ROLE OF LABORATORY IN INFECTION PREVENTION AND AMS

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The Microbiology Laboratory is a Valuable, but Largely Underutilized Partner In Antimicrobial Stewardship and Antimicrobial Resistance Monitoring

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Improving the diagnostic process (clinically, microbiologically, or in other ways) is an inherent part of any antimicrobial stewardship programme, since a good prescription starts with a good diagnosis.

Empirical treatment

- Guessing game
  - Is this infection SIRS
  - Viral or bacterial
  - What is the organism
    - True infection
    - Colonizer
    - contaminant
  - Sensitive or resistant to the abt

- Patient-specific culture & susceptibility report
- Surveillance
  - MDRO
  - Recognized clusters or outbreak
  - Helps to recognized emergence of new infection
  - Contact Screening
  - Environmental screening
- Outbreak detection & investigation
  - Find source
  - As an assessment tools for evaluating improvement
- Antimicrobial Stewardship
- Deliberation of Infection control committee
- Education

- Monitoring and preventing infections by detecting them when they occur
- The faster the detection the faster the **Directed** treatment given and all the isolation & prevention actions can taken
- This will prevent unnecessary antibiotics given that may create selection pressure - leads to antibiotic resistance and prevent the transmission of the infection to others

Patient-specific culture & susceptibility report

- WHAT ANTIBIOTIC TO USE
  - Actual pathogen & sensitivity pattern
  - Guide on empirical therapy / prophylaxis
- DECIDE TO STOP ANTIBIOTIC
  - This is NOT due to infection
  - This Not due bacteria

Directed Therapy

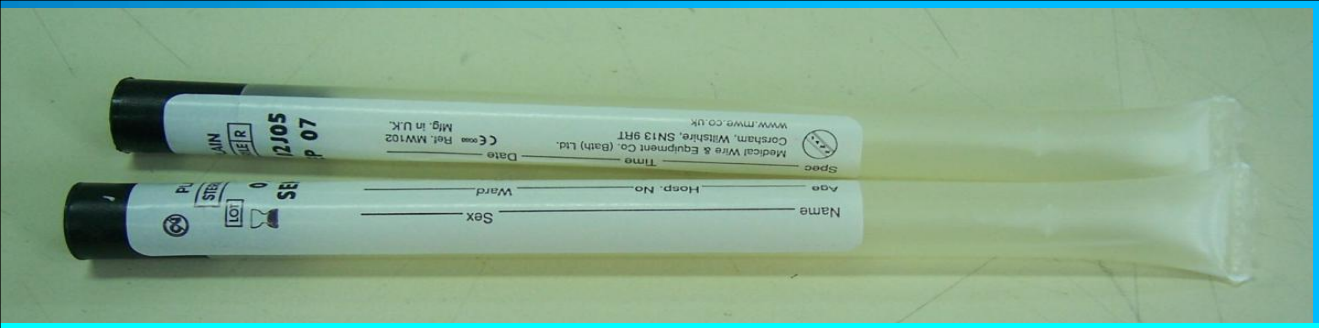
Fast & accurate report

Quality & timely specimens

Specimen Management

- The impact of proper specimen management on patient care is enormous.
- It is the key to accurate laboratory diagnosis and confirmation,
- Directly affects patient care and patient outcomes
- Influences therapeutic decisions
- Impacts hospital infection control
- Impacts patient length of stay, hospital costs, and laboratory costs, and influences laboratory efficiency.


Improper sample collection
Contaminati on / mixed growth
Purity
- Delay in Identification & sensitivity testing
Delay in reporting
Prolonged empirical therapy

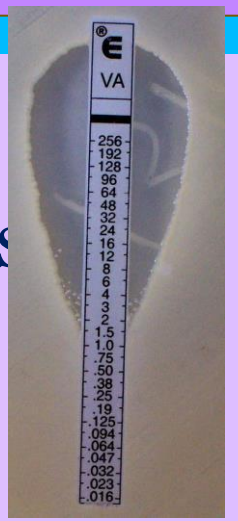


Specimen Collection - good specimen will give pure growth of the pathogen & Accurate Identification and Susceptibility Testing

- Which samples
  - not all infection are systemic …. Localized infection will lead to No Growth on blood culture bottles
- Method of sampling
  - Septic technique blood culture sampling
  - Surface swabbing of dirty wound
  - Aerobic/ anaerobic culture

release of proteases and reactive
oxygen species, result in tissue damage

Susceptibility Testing of Healthcare-Associated Pathogens



Perform accurate susceptibility testing

- Implementation of multiple techniques
  Rapid automated systems
    Disk Diffusion
    E-test
- Survey for MDR organisms
- Detect unexpected antimicrobial resistance

Surveillance

- MDRO
- Helps to recognized emergence of new infection
- Recognized clusters or outbreak
- Contact Screening
- Environmental screening

MDRO

- Communicate to treating doctors, ICN & ID
- Discuss with ICN

  - contaminant / colonizer / true infection
  - Isolation precaution
  - Screening of contacts
  - Mapping
  - Environmental screening
  - Institutes control measures

Helps to recognized emergence of new infection or MDRO

- Not usually isolated … may have a different antibiograms that may not be covered by the usual empirical therapy
  - in certain ICU's where Sternotrophomonas was not usually isolated
  - Candida auris – outbreaks in ICU's
  - CRE

Outbreak Recognition and Investigations

- Alert infection control of potential outbreaks
  - Detection of clusters
- Assist infection control in identifying source and controlling outbreaks
  - Cultures of Specimens from Hospital Personnel and the Environment
  - Molecular Typing
  - Organism Storage

Application of Molecular Typing Techniques

- Recognize and confirm an outbreak
  Clusters of patients within hospitals
  Track spread between hospitals over time
- Document hospital transmission
- Measure impact of intervention strategies
- Distinguishing relapse from re-infection in individual patients

Antimicrobial stewardship

- Fast & reliable report for Directed therapy
- Notify clinicians when critical infections are detected
- Provide regular pt specific liaisons with clinician & AMS team in high risk unit
- Perform surveillance for resistance organisms
- Cascade reporting
- provide comments that interpret isolate significance
- provide antimicrobial susceptibility interpretation
- provide antimicrobial management advice.
- Generating cumulative antimicrobial susceptibility reports to form local guidelines & clinical pathways

Cascade reporting

- Strategy of reporting antimicrobial susceptibility test results in which secondary (e.g., broader-spectrum, more costly) agents may only be reported if an organism is resistant to primary agents within a particular drug class
- The rationale behind cascade reporting is that if the secondary agents are not reported, it is less likely they will be prescribed

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Antimicrobial Stewardship in the Microbiology Laboratory: Impact of Selective Susceptibility Reporting on Ciprofloxacin Utilization and Susceptibility of Gram-Negative Isolates to Ciprofloxacin in a Hospital Setting

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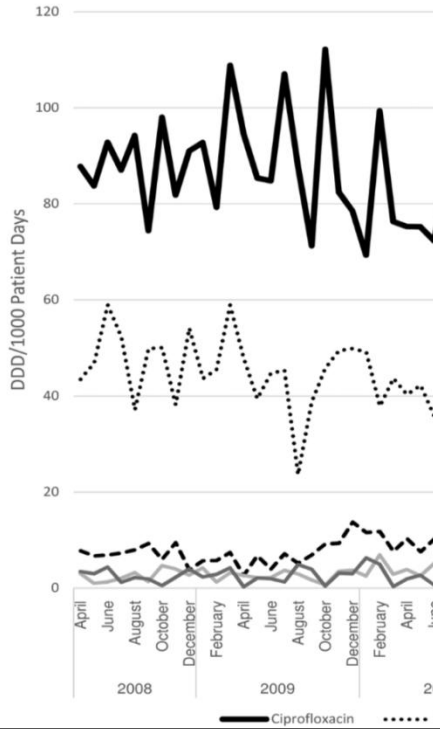


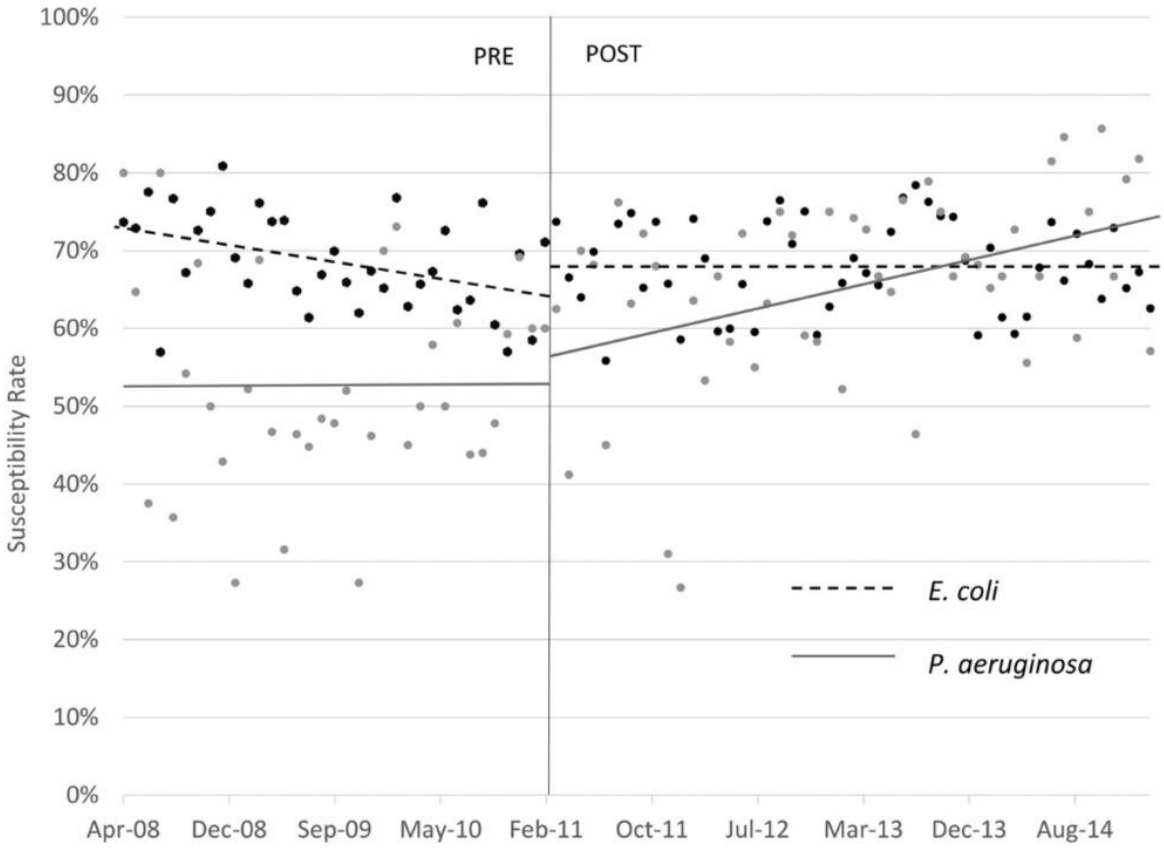


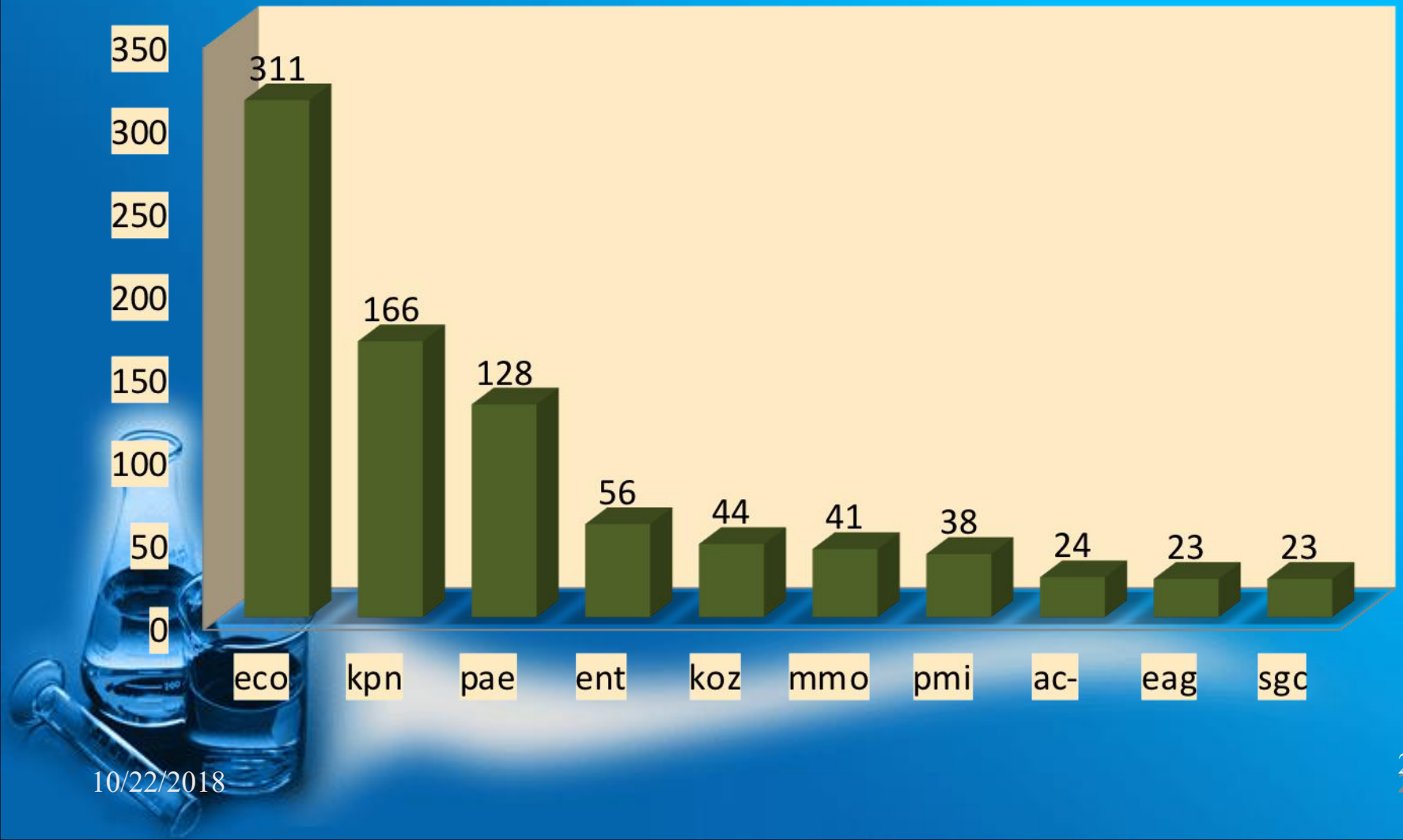
FIG 2 *E. coli* and *P. aeruginosa* susceptibility to ciprofloxacin before and after selective susceptibility reporting

Cumulative antimicrobial susceptibility reports

The clinical microbiology service also has a critical role to play in improving overall antimicrobial use through providing information, establishing guidelines and educating other hospital staff.

One key strategy is the production of annual cumulative antibiograms to indicate susceptibility patterns for key pathogens

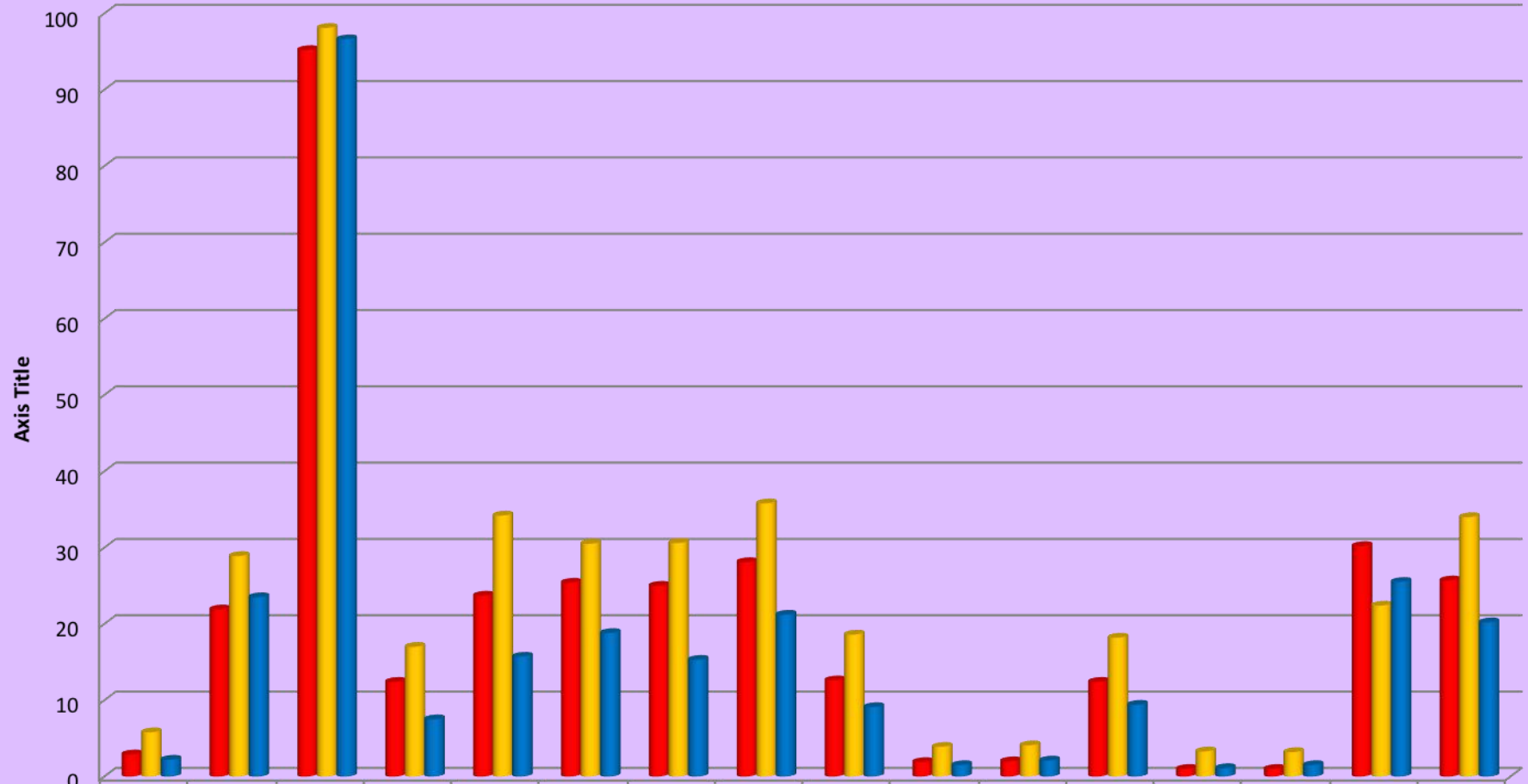
No. of common organism isolated from urine Jan-June 2018 (n=1020)



Comparing % of resistant of E.coli from Blood, Swab and Urine

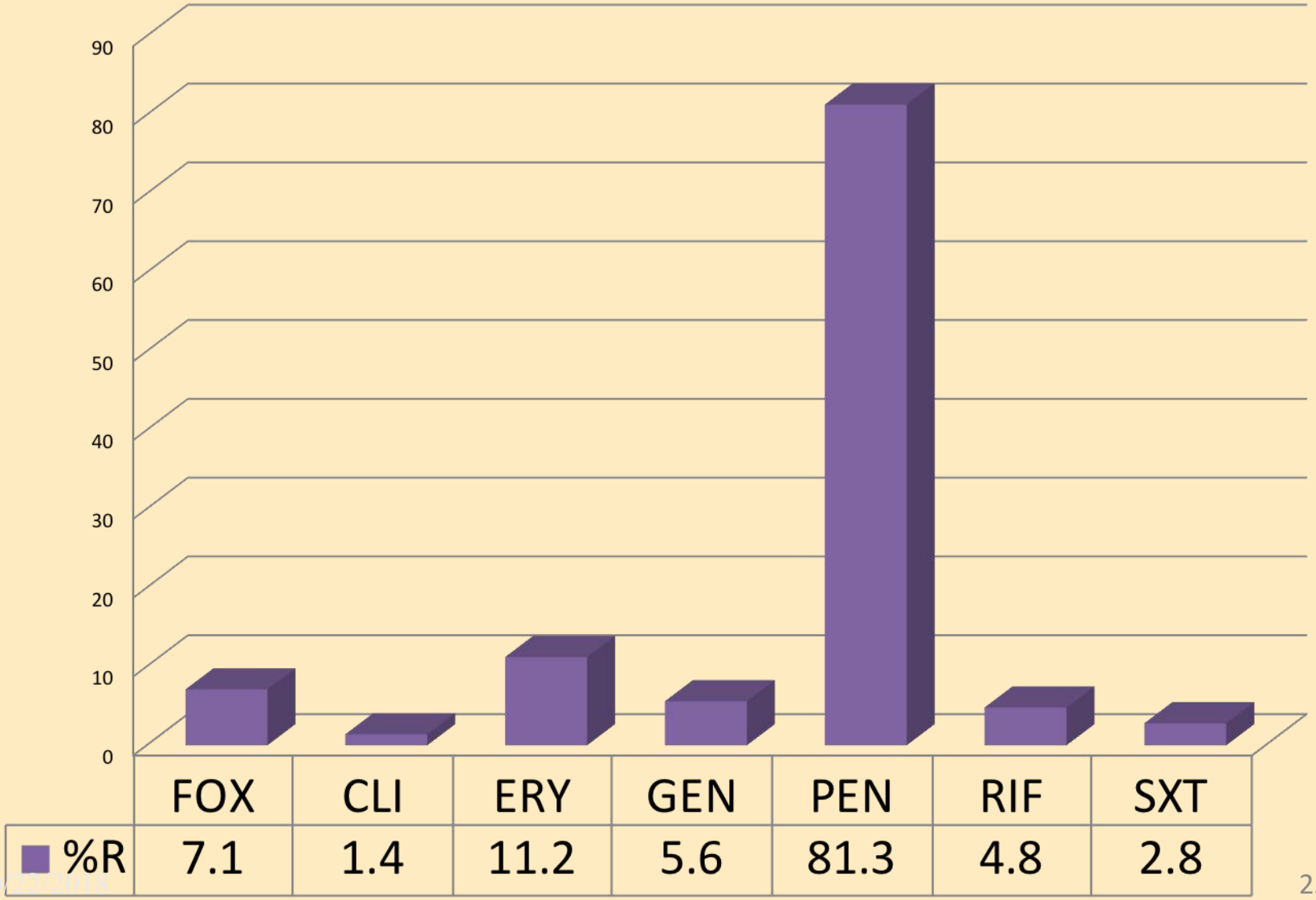
	AMK	AMC	AMP	FEP	CFP	CTX	CAZ	CXM	CIP	DOR	ETP	IPM	MEM	GEN	TZP	NIT	TGC
Blood	0	5.3	68.3	2.9	22.2	20.7	9.1	21.2	19.7	0	0	0.5	0.5	18.8	1.4	2.4	1.4
Swab	0.8	21.2	71.2	6.1	28.2	25	14.4	26.7	21.2	1.5	0	2.3	1.6	17.4	5.3	3.8	3
Urine	1.2	13.3	70.8	7		27.2	16	29.2	23.8	2.7	1.6	5.9	4.1	20.2	4.3	3.1	4.3

% of Resistant Klebsiella sp in Blood, Urine and total isolate



	AMK	AMC	AMP	FEP	CFP	CTX	CAZ	CXM	CIP	DOR	ETP	GEN	IPM	MEM	NIT	SXT
BL	2.9	21.9	95.2	12.4	23.7	25.4	25	28.1	12.6	1.9	2	12.4	1	1	30.2	25.7
UR	5.8	28.9	98.1	17	34.2	30.5	30.6	35.8	18.6	3.9	4.1	18.2	3.3	3.2	22.4	34
TOT	2.2	23.5	96.6	7.5	15.7	18.8	15.3	21.2	9.1	1.5	2.1	9.4	1.1	1.5	25.5	20.2

% of Staphylococcus aureus from Blood Resistant to commonly used antibiotics



- Antimicrobial stewardship is a key instrument in working to improve the use of microbiologic data in order to help facilitate the appropriate use of antimicrobials and therefore to minimize antimicrobial resistance, as well as other unintended consequences, such as antimicrobial toxicity, adverse drug reactions, and *Clostridium difficile* diarrhea

- AMS rounds –
  - Enhance communication
    - Selection of patients
    - Selection of types of samples
    - Rapid search of tests method
    - Rapid ID
    - Rapid susceptibility testing

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BIOMARKERS AND RAPID DIAGNOSTIC AND RAPID SUSCEPTIBILITY TESTING

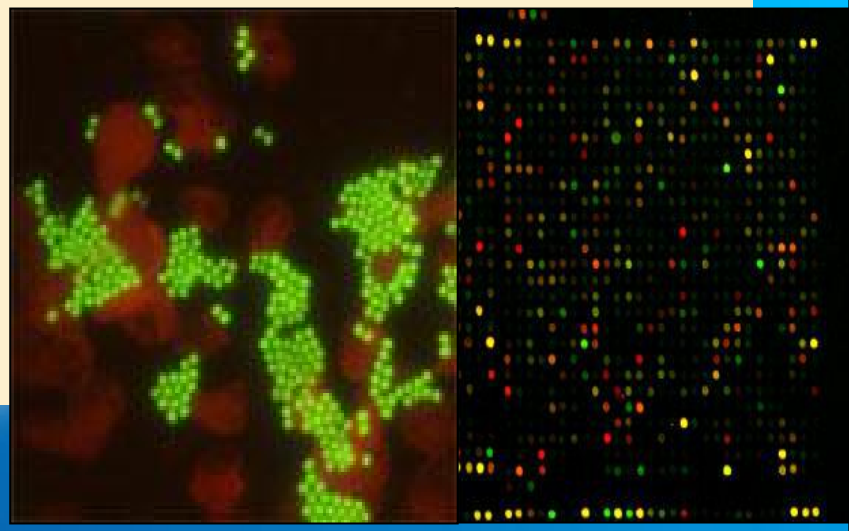
- CRP –
- It is widely used to monitor the clinical response in bacterial infections, but high intra- and interindividual variability makes it difficult to use for diagnostic purposes

- PCT, a prohormone of calcitonin, is secreted by a number of organs in response to bacterial—but not viral—invasion/infection .
  - Serum PCT is detectable as soon as 4 h and peaks between 12 and 48 h after infection onset.
  - Most studies have focused on its use for respiratory infections and sepsis
  - data support its use more often as an indicator to stop, rather to start, therapy.
  - A Cochrane review in 2012 of the use of PCT algorithms in acute respiratory infections found that the median exposure to antimicrobials was reduced from 8 to 4 days without any adverse impact on the mortality rate

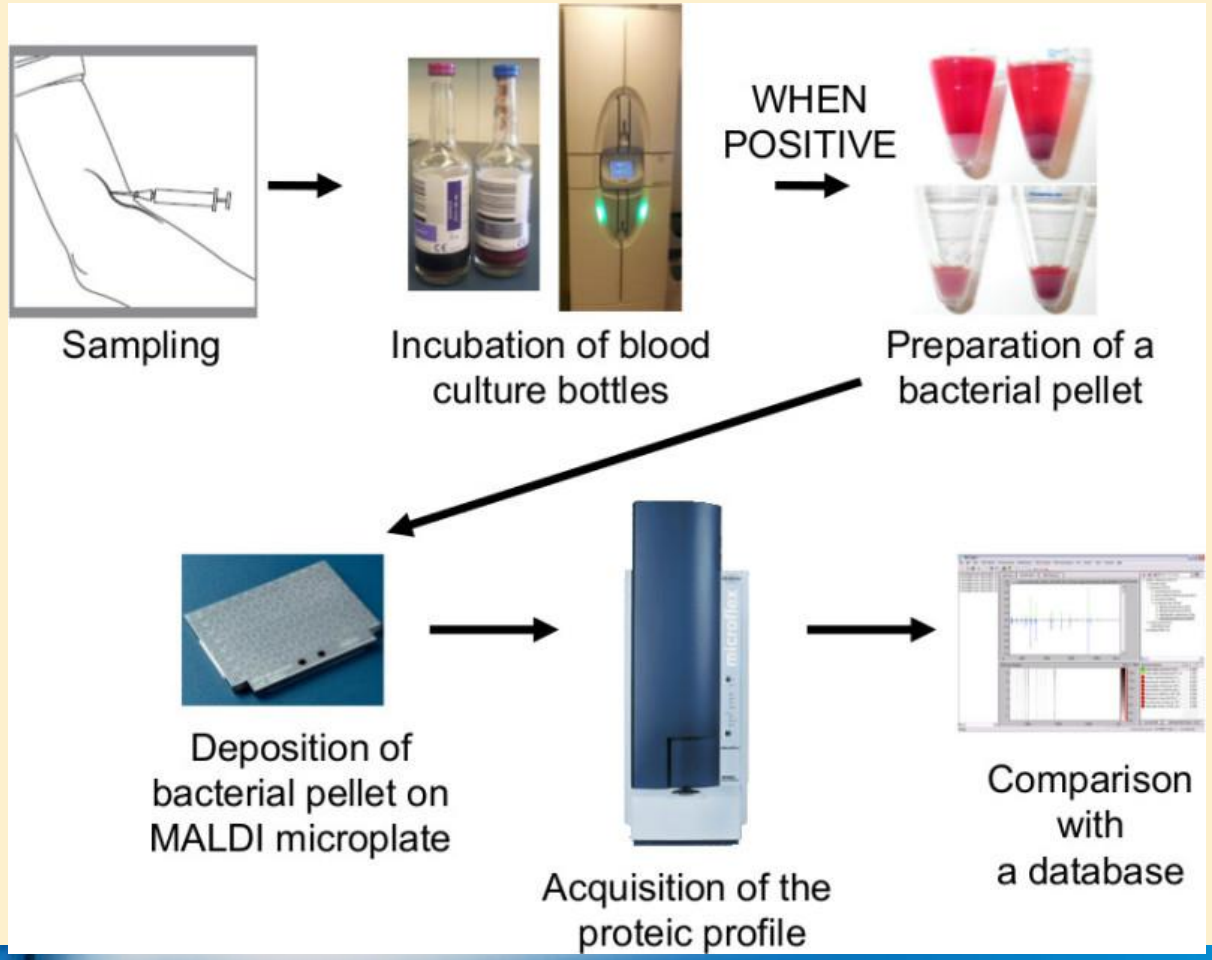
Rapid Diagnostic Testing

- Newer Identification techniques
- Molecular diagnostics-from days to hours
- Specific pathogens C. difficile
- Group A Strep

  Panels based on symptoms/sample types
- Respiratory Stool
- Surveillance MRSA
- VRE KPC
- Resistance genes



Rapid Diagnostic Testing (RDT) and Rapid Antimicrobial Susceptibility Testing



Positive blood culture bottle

Harvest 1 ml blood culture liquid in an Eppendorf tube
1 min

Solution 1+

Add **Solution 1+** and mix
30 sec

Centrifuge (1 min., 13.000 rpm)
discard supernatant
1 min

Solution 2

Add **Solution 2** and mix
1.5 min

Centrifuge (1 min., 13.000 rpm)
discard supernatant
1 min

Sample Preparation

Suspend pellet in 300 µl water

The MALDI Biotyper Solution

Blood Culture Direct Analysis

Blood culture bacterial pellet

Gram staining → **≤1h**

> 100% accurate

MALDI-TOF MS → **≤1h**

> 99% accurate

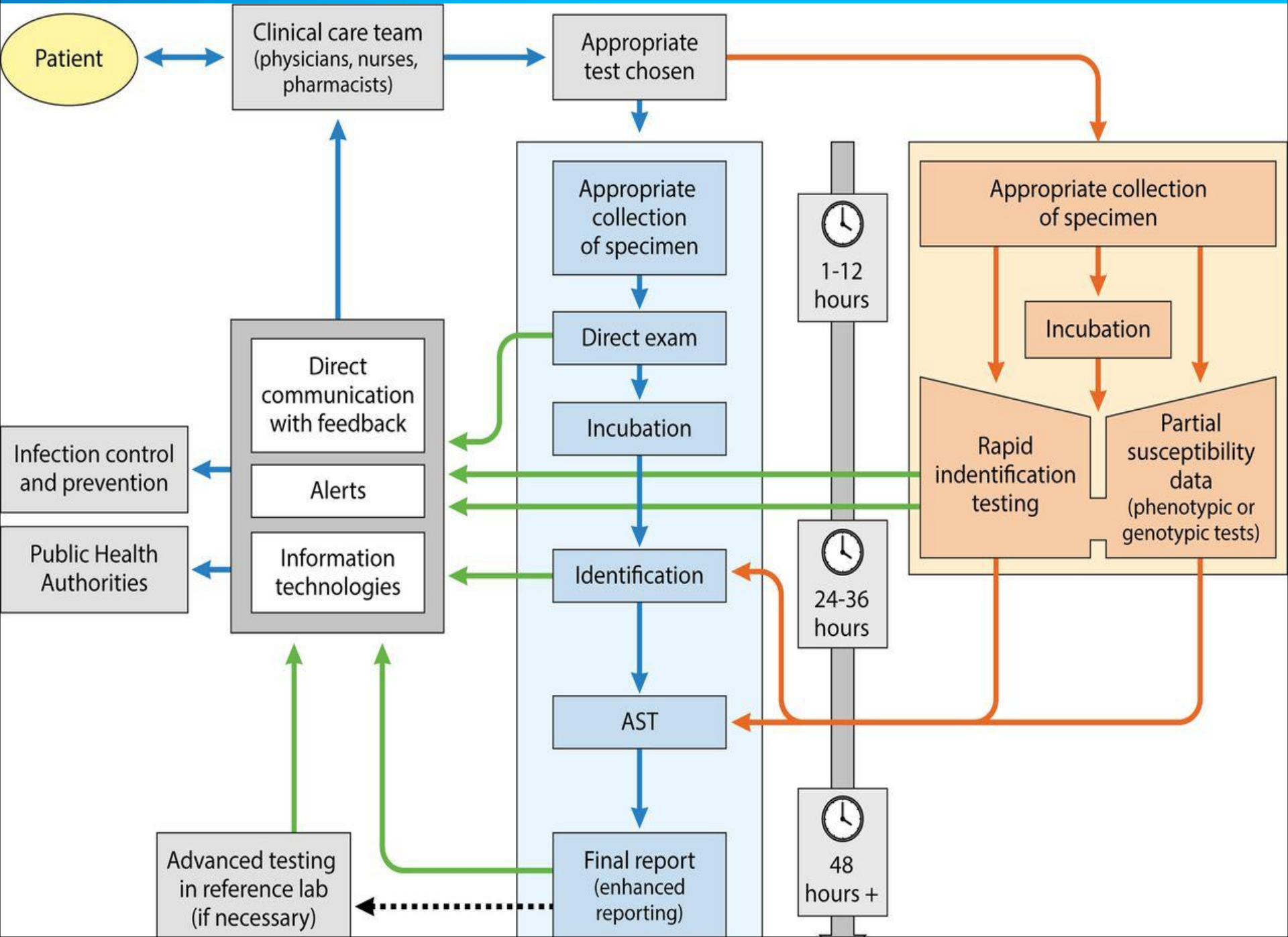
Antibiotic suceptibility testing → **16-24h**

> 99% accurate

POCT-PCR MRSA → **2-3h**

Sensitivity 99%

Specificity 100%


Patient
Clinical care team (physicians, nurses, pharmacists)
Appropriate test chosen
Appropriate collection of specimen
Direct exam
Incubation
Identification
AST
Final report (enhanced reporting)
1-12 hours
24-36 hours
48 hours +
Appropriate collection of specimen
Incubation
Rapid indentification testing
Partial susceptibility data (phenotypic or genotypic tests)
Direct communication with feedback
Alerts
Information technologies
Infection control and prevention
Public Health Authorities
Advanced testing in reference lab (if necessary)

Clinical evaluation

Patient

Diagnosis & treatment

Diagnostic Stewardship

- Right specimen
- Right test
- Right patient
- Right time

Health Care Provider

Antimicrobial Stewardship

- Right interpretation
- Right antimicrobial
- Right time

Rapid Diagnostic Test ordered

Rapid diagnostic test performed

Microbiology laboratory

Rapid diagnostic Result reported

THANK YOU