

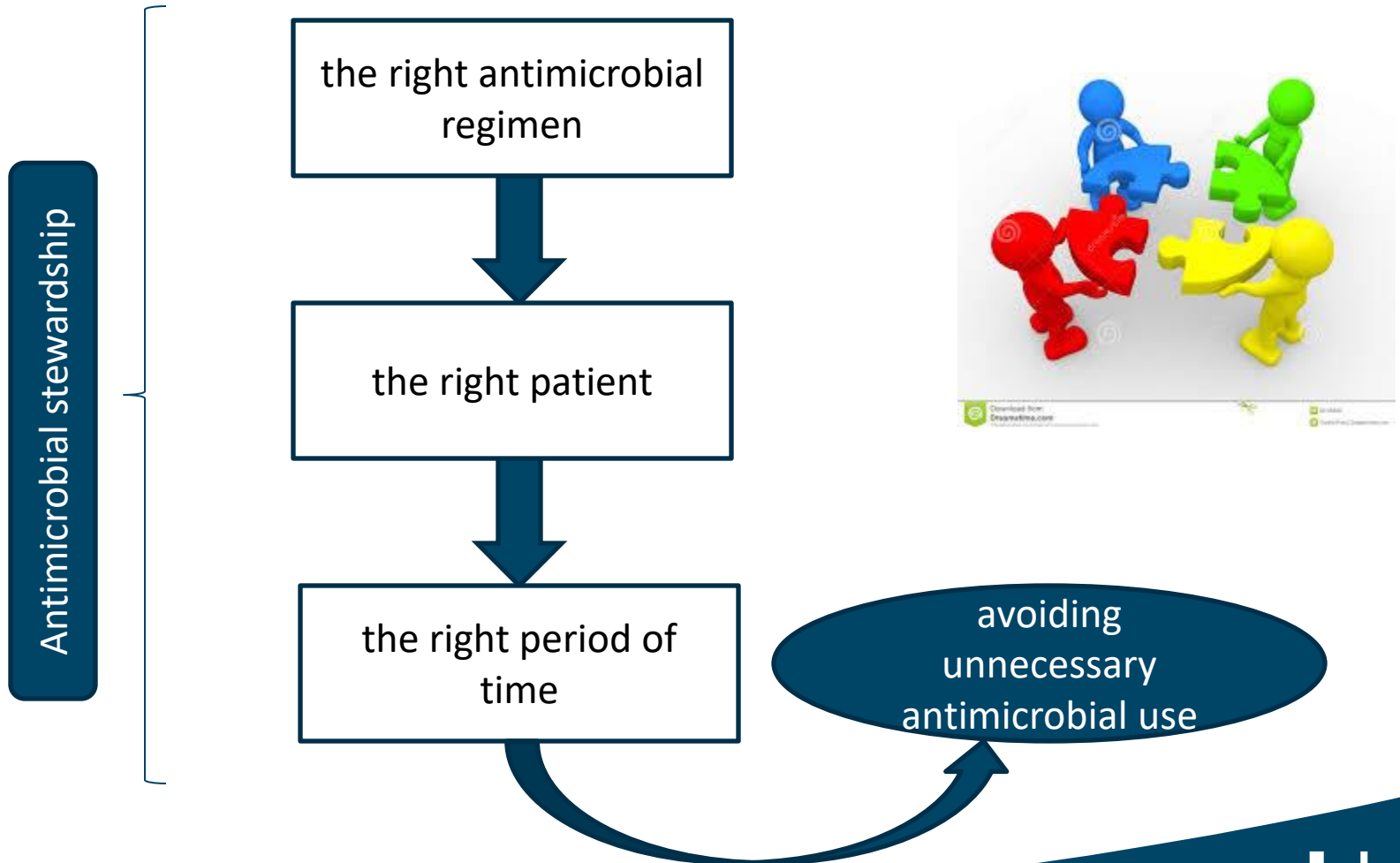
The role of microbiology in antibiotic stewardship

Tomislav Kostyanev, MD
University of Antwerp, Belgium

WHO&ESGAP course on antibiotic stewardship
25-26 January 2017, Skopje, Macedonia

The Essential Role of Clinical Microbiology Laboratories in Antimicrobial Stewardship

Author: Vera P. Luther, MD // Date: AUG.1.2015 // Source: Clinical Laboratory News



Key roles of the microbiology lab in AS

- **antimicrobial susceptibility reports**
 - cumulative and detailed; pathogen-antibiotic combinations
- **guidance in the pre-analytic phase**
 - appropriate sampling
- **rapid diagnostic test availability**
 - rapid detection of resistance
- **alert and surveillance systems**
 - rapid communication/reporting of results
 - screening

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Antimicrobial susceptibility reports

- Choice of appropriate tests
- Adherence to guidelines and quality procedures
- Reporting of AST results
- Communication of results

Antimicrobial susceptibility reports

- choice of appropriate tests:
 - rapid or conventional test
 - choice of panel drugs for antibiogram
 - relevant antibiotics for AST
 - adequate to site of infection/ward and microorganism
 - patient factors (age, renal function, underlying diseases, previous antibiotic exposure)
 - use of disc diffusion vs. MIC
 - i.e. *S. aureus* - vancomycin testing
- adherence to guidelines:
 - i.e. EUCAST, CLSI



Antimicrobial susceptibility reports

- selective or algorithm reporting of AST results
 - convenient and cost-effective
 - reporting only relevant results
 - members of the antimicrobial stewardship committee should be responsible for creating, maintaining, and updating such reporting algorithms



Antimicrobial susceptibility reports

- way of communicating the results
 - to clinician, epidemiologist and clinical pharmacologist (if applicable)
 - direct communication / consultation
 - stepwise approach



Reliable diagnosis of infection

- **Quality assurance – proactive process**
 - reproducibility and accuracy of the test results
- **Quality control – reactive process**
 - Internal QC
 - External QC
 - Participation in EQA programmes
 - National
 - International



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Guidance in the pre-analytic phase

- Quality and frequency of samples



Antimicrobial Stewardship Strategy:

Promotion of timely and appropriate microbiologic sampling

Implementing strategies to promote the appropriate and timely collection of cultures, ideally before antimicrobials are started, to help direct therapy and avoid unnecessary prescribing.



Description

This is an overview and not intended to be an all-inclusive summary. As a general principle, patients must be monitored by the health care team after changes to therapy resulting from recommendations made by the antimicrobial stewardship team.

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Rapid diagnostics

- The **time** that it takes a laboratory to report the results directly impacts:
 - the **duration of empiric antimicrobial therapy**,
 - the **time to directed therapy**,
 - or **discontinuation of unnecessary therapy**.



Rapid and reliable AST results

Rapid identification and antimicrobial susceptibility testing reduce antibiotic use and accelerate pathogen-directed antibiotic use

J. J. Kerremans ✉; P. Verboom; T. Stijnen; L. Hakkaart-van Roijen; W. Goessens;
H. A. Verbrugh; M. C. Vos

- prospective randomized clinical trial - 2-year period
- 1498 patients with positive culture to rapid intervention arm (746) or control arm (752)
- rapid arm was 22 h faster (AST), and 13h (identification)
- antibiotic use was 6 DDD lower in the rapid arm
- no significant difference in mortality rates

Antimicrobial resistance

MINI-REVIEW

The global threat of antimicrobial resistance: science for intervention

I. Roca¹, M. Akova^{2,25}, F. Baquero³, J. Carlet⁴, M. Cavaleri⁵, S. Coenen⁶, J. Cohen⁷, D. Findlay⁸, I. Gyssens⁹, O. E. Heure¹⁰, G. Kahlmeter^{11,25,26}, H. Kruse¹², R. Laxminarayan^{13,14}, E. Liébana¹⁵, L. López-Cerero¹⁶, A. MacGowan^{17,26}, M. Martins¹⁸, J. Rodríguez-Baño^{19,25}, J.-M. Rolain²⁰, C. Segovia²¹, B. Sigauque²², E. Taconelli^{23,25}, E. Wellington²⁴ and J. Vila^{1,25}

New Microbe and New Infect 2015; **6**: 22–29

- Limit the emergence and spread of resistant bacteria in the animal sector
- AMS measures in the community
- AMS measures in the healthcare settings
- Improve AMR diagnostics
- Fuel the AB pipeline

Rapid diagnostic tests

Sample preparation

Wish list

Sample preparation specific

- Able to directly handle the clinical sample as is
- Able to handle a wide variety of samples
- Capable of extracting the target from the sample with very high efficiency

Overall diagnostic test

- Very small, preferably hand-held device
- Results should be available within 20-30 minutes after the sample went into the device without further hands-on time
- Anybody should be able to handle it without any training

Remaining challenges

Sample preparation specific

- Yes, but preparatory steps might be required. Question on which is the best sample to use.
- Yes, but special requirements exist for some samples
- Yes, but often lacking quality control on sample

Overall diagnostic test

- Complex samples preparation modules are still relatively large
- High pathogen load samples can be handled with relatively high speed,. More complex samples still take more time.
- Sample in, result out tests do exist.

Rapid diagnostic tests

- Integrated sample preparation with minor or almost no sample handling

Pros

- Fully automated process, less hands-on time
- Fully controlled workflow

Cons

- Possibly validated for only a single sample type

Cepheid: Xpert® Carba-R



Biocartis: Idylla



- Less than 2 minutes hands-on time per sample
- Works for tissue slices (even paraffinized), blood, urine, stool, sputum or tissue
- All reagents in cartridge

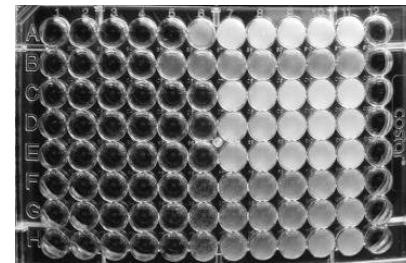
Rapid diagnostic tests

- So, although major advancements in molecular diagnostics have been made, we're still struggling, especially with resistance in gram negatives.
- In many cases you will have given that first dose of an antibiotic anyway...
- Revival the phenotypic tests?

bioMérieux: E-test



Broth Microdilution



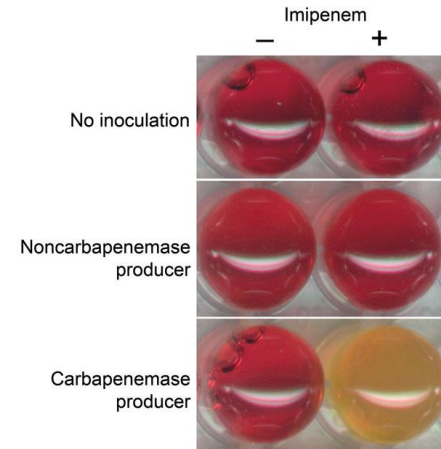
Becton Dickinson: Phoenix 100



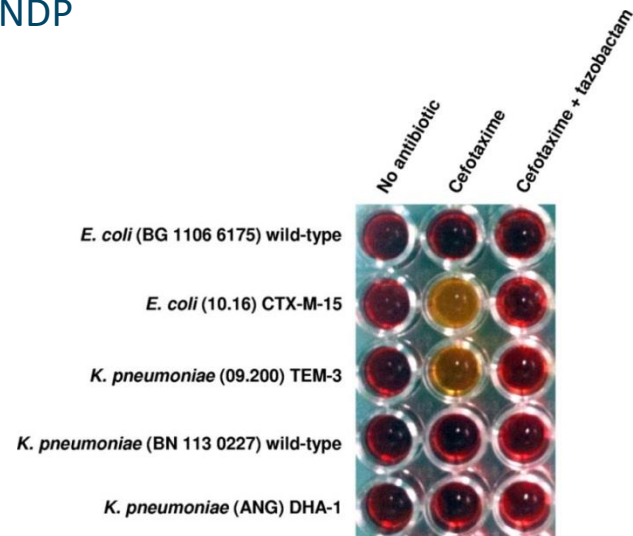
Rapid diagnostic tests

- Detection based on pH changes
- If any one of these enzymes is present, the medium becomes acid and the acidity indicator (pH) turns from red to yellow
- On isolates, within 2 hours
- Under research: directly from urine or whole blood

Carba NP



ESBL NDP



Rapid diagnostic tests – future?



Clinical Microbiology and Infection

Volume 23, Issue 1, January 2017, Pages 2–22



Review

The role of whole genome sequencing in antimicrobial susceptibility testing of bacteria: report from the EUCAST Subcommittee

M.J. Ellington^{1, †}, O. Ekelund^{2, †}, F.M. Aarestrup³, R. Canton⁴, M. Doumith¹, C. Giske⁵, H. Grundman⁶, H. Hasman⁷, M.T.G. Holden⁸, K.L. Hopkins¹, J. Iredell⁹, G. Kahlmeter², C.U. Köser¹⁰, A. MacGowan¹¹, D. Mevius^{12, 13}, M. Mulvey¹⁴, T. Naas¹⁵, T. Peto¹⁶, [J.-M. Rolain](#)¹⁷, Ø. Samuelsen¹⁸, N. Woodford¹.  

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<http://dx.doi.org/10.1016/j.cmi.2016.11.012>

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Surveillance screening

- Nasal/rectal carriage of MDR
 - *S. aureus*/ MRSA
 - ESBL Enterobacteriaceae
 - CR Gram-negatives
- Mass screening at admission
- Targeted screening – patients at risk:
 - Hematology, oncology, surgery
 - Patients with travel history
 - Transferred from hospitals with documented outbreaks



Thank you for your attention!

