The role of microbiological diagnosis in antimicrobial stewardship: A systems approach

Symposium on Advanced Infection Control 2020
Antimicrobial Stewardship
19-20 November 2020

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No disclosures

Antimicrobial Stewardship in Australian Hospitals*

Antimicrobial stewardship is a requirement of hospital accreditation

- National safety and quality health care standards
- Specified requirements and assessment process

Programs:

1. AURA — Antimicrobial Use and Resistance in Australia
2. NAPS — National Antimicrobial Prescribing Surveillance
3. NAUSP — National Antimicrobial Utilization Surveillance Program

*The focus of this presentation is on hospitals in particular Australian AMS/AMR also include aged care and surgical specific programs

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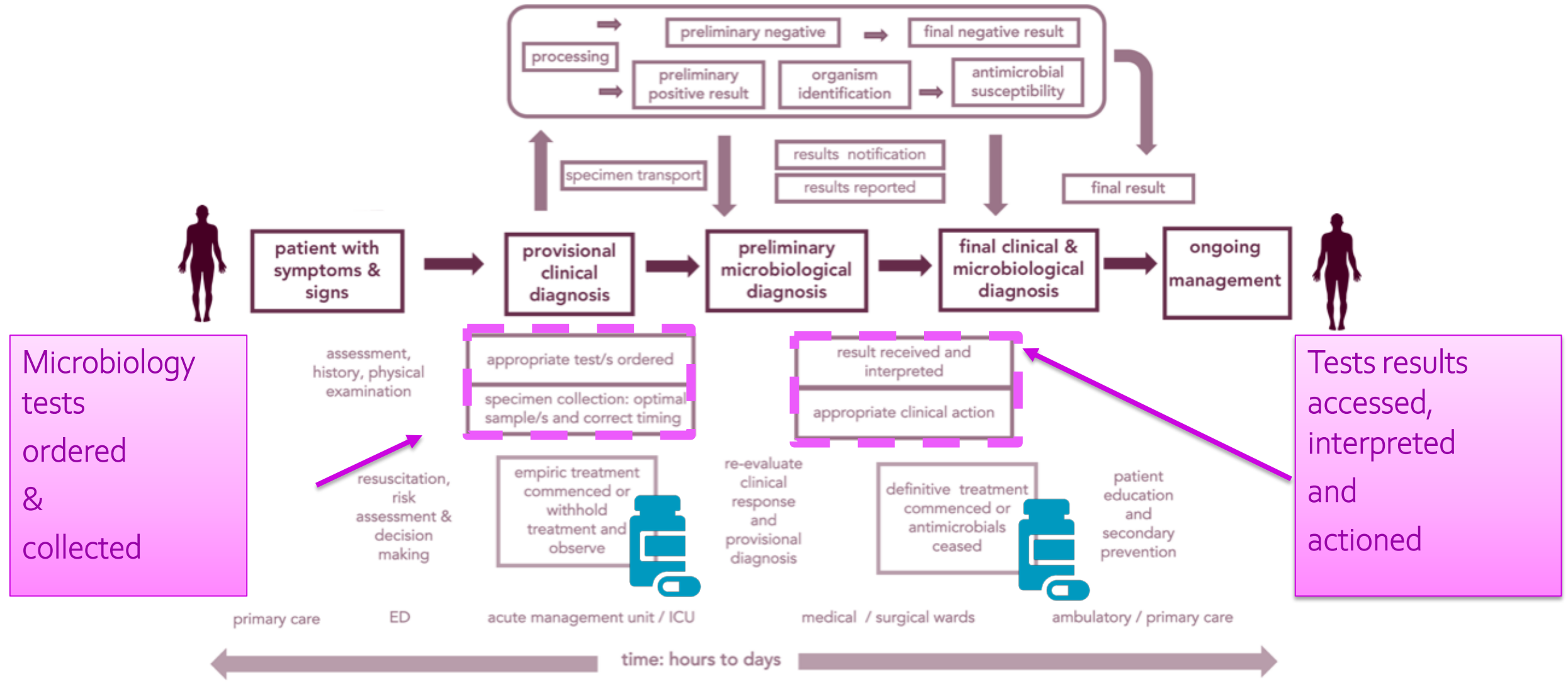
Antimicrobial Stewardship in Australian Health Care

2018

9 Role of the clinical microbiology service in antimicrobial stewardship

https://www.safetyandquality.gov.au/publications-and-resources/resource-library/antimicrobial-stewardship-australian-health-care

SMART Sepsis: Integrated Management



Antimicrobial Stewardship 2020

HOSPITAL NAPS National Antimicrobial Prescribing Survey

Hospital National Antimicrobial Prescribing Survey

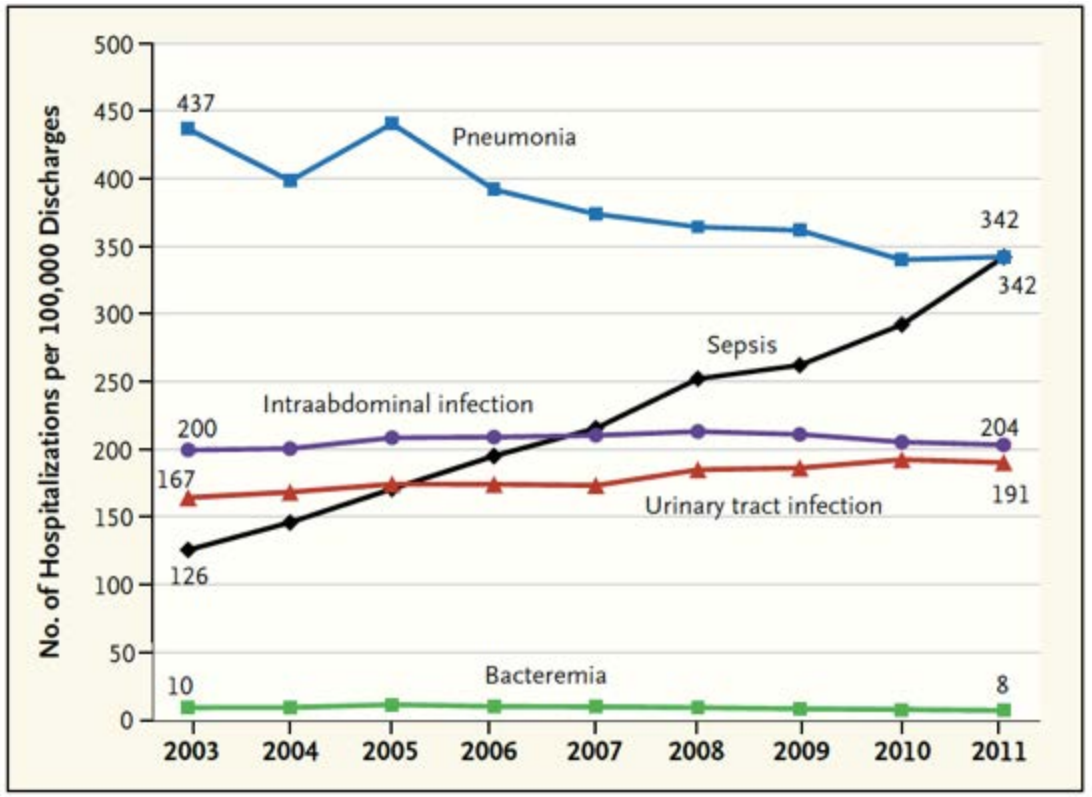
- 2013-2018 annual surveys
- 2018 26,714 prescriptions, 324 Australian hospitals

- Detailed information
- Antimicrobial use remains problematic
  - total usage is high with small improvements
  - appropriateness of prescribing 77.7 %
- AMS programs
  - routinely implemented
  - some improvements in process measures
  - improvement in outcomes difficult to achieve

Sepsis as a “diagnosis” increasing but specific diagnosis decreasing

Regulatory Mandates for Sepsis Care — Reasons for Caution

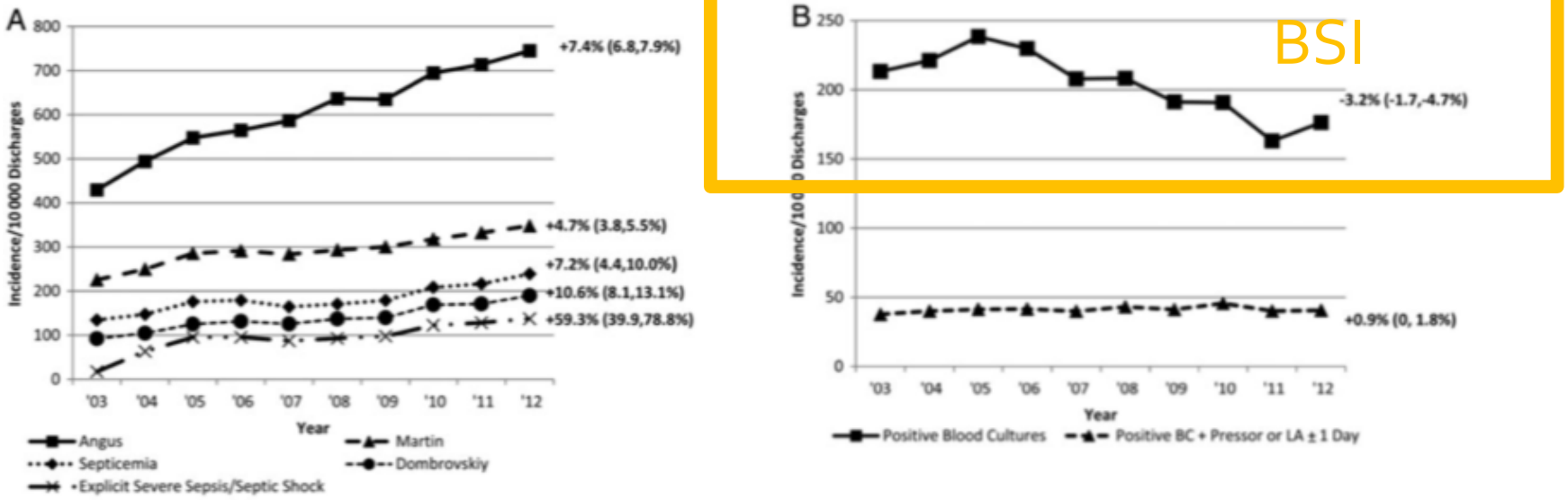
Chanu Rhee, M.D., Shruti Gohil, M.D., M.P.H., and Michael Klompas, M.D., M.P.H.



Hospitalizations for Which Certain Infection Codes Were Listed as a Primary Diagnosis, 2003–2011.

N ENGL J MED 370;18 NEJM.ORG MAY 1, 2014

Comparison of Trends in Sepsis Incidence and Coding Using Administrative Claims Versus Objective Clinical Data



incidence of hospitalisations for sepsis increased by 54-706%

incidence of hospitalisations with positive blood cultures decreased by 17%

Rhee C et al Clinical Infectious Diseases. 2015 1;60(1).

Diagnostic Errors that Lead to Inappropriate Antimicrobial Use

Filice 2015

- **CDS effectiveness depends on accuracy of original diagnosis**
- 500 patients, retrospective review
  - 55% diagnosis correct
  - **31% diagnosis incorrect**
  - 6% diagnosis sign or symptom only
- Appropriateness of antimicrobial strongly correlated with diagnostic accuracy
- 33% antibiotic therapy not indicated
- **Diagnostic error rate x2 higher than general inpatient diagnostic error rates**

Infect Control Hosp Epidemiol 2015;00(0):1–8

Antimicrobial prescribing practice in Australian hospitals

Results of the 2018 Hospital National Antimicrobial Prescribing Survey

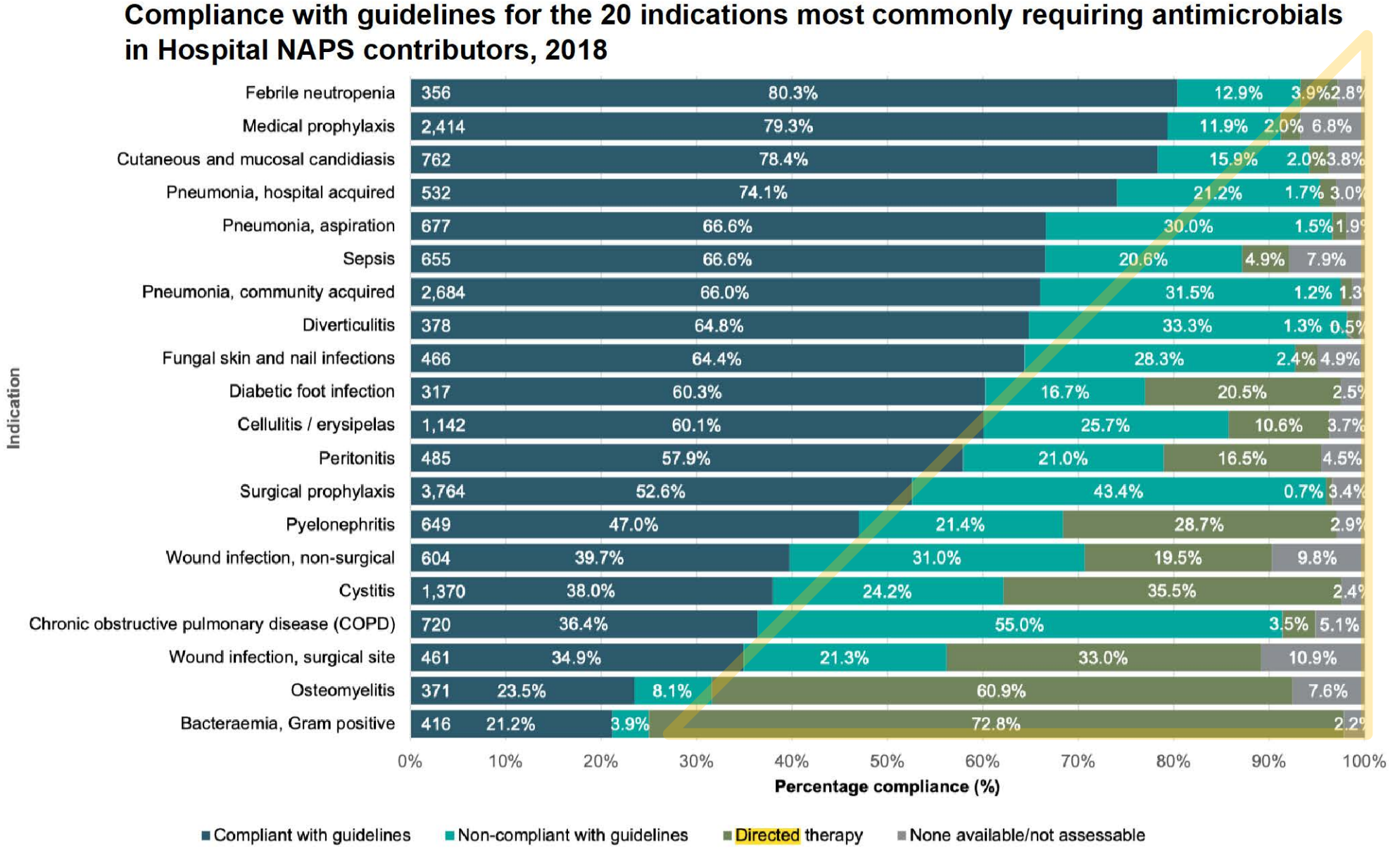
HOSPITAL NAPS National Antimicrobial Prescribing Survey

Directed Therapy 13.6%

Proportion of antimicrobials prescribed based on microbiology results 13.6%
>> 86% of patients empirical therapy

Table 5: Hospital NAPS compliance with guidelines and prescription appropriateness, for all prescriptions 2013–2018

		Percentage of total prescriptions (%)					
		2013	2014	2015	2016	2017	2018
Compliance with guidelines	Compliant with *Therapeutic Guidelines*[1]	44.5	44.3	45.3	42.4	44.8	44.2
	Compliant with local guidelines	14.1	12.6	10.4	9.7	9.3	9.4
	Non compliant	22.7	23.8	23.8	26.9	26.2	25.7
	Directed therapy	na	9.5	12.0	12.7	12.5	13.6
	No guideline available	12.0	5.3	3.7	4.0	3.3	3.7
	Not assessable	6.6	4.5	5.0	4.4	3.8	3.4
Appropriateness	Optimal	54.0	55.2	54.5	56.6	58.1	59.9
	Adequate	16.9	16.9	17.8	15.6	14.9	14.9
	Suboptimal	15.0	12.7	12.3	11.3	12.1	11.9
	Inadequate	7.7	10.5	10.0	11.2	10.2	9.5
	Not assessable	6.6	4.7	5.4	5.3	4.7	3.8



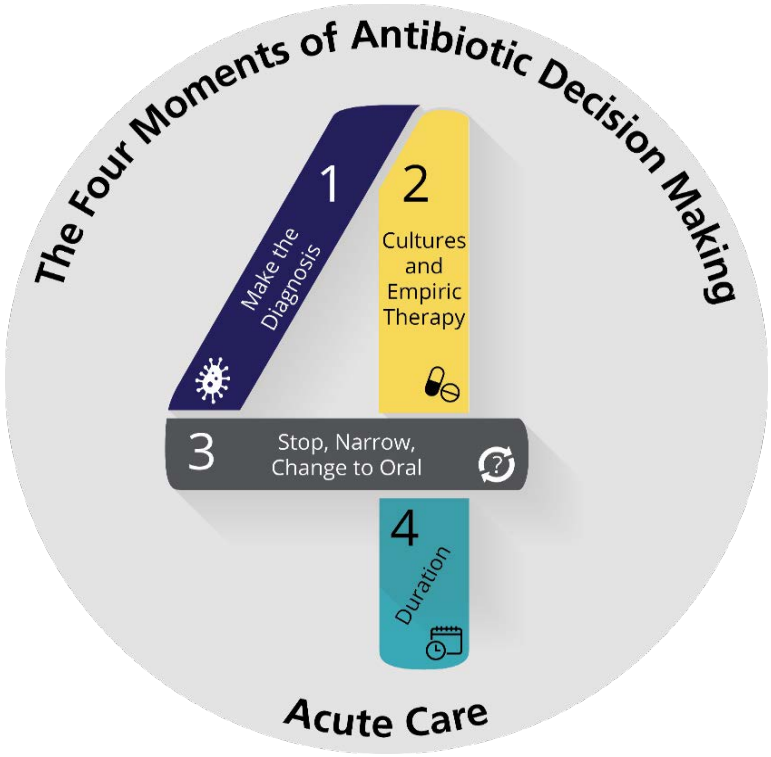
Australian Prescribing Survey (NAPS) 2018

The importance of diagnosis in AMS

- Antibiotic guideline compliance and computer decision support is a central pillar to AMS
- Effectiveness is lost and even harmful if the diagnosis is incorrect
- Poor use of microbiology diagnostic tests can contribute to diagnostic error

Infect Control Hosp Epidemiol 2013;34(6):558-565

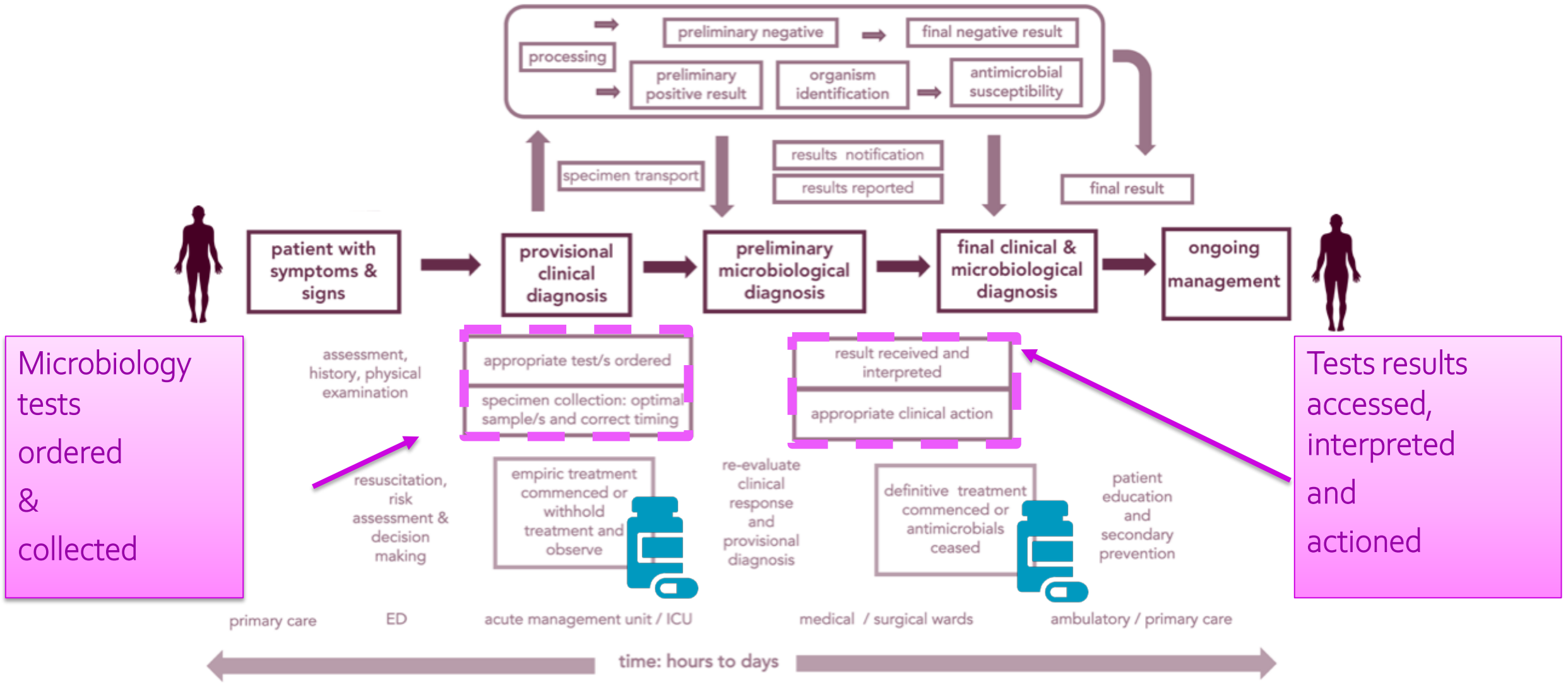
The Four Moments of Antibiotic Decision Making

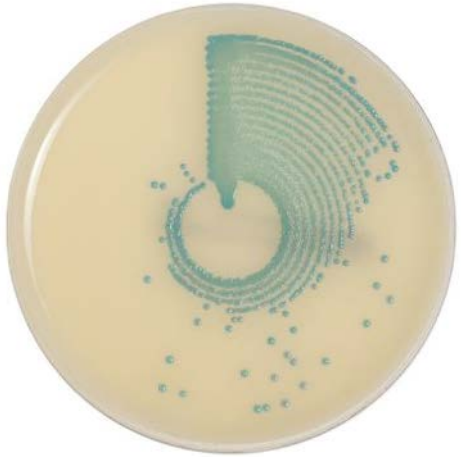


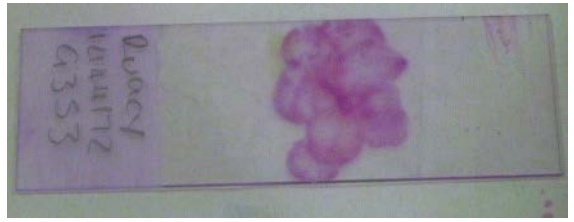
1. Does my patient have an infection that requires antibiotics?
2. Have I ordered appropriate cultures before starting antibiotics? What empiric therapy should I initiate?
3. A day or more has passed. Can I stop antibiotics? Can I narrow therapy or change from IV to oral therapy?
4. What duration of antibiotic therapy is needed for my patient's diagnosis?

AHRQ Pub. No. 17(20)-0028-EF
November 2019

SMART Sepsis: Integrated Management








mwe
Ref. MW170

Microbiology Test Use:

Diagnostic

Purpose: to direct patient management

- Rule in or rule out provisional diagnosis
- Guide patient treatment not only antibiotic selection

Diagnosis has multiple elements

- Condition
- Organism
- Susceptibility

Testing restricted to symptomatic patients only

Accurate interpretation of the test result is critical

Impact of suboptimal use of tests:

- Under-diagnosis
- Mis-diagnosis
- Over-diagnosis

Infection Control

Purpose: to direct infection control interventions

Management of risk

- Healthcare facility
- Other patients

Focus on specific organisms / antibiotic resistances

Test results: organism detected or not detected

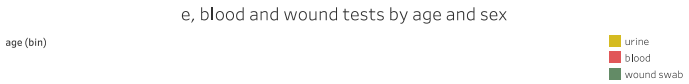
Testing involves:

- Symptomatic and asymptomatic patients ie screening
- Environment

Impact of suboptimal use of tests

- Under-detection

WA Health SMART Sepsis: Summary 2018 FYI



170,000
Patients

$6.2 m
Test
Fees

30,000
Wound Cultures

80,000
Blood Cultures

115,000
Urine Cultures

Improvement Targets

S pecific
M easurable
A chievable
R elevant
T ime-based

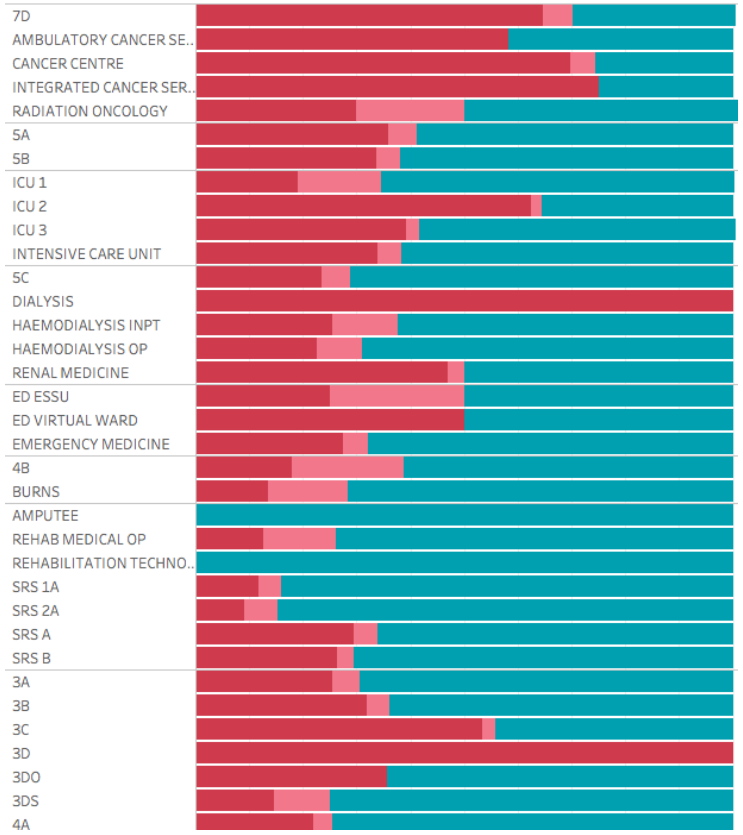
Midstream Urine Culture FY2017

- Use the data tool to identifying top performing and lowest performing units
- Why the variation? Learn from others to drive improvement

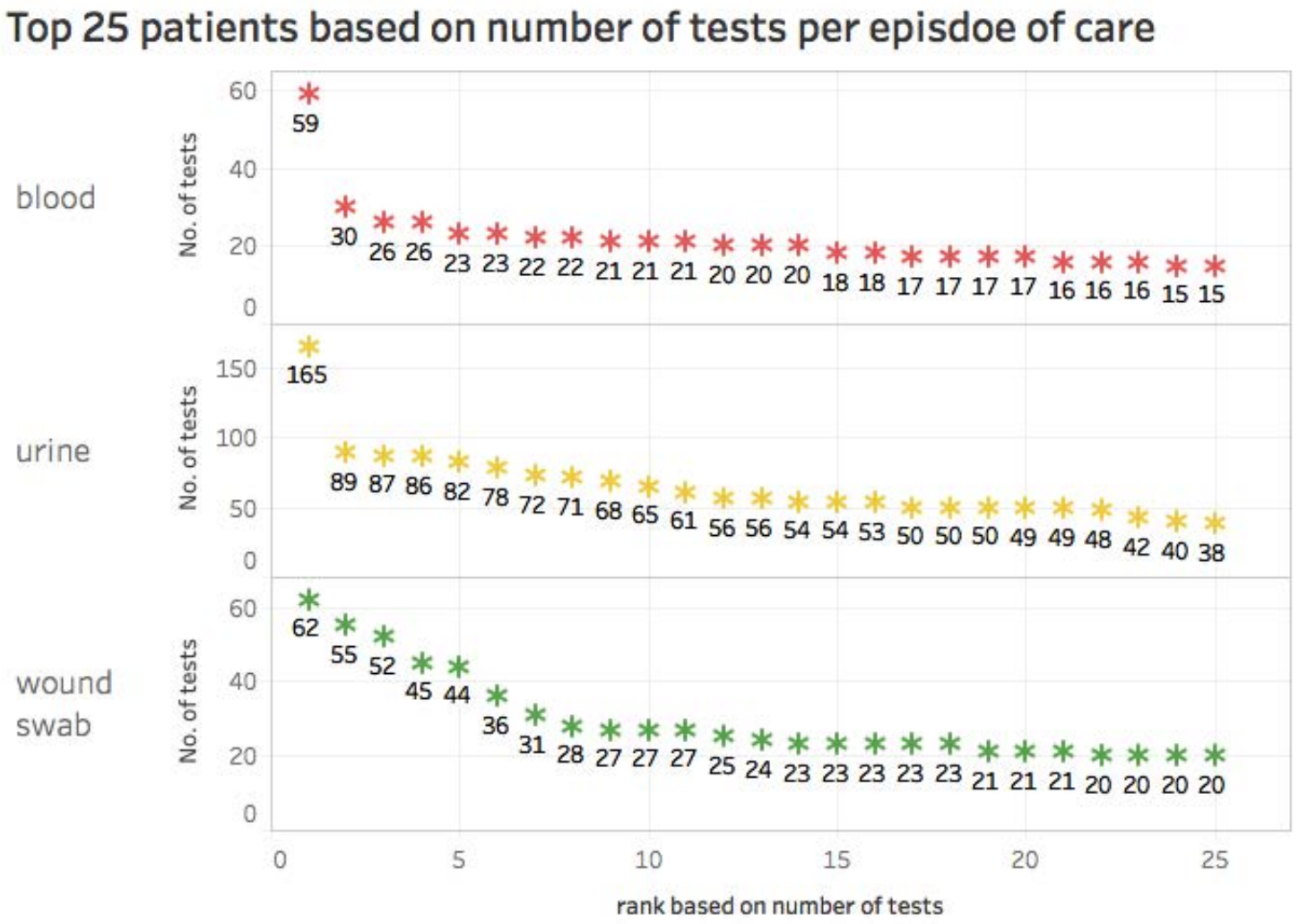
Wound Swab Cultures FY 2017

- 24% collections do not follow guidelines (2000tests on 725patients) $71,000/yr.
- Implement standardised processes to eliminate incorrect practice >> $70,000/year
- Other issues for wound swabs:
  - Inappropriate testing – ulcers, dirty sites, dry wounds
  - Specimen site labelling 10% do not have site specified – patient safety (1500 tests, 1400 patients)

Wide variation across the hospital



Repeat testing

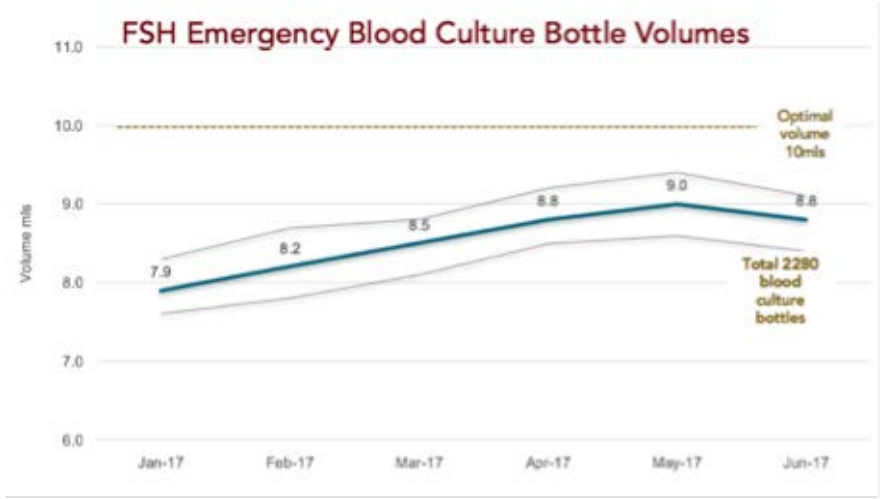


Indicators of over-use of tests

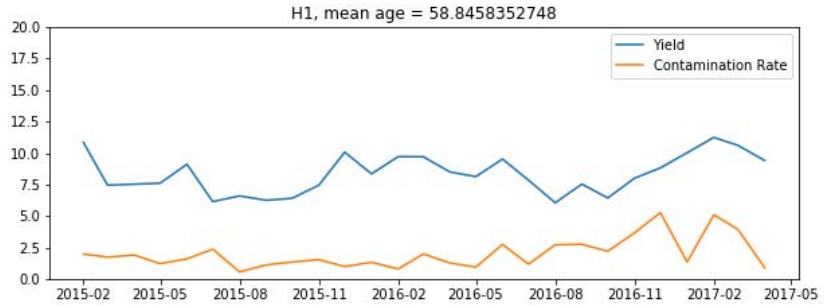
	Tests per visit > 3 (group)			
	1	2	3	>3
blood	49% 5,194 $143,770	29% 3,054 $107,398	11% 1,183 $58,958	11% 1,164 $115,730
urine	72% 15,202 $281,237	16% 3,286 $79,661	6% 1,218 $32,320	6% 1,275 $74,037

- 22 % of episodes of care that had a blood culture had more than 2 (max: 26)
- 28% had more than 1 urine (max: 154 MSU in a single admission)
- Reduce by 30% - $150,000/year

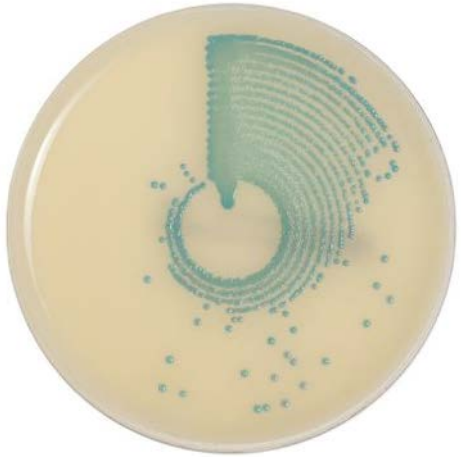
Blood Cultures ED

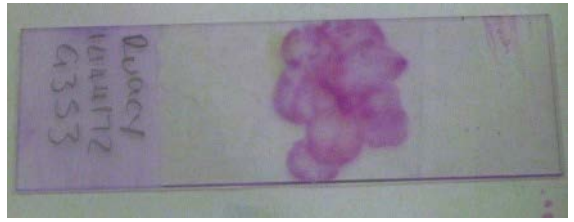


> 1 set collected per day	FSH
	RPH
	SCGH
	AHS
	RGH



- Rate of collection of more than 1 set: 40% ED (achievable best practice is > 90%) to increase detection of septicaemia by 28%
- Mean blood culture volume: 7.9-8.8 mls (best practice 10 mls) increase yield from blood culture testing by 15-20%
- Contamination rates: 2-5% (best practice 0.6-3%). Reduce to benchmark >> projected savings $ 100,00 – 500,000 / year






mwe
Ref. MW170

Microbiology User's Survey:
Knowledge Indication for urine culture

Indicate how frequently you recommend a urine culture for each fo the following clinical scenarios

- Routine practice on admission to hospital
- Pre-operative screening
- Patient with urinary catheter
- Patient with a fever
- Patient with confusion

Survey of 350 doctors and nurses WA tertiary hospital
WA SMART Sepsis: Education on microbiology test use as an antimicrobial stewardship strategy. ASM Microbe 2017 Benson & McClughan

Microbiology User's Survey:
Knowledge Indication for wound swab

Cellulitis without discharge	60%
Non-healing wound	
Cellulitis with purulent ooze	
Abscess fluid at time of drainage	

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Microbiology User's Survey:
Knowledge: Collection of Blood Cultures

If you are collecting a blood culture,please rate the importance of the different variables listed below:

Collection of blood cultures before antibiotics

Number of sets of blood cultures

Blood samples for multiple sets should be taken with separate stabs

Timing of collection in relation to fever spike*

The ideal volume of blood for each blood culture bottle (i.e. aerobic and anaerobic ..

Blood cultures:

1. **Before antibiotics** — 50 % reduced yield
2. **At least 2 sets from separate collections** — 28 % reduced yield
3. **10ml/bottle** — 3-5 % reduced yield per ml <10ml
4. **Aseptic technique**

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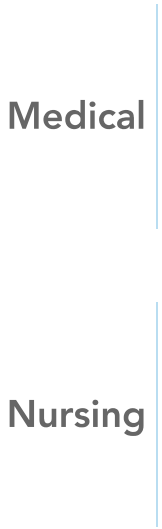
Microbiology User's Survey:

Previous formal education / training about microbiology culture test use



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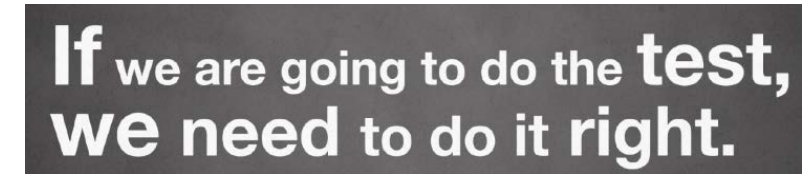
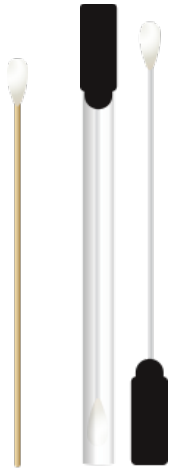
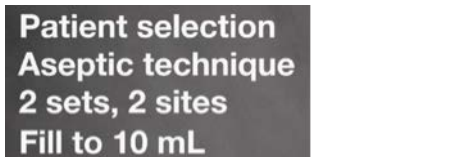
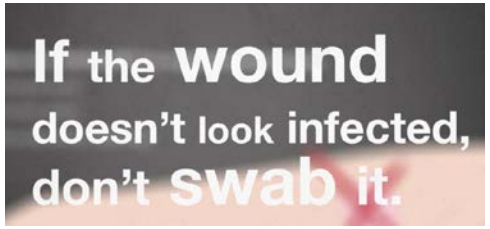
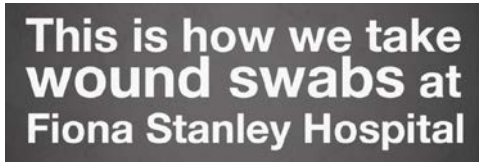
SMART Sepsis Education Videos

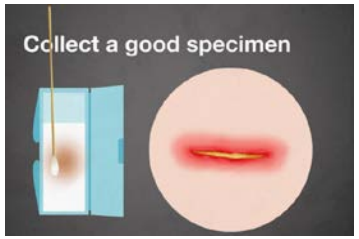


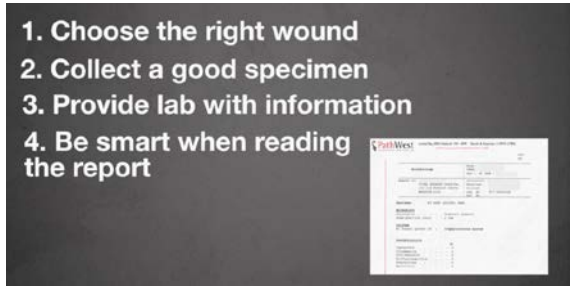


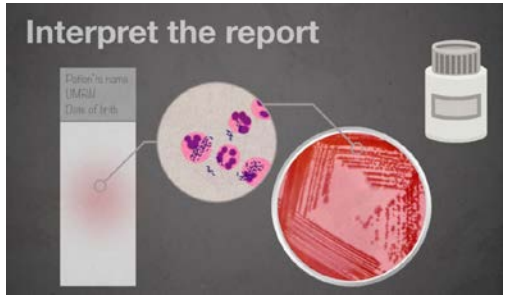








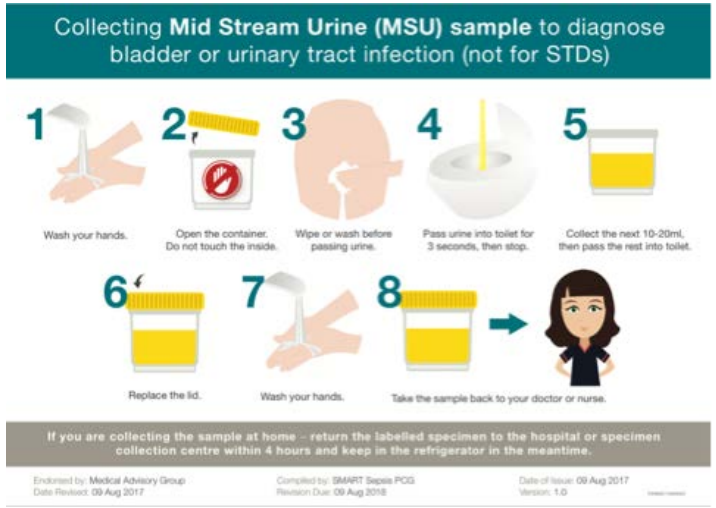




SMART Sepsis Project

Key targets

- Urine
  - Reduce unnecessary testing
  - Reduce contaminated samples
  - Stop catheter bag samples
- Blood cultures
  - Better target which patients to tests
  - 2 sets from different sits before antibiotics
  - 10mls blood per bottle
  - Aseptic technique
  - Reduce inappropriate repeat testing
- Wound swabs
  - Better target which sites to tests
  - Clean before collection
  - Collect adequate smear
  - Specifically identify the collection site

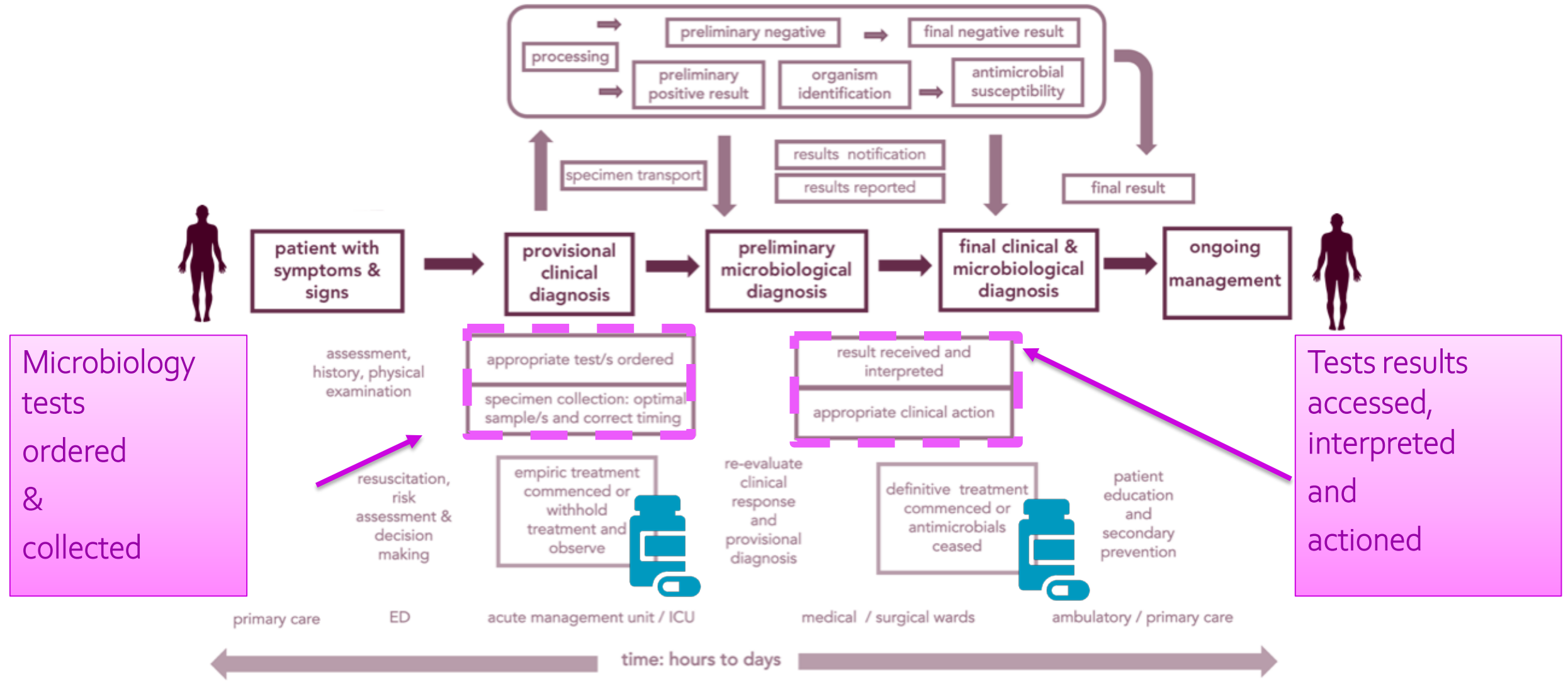


A Baker's Dozen of Top Antimicrobial Stewardship Intervention Publications in 2018

Musgrove et al. 2018 [17]	Multicenter, single pre- and postintervention, quasi-experimental study	Clinical microbiology laboratory changed wording in reports on non-pathogen-containing respiratory cultures to emphasize no *Staphylococcus aureus*, MRSA, or *Pseudomonas aeruginosa*.	• Mortality: historical 7 (2.3) vs intervention 3 (1); $P = .233$ Primary outcome • De-escalation: 39% vs 73%; $P < .001$ Secondary outcomes • Discontinuation of anti-MRSA therapy: 37% vs 71%; $P < .001$ • Discontinuation of antipseudomonal therapy: 32% vs 70%; $P < .001$ • Acute kidney injury: 31% vs 14%; $P = .003$ • In-hospital, all-cause mortality: 30% vs 18%; $P = .52$
Keller et al. 2018 [22]	Single-center, prospective time series analysis	To reduce the ordering of urinalyses and urine cultures in patients without symptoms of a UTI, a series of interventions including the distribution of educational materials and implementation of CDS alerts in the EMR was implemented. CDS alerts were placed on all orders for urinalyses, urine cultures, and for antibiotics commonly used for treating UTIs (nitrofurantoin, trimethoprim-sulfamethoxazole, ciprofloxacin, cefazolin, cephalexin, and ceftriaxone).	Primary outcome: Urinalysis orders did not significantly decrease • –10.2%; $P = .24$ Secondary outcome: Orders for urine cultures did significantly decrease • –6.3%; $P < .001$ Other results • Decrease in simultaneously ordering urinalyses and urine cultures (–5.8%; $P < .001$) • Decrease in urinalysis orders followed by antibiotic orders within 1–24 hours (–0.56%; $P = .021$) • Decrease in urine culture results followed by an antibiotic order within 24 hours (–0.24%; $P = .036$)

Chahine EB, et al. *Open Forum Infectious Diseases*. 2019;6(11).

SMART Sepsis: Integrated Management



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