



**Health**

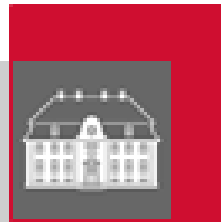
Hunter New England  
Local Health District

# The Role of Microbiologists in Antimicrobial Resistance Control

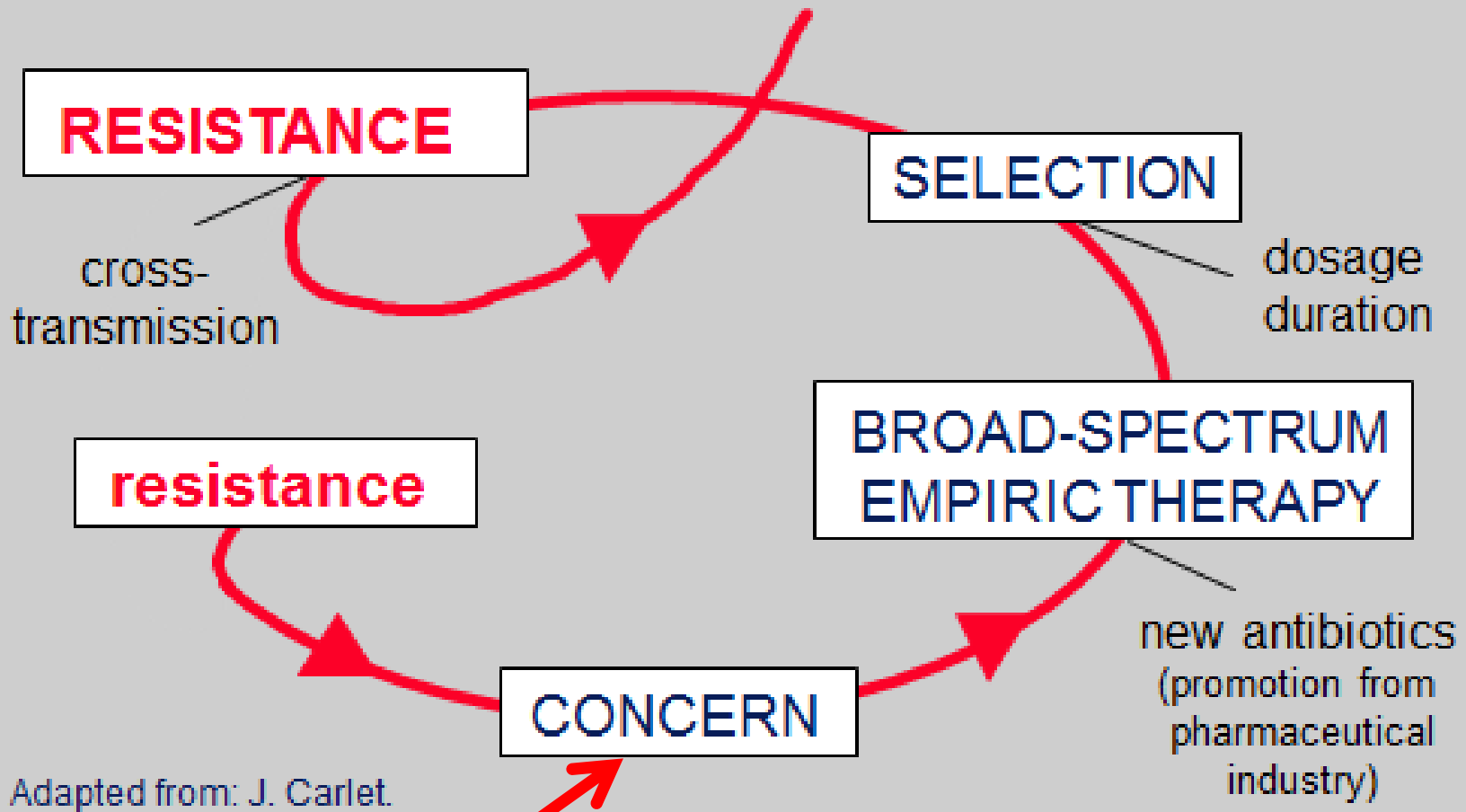
Professor John Ferguson, Hunter New England Health and  
University of Newcastle

Infectious Diseases Physician and Medical Microbiologist

TU, Kathmandu, April 2015



# The Antibiotic Resistance Spiral



**Consciousness of poor hospital hygiene/infection control**

# The impact of multi-resistant bacterial pathogens

1. Many resistant pathogens have a greater ability to cause disease (virulence)- **ADD** to the existing burden of disease
2. In hospitals, increased capacity of these pathogens to **SPREAD** between patients and from patients to staff
3. Threaten ability to treat common diseases – **INCREASED** likelihood of patient treatment failure and death
4. Advanced medical treatments become potentially unsafe – eg. neonatal and intensive care, elective surgery, transplantation, oncology

# Societal and economic impacts of AMR

## Increased cost:

- more expensive therapies must be used.
- longer durations of illness and treatment, often in hospitals, increases healthcare costs
- Increased economic burden on families and societies

## Potential to threaten health security, and damage trade and economies:

- global trade and travel allows resistant microorganisms to be spread rapidly to distant countries and continents through humans and food.
- Estimates that AMR may give rise to losses in GDP of more than 1% with indirect costs affecting society up to 3 times greater

# The Tragedy of the Commons

The population problem has no technical solution;  
it requires a fundamental extension in morality.

Garrett Hardin



Without cooperative approaches that protect resources held in common (eg. Antibiotics) inexorable degradation will occur (= antimicrobial resistance).

No 'technical' solution will substitute.

G Hardin - 1968

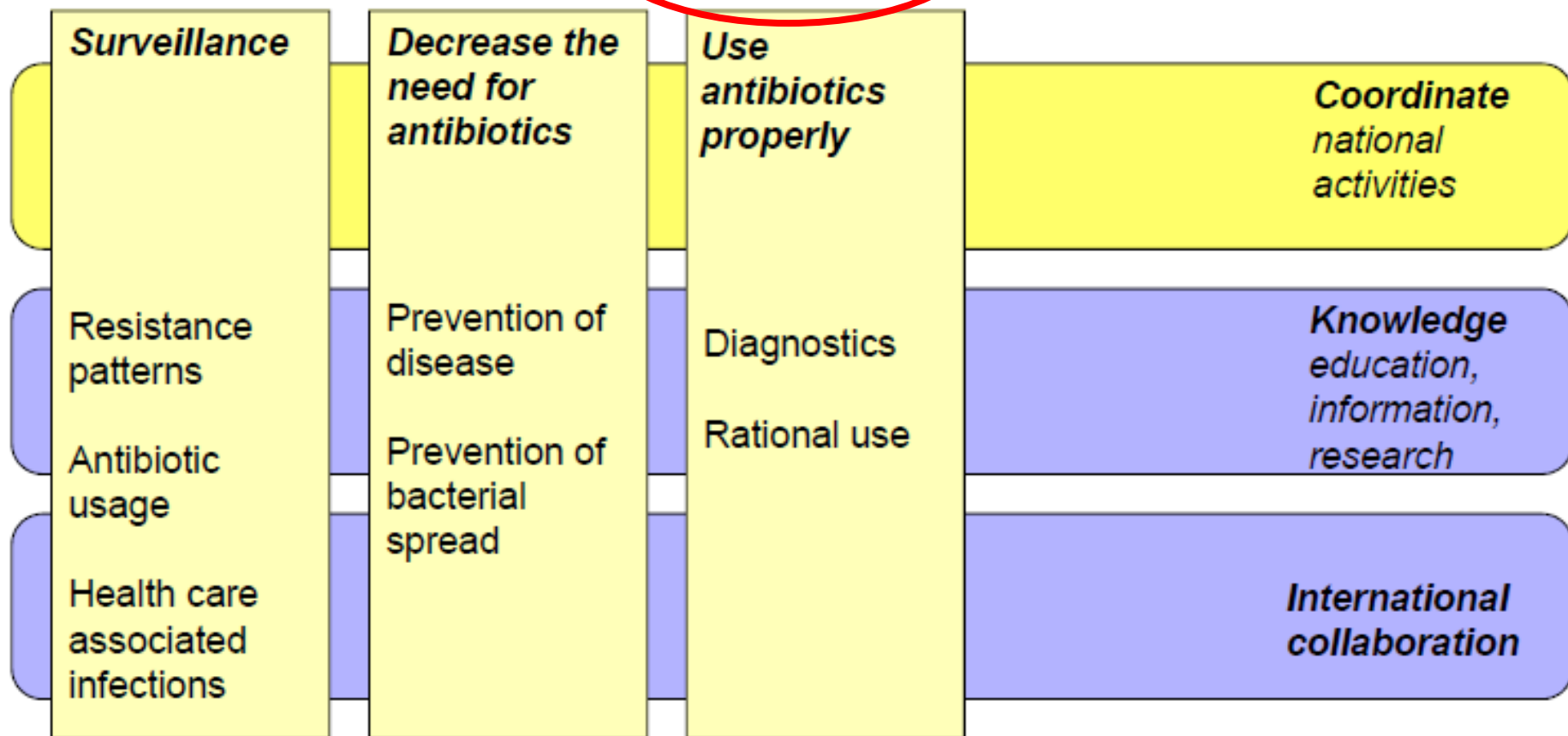
# Are technical solutions the answer?

- New antibiotic discovery
- Immunisation
- Better infection control methods
- Decolonisation – faecal transplant??
- Better sanitation?
- Better food production and agricultural systems?

*They are only part of the solution*

*Without collaborative changes to behaviour / regulation and effective implementation of known techniques (eg. Hand hygiene) etc we get nowhere in the long-term*

# The containment of antibiotic resistance needs **coordination**



# 'Coordination'

- Political will
- Leadership
- Strategic planning
- Systems of governance
- Regulation
- Incentives
- Engagement and awareness: everybody



# WHO Draft Global Action Plan 2015

- Revised March 2015 for World Health Assembly next month
- All nations will have to draft their own 2 year action plans-principles-
  - Whole of society engagement including a one health approach
  - Prevention first- emphasis on infection control
  - Access- need to preserve equitable access to antimicrobials
  - Sustainability
- 5 major objectives
  - Improve awareness and understanding of AMR
  - Strengthen knowledge and evidence base through surveillance and research
  - Reduce the incidence of infection
  - Optimise use of am in human and animal health
  - Develop economic case for sustainable investment in new medicines, diagnostic tools and vaccines etc



Global  
Antibiotic  
Resistance  
Partnership



Dec 2014  
report

# SITUATION ANALYSIS AND RECOMMENDATIONS

## Antibiotic Use and Resistance in Nepal

- “Antibiotic resistance is a global concern strongly affected by local factors. Progress will be best made when national experts collaborate to understand all aspects of antibiotic access, use and resistance within their own country context, and then work together to craft policy solutions tailored to meet their own needs.”

[http://cddep.org/blog/posts/garp\\_nepal\\_antibiotic\\_resistance](http://cddep.org/blog/posts/garp_nepal_antibiotic_resistance)

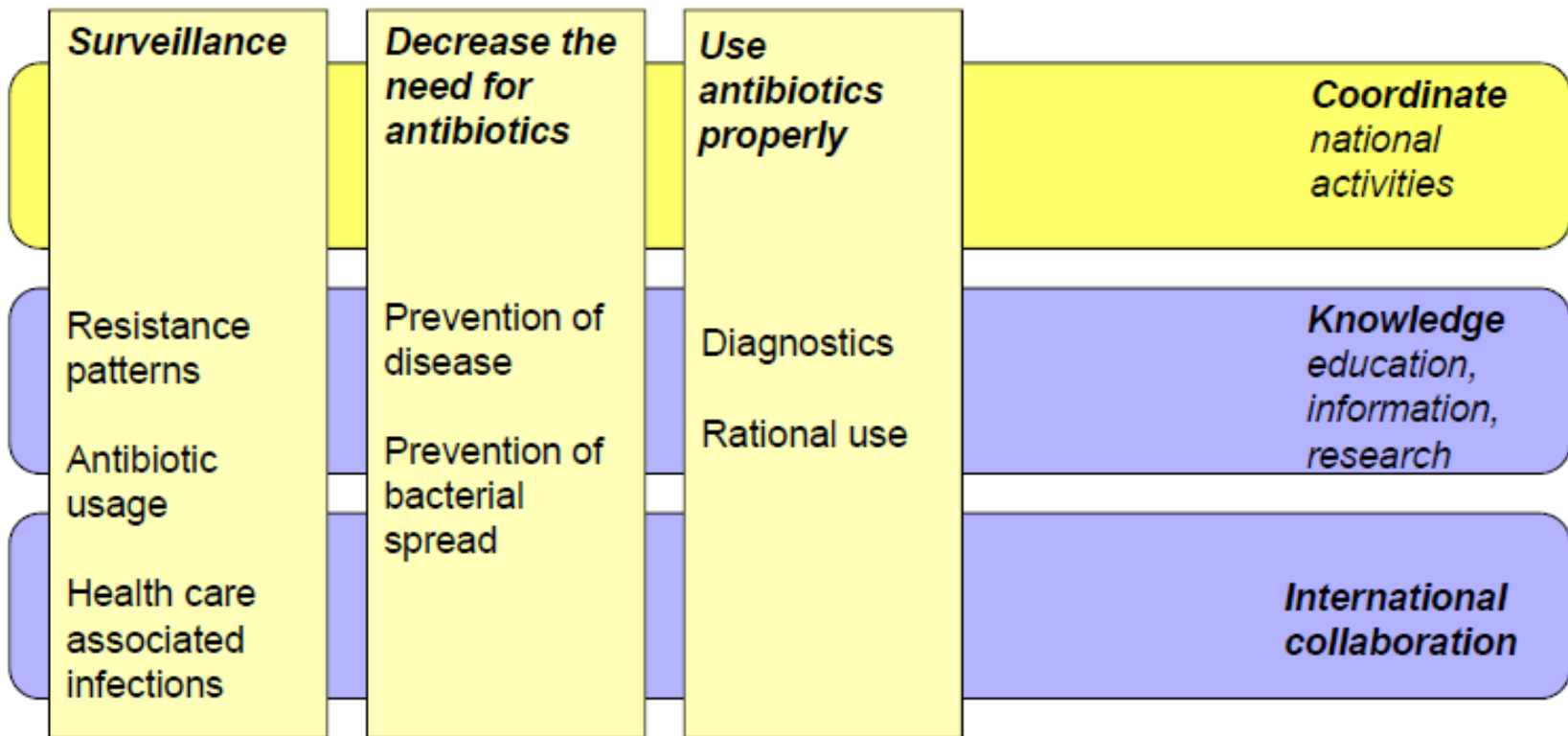
# Chennai Declaration 2012: Microbiology

**Table 3: Role of microbiologists and microbiology laboratories**

1. Constantly changing spectrum of Multi Drug Resistant (MDR) pathogens and the availability of newer technologies calls for the need of regular communication between the microbiologists and clinicians.
2. Microbiology labs need to be strengthened and be proactive with rapid & molecular diagnostics, early identification of emerging pathogens and detecting resistance accurately.
3. Generating cumulative antibiograms for emerging patterns of resistance.
4. Determining molecular epidemiology of resistant strains.
5. Dissemination of data at frequent and regular intervals.
6. Develop networking of institutes, Govt. and private hospitals/labs.
7. Develop standardized laboratory methods & Quality control protocols, for reliable data.
8. Rapid, sensitive, specific and point of care tests - bacterial infections/ resistance
9. Taking technology to the field - microarray based, Real time PCR based.
10. Mandatory NABL accreditation of the clinical laboratories.
11. Restrictive reporting of antibiotics. Microbiologists should release the sensitivity report on higher -end antibiotics, only if the bacteria are Multi Drug Resistant.
12. Government support for capacity building.
13. Identify Institutions in different regions as referral labs which will be responsible for making a repository of bacterial strains of interest/rare resistant markers, undertake genotyping of the resistant isolates and study emergence of new mechanism of resistance.

# Microbiology underpins nearly all elements of AMR control

The containment of antibiotic resistance needs coordination



# Microbiologist expertise is key!

- We know the bugs
- We need to know the drugs (antibiotics)
- We need to be experts in infection prevention and control
- We need to understand vaccines and immunisation
- We need to know about therapeutics and diagnostic methods

# Therapeutics

- Antibiotics are used for:
  - Prophylaxis
  - Empirical use
  - Directed use

Micro diagnostic services enable clinicians to move patients to directed treatment and improve outcomes for patients.

Major objectives of antimicrobial stewardship are to reduce prophylactic and empirical exposure to antibiotics.

# Imperatives for Microbiologists in hospitals

- We need to be relevant and trusted by clinicians:
  - Are relevant tests provided?
  - Do we directly contact clinicians to discuss critical results
  - Do we ask clinicians what they need and what they think of the service?
  - Do some of us go to their meetings and participate in discussions?
  - Do we invite them to our meetings etc?
  - Liaison rounding – intensive care, infection control

# Microbiology laboratory system elements

1. Pre-analytical
2. Analytical
3. Post-analytical

Quality systems- central reference - [WHO Laboratory Quality Management System Handbook 2011 \(pdf\)](#)



# Pre-analytical

- Sample collection- ensure optimal sample, patient identification and transport
- Evaluate specimen quality (sputum, urine, swabs) and provide feedback to clinicians to improve same.
  - Eg. Example comment on a specific urine sample: ‘The presence of squamous epithelial cells indicates poor collection and isolates may represent contaminating perineal flora’
- Evaluate blood culture contamination rates and double set culture rates and feedback to clinical services.

# Priority methods to have in place

- Blood culture system with adequate sensitivity for Staph, Strep and GNRs
  - Direct susceptibility testing from blood culture broth
  - Direct (rapid) methods of identification
- Urine cultures- rapid ID and direct susceptibility
- Reliable identification of key pathogens
- Reliable Antimicrobial Susceptibility Testing based on the relevant standard (CLSI or EUCAST)

Oakes AR et al J Clin Micro 1994: 32:40-45  
Comparison of direct and standardised testing of  
infected urine for AST by disc method

# Antibiotic susceptibility testing (AST): can clinicians rely on the data?

## Key technical considerations

Is the antibiotic testing standard being followed correctly?

[www.EUCAST.org](http://www.EUCAST.org) now internationally recommended rather than the expensive CLSI Standard.

Are appropriate control organisms available and quality controlled media available? etc

Question guide to QC:  
[http://hicsigwiki.asid.net.au/index.php?title=Antimicrobial susceptibility testing practice](http://hicsigwiki.asid.net.au/index.php?title=Antimicrobial_susceptibility_testing_practice)

Analysis and presentation of cumulative antibiograms- are they understandable?

Australian approach:  
<http://www.safetyandquality.gov.au/publications/specification-hospital-cumulative-antibiograms/>

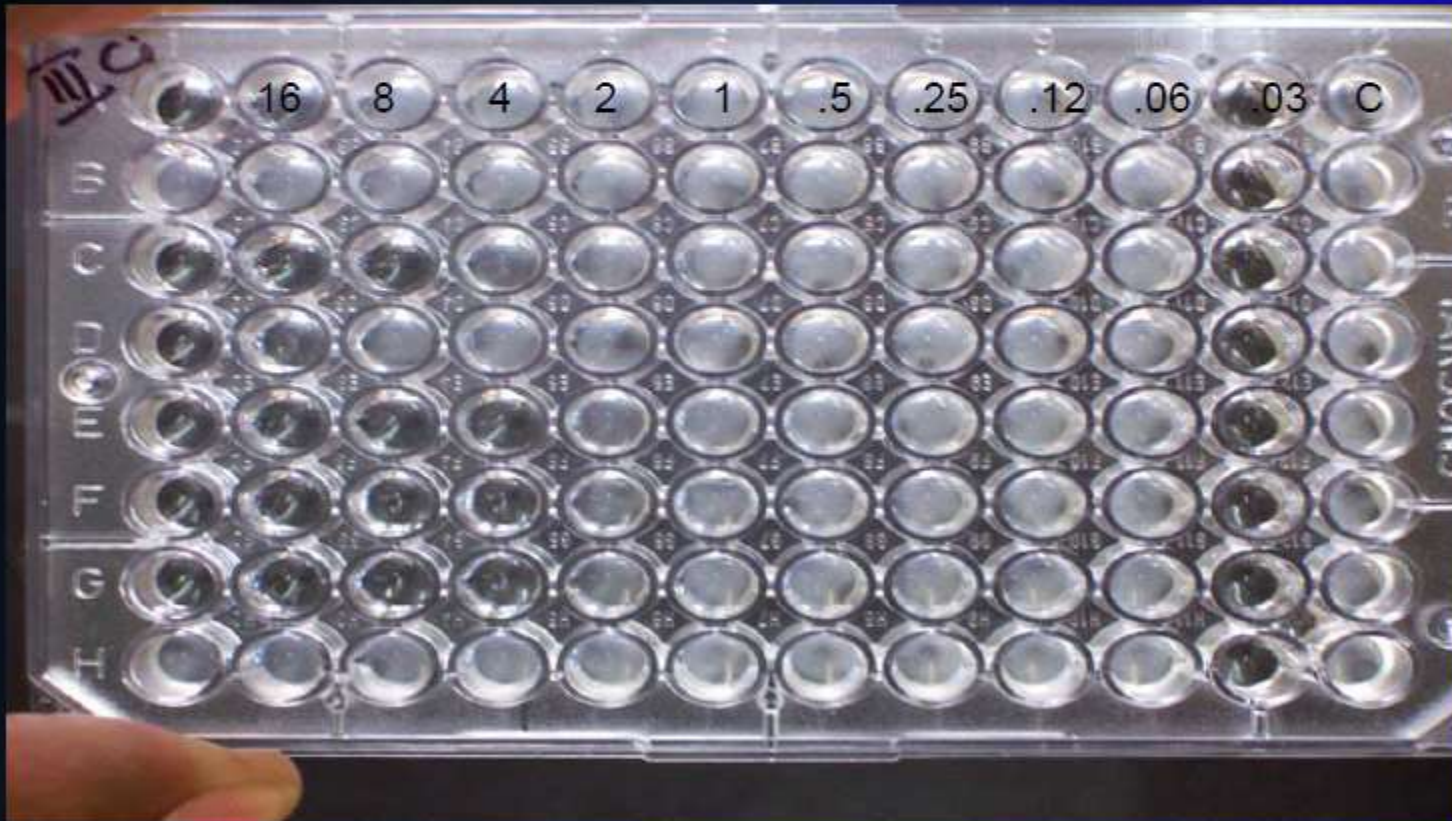
# Methods for susceptibility testing

## I. Phenotypic test methods

- **MIC determination** (broth micro dilution, gradient tests, disk diffusion, automated and semiautomated systems such as Vitek2, Phoenix, Microscan)
- based on **antimicrobial activity (MIC)** and **breakpoints**
- Predict susceptibility and resistance.
- Quantifiable.
- Require standardisation.
- Require breakpoints and breakpoints require agreement.

# MIC determination

## Broth microdilution in accordance with the ISO-standard\*



See the ISO, CLSI or EUCAST websites

# All other tests are surrogate MIC determination

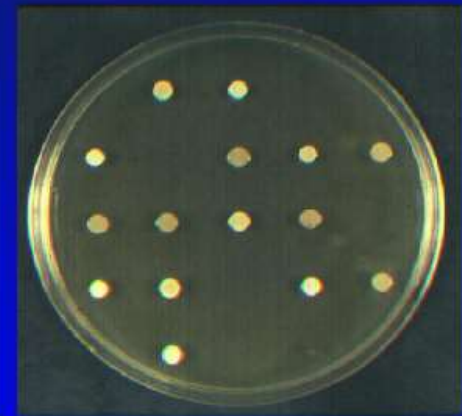


**Disk diffusion'**



**Gradient MIC test:**

Several manufacturers:  
bioMerieux (Etest)  
Oxoid (M.I.C.E.)  
Liofilchem (MIC-strip)



**Agar dilution**

# Clinical breakpoints vs. ECOFFs

## ECOFF

The ECOFF is the highest MIC value of isolates devoid of phenotypically expressed resistance.

- Wild type  $\leq X$  mg/L ( $X = \text{ECOFF}$ )
- Non wild type  $> X$  mg/L

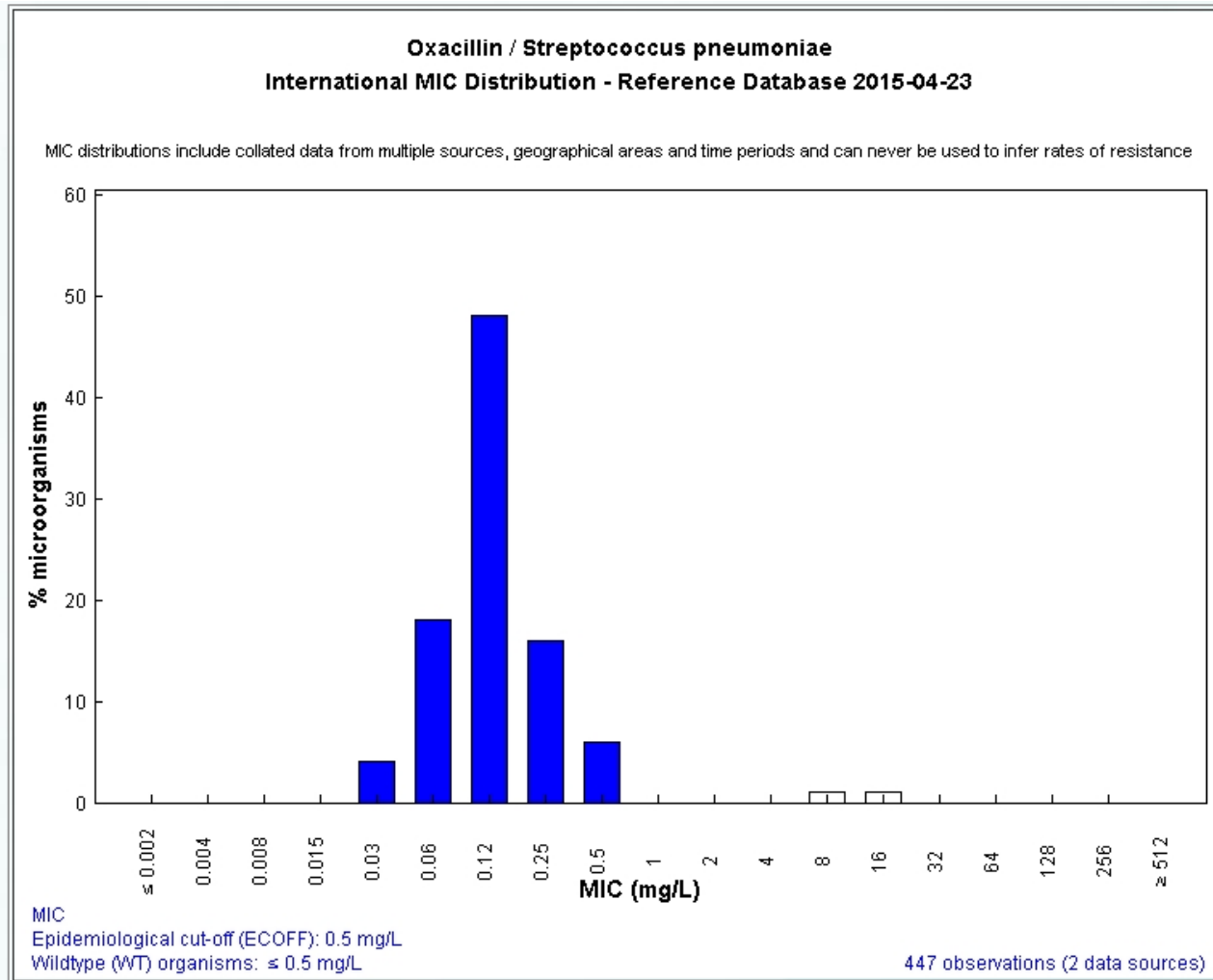
## Clinical breakpoints

An MIC concentration defined by man to predict clinical success and failure

- $S \leq Y$  mg/L
- $R > Y$  mg/L

Essential understanding arising out of EUCAST- see [www.EUCAST.org](http://www.EUCAST.org) for explanatory document.

# Example EUCAST WT distribution: non-WT strains well separated by the oxacillin-result



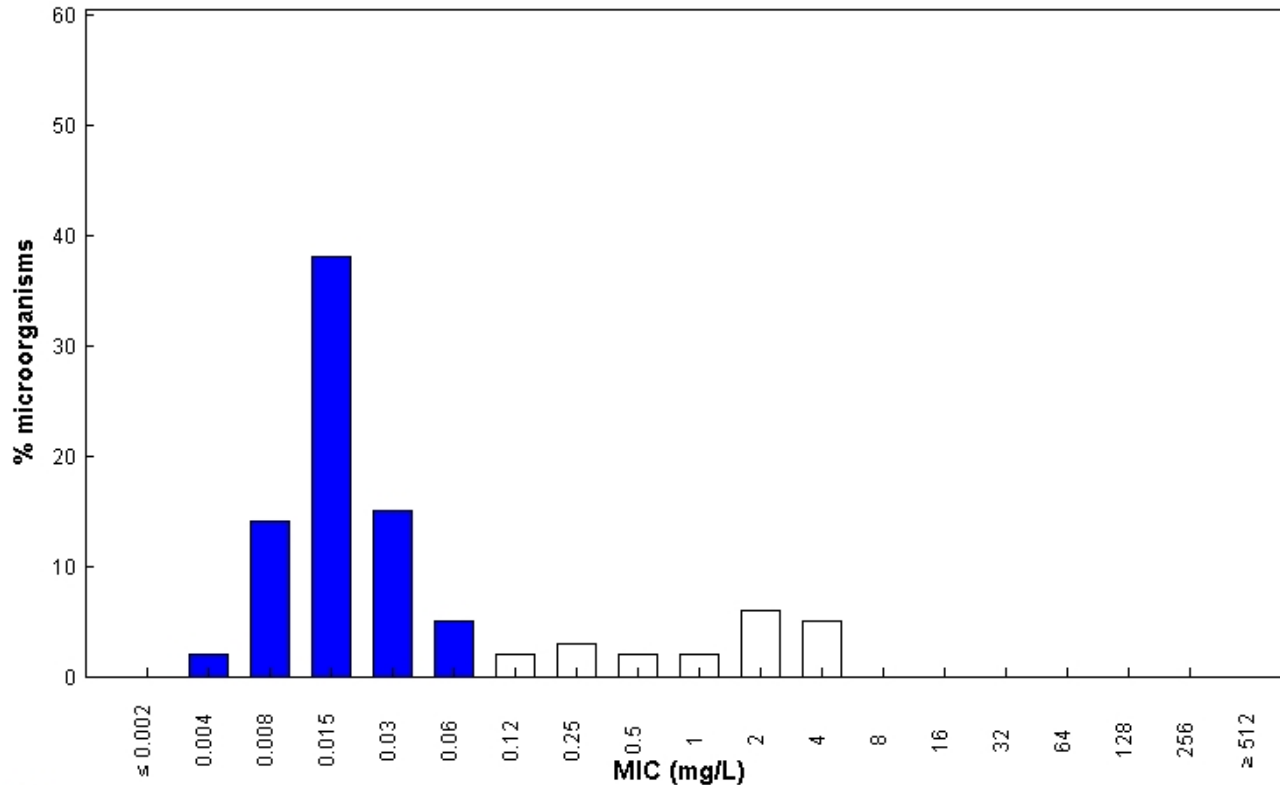
Screen for beta-lactam resistance with the oxacillin 1 µg disk. Isolates categorized as susceptible can be reported susceptible to benzylpenicillin, phenoxymethylpenicillin and aminopenicillins (with or without beta-lactamase inhibitor) irrespective of clinical indication. Isolates categorized as oxacillin resistant can be reported resistant to benzylpenicillin and phenoxymethylpenicillin in meningitis. For other beta-lactams, determine the MIC of the agent considered for clinical use.



# Penicillin- WT and non-WT insufficient MIC separation: use oxacillin instead

## Benzylicillin / *Streptococcus pneumoniae* International MIC Distribution - Reference Database 2015-04-23

MIC distributions include collated data from multiple sources, geographical areas and time periods and can never be used to infer rates of resistance



MIC

Epidemiological cut-off (ECOFF): 0.064 mg/L

Wildtype (WT) organisms: ≤ 0.064 mg/L

37742 observations (33 data sources)

Screen for beta-lactam resistance with the oxacillin 1 mcg disk. Isolates categorized as susceptible can be reported susceptible to phenoxymethylpenicillin and to benzylicillin and aminopenicillins (with or without beta-lactamase inhibitor) irrespective of clinical indication. Isolates categorized as oxacillin resistant can be reported resistant to phenoxymethylpenicillin and to benzylicillin in meningitis. For other beta-lactams determine the MIC of the agent considered for

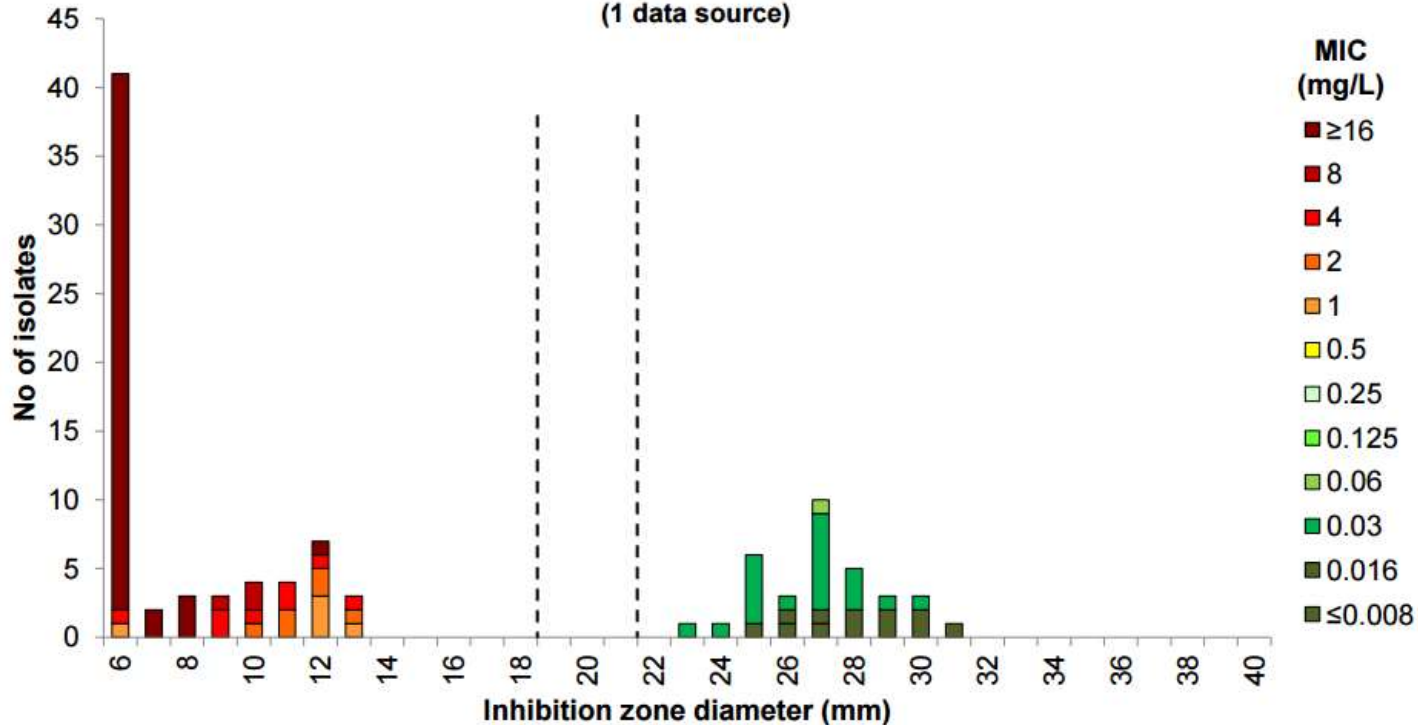
# Tools for determining clinical breakpoints

- Dose and mode of administration
- Clinical targets (indications)
- Target organisms (indications)
- MIC distributions of target organisms
- Resistance mechanisms of clinical importance in target organisms
- Pharmacokinetics of agent in target patients
- Pharmacodynamics of agent in relation to target organism
- Clinical outcome data for target infections

# Validation data example for disc zone cutoffs

Erythromycin 15 µg vs. MIC  
*S. pneumoniae*, 100 clinical isolates

(1 data source)

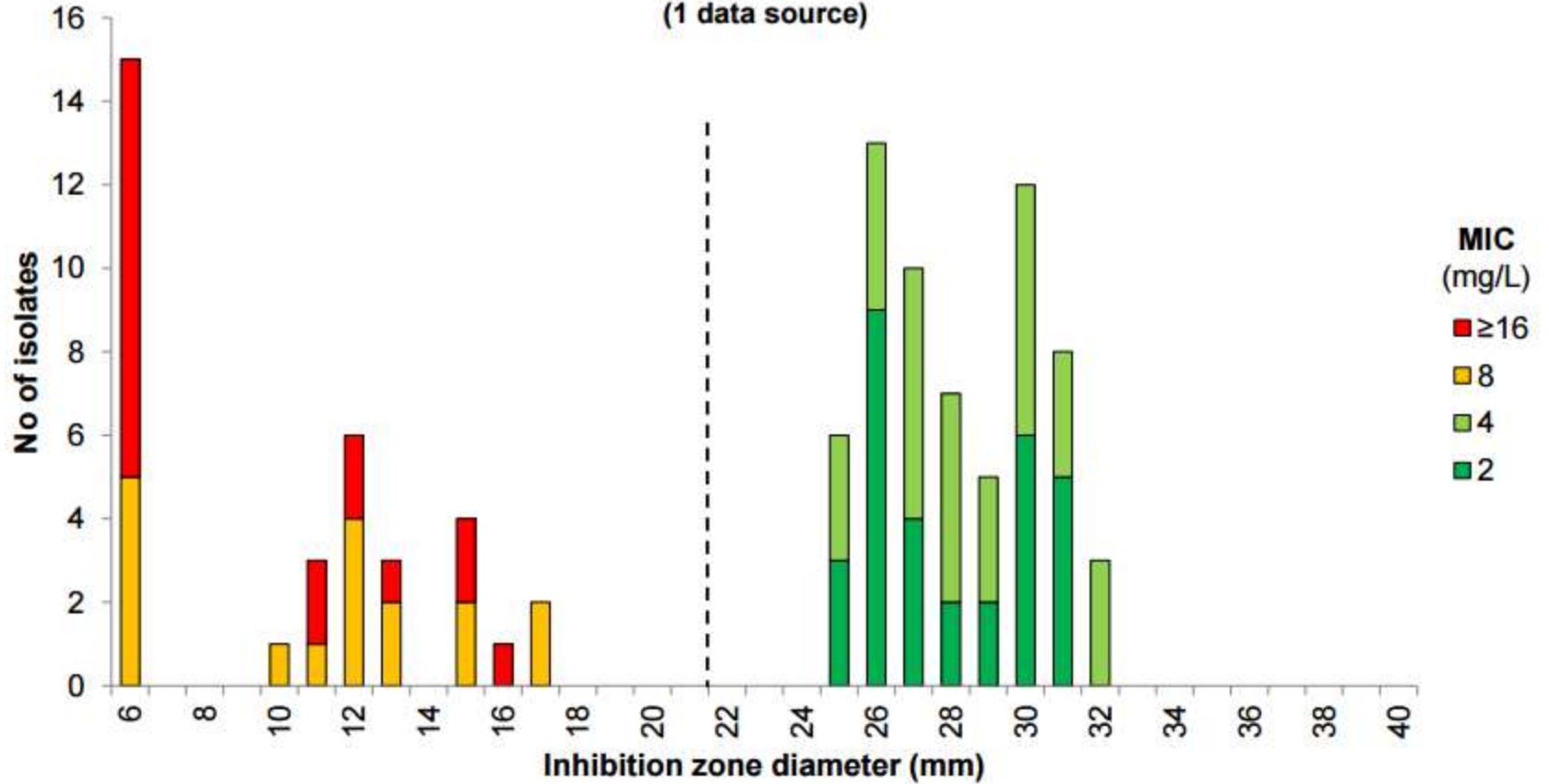


Breakpoints		ECOFF
MIC	S≤0.25, R>0.5 mg/L	0.25 mg/L
Zone diameter	S≥22, R<19 mm	

[http://www.eucast.org/fileadmin/src/media/PDFs/EUCAST\\_files/Disk\\_criteria/Validation\\_2015/S\\_pneumoniae\\_v\\_2.2\\_February\\_2015.pdf](http://www.eucast.org/fileadmin/src/media/PDFs/EUCAST_files/Disk_criteria/Validation_2015/S_pneumoniae_v_2.2_February_2015.pdf)

## Cefoxitin 30 µg vs. MIC *S. aureus*, 99 clinical isolates

(1 data source)



<b>Breakpoints</b>		<b>ECOFF</b>
MIC (screen)	$S \leq 4, R > 4$ mg/L	4 mg/L
Zone diameter (screen)	$S \geq 22, R < 22$ mm	

# S, I and R

- **Susceptible (S)**

- a micro-organism is defined as susceptible by a level of antimicrobial activity associated with a high likelihood of therapeutic success

- **Intermediate (I)**

- a micro-organism is defined as intermediate by a level of antimicrobial agent activity associated with **uncertain** therapeutic effect.

It implies that an infection due to the isolate may be appropriately treated in body sites where the drugs are physically **concentrated** or when a **high dosage** of drug can be used; ~~(it also indicates a buffer zone that should prevent small, uncontrolled, technical factors from causing major discrepancies in interpretations.)~~

- **Resistant**

- a micro-organism is defined as resistant by a level of antimicrobial activity associated with a high likelihood of therapeutic failure.

[www.eucast.org](http://www.eucast.org) CLSI also uses 'I' to indicate a buffer zone.

This is not required under EUCAST due the test and breakpoint methodology

# Detection of carbapenem-resistance

- Correct lab protocols essential
- Some carbapenemases produce only low level phenotypic resistance , not detected by disc testing
- Testing of alternative agents also required – colistin, aminoglycosides, tigecycline

REVIEW

10.1111/1469-0691.12678

## Detection of carbapenemases in *Enterobacteriaceae*: a challenge for diagnostic microbiological laboratories

J. Hrabák, E. Chudáčková and C. C. Papagiannitsis

Department of Microbiology, Faculty of Medicine and University Hospital in Pízeň, Charles University in Prague, Pízeň, Czech Republic

Clinical Microbiol Infection 2014, September  
PDF available from J Ferguson

# Clinical Liaison

- Micro lab provides key patient-specific information to the clinician.
- Liaison about results enables timely advice about appropriate empirical therapy (e.g. choice of agent, dose, route and duration).
- For critical results (e.g. blood or sterile site isolates), such liaison is best performed directly to clinicians by telephone contact from a clinical microbiologist or supervised registrar who may be located off-site

# Cascade reporting

**Example 1-** Staphylococcus aureus from blood culture- only parenteral agents are recommended for treatment.

First line report - flucloxacillin and cephazolin (based on ceftiofuran result)

Second line report for ceftiofuran-resistant (MRSA) - vancomycin

**Example 2-** E. coli from urine culture [reference EUCAST and CLSI guidelines]

First line report - amp, cephazolin/cephalexin, trimethoprim, gentamicin

Second line report- add amox+clav if amp and/or cephazolin= R  
add ceftriaxone if cephazolin= R  
add norfloxacin if amp/cz/aug=R or trim=R

Third line- add tob/ak if gent=R  
add pip+tazo if ceftriaxone=R  
add meropenem if pip+tazo=R  
add fosfomycin if norflox=R

Laboratories should make local susceptibility patterns widely known and routinely should only report on those agents which appear in their formulary and policy.<sup>16</sup>



# Interpretative report commenting

## 1. Report comments that interpret isolate significance:

Specimen type	Indication	Reporting comment
Blood	Isolate of CoNS from ICU patient — mixed or isolated after prolonged incubation (> 1 day), only one set taken	For optimal sensitivity and specificity, at least two separate blood culture sets (adult, 20 mL each) should be collected from separate venipuncture sites prior to beginning antimicrobial treatment. This patient had one set collected and has an isolated CoNS. This result is consistent with either infection or contamination — clinical correlation is required.
Faeces	Isolate of <i>Campylobacter</i>	<i>Campylobacter</i> gastroenteritis does not normally require antimicrobial treatment. However, in severe or prolonged cases and during pregnancy, azithromycin is recommended.

# Interpretative report commenting

## 2. Report comments that provide antimicrobial susceptibility interpretation:

Specimen type	Indication	Reporting comment
Any site	Penicillin-resistant, methicillin-susceptible <i>S. aureus</i> OR Beta-lactamase-negative <i>S. aureus</i>	<i>S. aureus</i> susceptible to flucloxacillin or dicloxacillin is also susceptible to <u>cephazolin</u> , cephalexin, and <u>amoxicillin+clavulanate</u> . Penicillin-susceptible strains can be treated with benzylpenicillin or <u>amoxicillin</u> . <u>Cephazolin</u> or cephalothin are suitable alternatives in the penicillin-allergic patient, unless the penicillin allergy is of the severe immediate type, in which case all beta-lactams should be avoided.
Any site	<i>S. aureus</i> sensitive to erythromycin	The erythromycin result can be used to predict clindamycin and lincomycin susceptibility.

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Respiratory tract

*Streptococcus pneumoniae* with penicillin minimum inhibitory concentration (MIC) of  $\leq 2$  mg/L

Penicillin-susceptible isolates of *S. pneumoniae* are susceptible to amoxicillin.

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- Oxacillin-resistance is the screen for raised penicillin MIC (resistance). For non-meningeal infections, benzylpenicillin remains effective.
- Macrolide or tetracycline resistance however indicates that use of these drugs is precluded – the resistance is high level

# Intrinsic bacterial resistances

- Excellent EUCAST document for reference- see [http://www.eucast.org/expert\\_rules/](http://www.eucast.org/expert_rules/)

# Interpretative report commenting

## 3. Report comments that provide antimicrobial management advice

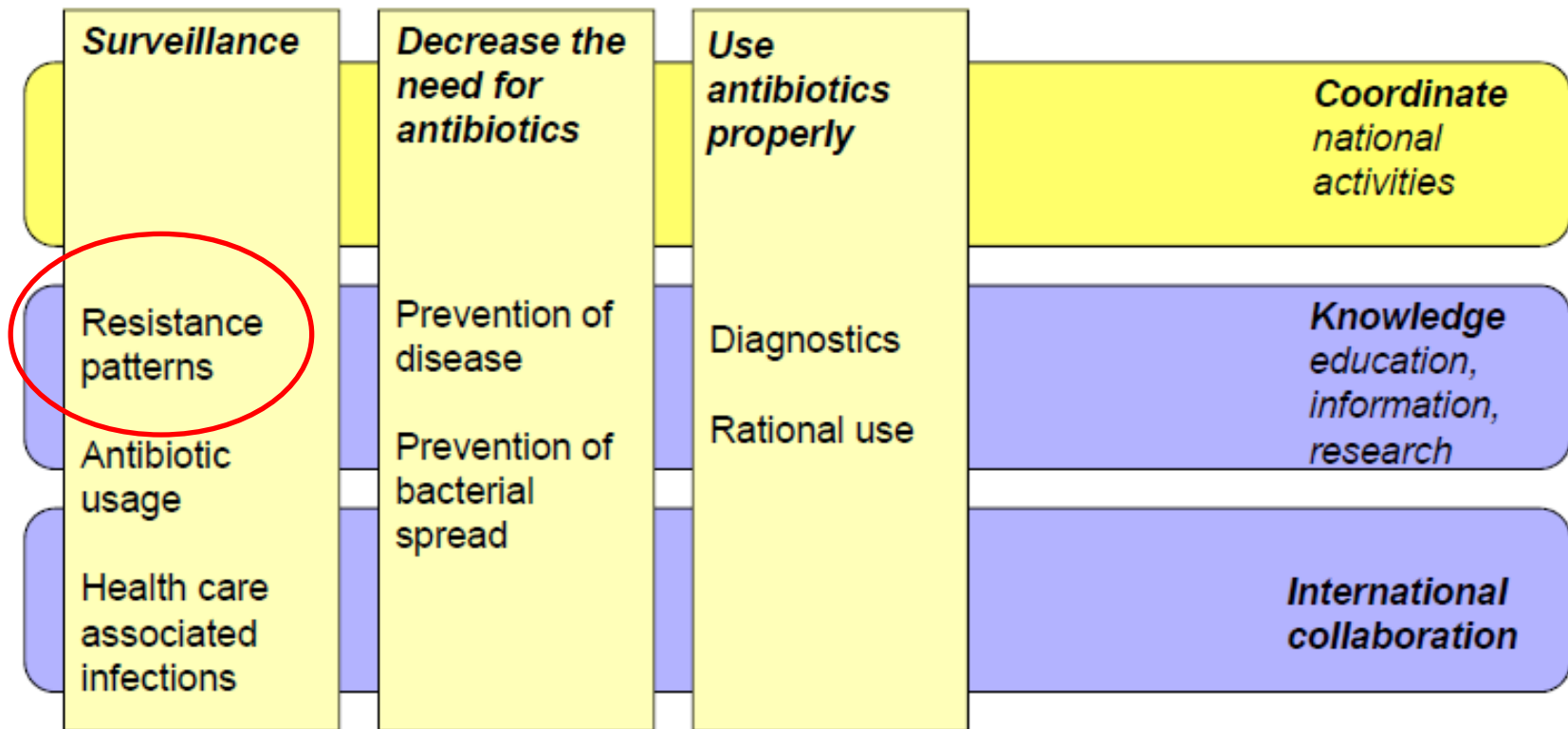
Specimen type	Indication	Reporting comment
Blood	<i>Staphylococcus aureus</i> isolate	Prolonged intravenous treatment is indicated, preferably via a peripherally-inserted central line. Relapse of <i>S. aureus</i> bacteraemia occurs in up to 5% of patients and may present up to 3 months following the event. Patients should receive education to this effect.
Pus or wound swab	Cellulitis patient with isolates of <i>Streptococcus pyogenes</i> or other $\beta$ -haemolytic streptococci, or MSSA	Monotherapy for cellulitis with flucloxacillin or dicloxacillin is effective in most patients. For a more complete discussion of this topic, refer to [insert information resource link].

# Situations where reporting of isolate and susceptibilities NOT recommended

- candida in sputum/et
  - pseudomonas species in swabs from legs, and most sputums
  - Stenotrophomonas
  - CoNS from non sterile sites
  - CoNS from single set blood cultures other than NICU patient
  - non Group A, C, G streptococci from throats
  - enterococci in urines - don't report low org counts ( $< 10^8$ ) or any counts when  $< 50$  wbc present; never in mixed cultures, probably never in young women (NEJM study)
  - Aspergillus in sputum
- 
- If we report isolates of dubious significance , then clinicians may treat inappropriately

# Microbiology underpins nearly all elements of control

The containment of antibiotic resistance needs coordination



# Cumulative antibiograms- essential local data for empiric rx guidelines

- Distinguish community from healthcare associated isolates
- Non-urine and urine specimen usually separate antibiograms
- Exclude repeat isolates, same patient within 365 days
- Express results as % susceptible
- Notate the number of each isolate tested against each drug

## REFERENCES

- WHONET software (free)
- Australian national standard for cumulative antibiogram construction – available online
- CLSI Cumulative antibiogram standard (commercial)



# Application of WHONET in the Antimicrobial Resistance Surveillance of Uropathogens: A First User Experience from Nepal

A.N. GHOSH, D.R. BHATTA, M.T. ANSARI, H.K. TWARI, J.P. MATHURIA, A.GAUR, H.S. SUPRAM, S. GOKHALE

## ABSTRACT

**Introduction:** WHONET is a freely downloadable, Windows-based database software which is used for the management and analysis of microbiology data, with a special focus on the analysis of antimicrobial susceptibility test results. Urinary Tract Infections (UTI) are a common medical problem and they are responsible for notable morbidity among young and sexually active women.

**Objectives:** The major objective of this study was the utilization and application of the WHONET program for the Antimicrobial Resistance (AMR) surveillance of uropathogens.

**Methods:** A total of 3209 urine samples were collected from patients who visited Manipal Teaching Hospital with a clinical suspicion of UTI, during December 2010 to July 2011. The isolation and characterization of the isolates were done by conventional methods. Antimicrobial Susceptibility Testing (AST) was performed by Kirby Bauer's disc diffusion method. The data entry and analysis were done by using the WHONET 5.6 software.

**Results:** Out of the 3209 specimens, 497 bacterial isolates were obtained and they were subjected to AST. *Escherichia coli* (66.2%) was the commonest bacterial isolate, followed by *Enterococcus* species (9.3%), *Staphylococcus aureus* (5.0%), and *Klebsiella pneumoniae* (4.2%). Among the gram-negative enteric bacilli, a high prevalence of resistance was observed against ampicillin and ciprofloxacin. The gram negative nonfermenters exhibited a high degree of resistance to ceftazidime. *Staphylococcus* species, showed a moderately high resistance to co-trimoxazole. One isolate was Vancomycin Resistant *Enterococci* (VRE).

**Conclusion:** This study, a first of its kind which was done in Nepal, was carried out by using the WHONET software to monitor, analyze and share the antimicrobial susceptibility data at various levels. This study was also aimed at building a surveillance network in Nepal, with the National Public Health Laboratory, Nepal, acting as a nodal centre. This would help in the formulation of antibiotic policies and in identifying hospital and community outbreaks at the nodal centre, as well as in sharing information with the clinicians at the local level.

**Key Words:** WHONET, Antimicrobial resistance surveillance, Urinary tract infection

- WHONET software excellent for tracking isolate data and producing antibiograms [www.whonet.org](http://www.whonet.org)

# Aust. standard cumulative antibiogram format based on CLSI standard

## 1. Signal resistance analysis

### Signal resistances

Signal resistances (as defined by ACSQHC 2013) include:

- methicillin-resistant *Staphylococcus aureus* (MRSA)
- vancomycin-intermediate and vancomycin-resistant *Staphylococcus aureus* (VISA, VRSA).
- vancomycin-resistant *Enterococci* (VRE)
- *Streptococcus pneumoniae* with a penicillin MIC  $\geq 0.06$ mg/L.
- ceftriaxone-resistant Enterobacteriaceae (potential ESBL-producers)
- carbapenem-resistant Enterobacteriaceae<sup>1</sup> (CRE)
- Other plasmid-mediated carbapenemase-producing gram negatives (such as *Acinetobacter baumannii* and *Pseudomonas aeruginosa*)

<http://www.safetyandquality.gov.au/publications/specification-hospital-cumulative-antibiograms/>

# Standard cumulative antibiogram format

1. Signal resistance analysis
2. Antibiogram table (excerpt)

Organism group	# strains (annualised)	% total	Routinely reported antibiotics							
			Ampicillin	Amoxicillin + clavulanate	Cefazolin / cephalixin	Flucloxacillin/ dicloxacillin	Gentamicin (aminoglycoside)	Erythromycin/ clindamycin	Tetracycline	Trimethoprim + sulphamethoxazole
All isolates	3,902	100%								
<i>Staphylococcus aureus</i> - ALL	1,656	39%				23%				
						1,656				
<i>Methicillin-susc. S. aureus</i>	1,316	34%	19%	S	S	100%	n/a	86%	98%	98%
			n=329			413		328	329	326
<i>Methicillin-resistant S. aureus</i>	340	9%	R	R	R	R	100%	72%	95%	96%
							51	85	87	85

# Standard cumulative antibiogram format

1. Signal resistance analysis
2. Antibiogram table
- 3. Commentary (excerpt)**

## Urinary isolate antibiogram: commentary

Please consult Therapeutic Guidelines: Antibiotic (TG:A) for recommended dosing and duration of therapy.

Infectious Syndrome	Therapeutic Guidelines (TG) empiric recommendations	Comment relating to the local cumulative antibiogram
<b>Urosepsis (severe)</b>	1. Ampicillin PLUS gentamicin  OR (if non-immediate hypersensitivity to penicillin)  2. Gentamicin alone  (ceftriaxone is reserved for patients with absolute or relative C/I for gentamicin use <sup>3</sup> )	Gentamicin retains activity against nearly all Gram negative uropathogens.  Ampicillin provides optimal coverage for streptococci and enterococci that may also cause UTI.  Early oral switch is indicated once a patient begins to respond to treatment (usually within 48hrs).

# Purpose of antimicrobial stewardship

- Optimise outcome for patient with infection - right diagnosis, right antibiotic , timing, dose, duration etc
- Minimise individual and community adverse impacts of antimicrobials- adverse events, added (super)infection, antimicrobial resistance

# Australian Hospital Accreditation: hospitals required to use antibiotics properly for the sake of patients and their safety...

32 | National Safety and Quality Health Service Standards

## Preventing and Controlling Healthcare Associated Infections

### Standard 3



#### Antimicrobial stewardship

Safe and appropriate antimicrobial prescribing is a strategic goal of the clinical governance system.

This criterion will be achieved by:	Actions required:
<b>3.14</b> Developing, implementing and regularly reviewing the effectiveness of the antimicrobial stewardship system	<b>3.14.1</b> An antimicrobial stewardship program is in place
	<b>3.14.2</b> The clinical workforce prescribing antimicrobials have access to current endorsed therapeutic guidelines on antibiotic usage <sup>45</sup>
	<b>3.14.3</b> Monitoring of antimicrobial usage and resistance is undertaken
	<b>3.14.4</b> Action is taken to improve the effectiveness of antimicrobial stewardship

## Actions required:

### 3.14.1 An antimicrobial stewardship program is in place

A system is in place to see that antimicrobials being prescribed responsibly

Prescribers educated about AMR & AMS?

Case audit and peer review feedback takes place

# Is therapy 'AIMED'? – a standard for prescribers

- A*ntimicrobial* selection and dosage should be compliant with guideline
- I*ndication* for treatment should be documented
- M*icrobiology before rx*
- E*valuate* at 48-72hrs
- D*uration* or review date explicit





# Audit

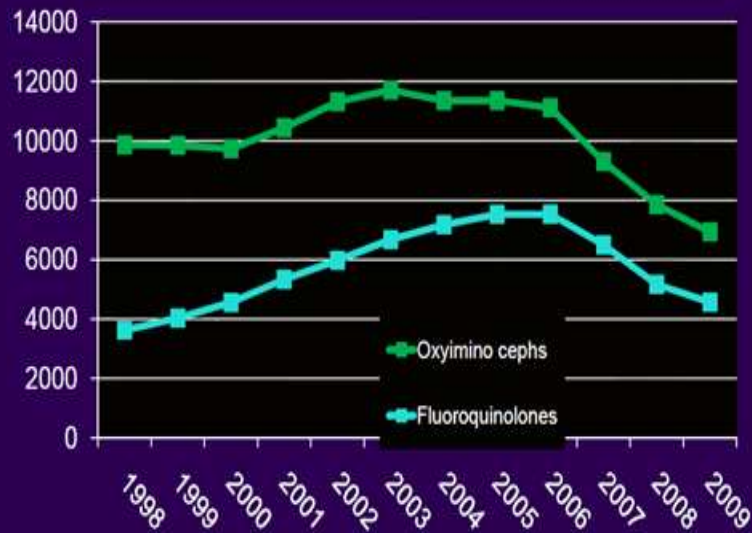
- Whole hospital point prevalence surveys (online Australian NAPS survey tool)
- Selected patient locations
- Selected types of antibiotic
- Intensive care microbiology / AMS rounds – daily to weekly

# Issues to target: syndromes

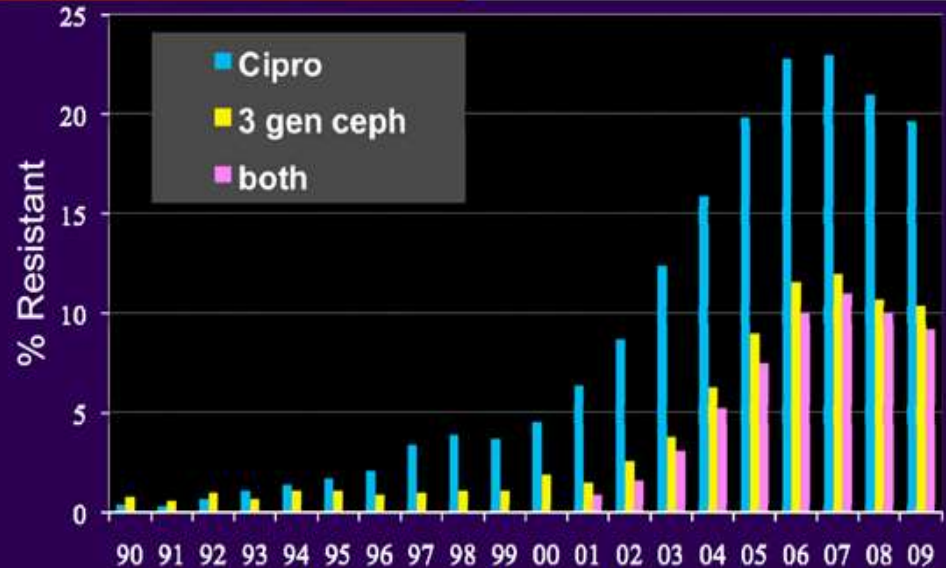
- Empirical management of sepsis – early recognition and treatment essential. First dose protocols for antibiotics based on local antibiograms
- Community pneumonia – penicillin-G as the mainstay. Assess severity, broaden cover only in ‘severe’, staphylococcal or ICU cases (even in diabetic patients)
- Acute on COPD – antibiotics play a minor role in management – amoxycillin or doxycycline
- Intra-abdominal sepsis – limit durations of treatment if perforation/soiling dealt with operatively within 6 hrs
- VAP – 3 day review always with view to de-escalation
- Uncomplicated Gram negative biliary sepsis – 5-7 days total rx

# Reducing use reduces resistance: UK a/m stewardship example

Declining usage: hospital antibiotic sales (kg), IMS data

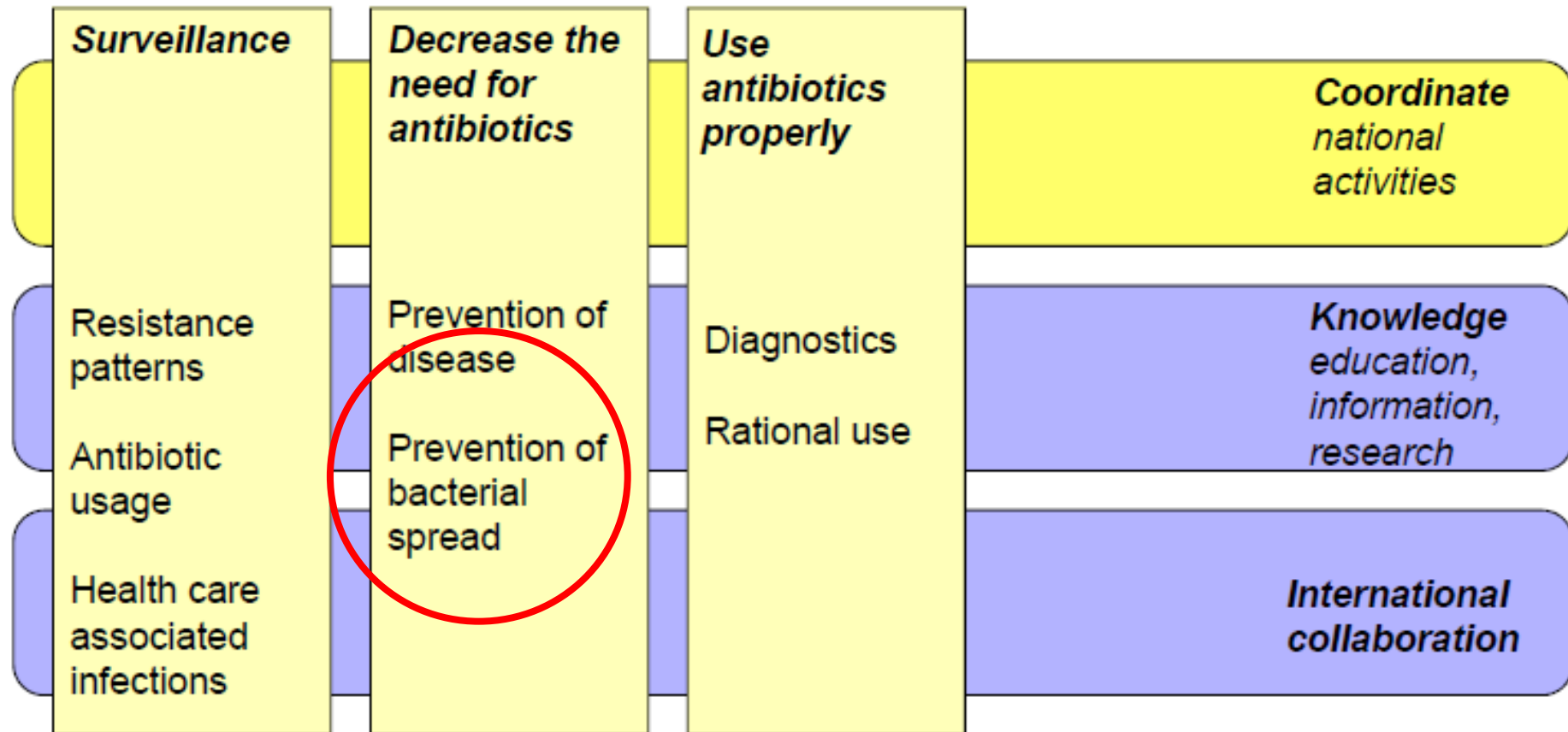


*E. coli* from blood & CSF in the UK  
- a recent fall in resistance



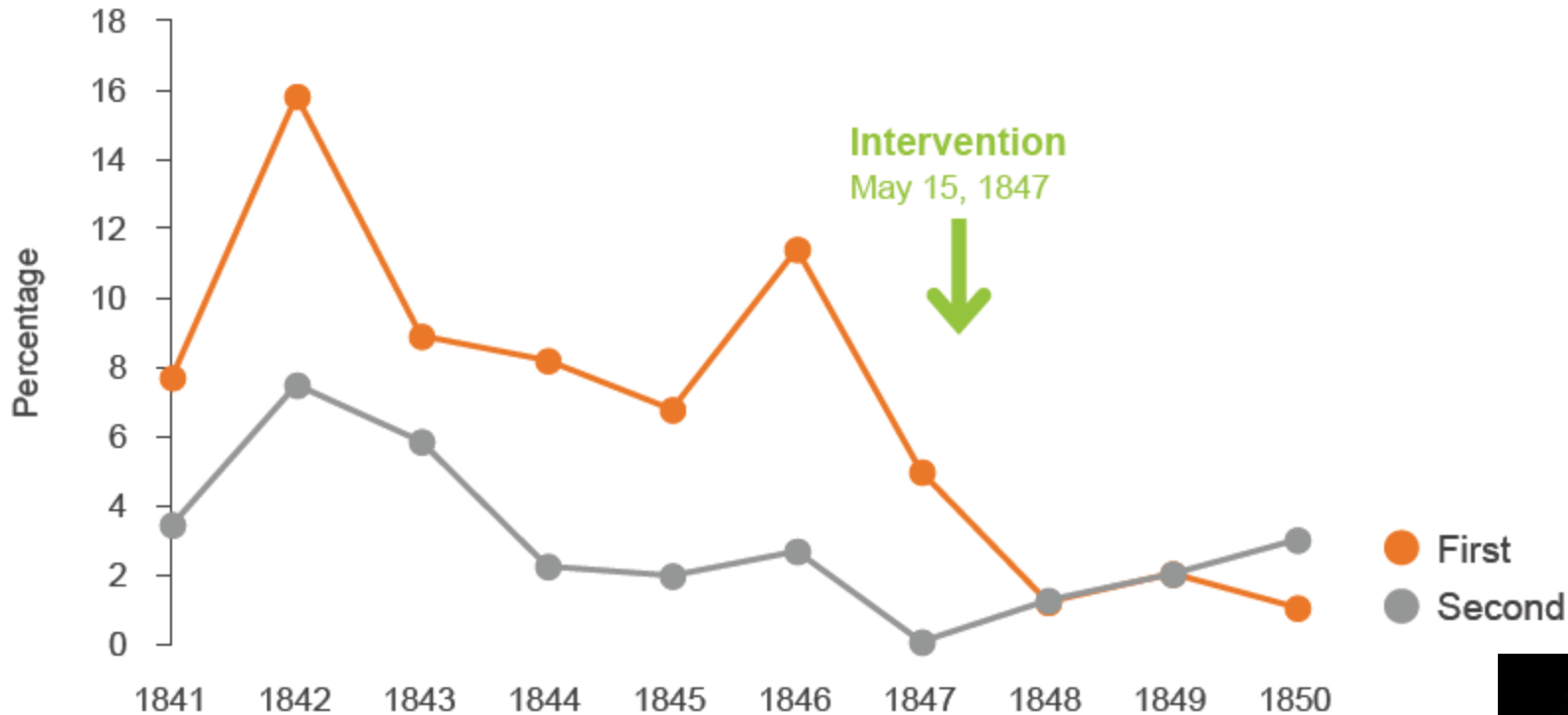
- coincides with decreased use = decreasing selection ?
- If plasmids can't be lost, is this strain displacement ?

# The containment of antibiotic resistance needs coordination



# Lessons learned from Semmelweis (1861)

*Hand disinfection saves lives- the first demonstration*



**Vienna: intervention:** Students and doctors required to clean their hands with a chlorinated lime solution when entering the labour room in particular when moving from the autopsy to the labour room

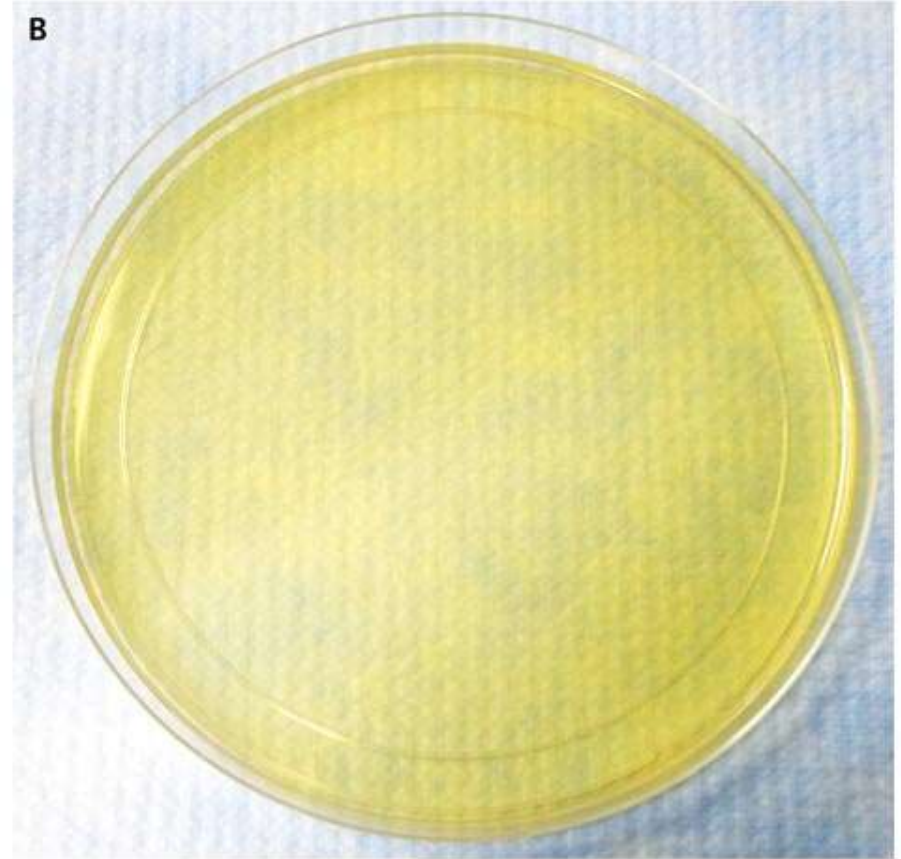


**Abdomen of an MRSA positive patient examined by a physician  
Hand cultured for MRSA before and after using alcohol hand rub**

A



B

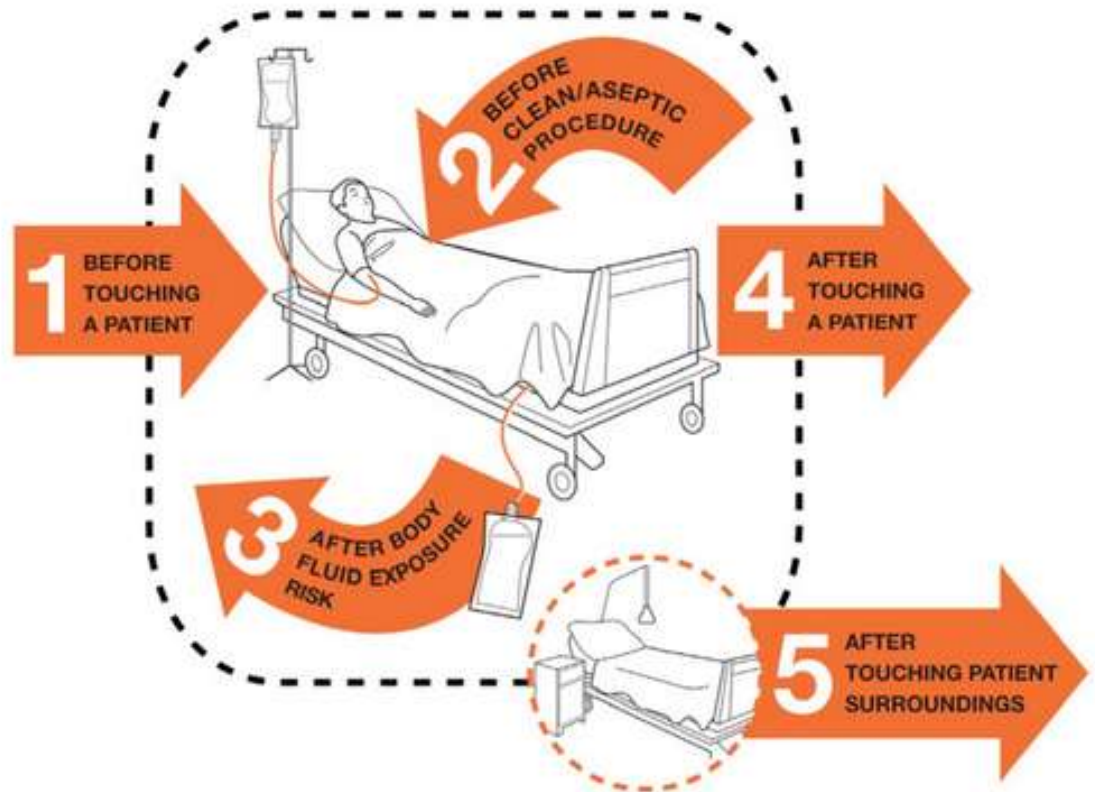


**Donskey C and Eckstein B. N Engl J Med 2009;360:e3**

MRSA= methicillin-resistant *Staphylococcus aureus*

# WHO 5 Moments for Hand Hygiene standard

[http://www.who.int/gpsc/tools/Five\\_moments/en/](http://www.who.int/gpsc/tools/Five_moments/en/)



# Alcohol hand rub – essential standard

## 1. Establish point-of-care availability

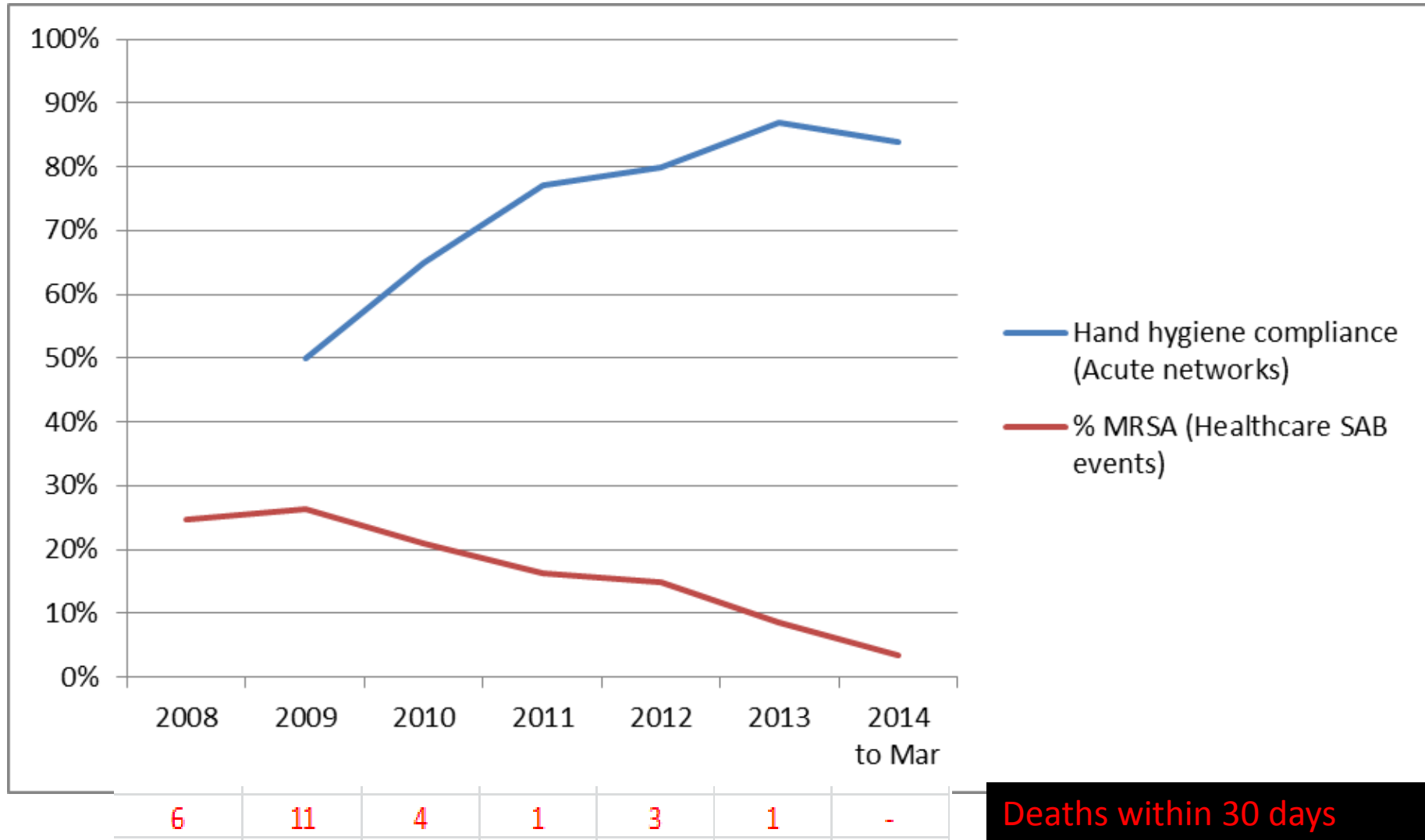


## 2. Educate staff and patients

## 3. Audit (check) compliance; feedback



# Aust. NSW HNE- Impact of increasing hand hygiene on healthcare MRSA bloodstream infections and mortality



Deaths within 30 days

# Reference : AMS in Australian Hospitals, Chapter 7 – role of clinical micro service

## 7.1 Key points

- The clinical microbiology service is an essential and integral part of organisational initiatives that underpin antimicrobial stewardship efforts.
- The establishment of best practice procedures for rapid microbiological evaluation is critical to delivering timely and accurate information.
- Intensive care units are an area of particular importance, as the control of resistance in these units can affect other areas of the hospital. The clinical microbiology service should therefore pay particular attention to services provided to these areas.
- Reports to the clinician from the clinical microbiology service can provide comments that interpret isolate significance, provide antimicrobial susceptibility interpretation, and provide antimicrobial management advice.
- 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.
- The clinical microbiology service provides surveillance data on resistant organisms for infection control purposes.