Diagnostic Stewardship

Will Simmons

TASP

Disclosure

- Dr. Simmons has the following relevant relationships
  - Dr. Simmons owns BD stock

- None of the planners have relevant financial relationship(s) to disclose with ineligible companies whose primary business is producing, marketing, selling, re-selling, or distributing healthcare products used by or on patients

All relevant financial relationships have been mitigated

Outline

- What is diagnostic stewardship?
- Can we help providers make better decisions?
  - When and how
- Making sure it works: Measures

What is Stewardship?

- Antibiotic Stewardship: “Effort to measure and improve how antibiotics are prescribed by clinicians and used by patients”

- **Diagnostic Stewardship:** “Optimizing diagnosis by improving the process of ordering, performance, and reporting of diagnostic tests”
  - I would add “**interpretation**”

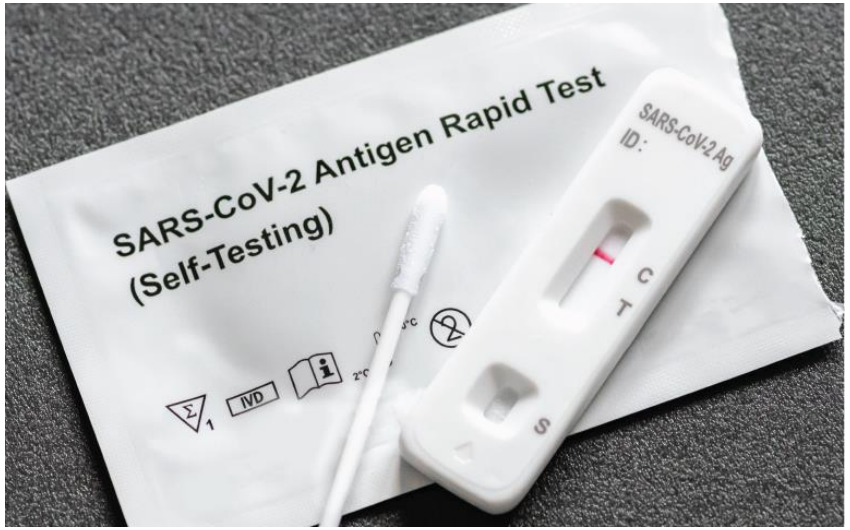
  - AKA: Right test, right patient, right action

What kinds of mistakes do we make?

- Over-testing
  - Overdiagnosis/overtreatment
  - Stress for patient, caregiver, provider
  - More testing: confirming negative
  - Missed/delayed actual diagnosis
  - **Hospital quality metrics + cost**
- Under-testing
  - Missed Diagnosis
  - Delay in treatment
- Sub-optimal diagnostic path

Goolden C, Shorten RJ. Diagnostic stewardship - optimization of superficial wound swab cultures can reduce the environmental impact of the microbiology laboratory. *Access Microbiol*. 2025;7(9):000977.v3. Published 2025 Sep 3. doi:10.1099/acmi.0.000977.v3

Think about the planet



- 20,000+ tons of plastic waste for LFAs/year
- One lab discarded superficial wound swabs if there was no clinical documentation of signs of infection
  - Intervention would have saved 700 lbs of plastic/year
- A positive blood culture generates greenhouse gasses equivalent to driving about half a mile

Goolden C, Shorten RJ. Diagnostic stewardship - optimization of superficial wound swab cultures can reduce the environmental impact of the microbiology laboratory. *Access Microbiol*. 2025;7(9):000977.v3. Published 2025 Sep 3. doi:10.1099/acmi.0.000977.v3

Raja J Hofmeister, Mark D Gonzalez, Jonathan Hildreth, Troy Savage, Amy Leber, Preeti Jaggi, Ancillary Benefit of Microbiology Culture Diagnostic Stewardship: Decreasing Health Care's Climate Impact, *Open Forum Infectious Diseases*, Volume 12, Issue 2, February 2025, ofae368, https://doi.org/10.1093/ofid/ofae368

Multiple Stakeholders: Differing Priorities

Patient	Lab	Med Center	Payor
Accurate Diagnosis	Cost of testing	Cost of care (within med center)	Cost of care
Rapid Diagnosis	Accurate test results	Throughput	
Number of tests/avoiding unnecessary tests	Volume of testing (can go either way)	Quality of care (but often specific metrics)	
Cost of care	Workflow		

Providers: It is all psychiatry

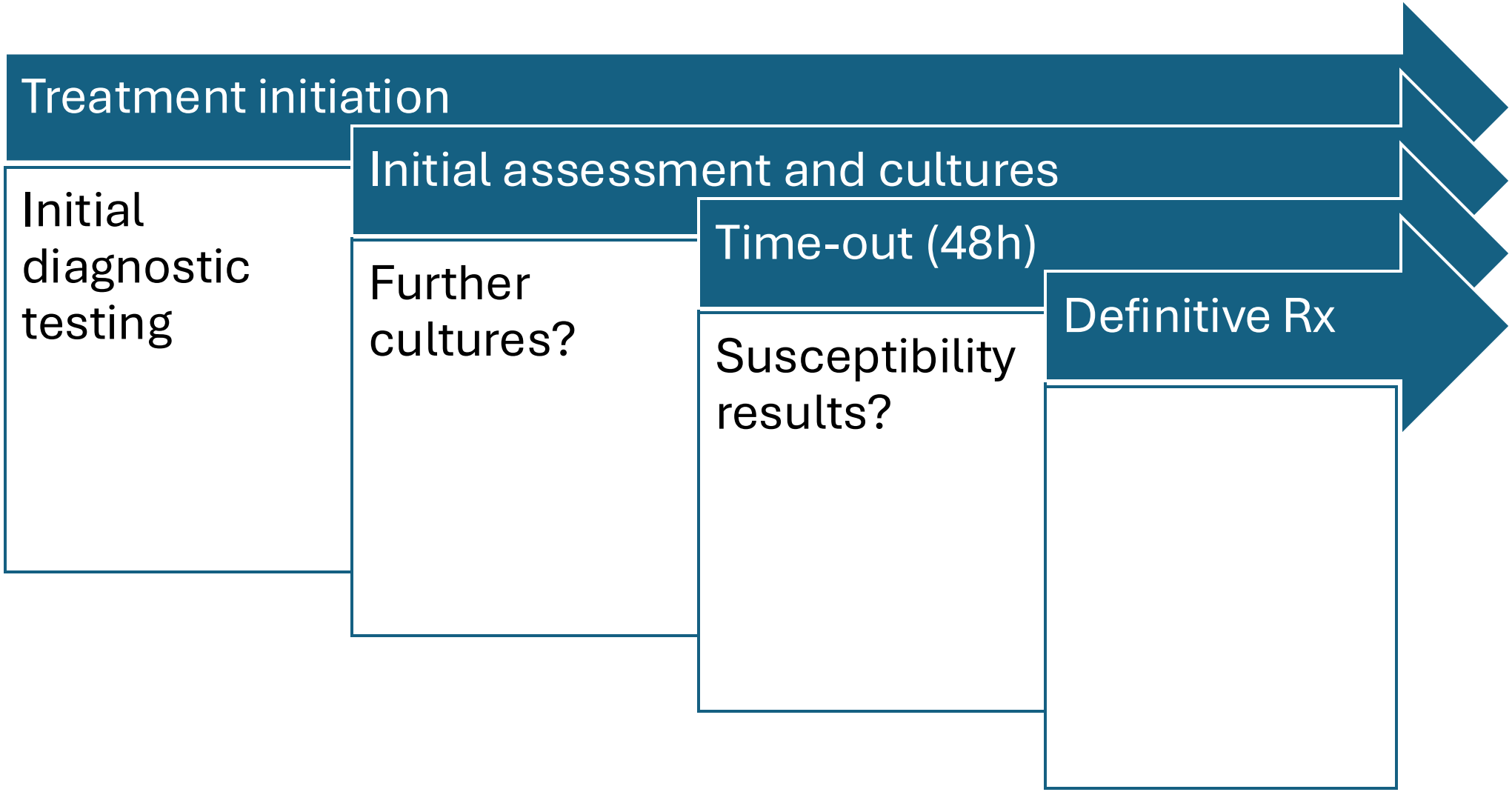
- Diagnostic tests are powerful nudges, regardless of whether we thought the test was reliable
- Diagnostic stewardship attempts to influence a clinician's impression of the likely value of a test, and their interpretation of a result
- In the face of many subjective factors

How to intervene?

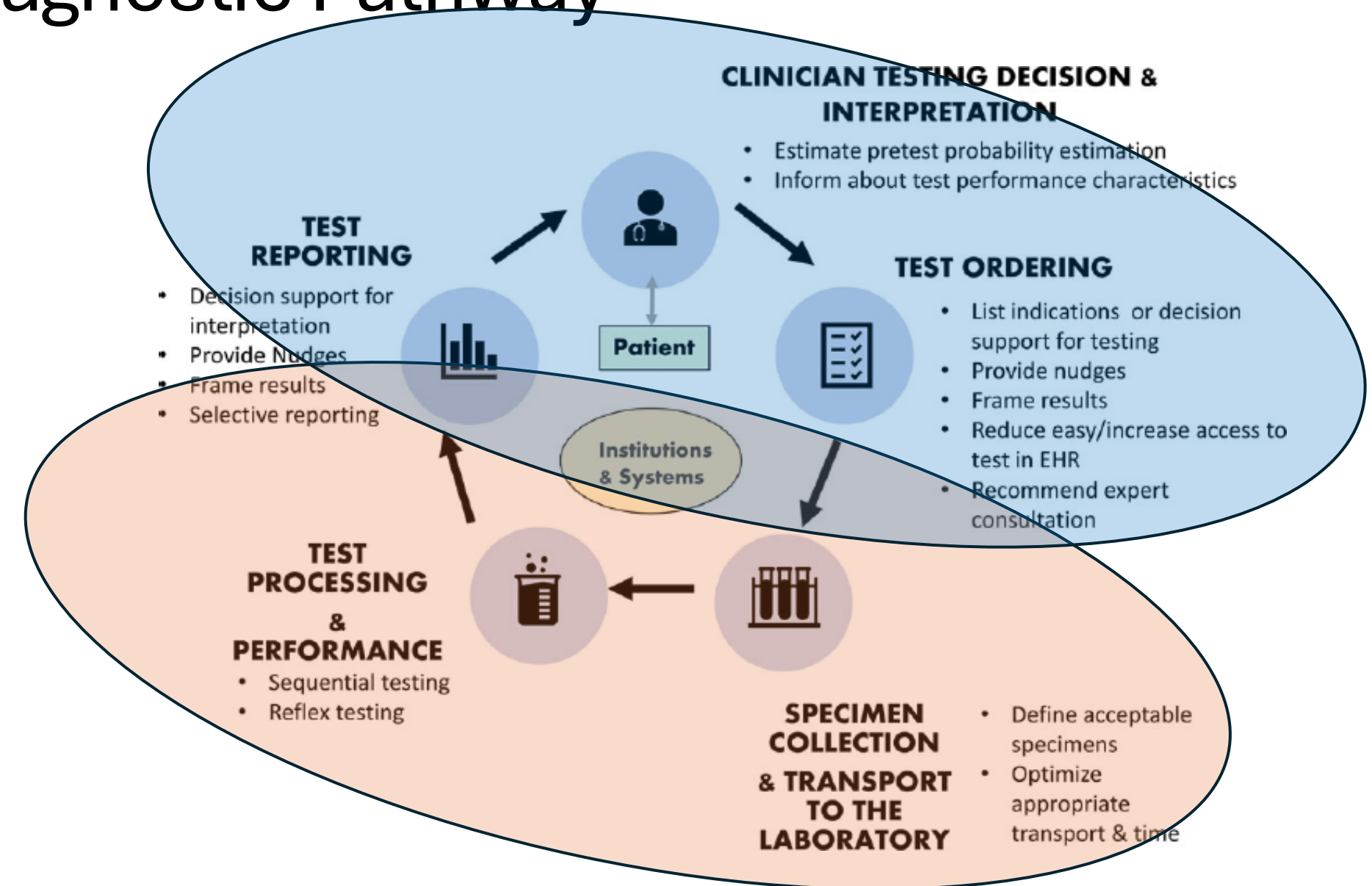
- Where in the process are we intervening?

- What tools do we have to intervene?

The four moments of antibiotic prescribing

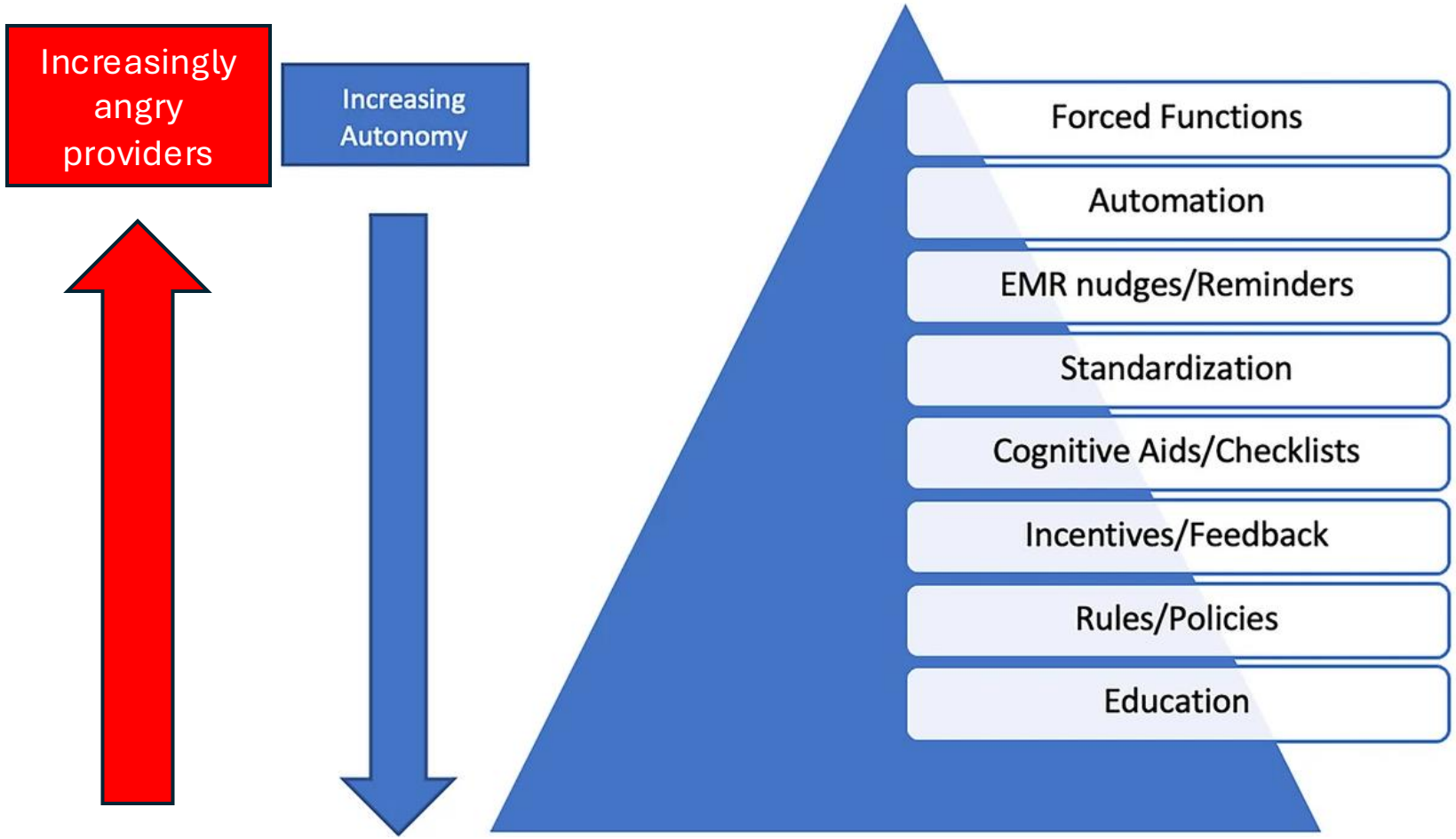


Diagnostic Pathway



How to intervene: choose your intervention

From: Quality Improvement Interventions and Implementation Strategies for Urine Culture Stewardship in the Acute Care Setting: Advances and Challenges



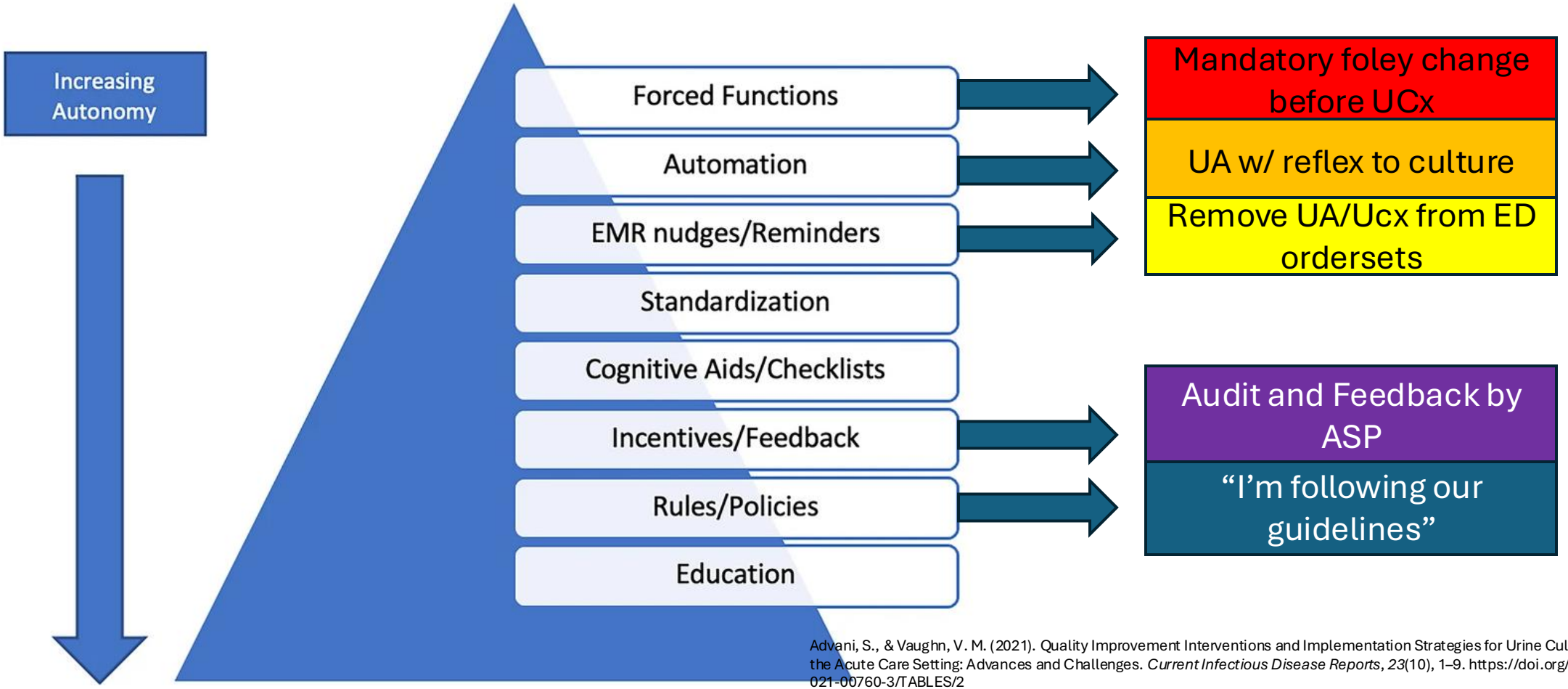
Advani, S., & Vaughn, V. M. (2021). Quality Improvement Interventions and Implementation Strategies for Urine Culture Stewardship in the Acute Care Setting: Advances and Challenges. *Current Infectious Disease Reports*, *23*(10), 1–9. https://doi.org/10.1007/S11908-021-00760-3/TABLES/2

The Classic Diagnostic Stewardship Problem

- Asymptomatic Bacteriuria!!!
- Treatment does not improve outcomes
- Treatment creates harms (side effects, resistance, LOS)
- 80% of hospitalized patients with ASB are treated

Reducing Urine Culture in ASB: Stewardship

From: Quality Improvement Interventions and Implementation Strategies for Urine Culture Stewardship in the Acute Care Setting: Advances and Challenges

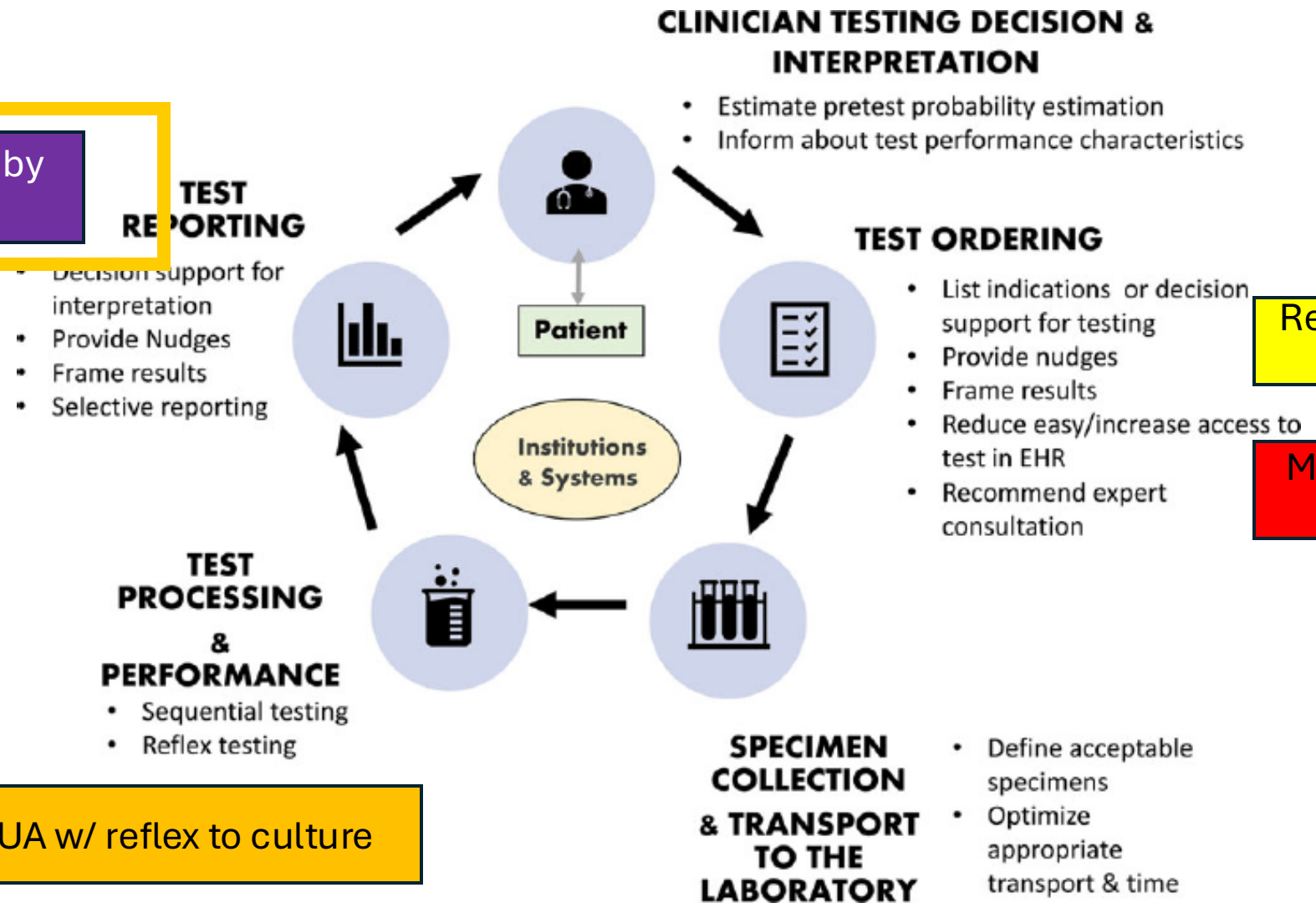


Advani, S., & Vaughn, V. M. (2021). Quality Improvement Interventions and Implementation Strategies for Urine Culture Stewardship in the Acute Care Setting: Advances and Challenges. *Current Infectious Disease Reports*, *23*(10), 1–9. https://doi.org/10.1007/S11908-021-00760-3/TABLES/2

Diagnostic Pathway

Guidelines

Audit and Feedback by ASP



Remove UA/Ucx from ED ordersets

Mandatory foley change before UCx

UA w/ reflex to culture

Valerie Vaughn:

Leis JA, Palmay L, Elligsen M, Walker SA, Lee C, Daneman N. Lessons from audit and feedback of hospitalized patients with bacteriuria. *Am J Infect Control*. 2014;42(10):1136-1137. doi:10.1016/j.ajic.2014.06.020
https://jamanetwork.com/journals/jamainternalmedicine/fullarticle/2806966

What if we just don’t tell them?

- A large AMC hid urine culture results from clinicians for non-catheterized med-surg patients, required phone call for release
- Results released immediately to anyone who called
- Treatment of ASB? 48% pre-intervention => 12% post intervention
  - No cases of untreated UTI on clinical review

Jerome A. Leis, Gabriel W. Rebick, Nick Daneman, Wayne L. Gold, Susan M. Poutanen, Pauline Lo, Michael Larocque, Kaveh G. Shojania, Allison McGeer, Reducing Antimicrobial Therapy for Asymptomatic Bacteriuria Among Noncatheterized Inpatients: A Proof-of-Concept Study, *Clinical Infectious Diseases*, Volume 58, Issue 7, 1 April 2014, Pages 980–983, https://doi.org/10.1093/cid/ciu010

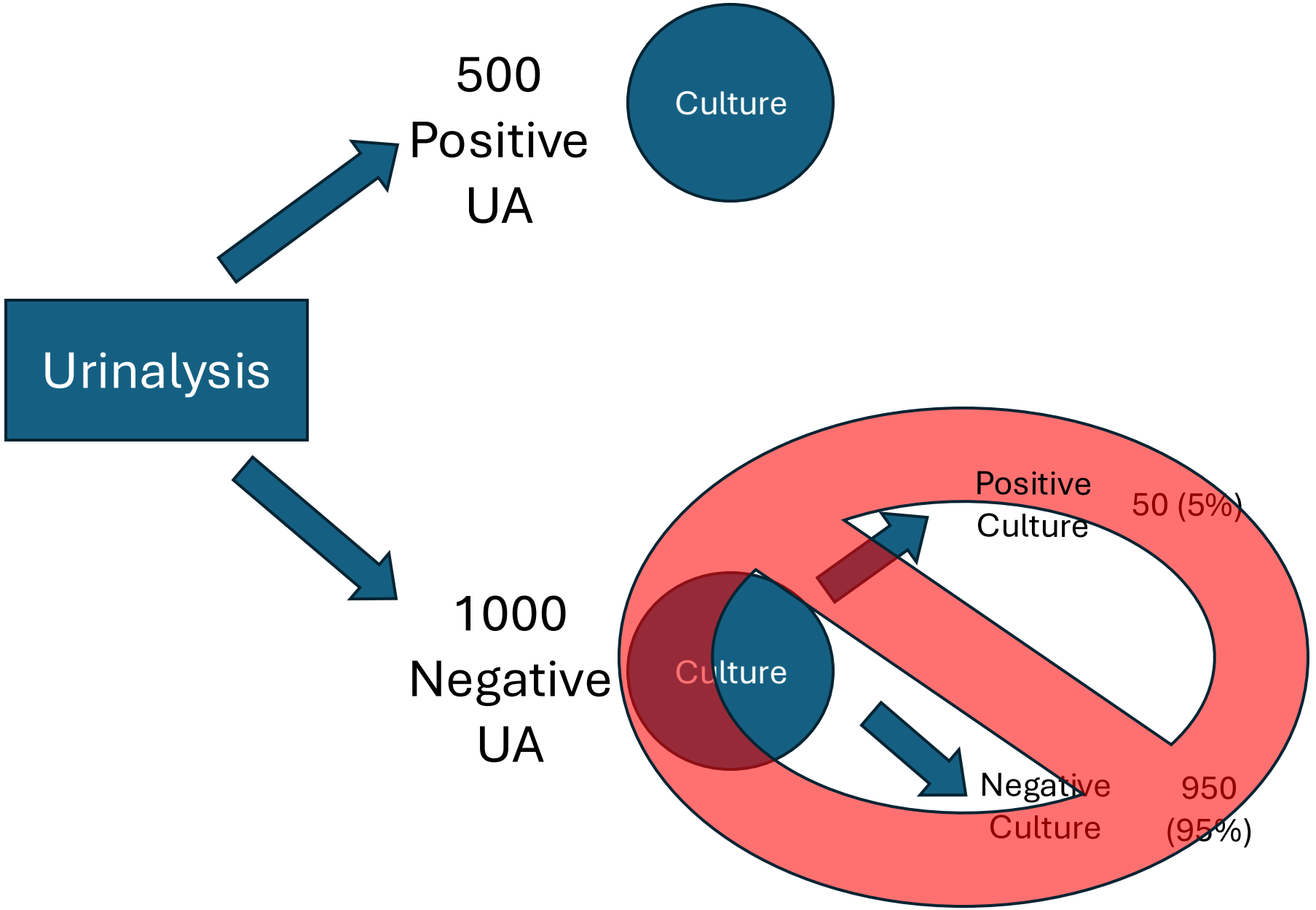
Implementation and the law of unintended consequences

Reflex UA to Urine Culture

Two approaches to urine cultures?

- 1500 Patients coming into ED, some have symptoms, some don’t
- Let’s imagine what would happen with a UA w/ reflex system
- Bizarro world: what if we just ran cultures only

Negative UA: Cultures avoided



Positive UA: It depends

WBCs, UA
<5 /HPF

11 to 20 !

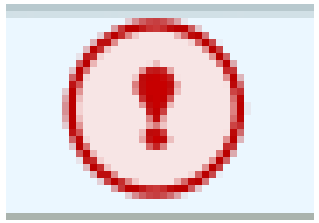
500 Positive UA

Urinalysis

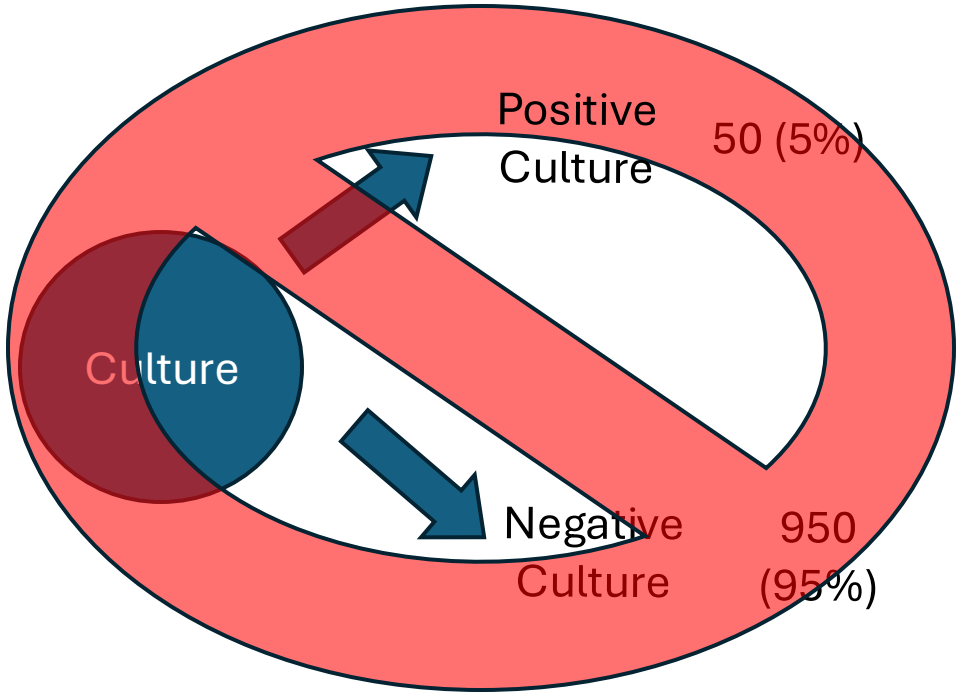
Culture

Positive Culture 250 (50%)

Negative Culture 250 (50%)

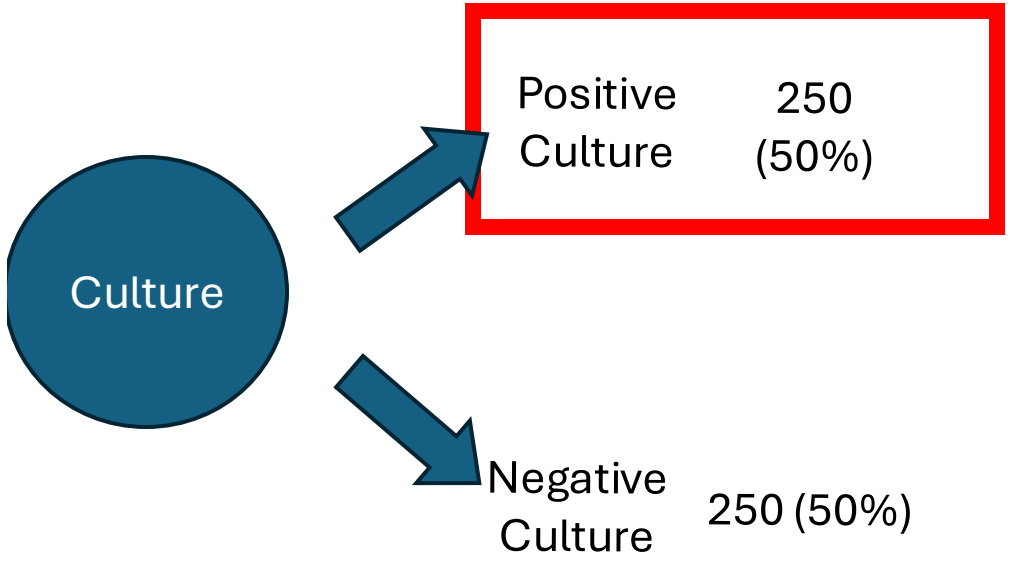


1000 Negative UA

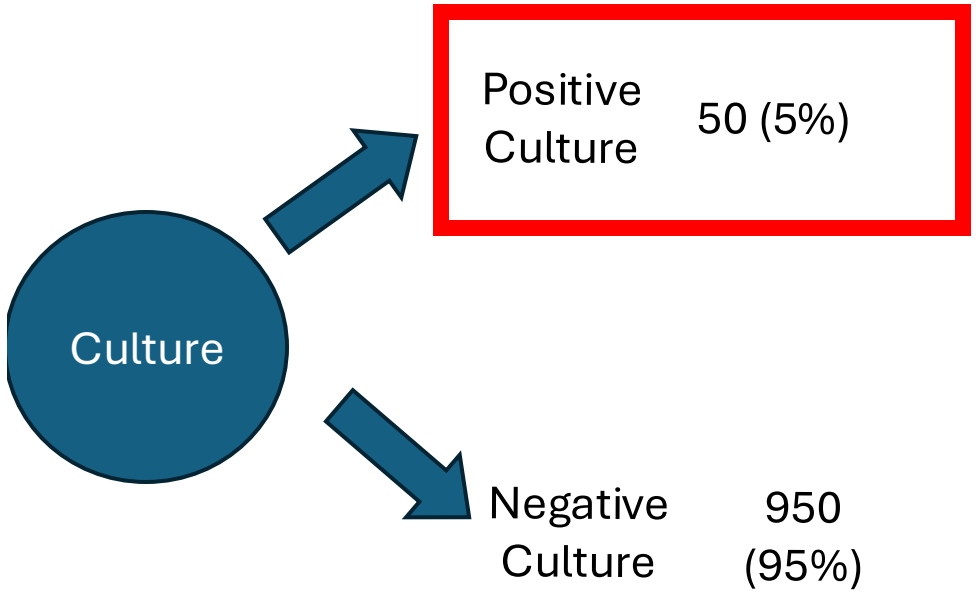


500 Positive Urine UA Treated?

Urine Culture Only!!



300 Positive Urine Cultures Treated



Process Measures: The “How”

Process measures: Are parts/steps in the system performing as expected?

1. The things we do: Percent of patients with sepsis who got a lactate on arrival

2. Steps in the process: Number of patients the EMR alert fired on, orderset use, etc.

Outcome Measures

Outcome measures: Is it achieving what we want?

- In healthcare, these are often patient outcomes

- Mortality in sepsis patients w/ and w/o lactate

- Duration of antibiotics for patients with pneumonia

- Length of stay for patients who used an orderset

Measures: you need all three

- Is your intervention doing what you want?
  - **Process measures:** easier to measure, can be well-correlated to hard to measure outcomes, may not always benefit patients
  - **Outcome measures:** difficult to measure, interactions complex

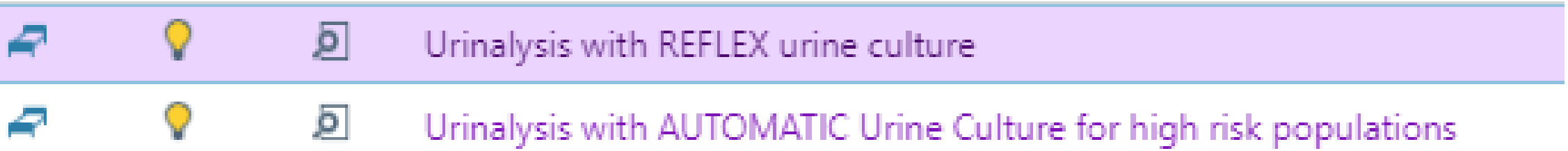
- **Balancing metrics**: watching for unintended consequences (i.e. doing not what you want)
  - Is it doing bad things to patients?

ASB Measures

- Process:
  - Urine cultures sent
- Outcome:
  - Total antibiotics given for UTI
  - Percent of patients treated for ASB
- Balance:
  - Urosepsis rates
  - Untreated UTIs

Why do we need both? Process measure

- The UCSF UA w/ Reflex Urine Culture Orders:

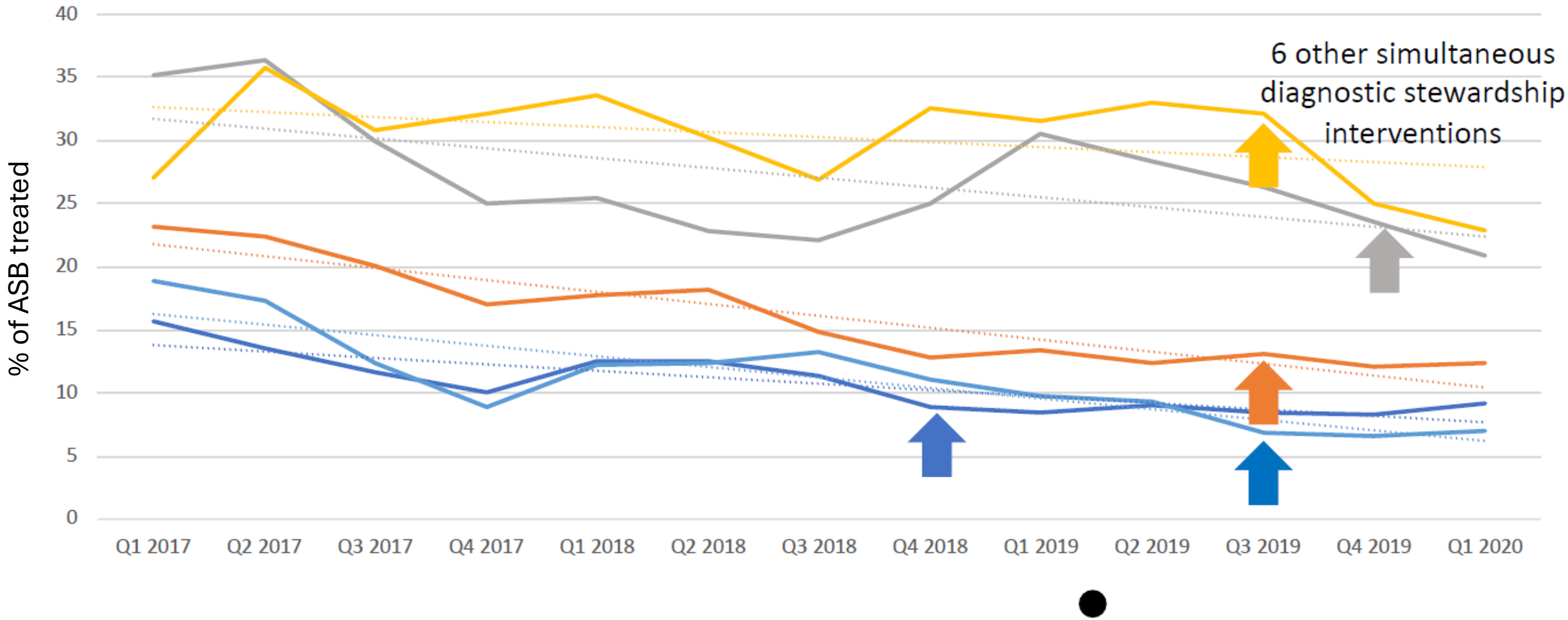


Question from Emergency Department

- Patients with negative UA where the culture is not being run
- Asking if in the future orders should be entered as “for high risk population” to ensure culture is run
- A process measure tracking urine cultures sent will catch this

Hospitals Removed Reflex Testing

Slide from Valerie Vaughn MD (Utah)



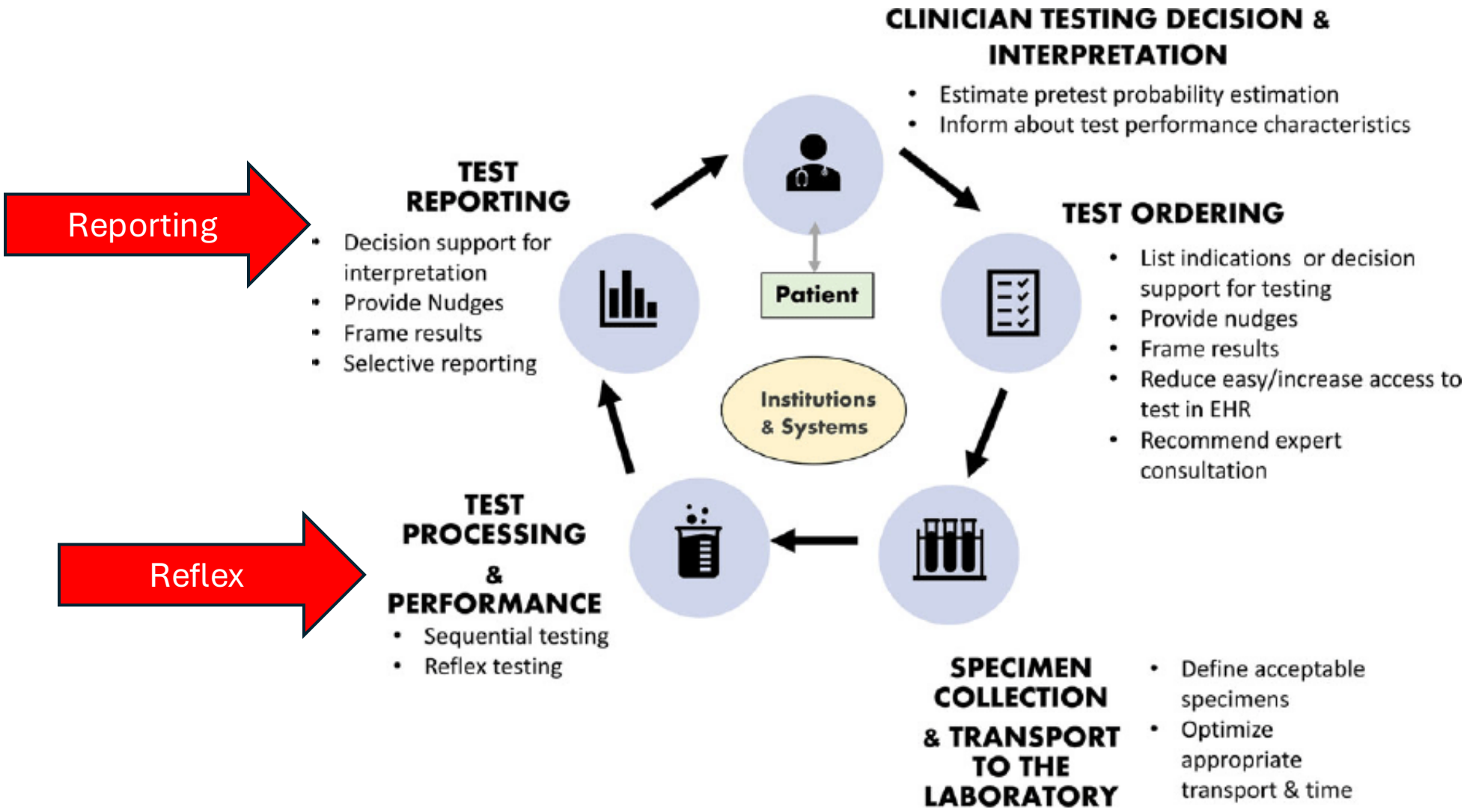
C difficile: Am I helping?

- AMC transitioned from one step PCR testing to two step testing with PCR reflexing to a Toxin EIA

- Interpretation assistance built into test results, education to providers

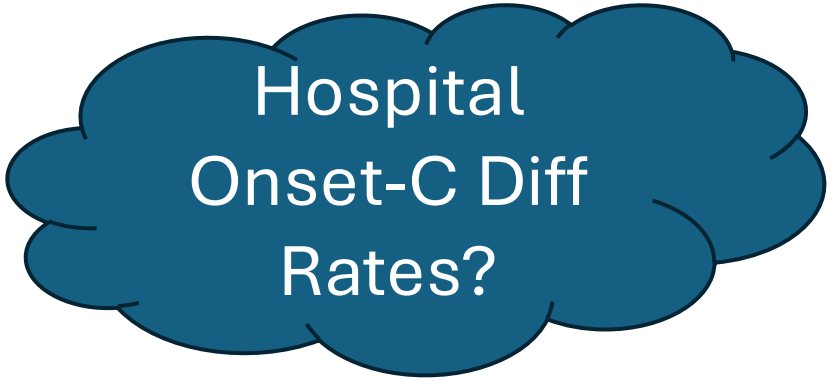
Moffa MA, Carr DR, Shively NR, et al. Impact of a multi-step testing algorithm on hospital-onset Clostridioides difficile rates and clinical outcomes. *Antimicrobial Stewardship & Healthcare Epidemiology*. 2025;5(1):e112. doi:10.1017/ash.2025.180

Diagnostic Pathway: Where + How?

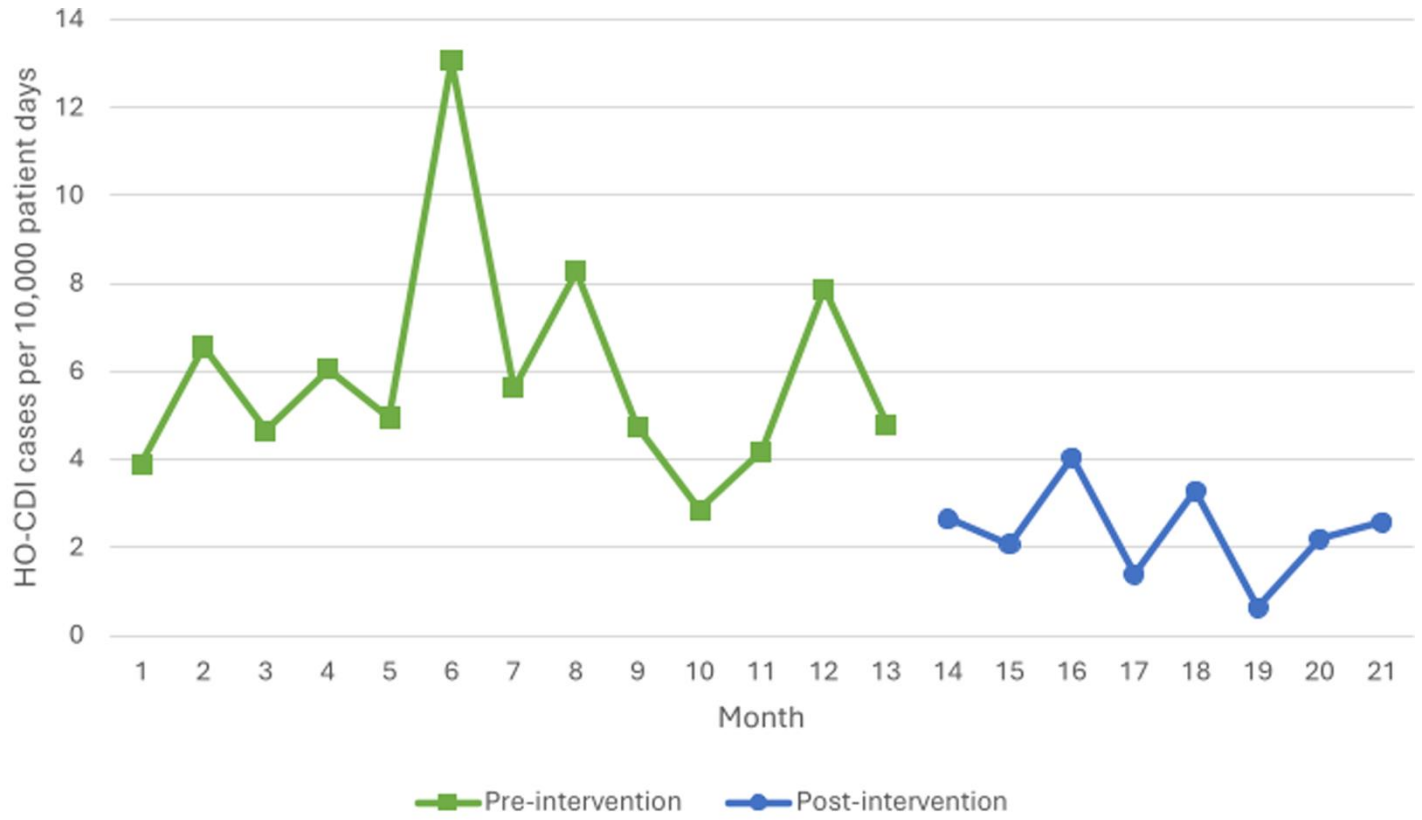


C Difficile: Measuring the intervention

- Process Measures:
  - Testing turnaround time
  - Cost?
  - ?Time for clinician interpretation of tests?
- Outcome measures:
  - Patients treated for CDI
  - Colonized patients treated
- Balancing
  - Colectomies
  - CDI positive readmits, subsequent treatment?



Hospital Onset C-diff dropped!



Abbreviations: HO-CDI, hospital-onset *Clostridioides difficile* infection

C difficile: did it … help?

- Of course, testing became more complex and expensive, and presumably slower (data not reported)
- Clinicians treated PCR +ve patients at… the same rate as before!
  - (no matter whether toxin negative)
- ID and GI consultation frequency increased
- No significant change in clinical outcomes…

UCSF Health Data

- More than half of our patients treated for C difficile are PCR positive/Toxin negative

- But these don’t count as NHSN cases, so we don’t pay much attention to them (wrongly, probably)

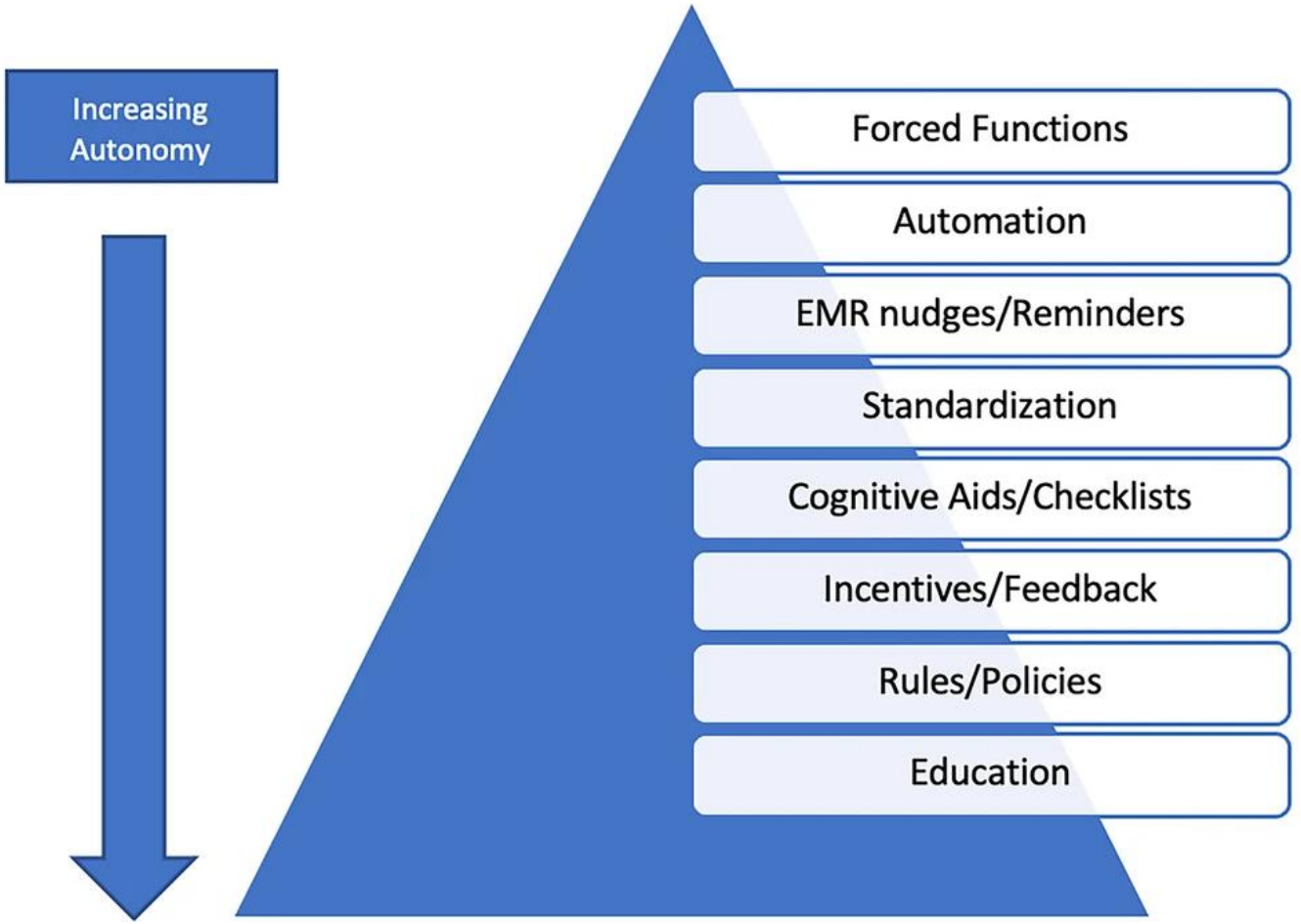
Takeaways

- Implementation is key
- Layering on poor quality tests may not be helpful
  - More information isn’t always better
- Culture trumps all?

Blood Culture Stewardship

- Blood Culture Shortage starting in late June 2024
- Critical need to reduce blood culture use
- Extreme and not-so extreme measures

From: Quality Improvement Interventions and Implementation Strategies for Urine Culture Stewardship in the Acute Care Setting: Advances and Challenges



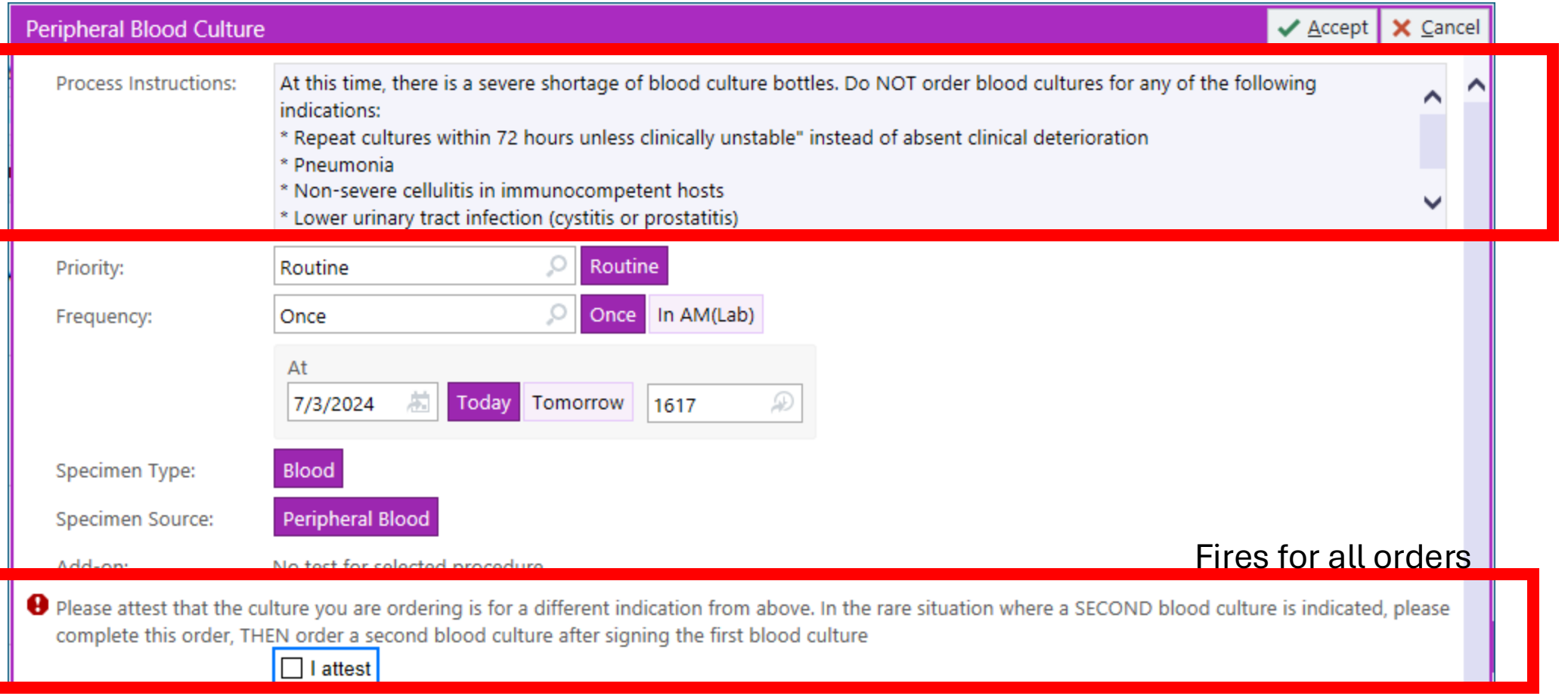
Remove from rainbow draw + ordersets

Team level auditing

Policy

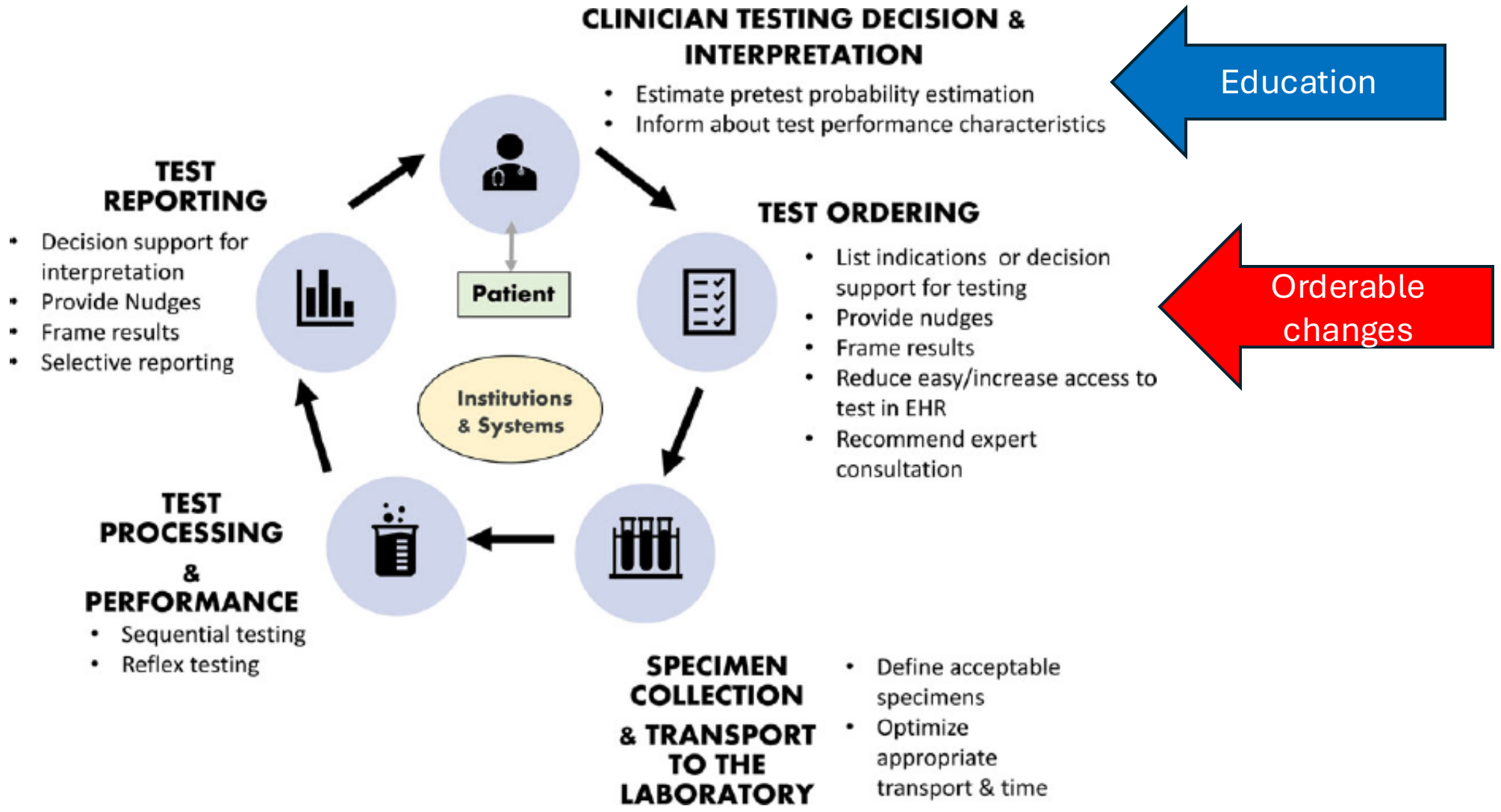
Lots of education, especially to high utilizing teams

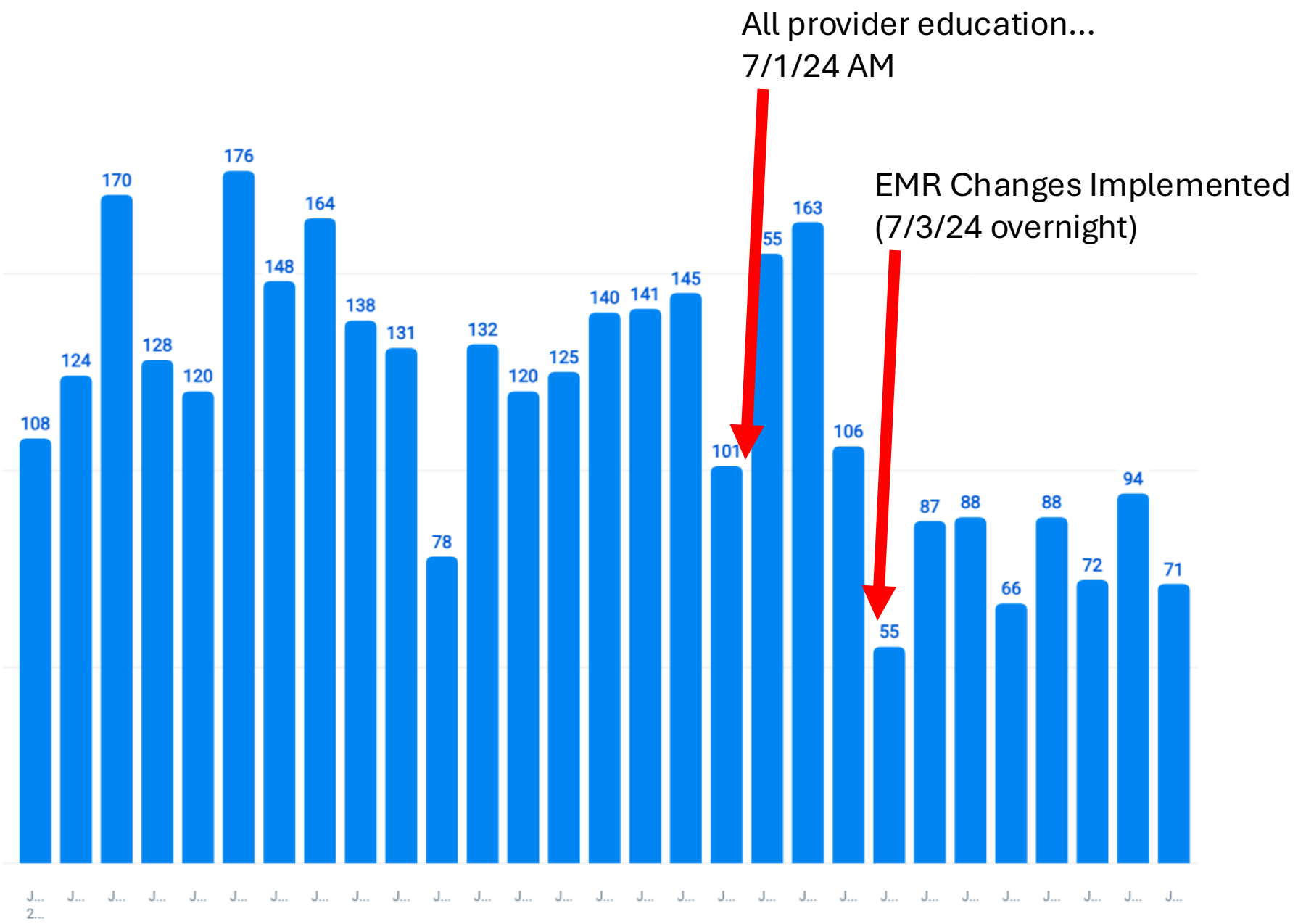
EMR Changes: a little mandatory checkbox



Fires for all orders

Diagnostic Pathway




All provider education…
7/1/24 AM
EMR Changes Implemented
(7/3/24 overnight)
108
124
170
128
120
176
148
164
138
131
78
132
120
125
140
141
145
101
55
163
106
55
87
88
66
88
72
94
71

Outcomes for BCx stewardship

- Process:
  - Adherence to guidelines
- Outcome:
  - Number of blood cultures used
  - Blood stream infections detected
- Balancing:
  - Late onset bacteremia
  - Safety reports
  - CLABSI?/Contaminant related

Joseph D Lutgring, Alexander Maillis, George C Bryant, Kathryn A Haass, Marissa McMeen, Henrietta Smith, Natalie L McCarthy, Kelly M Hatfield, L Clifford McDonald, Sujan C Reddy, Arjun Srinivasan, Margaret Dudeck, Hannah Wolford, The Impact of a Nationwide Blood Culture Bottle Shortage in 2024 on Healthcare Facilities in the United States, *Clinical Infectious Diseases*, 2025;, ciaf498, https://doi.org/10.1093/cid/ciaf498

Diagnostic Stewardship Summary

- “Optimizing diagnosis by improving the process of ordering, performance, and reporting (and **interpretation**) of diagnostic tests”
- Main intervention points: decision to test, ordering, and result reporting/interpretation
- Results are a powerful cognitive nudge for humans
- Measures are super important (and difficult!)

Thank You!

- Chloe Bryson-Cahn
- John Lynch
- Sarah Doernberg
- Valerie Vaughn
- Julie Szymczak