

# **You-TI and Antibiotic Stewardship *Chances (With Challenges)***

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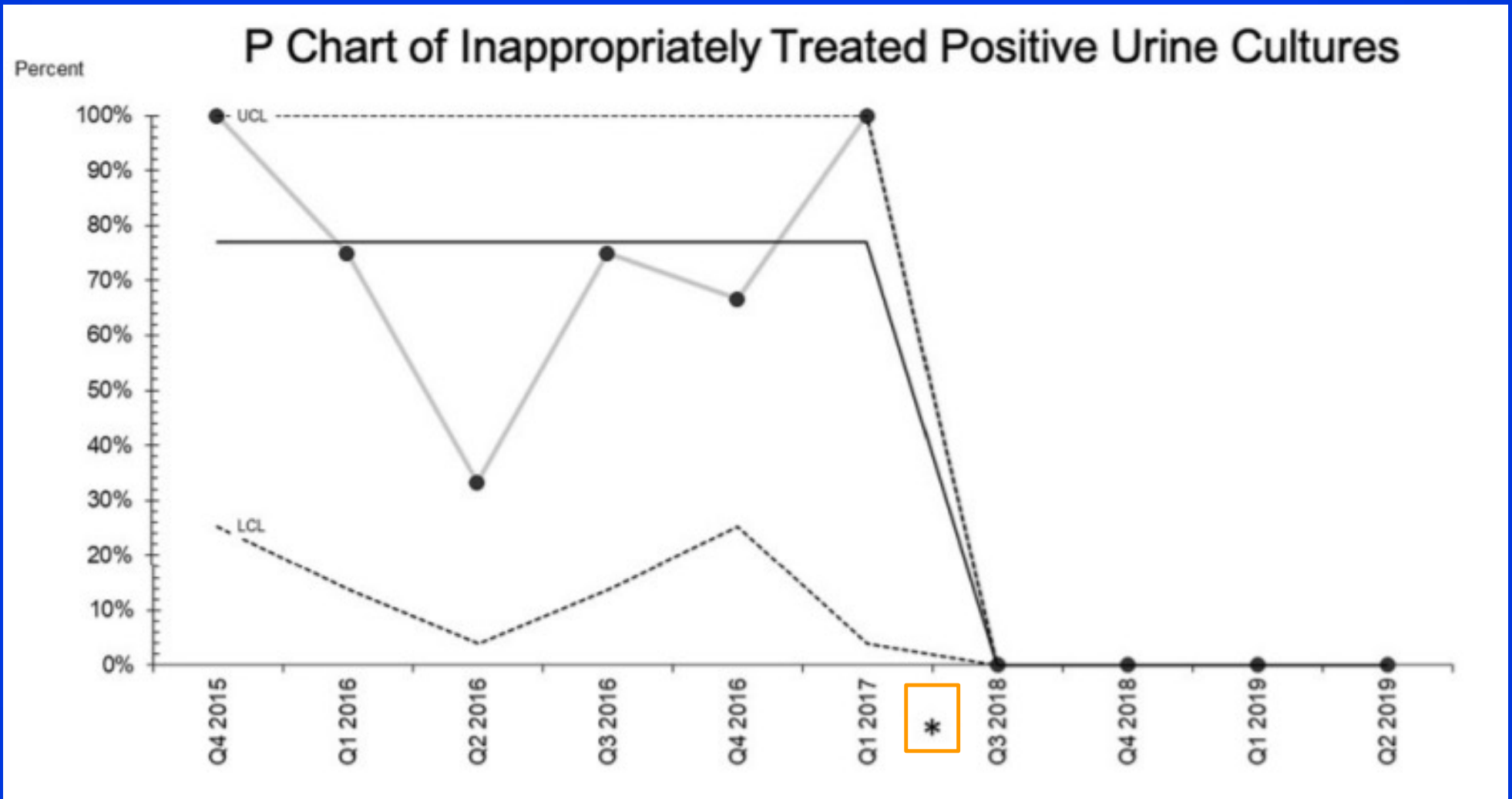
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# Stewardship Opportunities



- ◆ Minimize overdiagnosis
- ◆ Process urine correctly
  - ◆ In fridge and/or <2 hrs to lab or use preservative
- ◆ Judicious treatment & duration
- ◆ Limit antimicrobial prophylaxis
- ◆ D/C catheters ASAP

# One Published QI Study on UTI in the NICU



# UTI Risk Factors/Associations

- Gestational age
  - GU abnormality
  - Indwelling catheters - *actionable*
  - Length of stay
  - ? Maternal UTI
- 
- Circumcision - *protective*

# Etiology

- ◆ *E. coli* (13-28%, *higher in term babies*)
- ◆ *K. pneumoniae* (11-44%)
- ◆ Other GNR (21-27%)
- ◆ Enterococci (8-17%)
- ◆ GBS (2-4%)
- ◆ *S. aureus* (1-3%)
- ◆ CoNS (13-23%, *freq misclassification*)
- ◆ Candida (6-15%, *esp ELBW*s)

# Common Contaminants

- ◆ Lactobacillus sp.
- ◆ Corynebacterium sp.
- ◆ Coagulase-negative staphylococci
- ◆ Alpha-hemolytic streptococci (viridans)

# UTI & Concomitant Bacteremia/Meningitis?

- ◆ 9-13% w/ bacteremia
  - ◆ GPC or candida predictive, but not BW
- ◆ 1-3% w/ meningitis

>1000 UTIs from  
Pediatrix NICUs

Proportion of UTIs concordant with blood and CSF cultures

Organism	Blood	CSF
Gram-positive cocci	52/318(16%)	2/24 (8%)
CoNS	30/146 (21%)	1/9 (11%)
<i>Enterococcus</i>	10/128 (8%)	0/10(0%)
Group B <i>Streptococcus</i>	6/24 (25%)	1/2 (50%)
<i>Staphylococcus aureus</i>	5/12 (42%)	0/2 (0%)
Gram-negative rods	34/478 (7%)	0/34 (0%)
<i>Escherichia coli</i>	10/173 (6%)	0/13 (0%)
<i>Enterobacter</i>	12/108 (11%)	0/8 (0%)
<i>Klebsiella</i>	4/92 (4%)	0/5 (0%)
<i>Serratia</i>	3/35 (9%)	0/2 (0%)
<i>Pseudomonas</i>	2/27 (7%)	0/4 (0%)
<i>Proteus</i>	2/13 (15%)	0/0
<i>Candida</i>	41/147 (28%)	0/19 (0%)

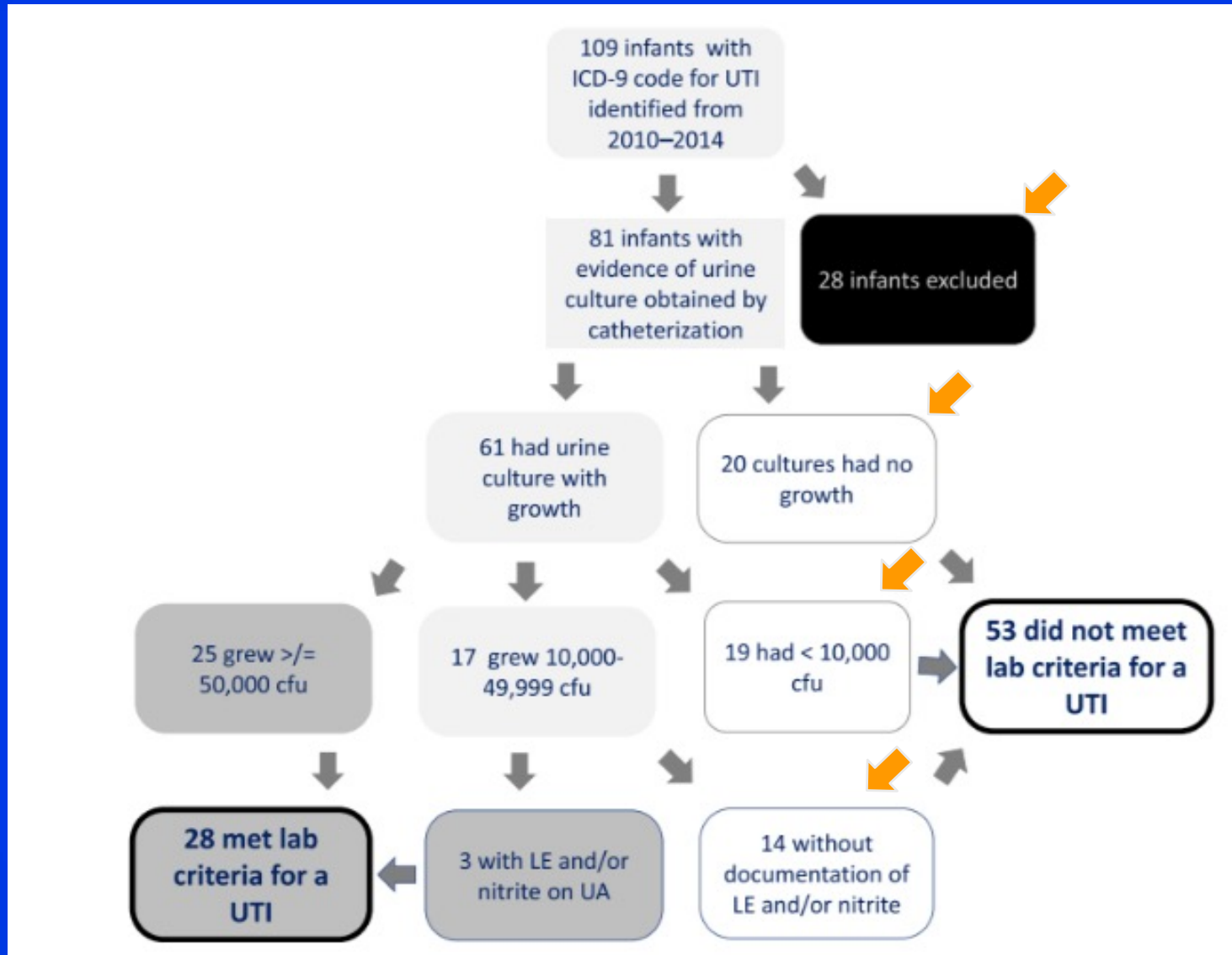
# Neonatal UTI Long-term Followup

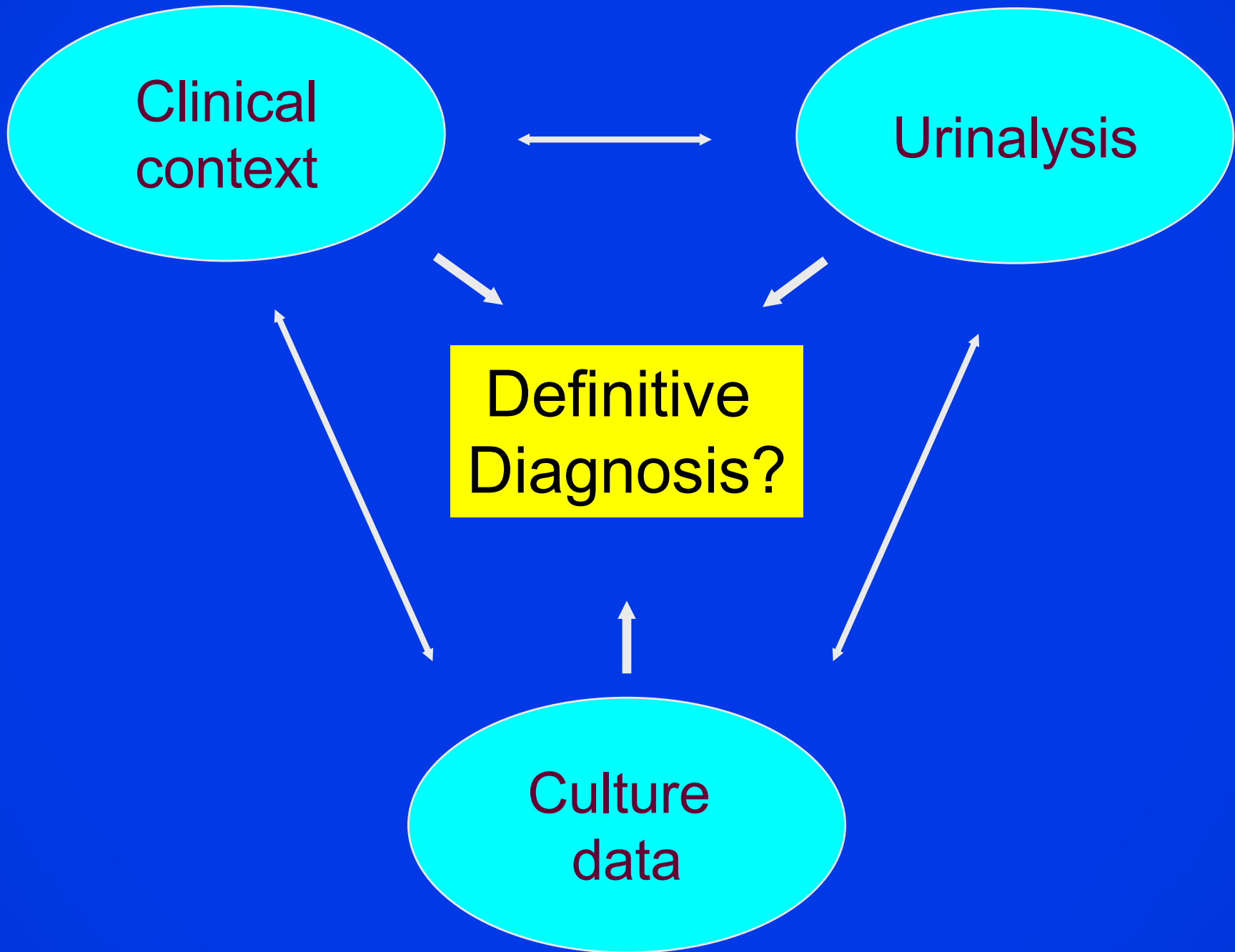
- ◆ 82 <34 GA Israeli babies
  - ◆ No recurrences (but 28% w/o F/U)
  - ◆ 18/59 with in-person eval 11-22 yrs later:
    - ◆ No/NL renal U/S abnormalities, eGFR, prot/album excretion, prot-Cr ratio, serum Cr
    - ◆ 4 with HTN (3 overweight)
- ◆ 18 Swedish babies: reduction in parenchymal thickness resolved by 17 yo



**A Step Back...**

# Is the Diagnosis Correct?





# Urinalysis Interpretation in the NICU

- ◆ **Leukocyte esterase**
  - ◆ False (+): gastroenteritis, urinary stones
  - ◆ False (-): neutropenia
- ◆ **Nitrite**
  - ◆ False (-): <4 hrs old, GPC bug

# A Bit About Pyuria

- ◆ Definition
  - ◆ Centrifuged ( $\geq 5/\text{hpf}$ )
  - ◆ Uncentrifuged w/ hemocytometer ( $\geq 10/\text{mm}^3$ )
- ◆ False (-) is reasonably common
  - ◆ Adenovirus, enterovirus, HIV
  - ◆ Indwelling catheter
  - ◆ Renal stones
  - ◆ RTA & interstitial nephritis
  - ◆ NSAIDs
  - ◆ Congenital TB

# Urinalysis Interpretation

Negative urinalysis (alone) does not R/O UTI in a neonate

# Urine Collection for Culture

- ◆ SPA v catheterization:
  - ◆ More urine
  - ◆ Less contamination
  - ◆ Possibly more painful

Dump the first bit from cath specimen

# Culture Interpretation

Source	Colony Count (cfu/ml)	UTI?	Comments
Cath or SPA	>50K	Yes	If symptomatic, cultures that grow 2 urine pathogens at >50K are consistent with a UTI.
Cath or SPA	10-50K	Suspected, esp w/ pyuria	
Cath	1-10K	Negative	
SPA	1-10K	Possible	Consider clinical context



This is no consensus on the diagnostic criteria for neonatal UTI so we have to be extra careful

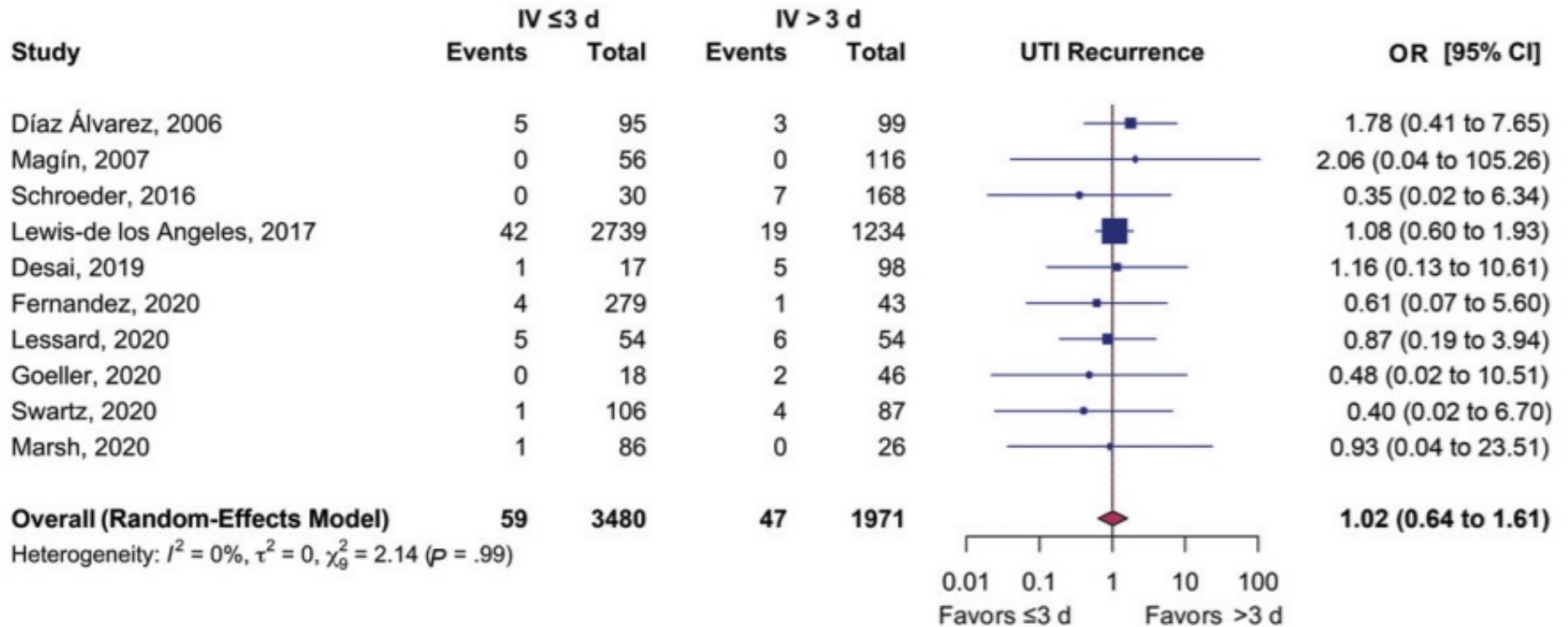
# UTI Treatment

System	Condition	Common Pathogens	Empiric Antibiotic Therapy	Antibiotic Duration
Neonatal Fever ( <u>Term Neonates</u> )	Suspected UTI	<i>E coli</i> <i>Enterococcus</i> species GBS	Ampicillin PLUS Gentamicin	These are empiric recommendations; specific choice and duration of antibiotic therapy should be guided by culture results

# UTI Treatment

- ◆ “Prelim GNR”, call the lab for best guess
  - ◆ “fat” v “long thin”?
  - ◆ Avoid anti-pseudomonals
- ◆ Deescalate “R/O sepsis” regimen ASAP
- ◆  $\geq 7$ d duration, change to PO if NL LP
- ◆ No “test of cure” unless clinical failure

# IV UTI Tx Duration & Recurrence <2m Olds



No diff with 0-1m v 1-2m or +/- bacteremia  
No prospective data, no stratification by GA

# Should Concomitant Bacteremia Change IV Duration?

- ◆ Probably not...
  - ◆ Clinical and lab findings generally similar
  - ◆ No association between IV duration and relapse in children <2m
  - ◆ Fewer data for preemies

# Antimicrobial Prophylaxis?

Scenario	Prophylactic Antibiotics?
Urinary tract dilation <i>in utero</i>	Possibly, if high grade
1 <sup>st</sup> UTI	No
2 <sup>nd</sup> UTI	Discuss with ID
Indwelling catheter in place	No

# Prophylaxis & *in utero* Urinary Tract Dilation?

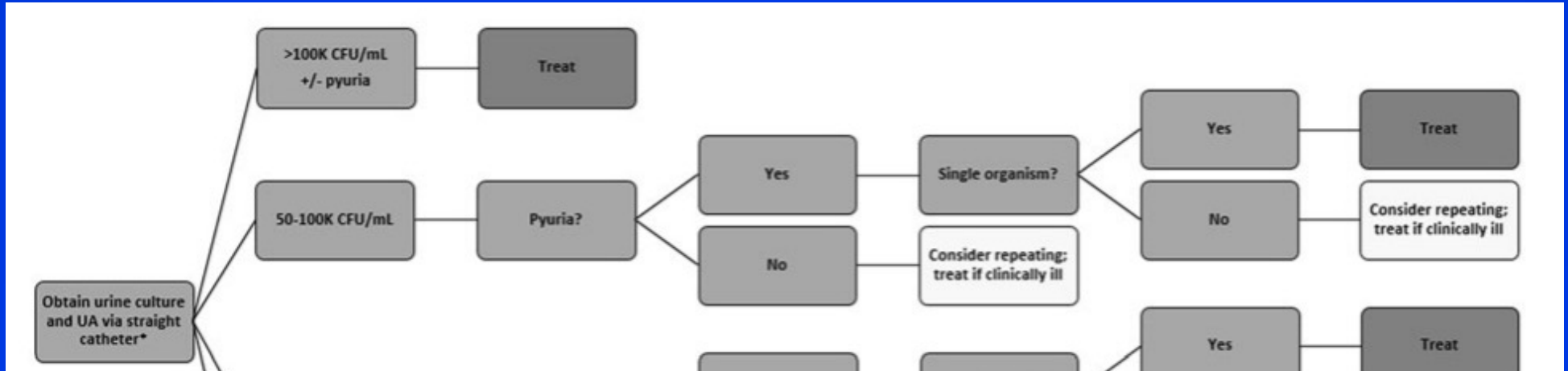
- ◆ Most resolve spontaneously
- ◆ ~50% of clinicians don't even if high level
- ◆ In first month, incidence = to gen pop (~0.1%)
- ◆ Get U/S within 2-4 weeks (Soc Fetal Urol)

TABLE 3. Common Medications Used for CAP

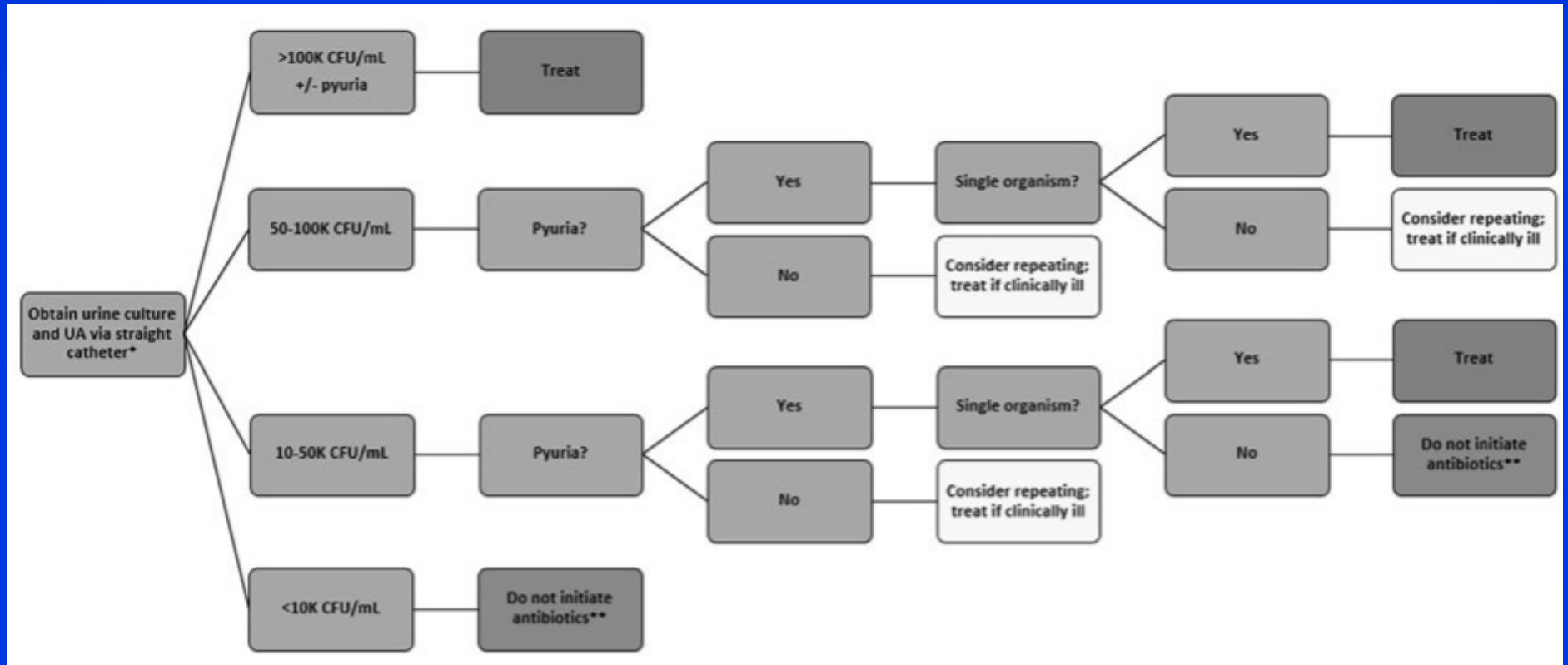
MEDICATION	TREATMENT DOSE	CAP DOSE	FDA-APPROVED INDICATIONS	COMMON ADVERSE EFFECTS
Amoxicillin	25–45 mg/kg per day PO divided into 2 doses	15–20 mg/kg daily	Any age, UTI treatment	Cutaneous/allergic reactions, gastrointestinal disturbances
Cephalexin	25–50 mg/kg per day PO divided into 2–4 doses	25 mg/kg daily or divided into 1–2 doses	Any age, UTI treatment	Cutaneous/allergic reactions, gastrointestinal disturbances
Nitrofurantoin	5–7 mg/kg daily divided into 4 doses	1–2 mg/kg daily	>1 month age, UTI treatment or prophylaxis	Hemolytic anemia, gastrointestinal disturbances, interstitial pneumonitis, cutaneous/allergic reactions
TMP	8–10 mg/kg TMP daily divided into 2 doses	2 mg/kg TMP daily	>12 years age, UTI treatment or prophylaxis	Cutaneous/allergic reactions, hematologic toxicity
TMP-sulfamethoxazole	8–10 mg/kg TMP daily divided into 2 doses	2 mg/kg TMP daily	>2 months age, UTI treatment or prophylaxis	Cutaneous/allergic reactions, hematologic toxicity, hepatotoxicity (kernicterus)



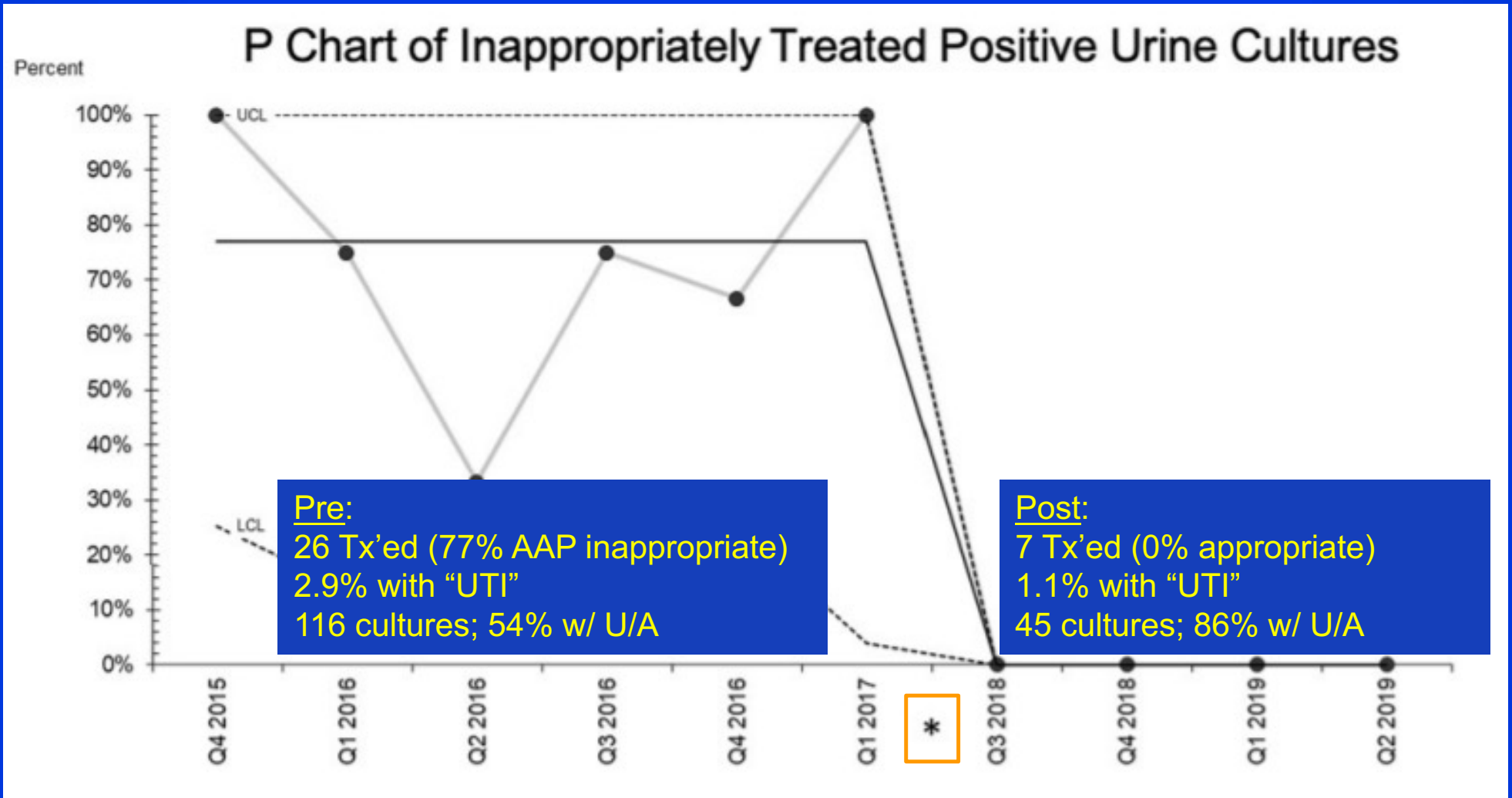
# U Wisconsin NICU ASP QI/PDSA



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# U Wisconsin NICU ASP QI/PDSA



No increase in subsequent SBI, more resp support, NEC, death

# Stewardship Opportunities



- ◆ Minimize overdiagnosis of UTI
  - ◆ **Seriously consider other diagnoses**
- ◆ Process urine correctly
- ◆ Judicious UTI treatment/duration
  - ◆ Consider a guideline (thanks UCI)
  - ◆ 7d fine, not >10d
  - ◆ PO OK if tolerable
- ◆ Limit antimicrobial prophylaxis:
  - ◆ *In utero* urinary tract dilation? – **Possibly**
  - ◆ After any neonatal UTI? - **No**
  - ◆ After recurrent UTI? - **Possibly**
- ◆ Indwelling catheter
  - ◆ **Pyuria not sufficient to Dx CAUTI**

**Thank you**

**AAP Red Book Committee  
is developing an ASP guideline  
for the NICU!**

# Should I Do Imaging?

	Renal/bladder Ultrasound	
1 <sup>st</sup> UTI	All patients	
2 <sup>nd</sup> UTI	All patients	

Ultrasound a poor predictor of VUR  
30-50% may have abnormalities, <10% severe

# Should I Do Imaging?

	Renal/bladder Ultrasound	VCUG
1 <sup>st</sup> UTI	All patients	If RBUS is abnormal or if severe illness (eg, prolonged instability, AKI, gross hematuria, etc.)
2 <sup>nd</sup> UTI	All patients	All patients

**Ultrasound a poor predictor of VUR  
30-50% may have abnormalities, <10% severe**

# VCUG Results in Those With UTI

Birthweight	Abnl VCU (%)
<1000g	8-16
1000-1500g	10-23
>1500g	18
<1500g	7-16
All birthweights	4-14

**If VUR, nearly all  
Grade I-II; <5% with  $\geq$  Gr III**



# UTI Prevalence

Gestational Age/Birthweight	Percent with UTI
≤28 wks	8-13
28-33 wks	3-23
>33 wks	1.1
Term	0.1-1

<1% in first few days...