteria (like Group B Strep) can lead to an over-abundance of gram-negative bacteria. Also, some beneficial bacteria, like Bacteroidetes, are sensitive to penicillin and ampicillin, meaning that they are also killed off by the antibiotic.

In summary, it does appear that IV antibiotics during labor have a short-term negative effect on the infant's microbiome, but that this negative effect can be lessened by breastfeeding. Research is needed to determine if giving probiotics to mothers and/or newborns can help lessen or reverse the impact of IV antibiotics on the infant's microbiome. Research is needed to determine if there are any long-term effects associated with the temporary reduction in beneficial bacteria.

What are the potential benefits and harms of the universal screening and treatment approach?

Potential Benefits:

- In clinical trials, using antibiotics (penicillin or ampicillin) during labor decreases the risk of early GBS infection by 83%, although there are limitations to the quality of this evidence (Ohlsson 2013)
- Penicillin rapidly crosses the placenta into the fetal circulation (at non-toxic levels) and can prevent GBS from growing in the fetus or newborn (CDC 2010; Barber et al. 2008).
- In large studies in the U.S., the universal approach (screening and treating all GBS-positive pregnant parents with antibiotics during labor) is associated with lower rates of GBS infections than giving antibiotics based on risk factors alone (Schrag et al. 2002).
- Most research has found that antibiotic resistance has not been a problem with penicillin, the drug most commonly used to prevent early GBS infection (CDC 2010; Melo et al. 2016). However, one recent study found a 12% resistance rate in Italy (Matain et al. 2016).

Potential harms:

- Although rare, severe allergic reactions have been reported. The risk is estimated to be 1 in 10,000 for a severe reaction, and 1 in 100,000 for a fatal reaction. (Weiss and Adkinson 1988).
- IV antibiotics have been shown to cause a short-term negative effect on the infant's microbiome; however, most infants will experience a recovery of their microbiome, and this recovery is enhanced by breastfeeding.
- There is an increase in the risk of maternal and newborn yeast infections, which can harm the breastfeeding relationship. In one study, 15% of women who received antibiotics in labor had mother-baby yeast infections (maternal nipple and infant mouth infections), compared to 7% of mothers who did not have antibiotics (Dinsmoor et al. 2005).
- Other potential harms have to do with side effects related to the antibiotic that is used (click on the link to see a comprehensive list of potential side effects for each antibiotic, but keep in mind that most of the serious risks are rare): Penicillin, ampicillin, cefazolin, clindaymycin, and vancomycin.
- The potential medicalization of labor and birth (RCOG 2003).

What are the best antibiotics for someone who is allergic to penicillin?

Many people who have an allergy to penicillin can take Cefazolin instead. One advantage to Cefazolin is that (like penicillin) it crosses the placenta quickly and reaches the fetus's bloodstream. Penicillin and Cefazolin also have a relatively narrow spectrum of antibiotic activity, which means they are less likely to

encourage antibiotic resistance. If someone is at high risk for anaphylaxis with penicillin (i.e., has a history of anaphylaxis or has had respiratory distress, hives, or swelling beneath the skin after receiving penicillin), then the CDC recommends several different antibiotics instead of Cefazolin. Which antibiotic a birthing person can take depends on the results of their GBS lab tests.

Alternative antibiotics include clindamycin and vancomycin. Unfortunately, clindamycin and vancomycin have never been tested in clinical trials for the prevention of early GBS infection. However, there is some research on whether these drugs can cross the placenta and reach therapeutic levels. Clindamycin faces high rates of drug resistance and doesn't concentrate as well as Cefazolin in the fetal bloodstream (CDC, 2010). It should never be used unless the pregnant parent's GBS has been specifically tested and it is known that these antibiotics will work on their particular strain of GBS. Vancomycin can be used in someone who is highly allergic to penicillin and whose GBS is either resistant to clindamycin or test results are not available. Vancomycin is used cautiously because it is a drug of last resort for many bacterial infections (CDC, 2016). It is also thought to be less effective than clindamycin for preventing early newborn GBS infection; however, new evidence suggests that vancomycin can reach effective levels more than 90% of the time using a different dose regimen (Towers and Weitz, 2017). This new approach might be more effective than what the 2010 CDC guidelines recommend.

Also, the effects of these more broad-spectrum antibiotics on the infant's microbiome are unknown, but it is possible that these antibiotics may have a stronger effect on the infant's microbiome, given their effectiveness against a broader range of bacteria. Finally, although some care providers may use erythromycin to prevent early GBS, the CDC states that erythromycin should never be used to prevent early GBS infection (CDC, 2010).

If I have antibiotics, does this mean I will be continuously hooked up to an IV?
Not necessarily. If you use the antibiotics, you will have an IV placed, but it only takes 15-30 minutes for the antibiotics to run in. The antibiotics are only given every 4 hours until birth, which for many people is only once or twice. When the IV is running, it should not limit positioning, walking, or even laboring in water.

For the hours in between, parents can ask for the IV can be "hep-locked" or "saline-locked" and detached, so that you are free from the IV pole. For more information about saline locks, please read my article about saline locks during labor here.

For low-risk, healthy pregnant people, it is a very reasonable request to ask for the IV to be hep-locked or saline-locked in between antibiotic doses. For more information on IV fluids during labor, please read this article here. To learn about the evidence for eating and drinking during labor, click here.

Are there any other options?
Risk-based approach
One alternative to the universal approach is the "risk-based approach." This is when you receive antibiotics based on other risk factors such as having a fever or your water being broken for more than 18 hours. This alternative is no longer recommended by the CDC. The number of birthing people who receive antibiotics is roughly the same whether you choose the universal approach or the risk-based approach—about 30%. However, as already mentioned, evidence from large observational studies shows that the universal approach is more effective than giving antibiotics based on risk factors alone.

Chlorhexadine (aka Hibiclens)
Chlorhexadine is a topical disinfectant that kills bacteria on contact. It binds easily to the skin and mucous membranes. In the vagina, the anti-GBS effects of chlorhexadine last from 3-6 hours. Chlorhexadine has been shown to be safe, is easy to administer, and only costs a few cents per use (Goldenberg et al. 2006). Hibiclens is a brand formulation that includes chlorhexadine. Most of the

research studies have used chlorhexadine; however, in the U.S., many midwives can only access Hibiclens.

In a Cochrane review that was updated in 2014 (Ohlsson et al. 2014), researchers combined results from 4 randomized, controlled trials that compared vaginal chlorhexadine vs. a placebo or no treatment on outcomes of 1,125 infants born to women who were GBS positive. The evidence from these studies was judged to be of very low quality. The researchers removed a 5th trial that had been included in previous versions of the Cochrane review, because it did not include women with known positive GBS status. They also corrected a data analysis mistake from the previous version.

In this updated review, the Cochrane reviewers found that chlorhexidine does not reduce the infants' risk of being colonized with GBS. They also found no difference in early GBS infection rates between people who used the chlorhexadine and those who did not. There were no cases of infant deaths from GBS in either group. The chlorhexadine group had higher rates of the side effects of stinging and irritation. The researchers called for a large clinical trial to test chlorhexadine for the prevention of early GBS.

Chlorhexadine may potentially be beneficial for pregnant people living in low-resource countries where access to antibiotics is limited. In their review of the literature, Goldenberg et al. (2006) found 2 studies from developing countries (Egypt and Malawi) where researchers tested chlorhexadine in the vagina every 4 hours during labor and then wiped the newborn with chlorhexidine shortly after birth. This is a lower level of evidence than the studies listed above, because neither of these were randomized, controlled trials. Instead, the researchers followed hospitals over a period of months when: 1) they did not use chlorhexadine, 2) they used chlorhexadine, and 3) they stopped using chlorhexadine. In both studies, researchers found that when chlorhexadine was used in both the vagina and wiped all over the newborn, there were immediate drops in newborn hospital admissions, newborn sepsis (blood infection) admissions, and newborn deaths due to infections. Unfortunately, researchers did not specifically count the number of GBS infections, just the overall number of babies who had admissions for sepsis.

So is chlorhexadine effective? Randomized, controlled trials show that in developed countries, applying chlorhexadine topically during labor does not make any difference in GBS colonization or early GBS infection rates. However, evidence from developing countries shows that chlorhexadine vaginal wipes PLUS newborn wipes may reduce sepsis rates in general. Chlorhexidine might be better than nothing, but it cannot prevent the ascent of GBS in the amniotic fluid unless it is given before the birthing person's water breaks and repeated before its effect wears off. Unlike IV antibiotics, there is no evidence that chlorhexadine can stop GBS from growing in the fetus before birth.

Garlic

Garlic has antibacterial properties, and some websites recommend putting garlic in the vagina to eliminate GBS before the GBS test. However, there is very little evidence to back up this treatment. One group of researchers put garlic extract and GBS in a petri dish together (Cutler et al., 2009). They found that the garlic was able to kill the GBS within about 3 hours. However, this treatment has never been tested in a scientific study with humans. Also, it's important to understand that back in the 1970's when researchers tried using penicillin during pregnancy, they found that the antibacterials temporarily lower levels of GBS, but levels almost always go up again by the time someone goes into labor. So by temporarily using garlic, this could help you get a negative test result, but the effect may wear off very quickly.

In a letter to the editor in a medical journal, Cohain (2009) described treating 8 women with long-term GBS infections using a half clove of freshly cut garlic, inserted into the vagina at bedtime and removed in the morning for 3 to 6 weeks, with maintenance doses used every 2-4 days. However, none of these women were pregnant, and all of them had active infections.

Based on this one small case report we do not have any research evidence yet to inform this practice in pregnant people who are colonized with GBS– meaning we have little evidence about the potential benefits and harms. For example, it is possible that long-term garlic or chlorhexidine use could potentially or theoretically have unexpected effects like premature rupture of membranes or increase other bacteria– even GBS– due to destruction of good bacteria, like lactobacilli. Until researchers examine the potential benefits and harms, there are a lot of unknowns related to this treatment.

Vaccines
Vaccines for GBS are under development, but are not available yet at this time (World Health Organization, 2005; Heath 2016). There is a push for a GBS vaccine for several reasons: 1) in-labor antibiotics do not prevent GBS infection 100% of the time (Velaphi et al., 2003), 2) in-labor antibiotics can have side effects, 3) in-labor antibiotics do not prevent other GBS problems, such as preterm labor or late-onset GBS disease in newborns, and 4) developing countries have not been able to implement widespread use of antibiotics for GBS during labor.

Probiotics
Taking probiotics (lactobacilli) may lessen your chances of being colonized with GBS. In 2016, researchers published the first randomized trial on using probiotics to switch GBS status from positive to negative (Ho et al. 2016). In this study, researchers randomly assigned 110 women in Taiwan who were GBS positive at 35-37 weeks to take either two probiotic capsules each night at bedtime, or two placebo capsules. Both the pregnant women and the researchers were blinded to the treatment, meaning that nobody knew who was taking a placebo or probiotic while the study was being carried out. The treatment for each person lasted 3 weeks on average, and the GBS culture test was repeated when women returned to the hospital to give birth. The results showed that 43% of GBS positive people who took probiotics were GBS negative when they went into labor, compared to 14% in the placebo group. The researchers state that although more research is needed, probiotics show promise for GBS prevention during pregnancy and birth.

The results from the Ho et al. randomized trial are supported by several "in vitro" (petri dish based) studies. In these studies, researchers put vaginal lactobacilli (including a commercially available version) in a petri dish with different strains of GBS. They found that the lactobacilli strongly inhibited the growth of GBS by increasing the acidity of the environment (Acikgov, 2005— article in Turkish; Zarate, 2006).

In another small clinical trial, researchers randomly assigned healthy, fertile (but non-pregnant) women to wear panty liners that were saturated with probiotics, or to wear placebo panty liners. The results showed that it is possible to transfer probiotics to the vagina using panty liners. The researchers also found that people who had higher levels of lactobacilli in the vagina had lower levels of GBS (Rönnqvist PD, 2007).

There is one larger clinical trial going on right now in which researchers are studying the effects of probiotics on Group B Strep colonization in pregnant people. Hopefully this study will give us more information about the potential effects of probiotics on GBS in pregnancy. The study is scheduled to finish recruiting in 2019. Read more.

Colloidal silver
A few websites mention colloidal silver as a remedy for preventing GBS infection. Although silver has anti-bacterial properties, no known research studies have ever been conducted on taking colloidal silver to prevent a GBS infection—and no studies have ever looked at the safety of colloidal silver in pregnancy. The potential benefits and harms of this substance are unknown. In 1997, the FDA stated that colloidal silver is not safe or effective for any condition.

Can infants acquire a GBS infection from staff handling the newborn?
Researchers are quite certain that infants catch early GBS infections before they are born—most likely from GBS in the amniotic fluid. As mentioned earlier, almost all infants with early GBS infection show symptoms within an hour after birth. However, infants can catch "late" GBS infections from the hospital (nursery, hands of hospital staff and family members) or the community. This is one reason hand-washing is so important (Kliegman et al. 2011).

If I am GBS positive, and I don't get the IV antibiotics for some reason, what kind of tests will my baby need to have?
As long as your baby appears to be doing well and you did not have any additional risk factors (<37 weeks, infection of the uterus, water broken >18 hours), then there is no need for your baby to have any special testing. There are some situations where the CDC recommends that a well-appearing infant have some blood tests. The CDC also recommends 48 hours of "observation" for infants who are born to GBS positive mothers, but there is no need to separate mom and baby for this observation period. To see the CDC's flow-chart with more details about newborn testing and observation, click here.

What do national organizations have to say?
In the United States:
In 2010, the U.S. Centers for Disease Control and Prevention recommended universal screening for GBS at 35-37 weeks and in-labor antibiotics for all women who test positive.

These recommendations are supported by the:
- American Congress of Obstetricians and Gynecologists
- American Academy of Pediatrics
- American College of Nurse-Midwives
- American Academy of Family Physicians
- American Society for Microbiology

In the United Kingdom:
- The United Kingdom National Screening Committee states that pregnant people in the UK should not be screened for GBS. The UK follows the risk-based approach. This includes giving antibiotics in-labor to all women who have fever, prolonged rupture of membranes >18 hours, GBS in urine at any time during pregnancy, preterm labor, or a prior infant with GBS. This means that many people who are actually GBS negative receive antibiotics directed at GBS, just based on their risk factors. In the UK, the rate of early GBS infections is 0.5 per 1,000 births, which is higher than the rate of 0.2 per 1,000 births in the U.S.
- The Royal College of Obstetricians does not recommend routine screening for GBS during pregnancy. However, they do state that in-labor antibiotics could be considered if GBS was detected in passing or if women have any of the risk factors listed above. Many people are already receiving antibiotics for these reasons.
- There is controversy in the UK over the lack of access to GBS testing within the National Health Service. Group B Strep Support is a consumer-based charity that advocates for women to have access to GBS screening in the UK.

In Canada:
- The Society of Obstetricians and Gynaecologists of Canada (SOGC) recommends offering GBS screening to all pregnant people and treating those who are positive with IV antibiotics.
- The Association of Ontario Midwives recommends GBS screening and has a great article for midwives to use in helping women make an informed choice regarding the treatment strategy.

In New Zealand
In 2014, multiple professional organizations released a consensus statement recommending that the risk-based approach should continue to be used in New Zealand. They mention that this recommendation may need to be revised once rapid-screening becomes more available. The rate of early onset GBS disease in New Zealand is comparable to the U.S., with 0.26 cases per 1,000 births.

The bottom line

- In the U.S., screening and treating all GBS-positive people with antibiotics during labor has been associated with lower rates of early GBS infections in newborns than giving antibiotics based on risk factors alone.
- There are both potential benefits and potential harms related to screening for GBS and giving antibiotics– talk with your treating healthcare provider about the best course of action for you.
- Research has shown that IV antibiotics negatively effects the infant microbiome, but for most infants these effects seem to be temporary, and breastfeeding can help lessen the negative effects.
- Since two-thirds of remaining early GBS infections are now due to false negative GBS test results, in the future more hospitals may begin to use the rapid in-labor test for GBS. The rapid test may help reduce the number of people who receive unnecessary antibiotics.
- The first randomized trial on using probiotics to reduce GBS colonization in pregnant people had promising results, with 43% of GBS positive women becoming GBS negative by the time of birth
- We do not have evidence to show that topical chlorhexidine or garlic use can prevent early GBS infections, since GBS infection usually occurs when GBS gains access to the amniotic fluid and gets into the fetus' lungs during labor.

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