

Fever

Ilene Claudius

Fever

10.5%-25% of PED visits

Fever: 100.4F = 38C little

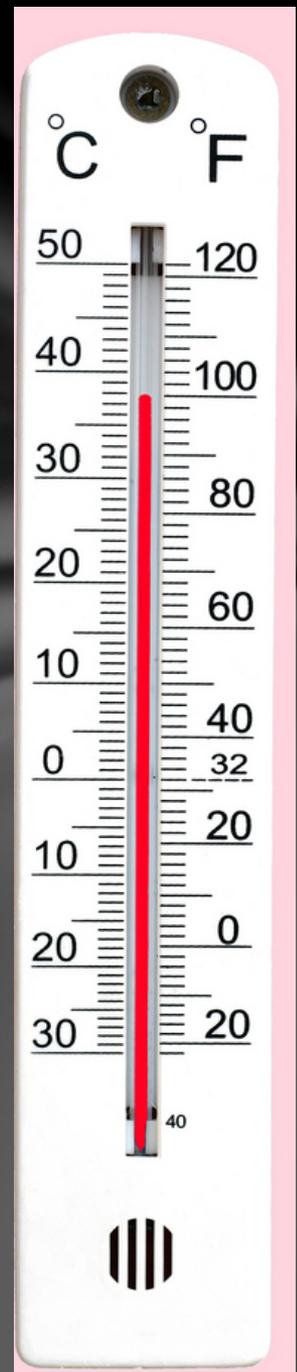
101.3 = 38.5 big

Most studies use 39C over 3 months

Hypothermia

SBI: meningitis, bacteremia, UTI +/-
bacterial enteritis

Pneumonia, STTI, viral syndromes



The neonate <28 days

SBI rate ~12-20%

3-7% bacteremia

~1% meningitis

UTIs

40% febrile neonates test positive
for a virus

Half of infants <90 days with IBI do
NOT look ill

“High-risk” patients SBI rate 26-
31%

“Low-risk” patients SBI rate 3.5-6%

Pathogens

- E Coli #1
- GBS
- Staph Aureus
- S Pneumo
 - 3% 1 week to 3 mo
 - Increases with increasing age toward 90 days
 - Vaccinations/ herd immunity don't help as much
- Klebsiella, Salmonella
- HSV <0.3%

What's done

All surveyed PED guidelines recommend:
blood, urine, CSF, antibiotics, admission

In reality:

Urine 75.6-80.7%

Blood 76.9-81.8%

CSF 71-77.5%

Hospitalization 75.4-81.6%

Antibiotics

Ampicillin for GBS, enterococcus, Listeria

Aminoglycoside or 3rd generation cephalosporin (care with ceftriaxone)

Consider acyclovir

1% neonates with CSF pleocytosis

History, AST, signs, ill

Untreated 70% mortality

20 mg/kg

1-2 months

SBI risk ~6-10%

Bacteremia ~2%

1.2-2% if well-appearing

10-11% if ill-appearing

UTI 8%

2.9% of UTIs in this age group have bacteremia regardless of fever

SBI Risk Stratification: Rochester (0-60d)

Well appearing infant

No skeletal, soft tissue, skin or ear infections

Full term birth

No prior illness

- No prior hospitalizations
- Not hospitalized longer than mother after delivery
- No prior antibiotics
- No hyperbilirubinemia
- No chronic or underlying illness

CBC normal

- WBC normal (5000 to 15,000/mm³)
- Bands < 1,500/mm³

If diarrhea, fecal leuks <5 WBC/hpf

Urine WBCs <10 WBC/hpf

- Sensitivity ~93%
- Specificity 26.3%

No adverse outcomes in mis-classified children

SBI Risk Stratification: Philadelphia (1-2m)

Well appearing infant
Reassuring examination

Labs

WBC $<15,000/\text{mm}^3$

B:N ratio <0.2

UA <10 WBC/hpf

Urine neg gram stain

CSF <8 WBC/ mm^3 and neg gram stain

CXR no infiltrate (if obtained)

If diarrhea: No blood, few to no leuks

- Sensitivity ~93-97%
- Specificity 26-42%

No adverse outcomes in mis-classified children

Step by Step

Exclusion: Clear source, no fever documented in ED or at home

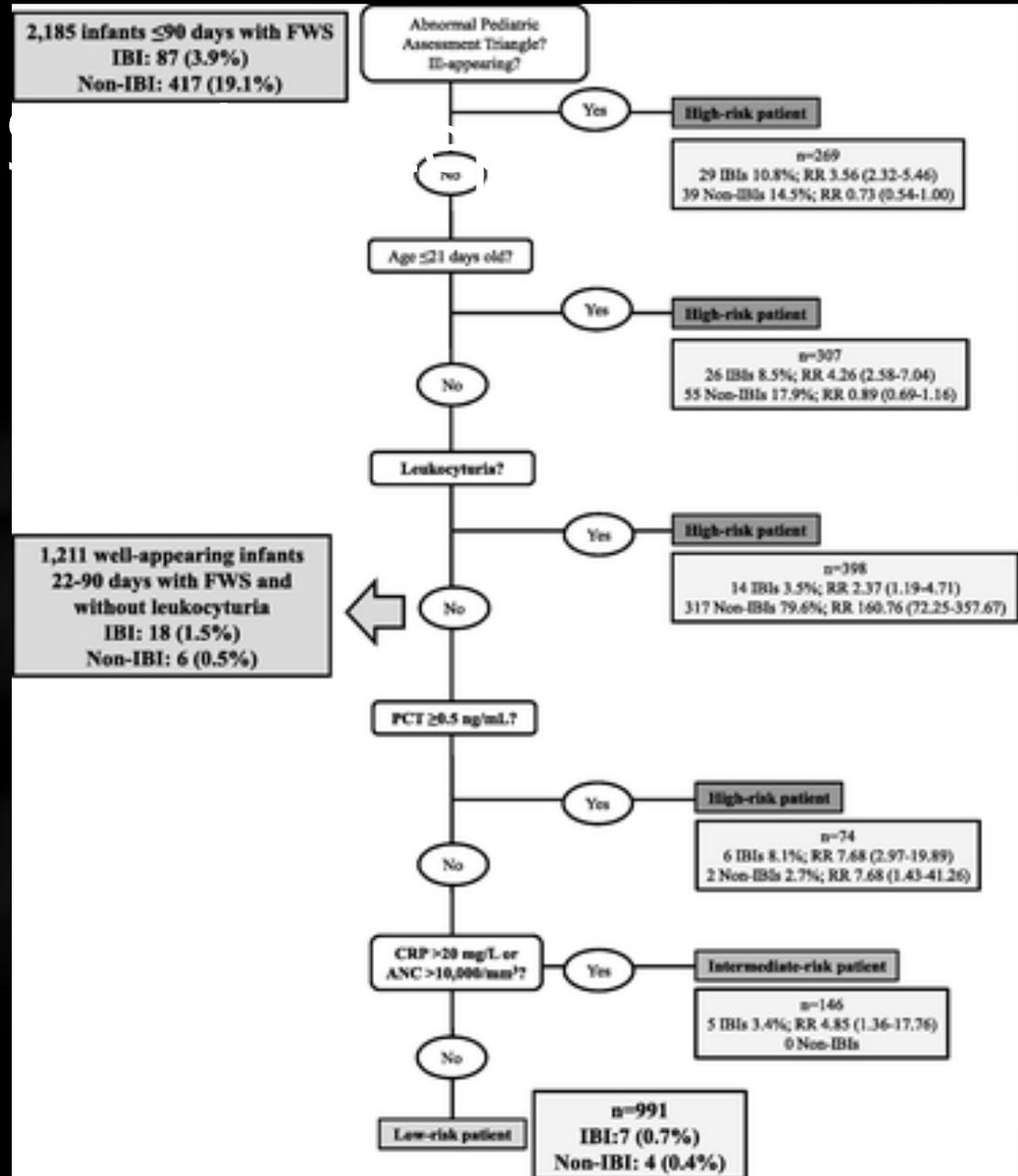
Low risk: Well-appearing, age >21d, No urine LE, Procalcitonin* <0.5ng/mL, ANC <10,000/mm³, CRP <20mg/L
*PCT takes 2-4hr to rise

Sensitivity 92%

Miss rate:

- 11/1000 with SBI (7 with IBI)
- 4 were 22-28 days
- 6 had fever < 2hr

Consider applying >28 days, observing fever <2-4hr duration



PECARN (JAMA Peds, 2/2019)

Infants < 60 days

Fever >38C measured in health care setting or within 24 hours at home

Rule

- Healthy
- Negative UA
- ANC ≤ 4090 / mL (4000)
- PCT ≤ 1.71 ng/ mL (0.5)

SBI: UTI, bacteremia, meningitis

w/u at provider discretion; phone f/u if no cultures

PECARN (JAMA Peds, 2/2019)

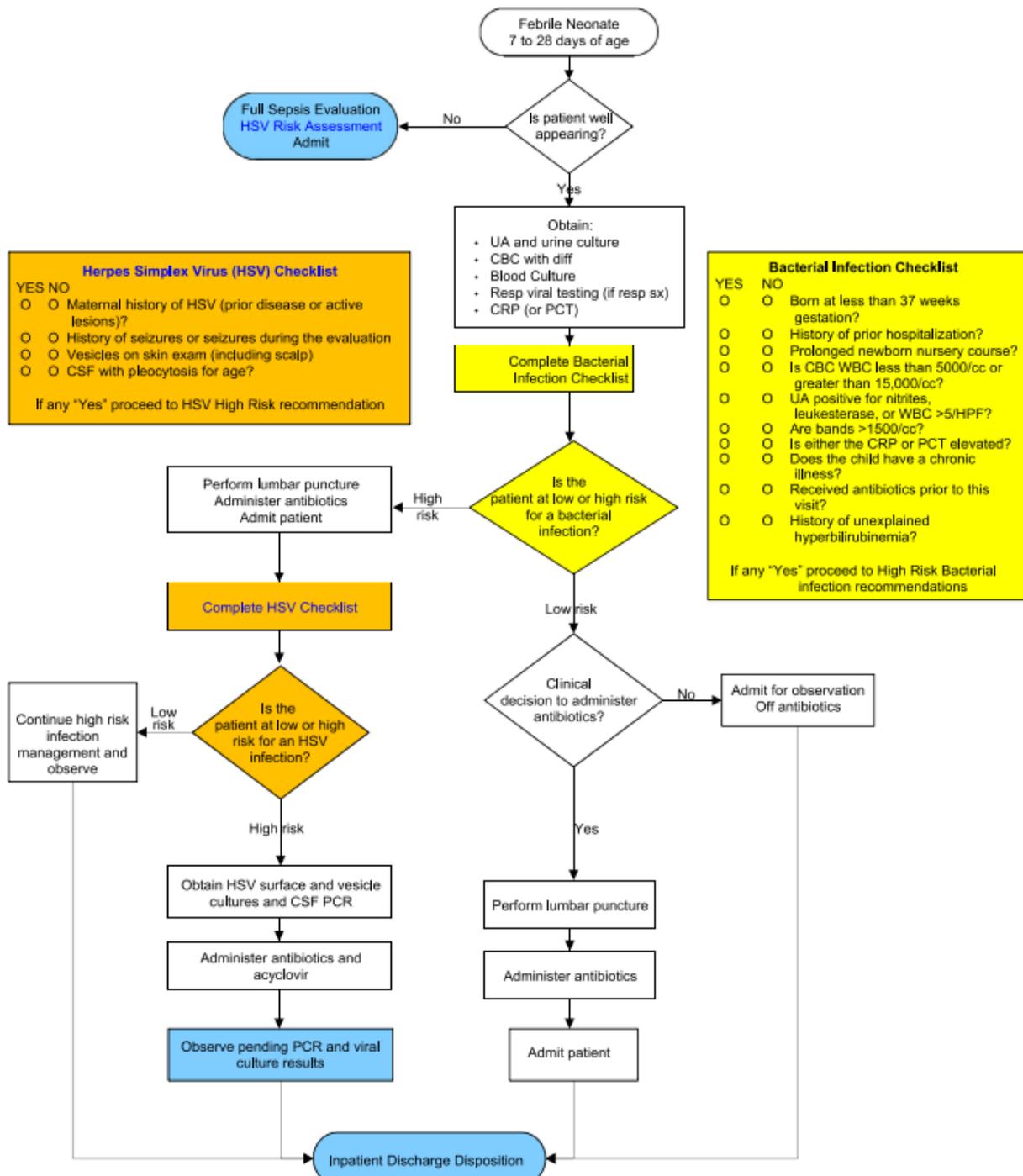
Prospectively derived on 908 infants;
validated on 913

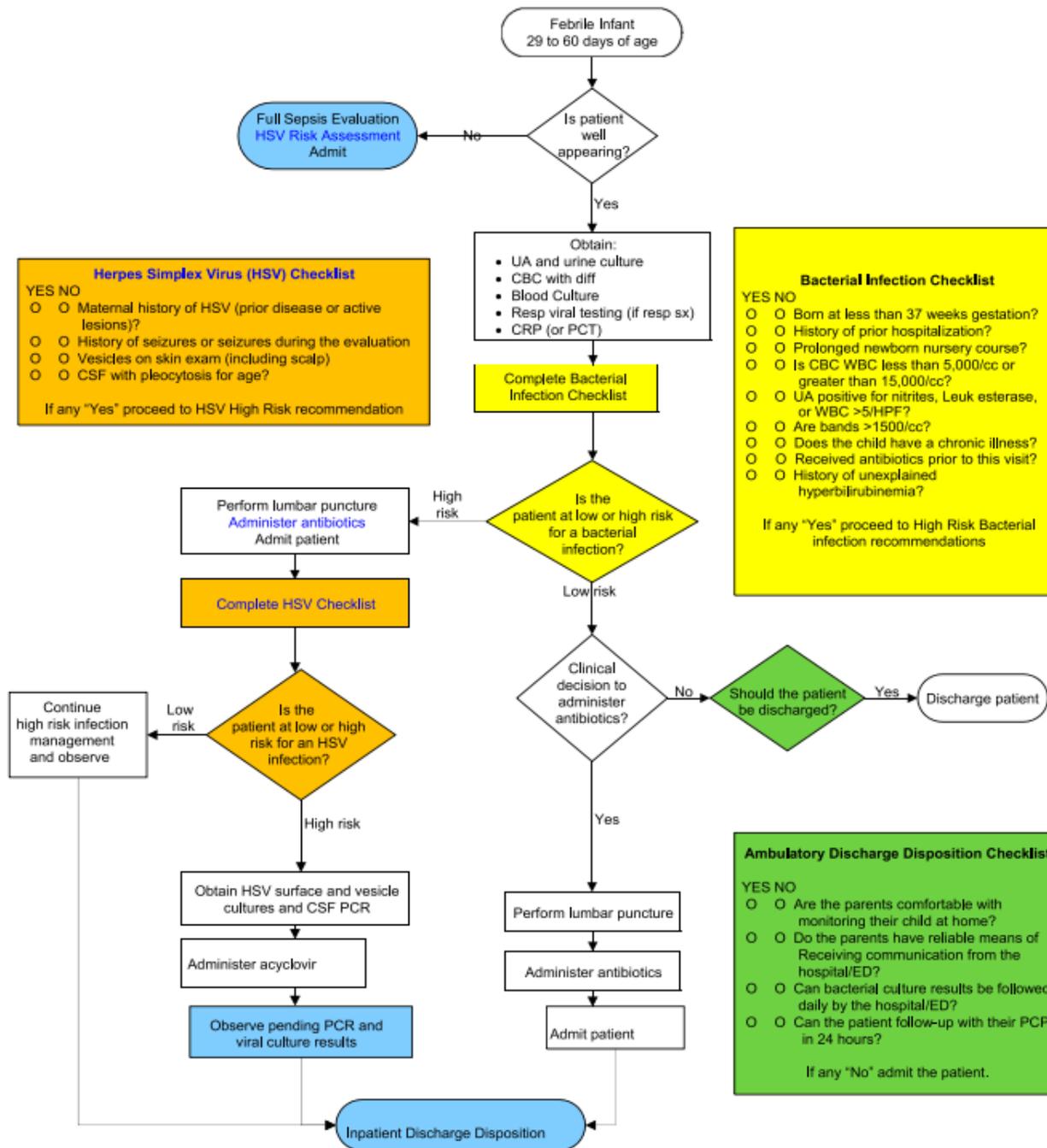
SBI rate 9.3% (1.4% bacteremia, 0.5% meningitis)

Sensitivity 97.7%, Specificity 96.7% for IBI

They missed 1 bacteremia and 2 UTIs

Height of fever also assoc with SBI (OR 1.5)





Revise Study, 2019

- MOC exercise
- Goal: decrease admission, LOS, and testing
- No difference in delayed diagnosis (0.9% vs 0.8%)
- No difference in missed diagnoses

Risk with Bronchiolitis

29-60 days RSV – SBI rate: 10-11.7%

29-60 days RSV + SBI rate 3.2-5.5%

- Mostly UTI
- Few bacterial enteritis

Pneumonia NOT counted in SBI, but rate for < 60 days was 5.7%

Clinical RSV SBI rate comparable to test +
Test + for ~ 14 days

-Levine, Yarden-Bilvesky

Association of Diagnostic Criteria With UTI Prevalence in Bronchiolitis: A Systematic Review and Meta-analysis

- 18 studies
- Ucx+ prevalence with bronchiolitis = 3.1%
- Prevalence of UTI was 0.8% (95% CI, 0.3%-1.4%) if defined UTI as:
 - +UA results (defined as the presence of pyuria or nitrites) *and*
 - +Culture
- Sensitivity analyses yielded similar results, including for infants younger than 90 days

Infants with Other Viral Pathogens

Influenza

- SBI rate 2.5-2.7% in under 2-3 mo with flu+ testing
- No IBI

Rhinovirus

- Prolonged shedding
- IBI rates in >28 days with rhino: 4% → 1.4%

PECARN:

- 3.7% virus positive had SBI vs 12.7% of virus negative
 - Bacteremia: 0.8% vs 1.4%
 - Meningitis: 0.4% vs 0.8%

Infants ≤ 90 days without virus 3X more likely to have SBI

2-3 months

PIDJ 2019

SBI <60 days was 18.5%

SBI 60-90d 16.6%

IBI <60d 2.3%

IBI 60-90d 1.1%

1% if well-appearing

Suggest urine and blood in 2-3 mo infants
with fever

Bacteremia risk at 3-36 months

- Pre-vaccine, FWS OB rate 2.4-11.6%
- 8/10 infants protected from IPD
- Now, risk of bacteremia <1%
- Occult bacteremia represents ~20% of all bacteremia
 - Risk of OB 0.05-0.36%
- Unvaccinated kids benefit from herd immunity
 - If 80% vaccinated, OB rate <0.5%
 - S. Pneumo and salmonella often resolve spontaneously
- 63-88% of positive blood cx are false positives

Pathogens

- S. Pneumo
- Strep pyogenes
- Enterococcus
- N meningitides
- Non-type H flu
- E Coli
- Moraxella
- Salmonella (6.5% with AGE → bacteremia in <1y)
- Staph aureus
- Brucella

UTI rates & UTI risks (AAP 2011)

3-12 mo

- Girls: 8.3%
- Boys 1.7%
- Note all come from uncircumcised male <3m UTI 20.1%

12-24 mo

- Girls: 2.1%

<i>Girls</i>	<i>Boys</i>
<i>White race</i>	<i>Non-black race</i>
<i>Age < 12 months</i>	<i>T > 39C</i>
<i>T > 39C</i>	<i>Fever > 24 hours</i>
<i>Fever > 2 days</i>	<i>Absence of other source</i>
<i>Absence of other source</i>	

Do I need a cath specimen?

No, but....

- The PPV of a positive bag specimen is 85%
- Consider repeating if positive
- Negative bag specimen is acceptable
- UA and culture suggested
 - But no cultures from bag specimens

Temperature readings

Oral and rectal temperature correlate well

Pacifier and rectal correlate well (0.772-0.913)

Infrared tympanic thermometer tends to underestimate slightly (sensitivity 87.3%)

Axillary differs from rectal 0.19-0.6C

- Adding 1 degree comes from 1 study from 1962 and 1 with 20 kids aged 1-6 months
- Difference inconsistent

History of documented fever

Neonates <28 days

- History of fever 8.4% SBI rate
- Fever at presentation 18% SBI rate

In PROS study, 27% of infants <3m with IBI had fever in the office

17% of infants with IBI had a history of fever at home but not in the ED

<3 mo: Prevalence of SBI and IBI was similar for infants febrile in the ED and for infants afebrile in ED with a reported fever at home (2 studies)

Subjective Fever

2017 meta-analysis of parental recognition of fever

- Sensitivity 87.5%
- Specificity 54.6%
- AOC 0.82

92% infants with documented, rectal temperature at home were febrile in the subsequent 48 hours

46% of infants with tactile fever at home had fevers in the subsequent 48 hours

1/26 infants with tactile fever + afebrile in the ED had a SBI (UTI)

Ramgopal, Pediatrics 2019

- For neonates with history of fever but afebrile at presentation
 - Odds of SBI if no subsequent fever: 0.42
 - Odds of SBI if no fever on presentation, but developed fever: 1.93
 - Mean time to develop fever 5.6 hours

Question: Can I stop at 1 infection?

Infants <60 days

9% of infections had multiple sites

- 52% bacteremia associated with a UTI
- 10% UTI associated with bacteremia

-Greenhow, 2014

Meningitis + UTI controversial

- 0.25% in 2019 J Peds meta-analysis 29-80d
- 0.8% ABM in one study + case of HSV
 - 0.9-1.2% <29 days
 - 0.2% 29-60 days