INPATIENT MANAGEMENT OF

Febrile Infants
1 to 90 days old

This care process model (CPM) was developed by Intermountain Healthcare's Pediatric Specialties and Intensive Medicine Clinical Programs, in collaboration with the University of Utah Department of Pediatrics. It recommends an evidence-based approach for assessing, monitoring, and treating infants 1 to 90 days old who are being admitted to the hospital with a rectal temperature of 38°C or higher. Note that a separate CPM for febrile infants in the emergency department complements this model and that a separate document defines care for neonatal sepsis (Neonatal Early Onset Sepsis Clinical Pathway for Level I and II Nurseries).

About this update

This update reaffirms all key points of the original 2008 model while adding clarification and new recommendations regarding viral testing.

KEY POINTS REAFFIRMED

- **Risk classification is crucial.** Our care shouldn't be the same for all infants with fever. Low-risk infants have approximately a 1.4% occurrence of serious bacterial infection (SBI), but high-risk infants have an occurrence of 21%.[1] Modified Rochester criteria for high risk, as determined by studies within Intermountain Healthcare,[2] are listed on page 3 of this model.
- **Lab tests (CBC and UA) are needed to classify infants as high or low risk for SBI.** CBC and urinalysis (obtained via cath urine specimen) are key in identifying high-risk infants. You cannot assess risk through examination alone. In a study of over 3,000 febrile infants, only 58% of those with bacteremia/bacterial meningitis appeared clinically ill.[3] CBC and UA can help staff decide whether to admit or discharge to home — and can help guide treatment and length of stay if the infant is admitted.
- **Viral testing helps to classify infants further, which can decrease hospital stays and unnecessary use of antibiotics.** Testing for respiratory viruses should be performed throughout the year. Although RSV and influenza peak during the winter (November to April), other viruses circulate year-round. Since the incidence of enterovirus (EV) in febrile infants is particularly high in the summer (up to 50% higher in August and October), enterovirus PCR testing is recommended from June through November as well as with any finding of CSF pleocytosis.[4,5]
- **If SBI test results are negative and viral status is confirmed, antibiotics can be stopped and most infants sent home.** After 24 hours you can use viral and other test results to shorten antibiotic treatment and length-of-stay for admitted infants and those with non-serious viral infection.[2,6] Minimum recommended discharge criteria are documented on page 3 of this CPM.

NEW IN THIS UPDATE: clarification, new recommendations regarding viral testing

See page 3 of this model for more discussion on the points summarized below:

- **Enterovirus PCR testing.** Note that we recommend testing seasonally (June through November) — and always with a finding of CSF pleocytosis.
- **RSV-positive PCR results.** Any infant age 29 to 90 days of age with a positive RSV result and temperature ≤38.5°C does not need additional testing and may be treated as low risk for SBI.
- **Rhinovirus-positive PCR results.** Intermountain data indicate that detection of rhinovirus alone is not significant in predicting a low risk for SBI.[7] Treat as viral negative.
- **Neonatal HSV signs.** Neonatal HSV is very rare, but very serious. We recommend testing and treating infants age 42 days and younger with vesicular skin lesions, seizure, or positive CSF results. Testing and treating may be indicated in infants with a septic appearance.

Why Focus ON FEVER IN YOUNG INFANTS?

Fever is a very common problem in young infants. While only 8% to 10% of babies will have serious bacterial infection (SBI), the consequences of a missed diagnosis are grave. Yet overtreating the 90% of infants who do not have SBI also poses risks.

What's needed is a consistent approach that effectively evaluates risk, treats infants appropriately, and stops antibiotic treatment as soon as possible. This model outlines such an approach.

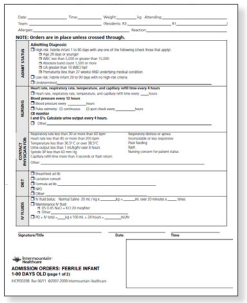
RESULTS

- **Pilot:** Early discharge based on the recommendations in this CPM was piloted on 100 infants at Primary Children's Medical Center and resulted in savings over $3,000 per admission and a 98% satisfaction rating from parents.[8]
- **System-wide implementation:** This model has helped ensure that febrile infants 1 to 90 days old consistently receive appropriate, evidence-based care at Intermountain hospitals. In the last 5 years and since system-wide implementation 3 years ago, we have seen these improvements (shown as a % of our cases):
  - Initial lab testing to determine risk status (increased from 57% to 87%)
  - Appropriate viral tests conducted (increased from 56% to 74%)
  - Discontinuation of antibiotics within 36 hours for inpatient febrile infants with negative cultures (increased from 38% to 60%)
  - Length of stay less than 42 hours with negative cultures (increased from 46% to 84%)

GOALS

- Ensure that appropriate labs are collected for infants 1 to 90 days old being admitted to the hospital with a fever.
- Minimize use of antibiotics and length of hospitalization for infants ruled out for SBI.
- Decrease inappropriate HSV testing and treatment.
- Improve treatment — using appropriate antibiotics — for infants with confirmed SBI.

ALGORITHM: INPATIENT CARE OF FEBRILE INFANTS 1–90 DAYS OLD



ADMIT patient to hospital
using Febrile Infant Admission Orders
(Form no. POD298)

Assess for HIGH RISK criteria, and classify as HIGH or LOW RISK if not already done **(a)**

Verify labs obtained prior to admit and obtain any missing labs **(b)**

Evaluate for neonatal HSV based on any signs/findings per **(c)**

Any HIGH RISK criteria or suspicion of HSV?

yes → **HIGH RISK**

Start Treatment

Start SBI treatment per Febrile Infant Admission Orders, including:
- Antibiotics
- IV fluids if indicated
- Tylenol PRN

IF SUSPECTED HSV, add acyclovir to the treatment recommended for SBI.

Verify bacterial and viral test results
See p. 3 discussion for important considerations re: results

Bacteria (+)
- TREAT for SBI
- Assess if current treatment is adequate (review sensitivities and antibiotic use) and adjust accordingly

- Plan for discharge
- Identify discharge criteria **(d)**
- Consider PICC placement

Bacteria (-)
Virus (+)
(but rhinovirus *excluded)*
- D/C antibiotics
- May meet discharge criteria **(e)** within 24 hours LOS

HSV (+)
- CONTINUE acyclovir
- CONTACT ID specialist

- Plan for discharge
- Identify discharge criteria **(d)**
- Consider PICC placement

Bacteria (-)
Viral (-)
(or rhinovirus *only +)*

Infant appears well
- D/C antibiotics
- May meet discharge criteria **(e)** within 36 hours LOS

no → **LOW RISK**

Start Treatment

Start SBI treatment per Febrile Infant Admission Orders, including:
- Antibiotics if indicated
- IV fluids if indicated
- Tylenol PRN

Verify bacterial and viral test results
See p. 3 discussion for important considerations re: results

Bacteria (+)
- TREAT for SBI
- Length of treatment varies based on site of infection and type of organism

- Plan for discharge
- Identify discharge criteria **(d)**
- Consider PICC placement

Bacteria (-)
Viral (+) or (-)
(respiratory/enterovirus)
- D/C antibiotics
- May meet discharge criteria **(e)** within 24 hours LOS

DISCUSSION

Laboratory studies

- **Samples for bacterial studies.** Samples for all planned bacterial studies should be gathered before any antibiotic treatment is begun. Collecting CSF or blood samples after antibiotics have been started may result in false negative results.
- **Viral studies: importance, conditions.** Viral studies can help determine risk for SBI; infants with a virus (other than rhinovirus) are less likely to have SBI. Enterovirus PCR on blood and CSF is recommended from June through November and with all findings of CSF pleocytosis.[4,5] Testing for respiratory viruses is recommended year-round.[2,6]
- **RSV-positive PCR results.** Follow these guidelines:
  - If the infant is 28 days or younger, we recommend testing at least blood and urine. The most common cause of SBI in this group is UTI with or without bacteremia.[9,10,11]
  - If the infant is 29 to 90 days old and the fever is ≤38.5°C, no additional lab testing is needed and the infant may be treated as low risk for SBI. (These infants have less than 2% risk of SBI.)[2,12]
  - At any age, if you intend to give antibiotics (for example, for pneumonia), then complete all testing: blood, urine, and CSF.
- **Rhinovirus-positive PCR results.** Although rhinovirus is the most frequently identified virus, Intermountain data indicate that detection of rhinovirus alone is not significant in predicting a low risk for SBI. Infants with only rhinovirus detected have the same risk of SBI as viral negative infants (approximately 12%).[7] Treat as a viral negative result; use clinical judgment for discharge planning.
- **Neonatal HSV: signs, testing, treatment.** Herpes simplex virus infection is less common than SBI, but it has devastating results. Initial signs of HSV infection can occur any time between birth and approximately 6 weeks of age.[13] Thus, we recommend testing for HSV in certain cases — see note (c) at right — and recommend treatment with acyclovir when testing is indicated.[14,15] *Note: when obtaining lesion and surface culture samples, use a new swab for each site to eliminate the possibility of spreading infection. (Swabs may be placed in same tube for a single, multi-site analysis.)*

Medication

Data from 1999 to 2005 from Primary Children's Medical Center and across Intermountain show that *E. coli* remains the most common cause of SBI in infants 1 to 90 days old.[16] Antibiotics selected for treating SBI should be active against both Gram-negative and Gram-positive causes of SBI, since ampicillin resistance occurs in at least 50% of cases. Acyclovir is the standard treatment for neonatal HSV; it should be discontinued if test results prove negative for HSV.

Note that in the table below, none of the recommended regimens is appropriate for treatment of *Staphylococcus aureus*; **if *S. aureus* is suspected, consider an alternative regimen with guidance from a pediatric infectious disease specialist.**

Diagnosis	1 to 28 days	29 to 90 days
Suspected **UTI** *(positive LE, nitrite, or bacteria; or WBC/hpf >10)* *OR* **no focus identified**	• Ampicillin (50 mg/kg/dose IV every 6 hours ***AND*** • Cefotaxime (50 mg/kg/dose IV every 6 hours)	• Ceftriaxone (100 mg/kg/dose IV every 24 hours) *Note: Ampicillin is preferred agent if Gram stain of urine shows Gram-positive cocci*
Suspected **bacterial meningitis*** *OR* **abnormal CSF**	• Ampicillin (75 mg/kg/dose IV every 6 hours) ***AND*** • Gentamicin (5 mg/kg/dose IV every 24 hours, trough less than 1) ***AND*** • Cefotaxime (75 mg/kg/dose IV every 6 hours)	• Ampicillin (75 mg/kg/dose IV every 6 hours) ***AND*** • Gentamicin (5 mg/kg/dose IV every 24 hours, trough less than 1) ***AND*** • Ceftriaxone (100 mg/kg/dose IV every 24 hours)
Suspected **HSV***	Acyclovir (20 mg/kg/dose IV every 8 hours)	

** Consult with pediatric infectious disease specialist*

(a) HIGH RISK for SBI Criteria:

Any ONE of the following:

- Age ≤28 days
- WBC <5,000 or >15,000
- Absolute band count ≥1,500
- Urine: any positive LE or nitrite; if microscopy any positive bacteria or >10 WBC/hpf
- Prematurity (<37 weeks) AND an underlying medical condition

(b) LABS

- UA dipstick: catheterized specimen
- Urine culture: catheterized specimen
- Complete blood count with manual differential
- Peripheral blood culture
- Respiratory virus testing (DFA or RVPCR). *Note: If RSV is positive and the infant is ≤28 days, test at least blood and urine. At any age, if you plan to give antibiotics, complete all testing: blood, urine, and CSF.*
- Enterovirus PCR (blood and CSF, sterile body fluids only): order June-November and with any finding of CSF pleocytosis.[4,5]

(c) Neonatal HSV EVALUATION

INITIAL EVALUATION is based on signs:

- **Age 42 days or younger:**
  - **TEST AND TREAT** if infant exhibits **vesicular skin lesions, abnormal CSF,** or **seizures.**
  - **CONSIDER TESTING AND TREATING** if infant exhibits **septic appearance**.
- **Older infants:** primary neonatal HSV is rare in infants older than 42 days. Infectious disease team consult may be indicated.

TESTING for HSV:

- Order blood PCR, CSF PCR, culture/PCR of skin lesions, culture/PCR of surface sites (mouth and throat, eyes, umbilicus, perirectal).
- With HSV testing, consider infant "High Risk"— begin treatment per Admission Orders.

(d) Minimum DISCHARGE CRITERIA

For **UTI** and **BACTEREMIA:**

- Able to eat
- Afebrile
- Home antibiotics arranged
- Follow-up arranged
- For bacteremia only: follow-up blood culture is negative

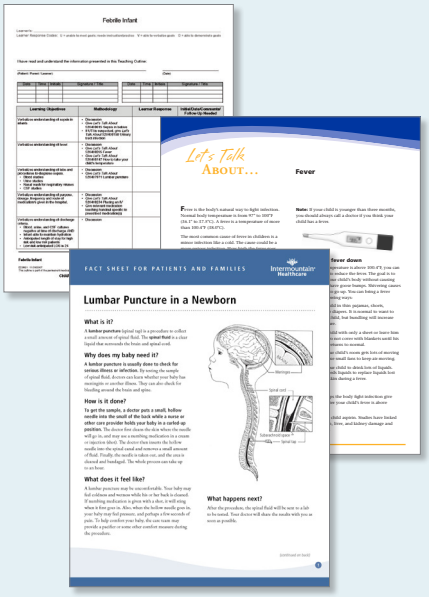
For **BACTERIAL MENINGITIS** and **HSV:**

- Consult with infectious disease specialist

(e) Minimum DISCHARGE CRITERIA[17,18]

For **SBI RULED OUT:**

- Able to eat
- Follow-up arranged



RESOURCES

Patient and provider tools relating to care of the febrile infant are available on the Clinical Programs website at: **intermountain.net/clinicalprograms**. Select the "Febrile Infant" topic page to access the following tools:

- This CPM
- A related CPM for Emergency Department assessment
- Febrile Infant Admission Orders
- Patient education

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CAREGIVER EDUCATION

Caregiver education is a critical part of discharge planning. Education for caregivers of febrile infants should include the following topics:

- How to give prescribed medication
- How to take their baby's temperature
- Signs of dehydration
- Steps to take to reduce fever and prevent the spread of infection
- The importance of returning for follow-up appointments

The following tools are available to guide this education. These tools are available on intermountain.net/clinicalprograms on the "Febrile Infant" topic page.

- Febrile Infant Teaching Outline
- Fact sheet and "Let's Talk About…" handouts, in English and Spanish:
  - Lumbar Puncture in a Newborn
  - Fever
  - Urinary tract infection
  - Sepsis in babies
  - How to take your child's temperature
  - How to give medicine
  - Placing an IV

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This CPM is based on best evidence at the time of publication. It is not meant to be a prescription for every patient. Clinical judgment based on each patient's unique situation remains vital. We welcome your feedback; contact Carolyn.Reynolds@imail.org