Urinary Tract Infections: Improving Clinical Management and Outcomes

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Learning Objectives:

- Review the burden of UTIs in dollars, time and health outcomes
- Discuss available diagnostic technologies to detect UTIs
- Describe the correlation between rising antibiotic resistance and inappropriate antibiotic treatments
- Identify opportunities to improve clinical management of UTI to improve patient care and outcomes

Outline:

- UTI Epidemiology and Pathogenesis
- Diagnosis and Antibiotic Treatment
- Overview of Laboratory Diagnosis of UTI
- Laser Scatter Technology for detection of UTI
- Considerations for Implementation of Laser Scatter Technology
- Cost savings and Potential Impact on Patient Management

Urinary Tract Infection (UTI) Epidemiology.

- One of the most common infections. ~10.5 million office visits, 2-3 million ER visits and 100,000 hospitalization/ year
- Economic burden exceeds $3.5 billion/year
- One in every three women experience at least one episode of UTI in their lifetime
- One of the most leading cause of nosocomial infection (35.0-40.0%)

UTI Classification

Lower (Cystitis), Upper (Pyelonephritis)

Complicated, Uncomplicated

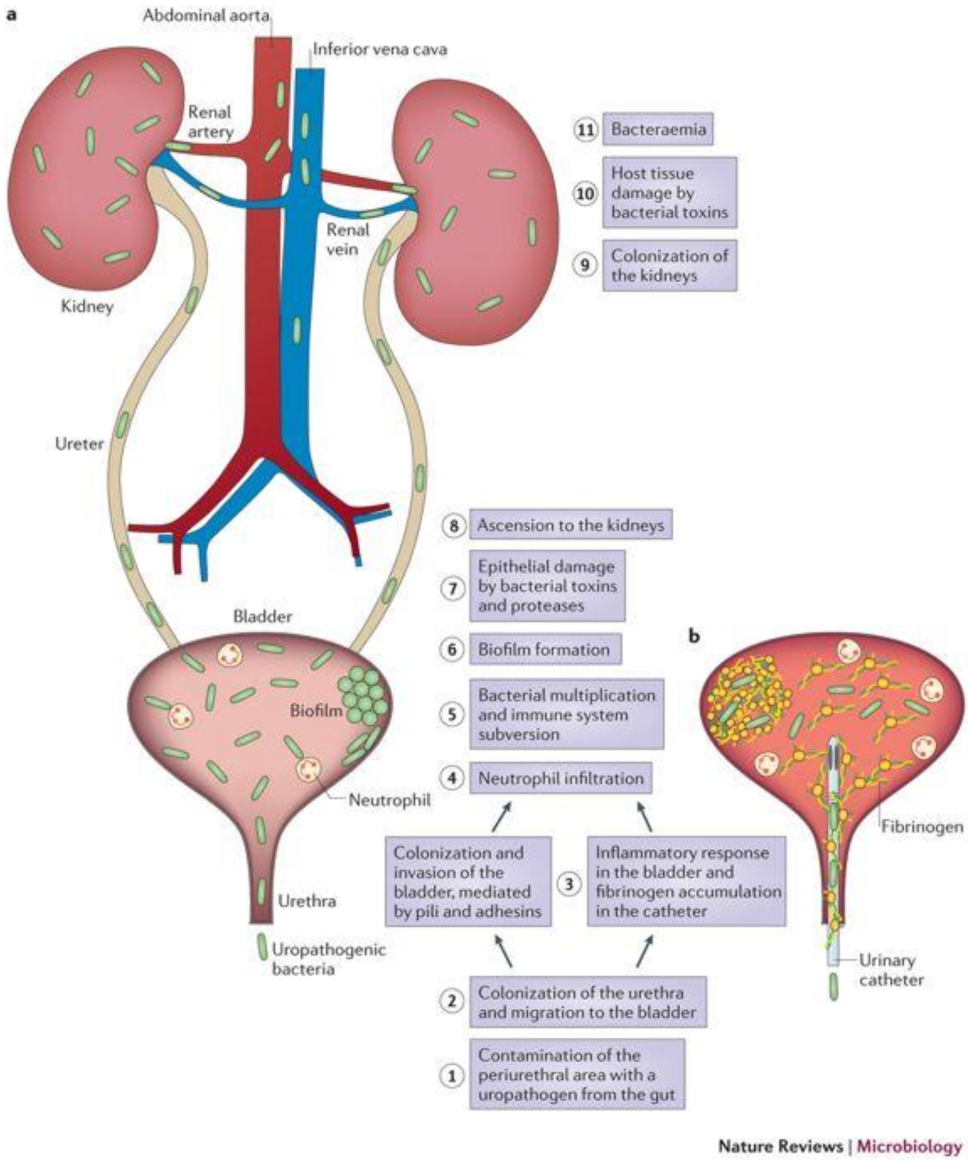
Risk factors:

- Infants, Pregnant women, Elderly, Spinal cord injury and/or with catheters
- Diabetics, Multiple sclerosis and HIV

Flores Mireles, A et al. Nat Rev Micro, 2015

La Rocco MT, Clin Micro Rev, 2016
Schappert et al, Vital Health Stat, 2011

Pathogenesis of Urinary Tract Infection



Flores Mireles, A et al. Nat Rev Micro, 2015

UTI- Impact on Health Care

VERY HIGH TEST VOLUME

MAJORITY OF SPECIMENS ARE NEGATIVE

INEFFICIENT AND COSTLY 2-4 DAY DIAGNOSTIC PROCESS

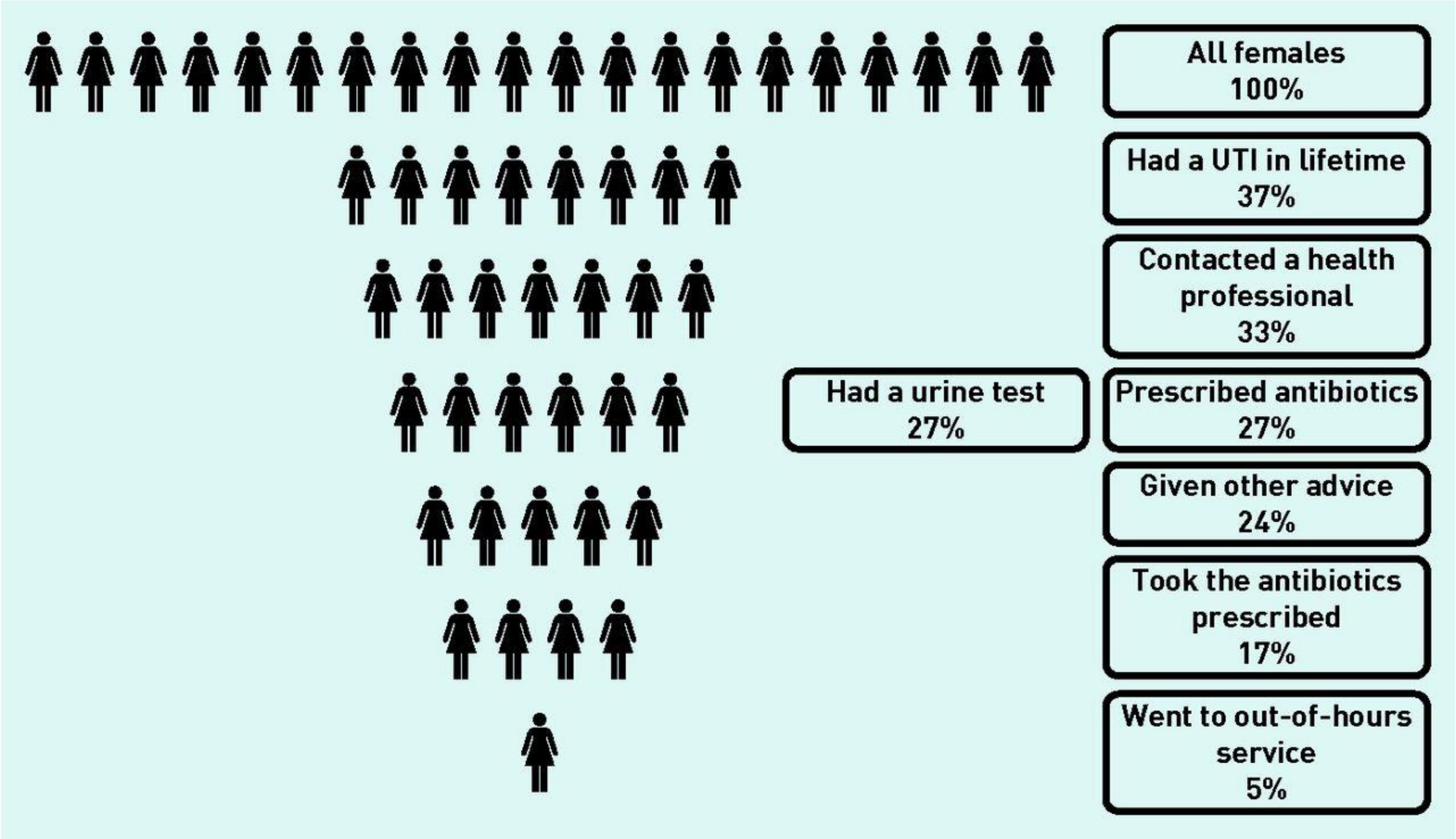
UP TO 50% RESISTANCE TO EMPIRIC ANTIBIOTICS

21% READMISSION RATE & 4.1 DAYS OF LOS

52% INCREASE IN UTI HOSPITALIZATIONS AT A COST OF $2.8B

Clin Mic News, 36(12) 87 – 93, J of Clin Mic, 49(3), 1025–102, Clin Infect Dis, 41 Suppl 2:S113–9, MDxI 2017 Data, O F Infect Dis, 4(1), ofw281

Uncomplicated UTI: Health care visits and Management (N = 2424).



Chris C Butler et al. Br J Gen Pract 2015

Diagnosis of Urinary Tract Infection

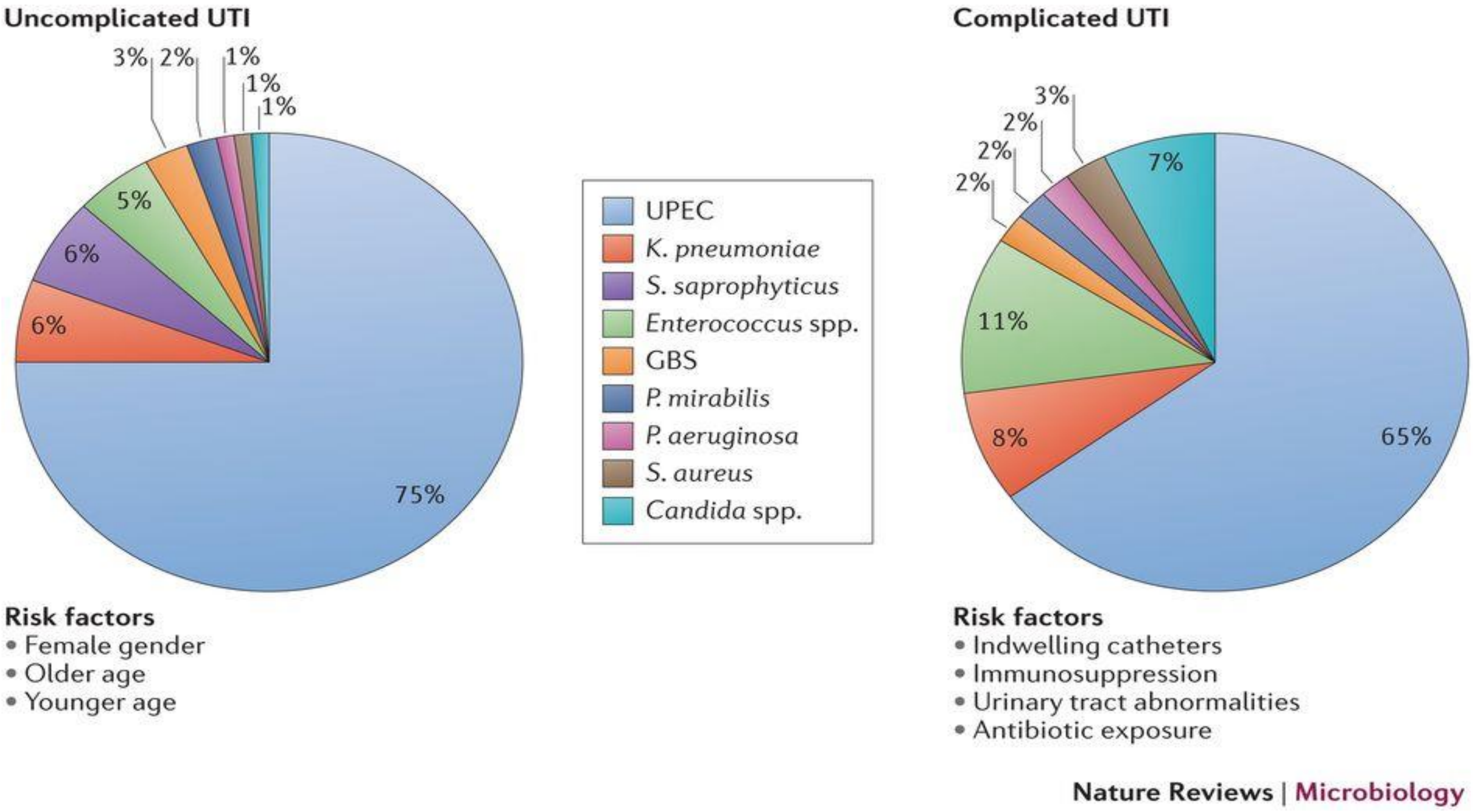
Clinical diagnosis of UTI is challenging:

- Large number of infections occur each year, especially in busy ED or out-patient settings
- Difficult to distinguish between from other disease that have similar presentation
- Asymptomatic bacteriuria - over testing and treatment
- Neutropenic patients requires different diagnostic criteria

Initial laboratory diagnosis of UTI:

- Most common urine test is dipstick/urinalysis- Indirect evidence for UTI, Lacks sensitivity
- Bacterial culture is ‘gold standard’ but time consuming (24-48 hours)

Wilson ML et al. Clin Infec Dis 2004



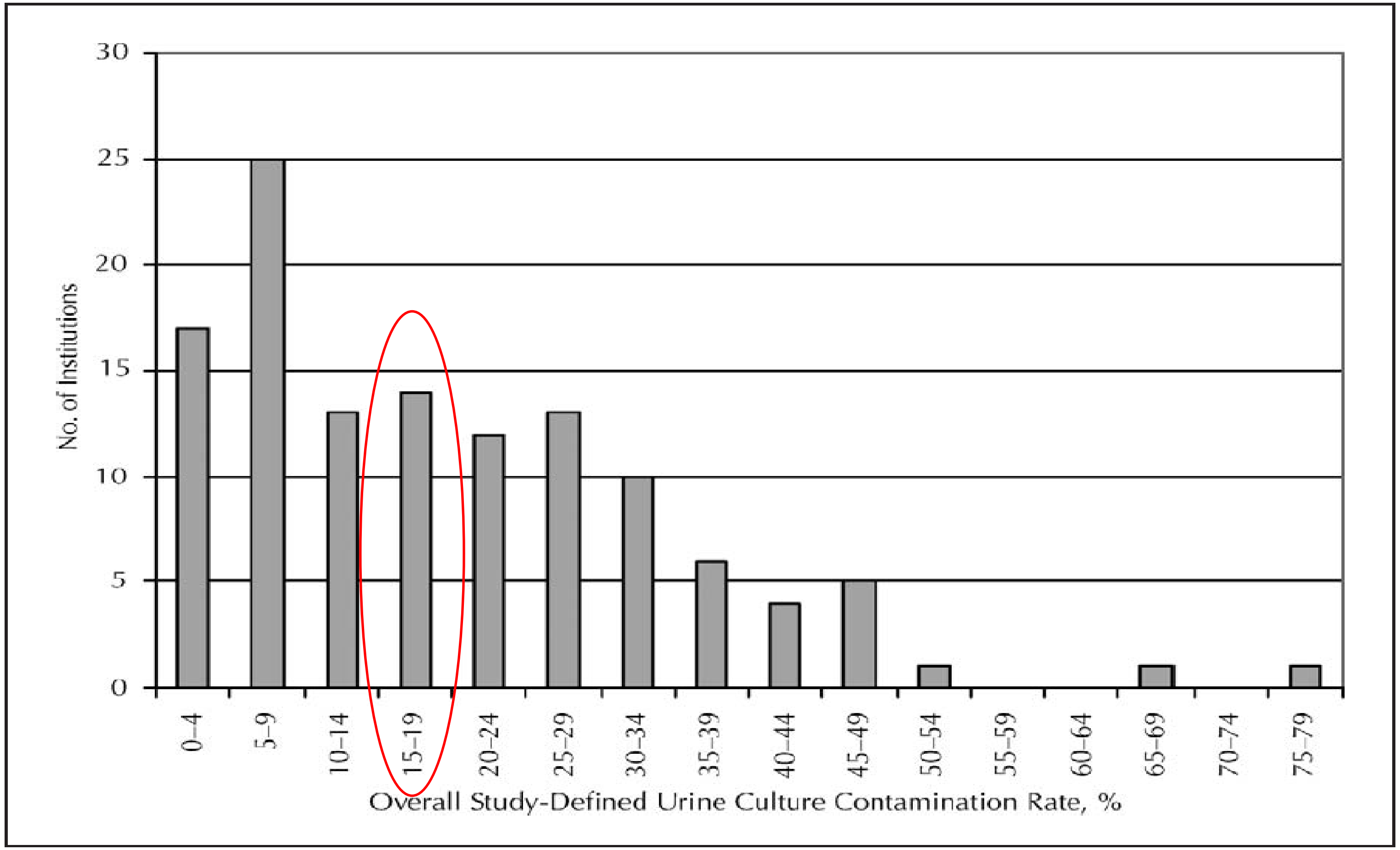
Flores Mireles, A et al. Nat Rev Micro, 2015

Rate of Urine Culture Contamination

Type of Study: Laboratory Survey

Number of Labs: 127

Year: 2005



Bekeris LG et al, Arch Pathol Lab Med, 2008

Overuse of Antibiotics

- Variable performance of Urine dipstick and Urinalysis tests
- Slow turnaround time of Culture - Gold Standard
- Lack of prompt follow-up of negative culture results
- Improper selection, Overuse of broad spectrum antibiotics and poor adherence

Overtreatment of Presumed Urinary Tract Infection in Older Women

Study Type: Retrospective chart review

Settings: Emergency Department, Women >70 years

Total enrollment: 153

Characteristics	All, n=153	UTI confirmed, n=87 (57%)	UTI not confirmed, n=66 (43%)
Age, mean	83	84	81
Pos UA, n(%)	148 (97)	85 (98)	63 (95)
Bacteriuria, n(%)	123 (80)	77 (89)	46 (70)
Pyuria, n(%)	132 (86)	76 (87)	56 (85)
Pos Cx, n (%)	87 (57)	87 (100)	0 (0)
Antibiotics	145 (95)	82 (94)	63 (95)

Catheterization yielded a lower proportion of false-positive UA (31%) than clean catch (48%)

Gordon et al. J Am Geriatr Soc, 2013

Urinary Tract Infection and Antibiotic Use

TABLE 1. Results of Urine Tests Performed on 175 Patients Who Were Diagnosed With UTI in the ED

	Age, mo			
	<2	**2–24**	**>24**	**Total**
No. patients	2	22	151	175
Urine collection method*				
Catheterization	2 (100%)	22 (100%)	11 (7%)	35 (20%)
Clean catch	0	0	138 (91%)	138 (79%)
First-pass void†	0	0	1 (0.7%)	1 (0.6%)
Undocumented method	0	0	1 (0.7%)	1 (0.6%)
Urinalysis results				
Pyuria (LE positive and/or >5 WBC/HPF)	2 (100%)	22 (100%)	140 (93%)	164 (94%)
Urine dipstick				
No. patients	2	22	150	174
LE (+), nitrite (+)	0	10 (45%)	37 (25%)	47 (27%)
LE (+), nitrite (−)	1 (50%)	12 (55%)	102 (68%)	115 (66%)
LE (−), nitrite (+)	0	0	9 (6%)	9 (5%)
LE (−), nitrite (−)	1 (50%)	0	2 (1%)	3 (2%)
Microscopy				
No. patients	1	5	43	49
>5 WBC/HPF	1 (100%)	5 (100%)	38 (88%)	44 (90%)
Urine culture results*				
≥50,000 CFU/mL of single/predominant uropathogen‡	1 (50%)	19 (86%)	77 (51%)	97 (55%)
≥50,000 CFU/mL of nonuropathogen or mixed pathogens	0	0	4 (3%)	4 (2%)
10,000–49,000 CFU/mL of any organism(s) except mixed flora§	0	0	11 (7%)	11 (6%)
<10,000 CFU/mL of any organism(s) except mixed flora	0	0	12 (8%)	12 (7%)
Mixed flora only	0	0	13 (9%)	13 (7%)
Sterile	1 (50%)	3 (14%)	34 (23%)	38 (22%)
UTI final result				
Confirmed¶	1 (50%)	19 (86%)	70 (46%)	90 (51%)
Not confirmed	1 (50%)	3 (14%)	81 (54%)	85 (49%)

Overuse of Antibiotics in Primary Care Pediatrics

Figure 1. Flowchart demonstrating the process of selection of outpatient case.

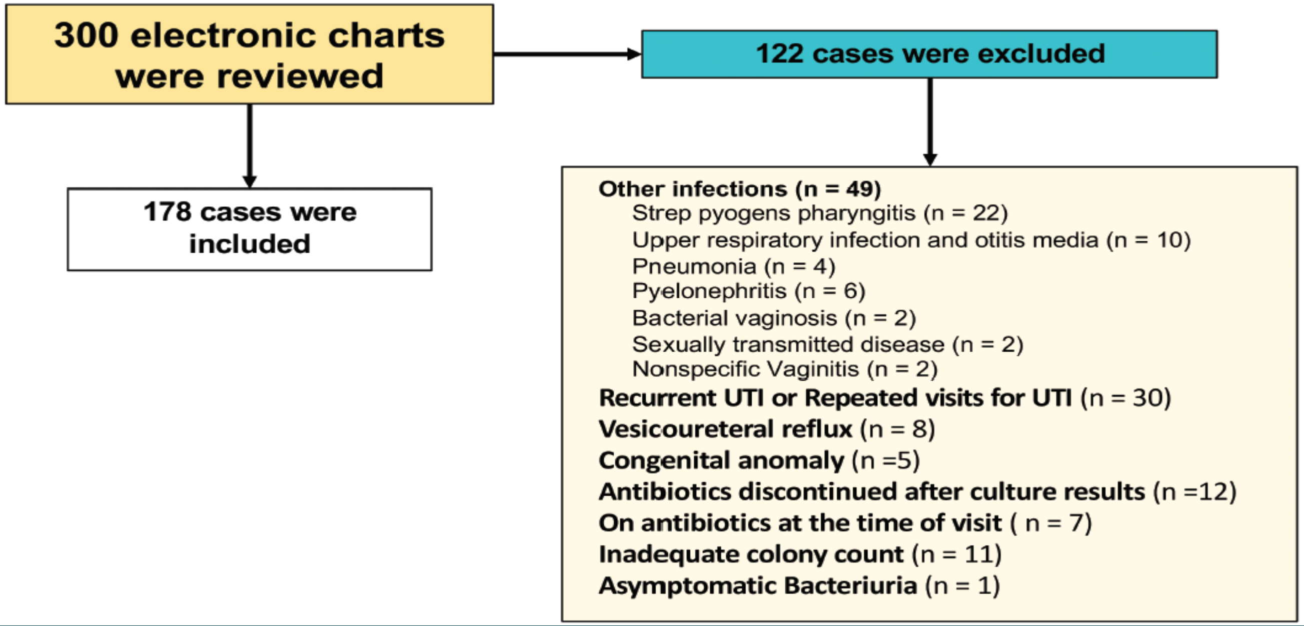


Table 2. Days of Antibiotics Prescribed for All Included Patients ($\chi^2 = 2.30$, $p = 0.129$)

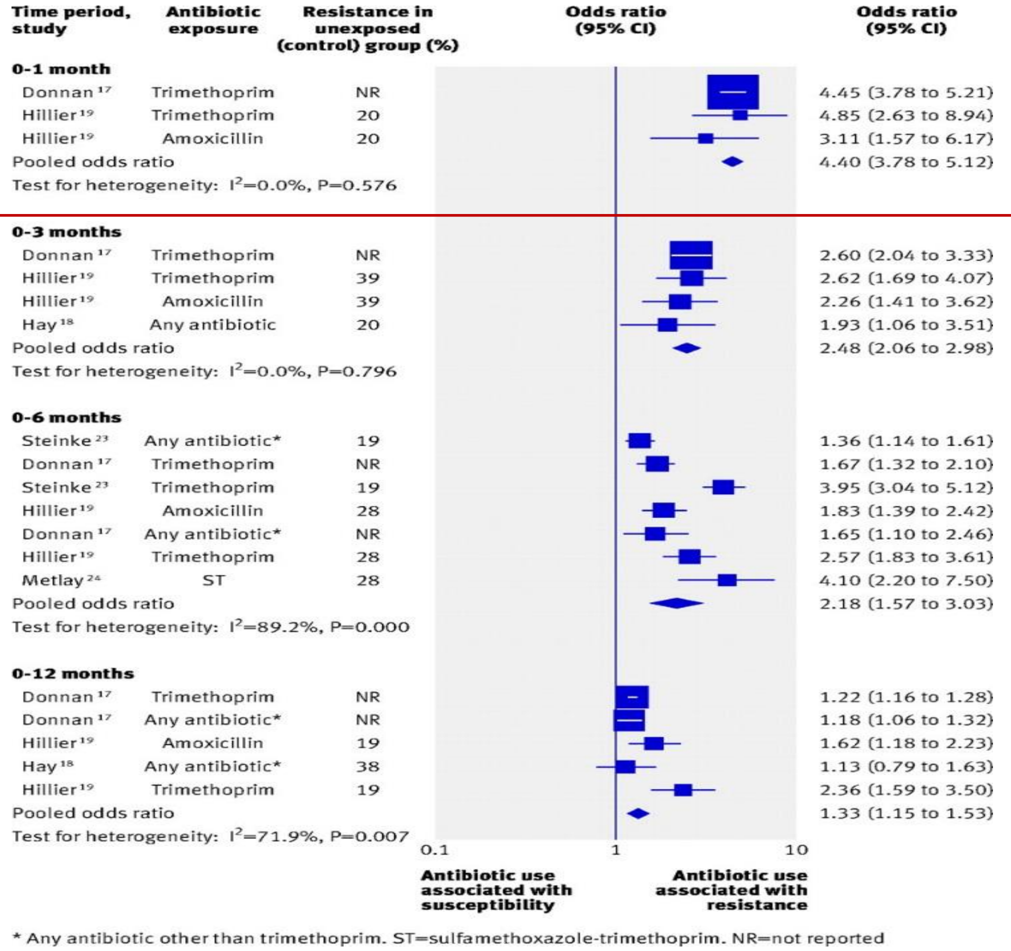
Days of Antibiotics	Appropriately Diagnosed (n = 53), no. (%)	Inappropriately Diagnosed (n = 125), no. (%)
<7 days	46 (86.7)	96 (76.8)
≥7 days	7 (13.3)	29 (23.2)

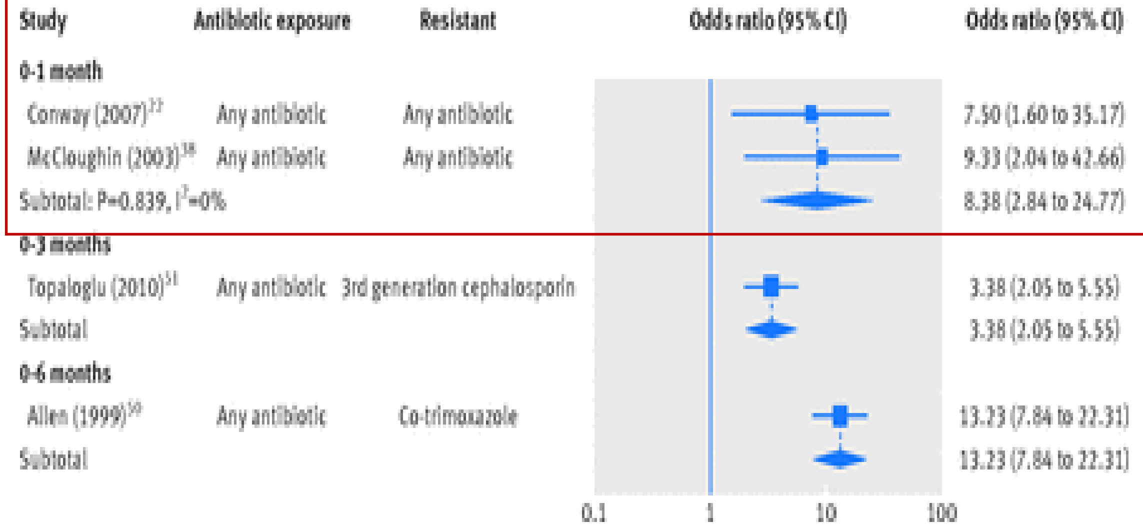
J Pediatr Pharmacol Ther 2019 Vol. 24 No. 1

Impact of Overuse of Antibiotics

- Adverse side effects
- Selection and Emergence of MDR bacteria
- Recurrent UTI
- Increase in Health-care cost
- *C. diff* associated diarrhea

Previous Antibiotic use and bacterial resistance: systematic review and meta-analysis



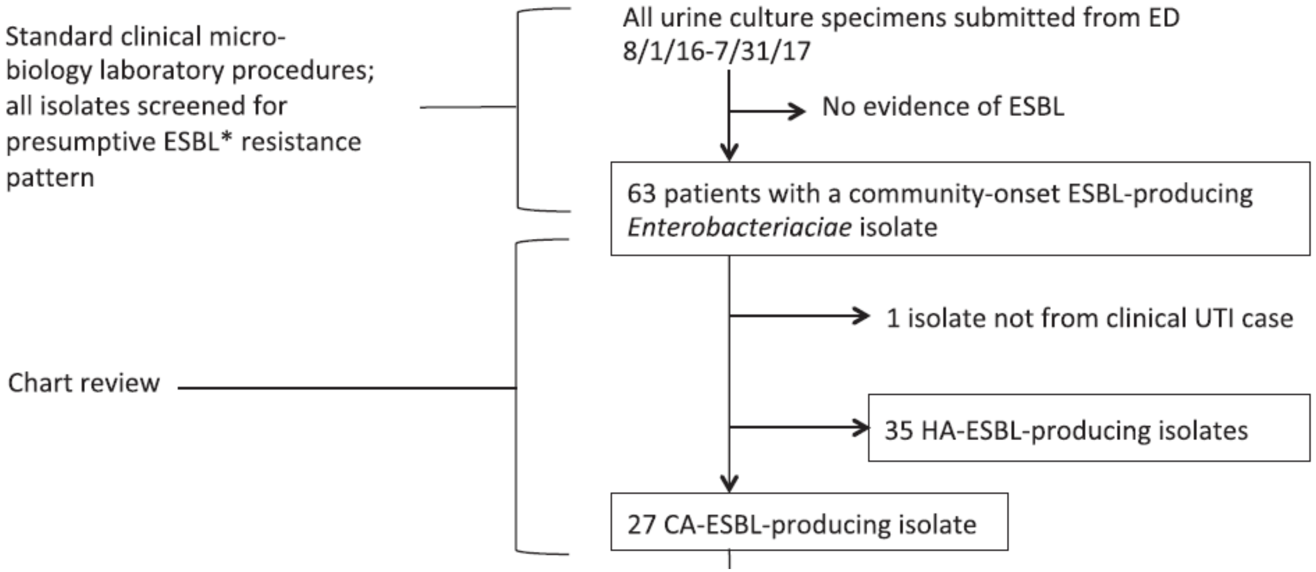


BMJ 2016;352:i939

BMJ 2010;340:c2096

Emergency Department UTI Caused by ESBL–Producing Enterobacteriaceae:

1045 patients in ED diagnosed with UTI



71% resistant to levofloxacin,
65% resistant to trimethoprim-sulfamethoxazole
23% resistant to nitrofurantoin
3% resistant to amikacin

Initial antibiotic choice was discordant with isolate susceptibility in 26 of 56 cases (46%; 95% CI 33% to 60%)

Ann Emerg Med. 2018 Oct;72(4):449-456

Resistance profiles for Uropathogens

Uropathogen	Antibiotic resistance range	Genotype	Resistance Provided	Alternative treatments for resistant strains	
				Antibiotic Therapies	Combination Therapies
Gram negative					
E. coli [1-4]	MDR	ESBL (CTX-M)	Penicillin, cephamycin, cephalosporin,	Fosfomycin, nitrofurantoin, fluoroquinolones cefepime, ertapenem, aminoglycosides	Antibiotics+ inhibitor: ceftolozane/tazobactam
Klebsiella spp [1-5]	MDR	ESBL, KPC, Qnr	Penicillin, cephamycin, cephalosporin, carbapenem, nitrofurantoin, quinolone	Fosfomycin, polymyxin B, fluoroquinolones, tigecycline aminoglycosides, ertapenem, cefepime, tigecycline	Antibiotic+ inhibitor: Pipercillian/Avibactam Antibiotic+ inhibitor: ceftoxime/Avibactam Antibiotic+ inhibitor: cefepime/Avibactam
Proteus spp [1]	Resistant		Nitrofurantoin, methicillin	Fosfomycin	
Pseudomonas spp [1]	MDR	ESBL (OXA), CRE, AmpC, efflux pumps	Penicillin, cephamycin, third generation-cephalosporin, carbapenem, nitrofurantoin	aminogylcosides	Antibiotics+ inhibitor: ceftolozane/tazobactam Antibiotics+ inhibitor: BAL30072/BAL2988/ clavulanate Antibiotics: colitsin/amikacin
Gram positive					
Enterococcus spp [2,4,5]	MDR	Van genes, β-lactamases, PBP mutations	Cephalosporins, penicillin, trimethoprim, clindamycin, aminoglycosides, glycopeptides	Nitrofurantoin, fosfomycin, fluoroquinolones linezolid, daptomycin, tigecycline	Antibiotics: ampicillin/ aminoglocosides
Staphylococcus saprophyticus [2]	Susceptible			Trimethoprim-sulfamethoxazole, ciprofloxacin	

Flores Mireles, A et al. Nat Rev Micro, 2015

Value to HealthCare Quality and Cost

UTI ranked among the 10 most common reasons for readmissions[1]

Principal diagnosis for index hospital stay	Number of all-cause, 30-day readmissions	Toal cost of all-cause, 30-day readmissions ($M)
Congestive heart failure; nonhypertensive	134,500	1,747
Septicemia (except in labor)	92,900	1,410
Pneumonia (except TB and STD)	88,800	1,148
Chronic obstructive pulmonary disease and bronchiectasis	77,900	924
Cardiac dysrhythmias	69,400	838
Urinary Tract Infection	56,900	621
Acute and unspecified renal failure	53,500	683
Acute myocardial infarction	51,300	693
Complication of device, implant or graft	47,200	742
Acute cerebrovascular disease	45,800	568
Total	718,200	9,374

[1]Adapted from the Weighted national estimates from a readmissions analysis file derived from the Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), State Inpatient Databases (SID), 2011
[2]MdXI Data 2017

Children's Mercy KANSAS CITY

Personalized Medicine to Tackle Antibiotic Resistance

ONE OF THE BIGGEST GLOBAL HEALTH CARE PROBLEMS OF OUR TIME

Resistance to antibiotics could bring "an end to modern medicine as we know it"
Director General of the World Health Organization

CONSEQUENCES OF BACTERIAL RESISTANCE

Death	23,000	100,000+	25,000
Illnesses	2,049,442		400,000
Annual Costs	$26 Billion	¥80 Billion	€1,5 Billion

Diagnostic Stewardship combined with Antibiotic Stewardship is key to success

1. Pulcini et al., Eur J Clin Microbiol Infect Dis, 2007.
2. Davey et al., Emerg Infect Dis, 2006.
3. Cadieux et al., CMAJ, 2007.
4. Linder et al., JAMA, 2001.
5. CDC (Centers for Disease Control and Prevention), the Get Smart program.
6. Spiro et al., JAMA, 2006.
7. Little P, BMJ, 2005.
8. Zwart et al., BMJ, 2000.
9. Siegel et al., Pediatrics, 2003.

Laboratory Test for Urinary Tract Infection

Ideal Test Characteristics:

i) High Sensitivity and Specificity

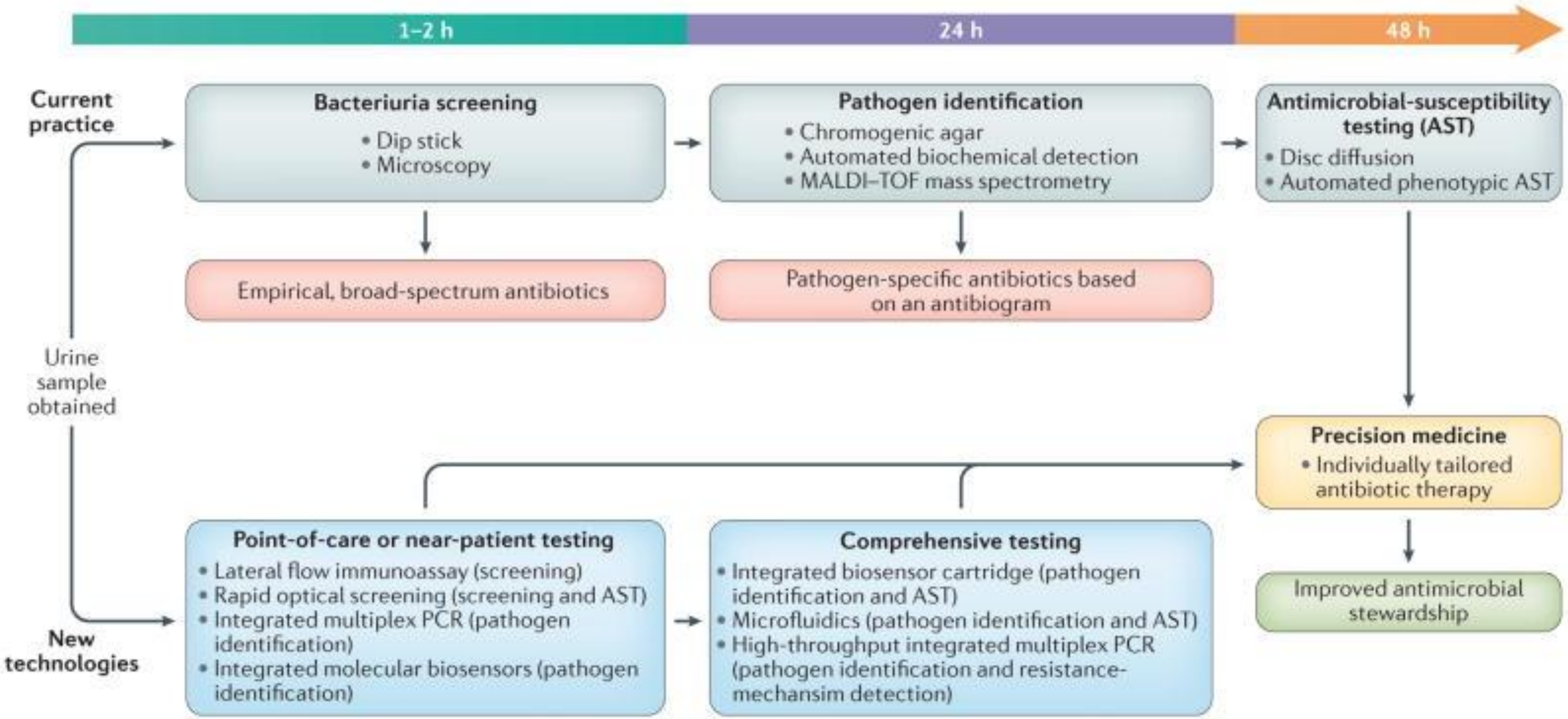
ii) Short turn-around-time

iii) Easy set-up

iv) Inexpensive

v) Simultaneous ID and AST

Overview of the clinical workflow of existing and future diagnostic technologies for UTI



Davenport M. Nat Rev Urol. 2017

UTI Pathogen Detection

Technology	Commercial assay	AST	Advantages	Disadvantages
Nitrite and Leukocytes esterase	Dipstick	No	POC	Poor Specificity
Conventional culture	VITEK MicroScan	Yes	Standard of Care, sensitive and inexpensive	Time consuming, not translatable to POC application
Urinalysis and Microscopy	SediMax CLINITEK Atlas Sysmex UF-1000i Iris iQ2000	No	Fast, detects presence of bacteria	Poor sensitivity, no pathogen identification
MALDI-TOF	VITEK MS Bruker MALDI-TOF	Under Development	Fast, sensitive, specific, potential for simultaneous AST detection	Expensive for initial equipment
FISH	AdvanDx QuickFISH	Under Development	Rapid detection, high sensitivity and specificity	Required multiple probes for all possible urinary pathogens
Microfluidics	UTI Biosensor Assay (Not FDA approved)	Under Development	Integrated platform, rapid detection direct from patient sample, small footprint	System is not fully automated, poor data from low concentration of bacteria
PCR (clinical isolates)	GeneXpert SeptiFast FilmArray	Resistance-gene probes available	Specific, sensitive, and rapid	Required multiple probes for all possible urinary pathogens and extensive initial processing
Immunological based assay	RapidBac	No	Rapid and inexpensive	Poor specificity and sensitivity
Forward Light Scattering	BacterioScan Light Scatter Technology	Under development	Inexpensive, potential for AST	ID/AST not available

Davenport et al. Nat Rev Urol. 2017

Urine Culture- Interpretation

Type of Urine	1 uropathogens	2 uropathogens	>3 uropathogens
Voided midstream from all outpatients	<10,000 CFU/ml, minimal ID	For each <100,000 CFU/ml , minimal ID	Report ≥3 organisms. Suggests contamination, no further workup.
	≥10,000 CFU/ml or ≥1,000 CFU/ml in females 14-30, Definitive ID and AST	For each ≥100,000 CFU/ml definitive ID and AST	
Indwelling catheter; voided urine from all inpatients	<10,000 CFU/ml, minimal ID	For each <100,000 CFU/ml, minimal ID	If voided urine, or if catheter collected and urinalysis WBCs or leukocyte esterase is available and negative, report as for voided outpatient urine. *Otherwise* Minimal ID of each uropathogen with a comment to notify laboratory if further workup is required.
	≥10,000 CFU/ml definitive ID and AST	For each ≥100,000 CFU/ml, definitive ID and AST	
Straight catheter; pediatric catheterized, suprapubic, kidney, cystoscopy yeast cultures Straight catheter; pediatric catheterized, suprapubic, kidney, cystoscopy yeast cultures	100 to 1000 CFU/ml with normal urogenital or skin microbiota, minimal ID[e]	For each <1,000 CFU/ml minimal ID[e]	For each < 10,000 CFU/ml, minimal ID
	≥1,000 CFU/ml or any pure culture of lower count of uropathogen, definitive ID and AST	For each uropathogen that is≥1,000 CFU/ml definitive ID and AST	For each that is ≥10,000 CFU/ml, definitive ID and AST OR Contact the physician to determine the extent of workup

McCarter YS, Cumitec 2C, 2009

Diagnosis of UTI in Children

TABLE 1 Survey of pediatric urine culture practices in North America

Institution	Country	Culture threshold by specimen type (CFU/ml)			
		Clean catch	Catheter	Suprapubic	Bag urine
1	USA	$>10^5$	$>10^3$	$>10^3$	Not accepted
2	USA	$>10^4$	$>10^3$	$>10^3$	$>10^4$
3	Canada	$>10^5$	$>10^5$	$>10^4$	$>10^5$
4	USA	$>10^4$	$>10^4$	Any count	$>5 \times 10^4$
5	USA	$>10^3$	$>10^2$	Any count	Not accepted
6	USA	$>5 \times 10^4$	$>10^4$	Any count single uropathogen (UP) (broth), $>10^3$ 2 UP	Not accepted
7	USA	$>10^5$	$>10^5$	$>10^2$	$>10^5$
8	USA	$>10^5$	$>10^5$	$>10^2$	$>10^5$
9	Canada	$>5 \times 10^4 \pm >10$ WBC/mm^3, $>10^4$ to 5×10^4 with >10 WBC/mm^3	$>5 \times 10^4$ CFU/ml $\pm >10$ WBC/mm^3, $>10^4$ to 5×10^4 with >10 WBC/mm^3	$>10^3$	$>10^5$ with >10 WBC/mm^3
10	USA	$>10^4$	$>10^4$	Any count	$>10^4$
11	Canada	$>10^4$	$>10^4$	$>10^2$	$>10^4$

[a] ID/AST, identification and antimicrobial susceptibility testing.

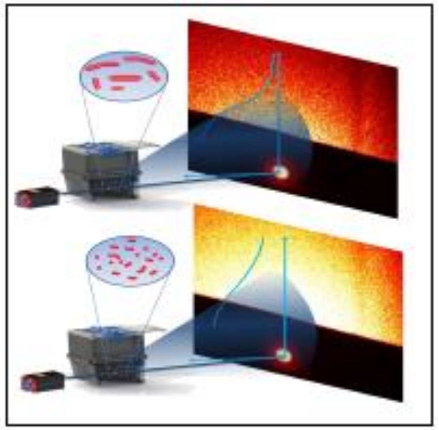
Doern *et al* 2016 JCM Vol 54 (9)

Forward Light Scatter Technology

360 µl urine

+

2.5 ml TSB



- Laser beam is directed through a liquid sample containing replicating bacteria in nutrient broth
- Over time as bacteria replicate in the media, the laser beam is refracted and scattered
- Higher degrees of light refraction represent higher initial bacterial load and continued bacterial growth
- The degree of optical scatter is graphed over time by the machine, allowing identification of ‘presumptive positive’ or presumptive negative’ samples

Critical questions:

- Performance of Light Scatter technology as a screening tool for detection of UTI.
- Comparison of Light Scatter technology with Urinalysis assay
- Implementation of Light Scatter technology- Considerations
- UTI screening with Light Scatter technology: Potential for impact on outpatient management.

Clinical Performance of Light Scatter Technology

- Multisite clinical study with ~3000 clinical urine specimens in 2016-2017
- No restrictions on patient age, gender, specimen type (unpreserved/preserved), or collection method

Overall performance of 216Dx for bacterial Density of ≥50,000 CFU/mL

		Reference method*		
		Positive	Negative	Total
216Dx	Positive	592	672	1264
	Negative	14	1733	1746
	Total	606	2404	3010

Sensitivity: 97.7% (592/606), 95% CI: 96.2%; 98.6%

Specificity: 72.0 (1732/2404) 95% CI: 70.2%; 73.8%

PPA: 46.8% (592/1264) 95% CI: 44.1%; 49.6%

NPA: 99.2% (1732/1746) 95% CI: 98.7%; 99.5%

*Bacterial culture

FDA Decision Summary, https://www.accessdata.fda.gov/cdrh_docs/reviews/K172412.pdf

Performance of Light Scatter Technology and Urinalysis for detection of UTI

Performance	Light Scatter Technology vs Urine culture (95% CI)	UA vs Urine culture (95% CI)
February-March and October 2016	Outpatient + Inpatient (610)	Outpatient + Inpatient (414)
Sensitivity	76% (68-83)	59% (48-69)
Specificity	84% (80-87)	87% (83-90)
PPV (precision)	55% (48-63)	53% (43-63)
NPV	93% (90-95)	89% (86-92)
Accuracy	82%	81%
TP	97	48
FP	78	43
TN	405	289
FN	30	34

216Dx was negative for 155 (25%) samples that grew potential contaminated/mixed culture.

Majority of the samples were obtained from Inpatients (n=541) and were treated with antibiotics (26%).
12/30 FN samples obtained from patients that were treated with antibiotics prior to urine collection

Roberts et al. Lab Med, 2017

Clinical Performance of Light Scatter Technology in Pediatric Population

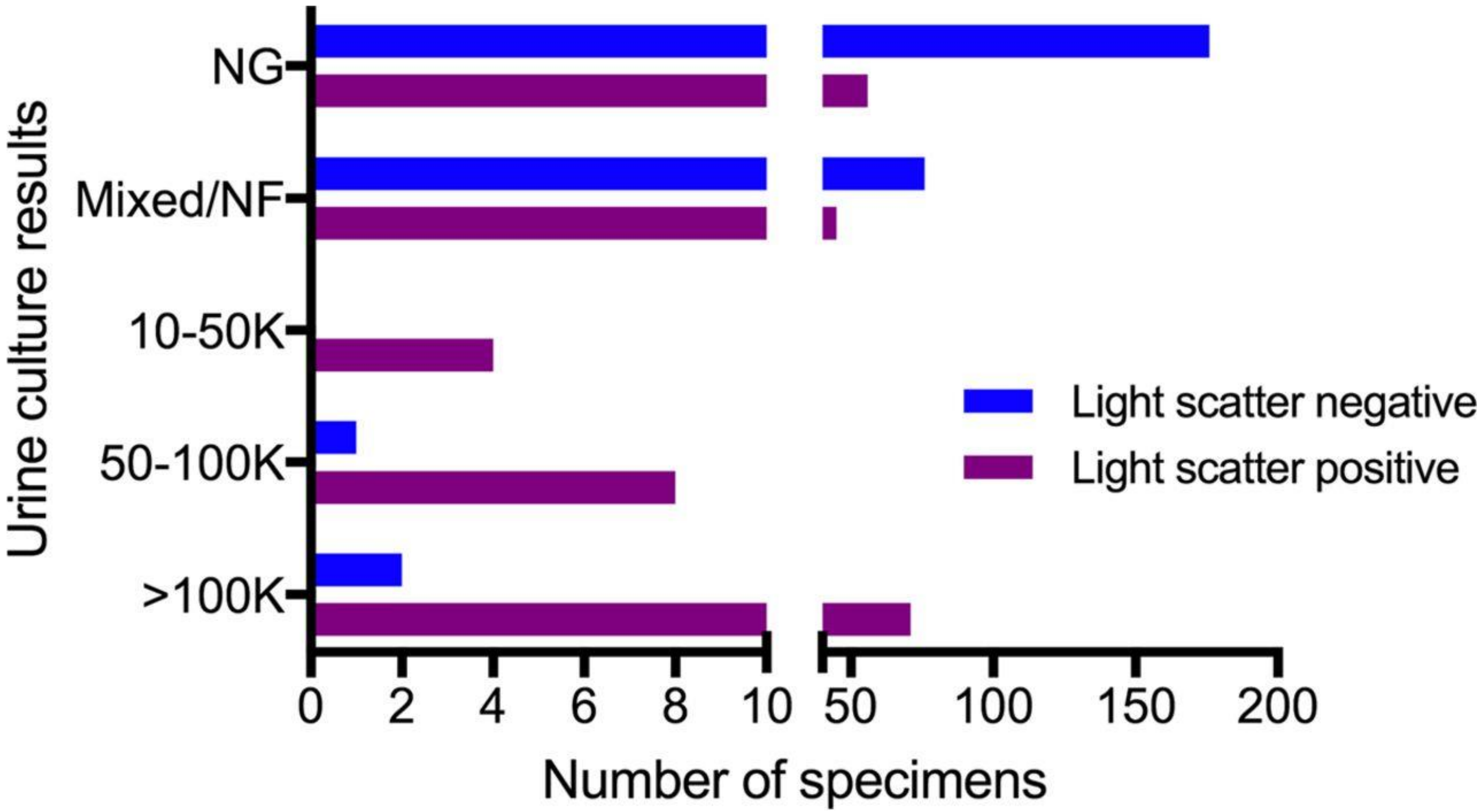
Prospective study (n=439).

Sensitivity: 96.5%

Specificity: 71.4%

PPA: 45.1%

NPA: 98.8%



Montgomery et al. J. Clin. Microbiol. 2017

Performance of Light Scatter Technology

2018	Sample type	Cut-off	Number of sample	Sensitivity (%)	Specificity (%)	PPV	NPV	Accuracy	Reference
Mercy Hospitals, MO	Unpreserved	10,000 CFU/mL	318	93.7*	56.1	47.6	95.4	37.3	Microbe 2017
UNC	All types, Pediatric	Clinically relevant	169	100.0	58.4	31.3	100.0	ND	IDWeek 2017
St. John, Detroit, MI	All types, Adult patient	10,000 CFU/mL	224	95.5	57.8	51.6	96.5	ND	Microbe 2018
Children's Mercy, MO	Clean-Catch, Pediatric	10,000 CFU/mL	287	92.1	82.7	44.8	98.6	84.0	IDWeek, 2018
St. Louis University, MO	All types	10,000 CFU/mL	194	100.0	81.7	50.0	100.0	84.5	AACC 2018
Loyola University, IL	All types	10,000 CFU/mL	348	91.7	74.1	ND	ND	ND	Microbe 2018

Laboratory Cost savings:

Reduction of Unnecessary culture ~50%,

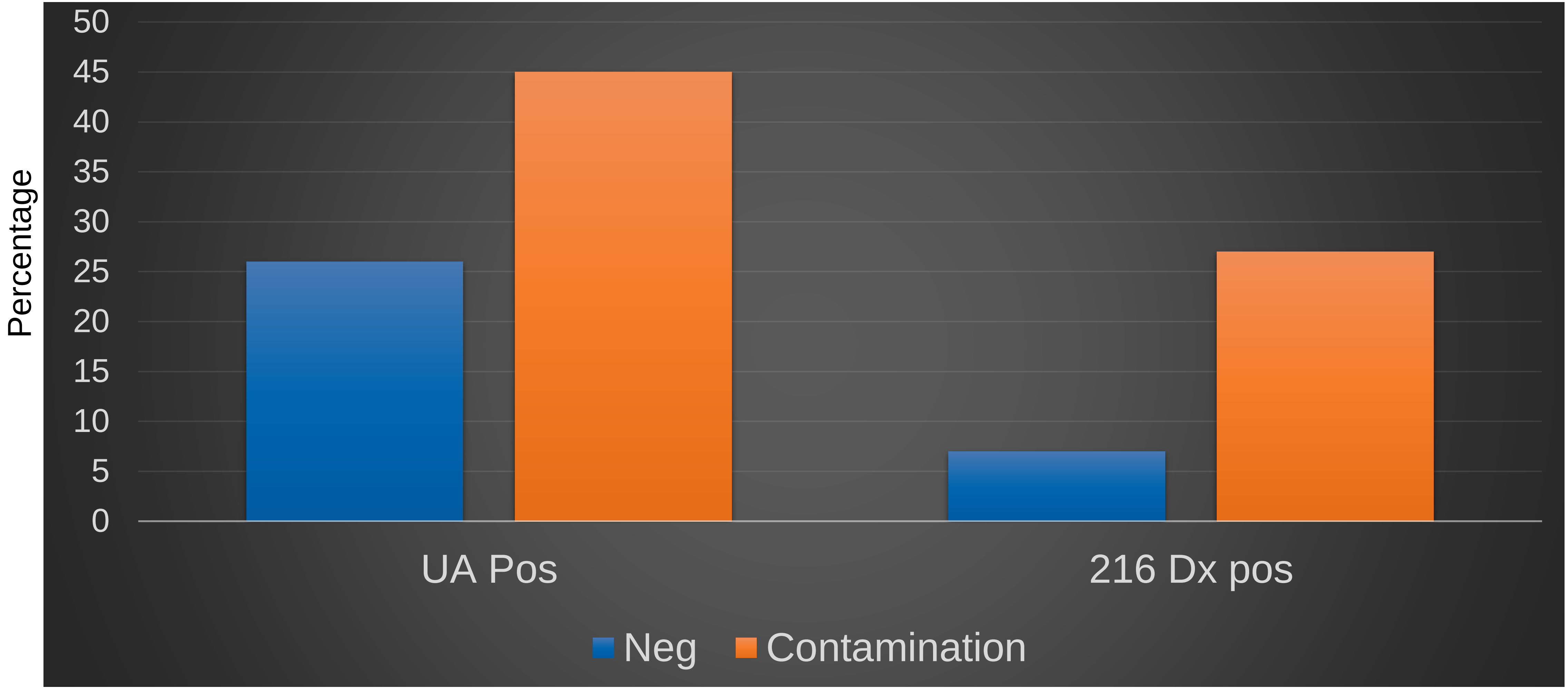
Provides clinicians confidence in managing patients with early result availability

Performance of Urinalysis and Light Scatter Technology

Assays	TP	FP	TN	FN	Sensitivity (%95 CI)	Specificity (%95 CI)	PPV (%95 CI)	NPV (%95 CI)	Accuracy %
UA	37	90	159	1	97.3 (84.5-99.8)	63.8 (57.5-69.7)	29.1 (21-5-38.0)	99.3 (96.0-99.9)	68.0
216Dx	35	43	206	3	92.1 (77.5-97.9)	82.7 (77.3-87.1)	44.8 (33.7-56.5)	98.6 (95.5-99.6)	84.0

Hassan et al., “JCM under review”

Light Scatter Technology Vs UA False Positives



Hassan et al., “JCM under review”

Reducing Culture work-up

Starting samples, n=287

1st Screen-UA

Remove 56% (n=160), missed 1 TP

UA positive, 44.0% (n=127)

2nd Screen- Light Scatter Technology

Remove additional 55% (n=69), missed 3 TP

Light Scatter Technology
Pos 45.0%, **n=58**

Culture Pos 60.0%, n=35

Pros: 2-step screening (UA and Light Scatter Technology) process will remove 80.0% of unnecessary culture work-up.

Cons: Would miss 4/38 (10%) of TP

UA as a stand alone screening assay: 44% (127/287) reflexed to urine culture

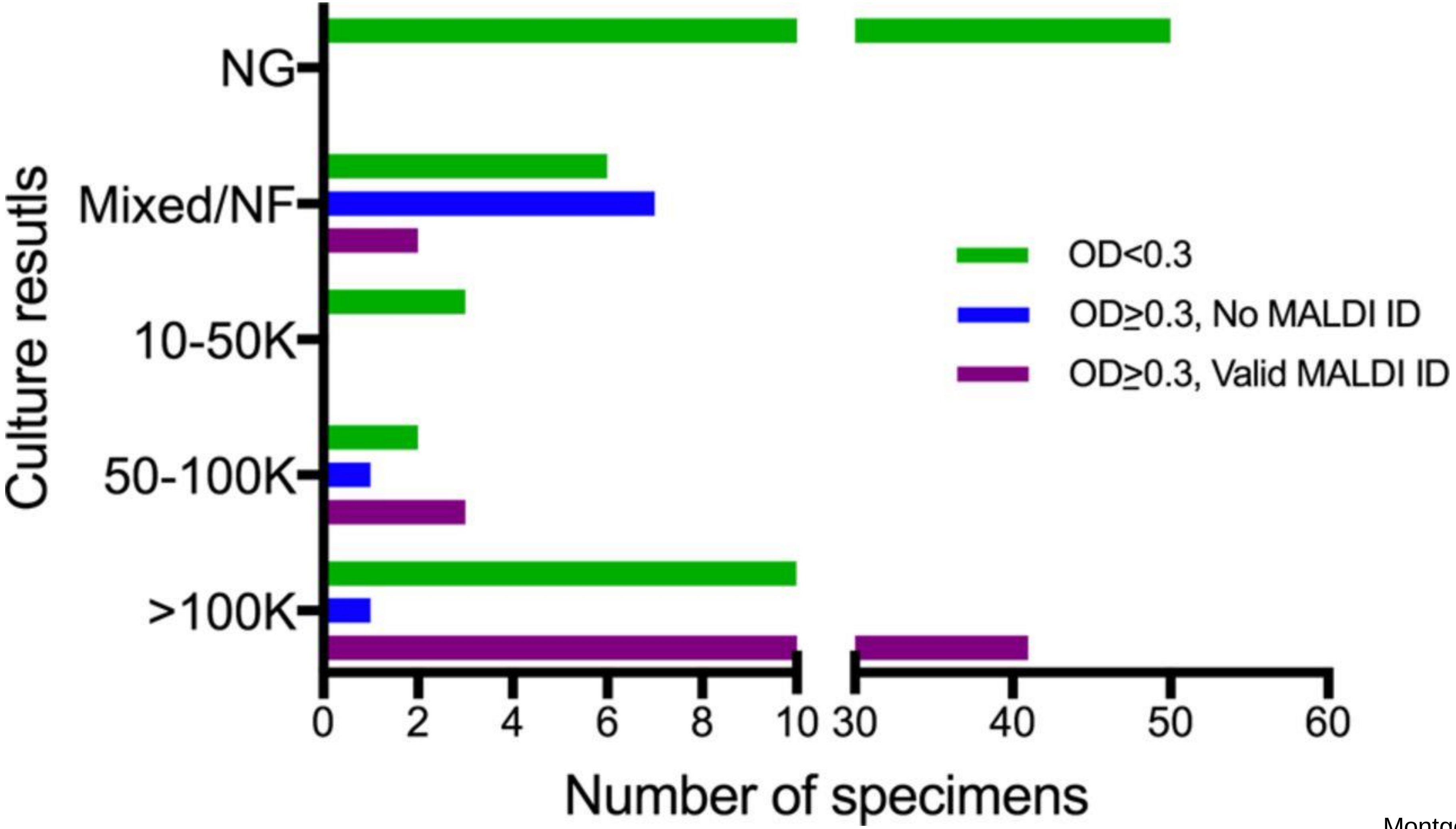
Light Scatter Technology as a stand alone screening assay: 27% (78/287) reflexed to urine culture

UA and Light Scatter Technology combined screening assay: 20% (58/287) reflexed to urine culture

Implementation of Light Scatter technology- Considerations

- Reflex Bacterial Identification
  - MALDI-TOF, Gram Stain, Multiplex PCR, FISH
- Reflex Antimicrobial Resistance testing
  - Light Scatter technology, Automated AST systems, Multiplex PCR
- Turn Around time
  - Batched mode Vs real-time, OP Vs IP.
  - Consultation with clinicians and ASP program

Density-based stratification and MALDI-TOF MS analysis results compared with results for the reference standard.



Montgomery et al. J. Clin. Microbiol. 2017

Performance of Light Scatter Technology and Urinalysis *vs* Bacterial Culture

	Bacterial Culture results		
	Pos, n=38	**Neg, n=122**	**Contamination, n=127**
216Dx Pos (n=78)	35 (92.0%)*$	9 (7.0%)#	34 (27.0%)^
216Dx Neg (n=209)	3 (8.0%)	113 (93.0%)	93 (73.0%)
UA Pos (n=127)	37 (97.0%)	32 (26.0%)	58 (46.0%)
UA Neg (n=160)	1 (3.0%)	90 (74.0%)	69 (54.0%)

MALDI-TOF ID Passed: *27/35 (77%)
MALDI-TOF ID Failed: $8/35 (23.0%), #9/9, ^34/34

6/8 urine samples not identified by MALDI-TOF were <50,000 cfu/ml, 2/8 urine samples were >100,000 cfu/ml

Rapid Susceptibility Testing using Light Scatter Technology

Sample: 3 isolates of *Staphylococcus aureus*, *E. coli* and *Pseudomonas aeruginosa*

Method: AST was performed by two commercial systems (Vitek2 and MicroScan) as reference and by Laser Scatter Technology

Summary of minor errors

Test comparison	ID no.	Bacterium	Antibiotic
Light Scatter Technology (LST) vs. MicroScan	3267	*E. coli*	Cefepime
LST vs. MicroScan	9018	*P. aeruginosa*	Cefepime
LST vs. Vitek	9018	*P. aeruginosa*	Cefepime
LST vs. Vitek	9018	*P. aeruginosa*	Gentamicin
LST vs. Vitek	2700	*P. aeruginosa*	Ciprofloxacin
LST vs. Vitek	9018	*P. aeruginosa*	Ciprofloxacin
LST vs. Vitek	6172	*S. aureus*	Moxifloxacin

Results:

- Overall agreement between 216Dx and MicroScan was 88.9%
- Overall agreement between 216Dx and Vitek2 was 72.2%
- No very major or major errors were seen

Hayden RT, J Clin Micro, 2016

Antimicrobial susceptibility testing results

Antibiotic(s) tested	No. positive/total no. of specimens tested (% categorical agreement)[a]	Error classification[b]
Ampicillin	39/40 (97.5)	Minor (E. coli, n = 1, ref R, tested I)
Ampicillin-sulbactam	38/40 (95)	Minor (E. coli, n = 2, both ref I, tested R)
Piperacillin-tazobactam	39/40 (97.5)	Major (E. coli, n = 1, ref R, tested S)
Cefazolin	40/40 (100)	
Ceftazidime	40/40 (100)	
Ceftriaxone	40/40 (100)	
Cefepime	40/40 (100)	
Imipenem	40/40 (100)	
Ertapenem	40/40 (100)	
Ciprofloxacin	40/40 (100)	
Levofloxacin	40/40 (100)	
Gentamicin	40/40 (100)	
Tobramycin	39/40 (97.5)	Minor (E. coli, n = 1, ref I, tested R)
Amikacin	40/40 (100)	
Trimethoprim-sulfamethoxazole	40/40 (100)	
Nitrofurantoin	40/40 (100)	
Total	605/610 (99.2)	

↲a Organisms tested included *E. coli* (*n* = 37), *Proteus mirabilis* (*n* = 2), and *K. pneumoniae* (*n*= 1).

↲b ref, reference method; I, intermediate; R, resistant; S, susceptible.

Sample size: 40
Drug-panel:16
Overall categorical agreement: 99.2%

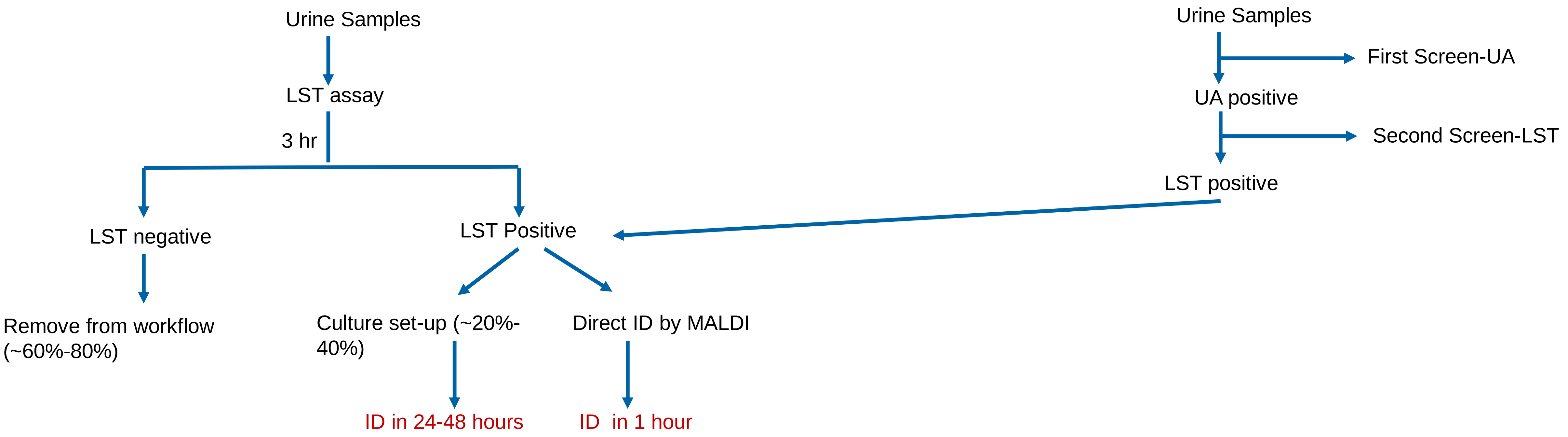
Montgomery et al. J. Clin. Microbiol. 2017

LST and impact on laboratory work-flow

- 60% to 80% of urine cultures are either negative or contaminated
- Due to high NPV, can remove all these culture plates from daily work-flow as soon as 3-5 hours of sample receipt in laboratory

Use of LST without Urinalysis assay

Use of LST in combination with Urinalysis assay



Potential Impact of UTI screening with Light Scatter technology

Goal:

Rapid detection of UTI

Factors:

Clinical diagnosis

Pre-analytical - specimen collection, transport and storage

Analytical - Standardization, Turn around time

Post analytical - Reporting and Collaboration with ASP

Urine Culture Follow-up and Antimicrobial Stewardship in a Pediatric Urgent Care Network

Culture

Laser Scatter Technology
3 hr TAT

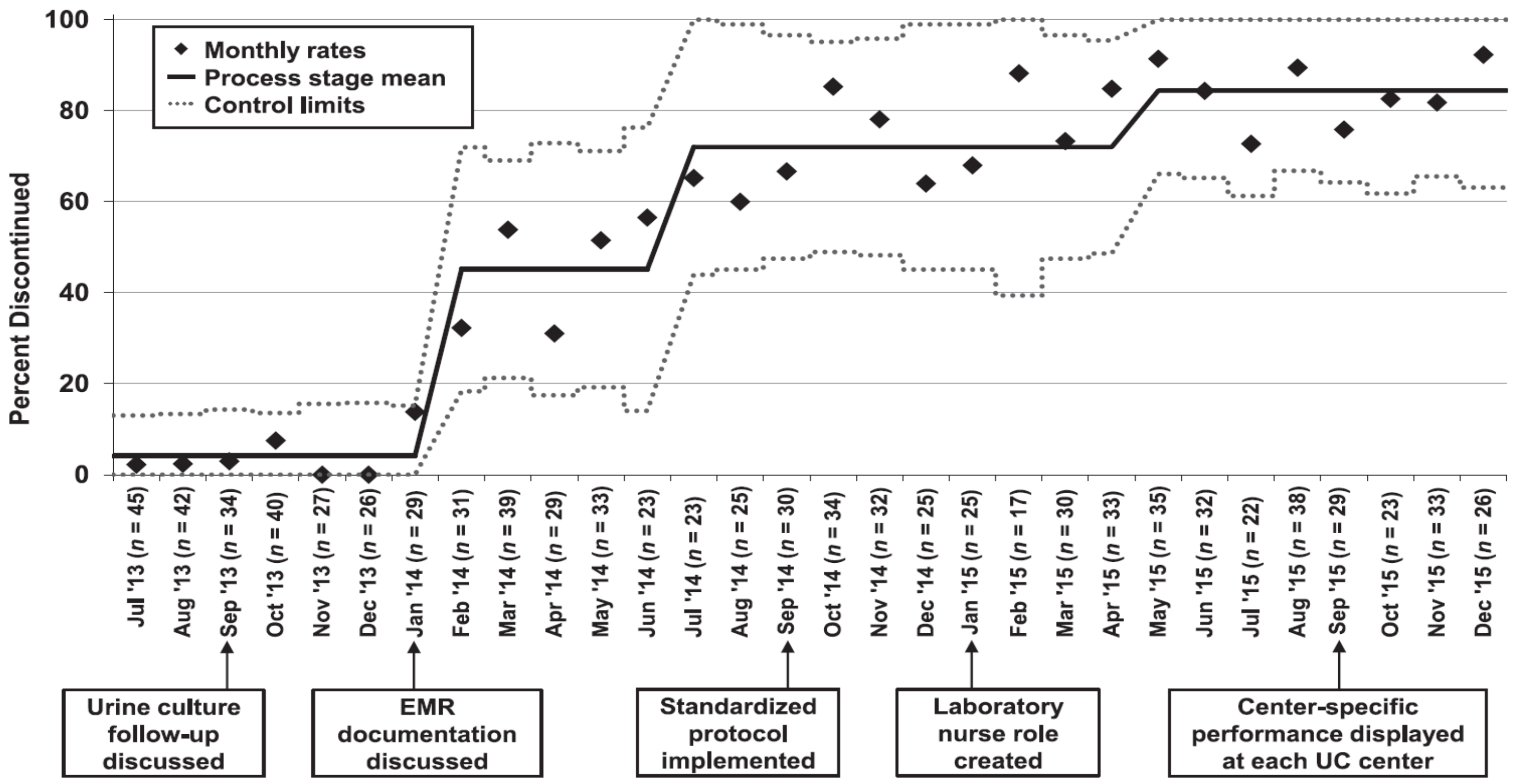


FIGURE 2
The Shewhart p-chart demonstrates the monthly antibiotic discontinuation rates for patients who were treated empirically for a UTI but had a negative urine culture result. Interventions are indicated below the chart with arrows designating the time each intervention occurred.

Saha et al Pediatrics, April 2017, VOLUME 139 / ISSUE 4

Summary

- Accurate diagnosis of UTI is important to reduce overuse of antibiotics and associated complications

- Rapid diagnosis of UTI is important to avoid initiation of unnecessary antibiotics and/or facilitate early discontinuation of antibiotics

- Implementation of rapid UTI screening test will result in cost savings and improved workflow in laboratory diagnosis of UTI

- Integration of rapid UTI screening results in clinical decision making has the potential to improve clinical management and outcomes

Questions