Diagnostic Stewardship

Let's stop running tests we do not need so that we can run the ones that save lives
Who are we?

Mads Lause Mogensen  
M.Sc., Ph.D.  
Chief Executive Officer (CEO)

We are part of the Judex family
Three Available Products

- highly configurable modules can be combined in numerous ways

TREAT Lite
A supporting tool for the antimicrobial stewardship team which includes patient overview, review tools and statistical facilities

TREAT Steward
A fully integrated antimicrobial stewardship tool helping clinicians to select the most optimal antimicrobial therapy at point of care

TREAT Lab
A diagnostic stewardship tool for the microbiological laboratories that identifies populations for whom rapid diagnostics are cost-effective
The Challenge of antimicrobial therapy - the microbiological battle toughens against the "Super bugs"

- **Antimicrobial resistance is one of the world’s most pressing public health threats**
  - In 2050 it will kill more people than cancer

- **Excessive or inappropriate prescription of antimicrobials contributes to the problem**
  - Today 30-50% of all antibiotic prescriptions are useless

- **Antimicrobial treatment reflects a balance between two conflicting goals**
  - The choice of antibiotics treatment is difficult

Minimizing use of antimicrobials as they promote the emergence and spread of resistant bacterial strains.

Ensuring that the treatment is covering the bacteria causing the infection.
Antimicrobial- and diagnostic stewardship
- providing the optimal care to patients suspected of infection

With conventional diagnostics, the causative agent is found after 2-3 days, or, in up to half of all cases, not at all.

Alternative diagnostic approaches exist, but typically share at least one of two problems:
1) They are expensive and
2) They have too many false positives or false negatives.

Software solutions can support both diagnostic- and antimicrobial stewardship practices ensuring that tests are ordered for the right patients and the results of these are interpreted and reported back to the treating physician.
Rapid diagnostics
-is faster always better?

- Rapid diagnostics can help to guide treatment
  - Reduce the time to effective therapy, narrow the spectrum where possible

- The effect of early treatment is greatest in severe patients
  - Mortality increases 8% per hour delay in septic shock

- Longer delays do not significantly effect mortality for less severe patients
  - Conventional diagnostics may still be suitable for most

- Choosing the right patients ensures the most effective use of limited resources
  - The greatest clinical impact of rapid diagnostics will be for high-risk patients

1 Kumar et al. (2006) Crit Care Med 34(6) 1589-1596
2 Wisdom et al. (2015) Emerg Med Australasia 27(3) 196-201
Application of risk assessment

- supporting stewardship initiatives in the clinical microbiology laboratory

Conventional microbiology
(Total: 35 - 80 hours)

- Patient suspected for infection
- Blood sample for culturing arrives in the laboratory
- Incubation
- Gram stain / morphology
- Standard practice

SepsisFinder™ identifies high-risk patients for direct blood diagnostics

PCR diagnostics with TREAT Lab™
(Total: 6-10 hours)

- PCR Diagnostics

Fast diagnostics with TREAT Lab™
(Total: 25 - 35 hours)

- Rapid diagnostics
The solution is to use risk assessment - the secret of the decision engine is continuous nodes in a causal probabilistic network

- Use a technology that can handle missing data (Causal Probabilistic Network)
- The model uses approximately 10 infection-related parameters
- All parameters can be found via IT-integrations – no manual input
- The outcome is a prediction of the likelihood that a patient has bacteremia and the patient’s mortality, which can be used for assignment of the most optimal workflow
Risk assessment – it works!
- Survival curves show nice identification of high- and low risk groups

- 9500 patients with suspected infection at a tertiary referral centre in Israel (Bacteremia rate ~6%, 30-day mortality ~10%, ~8 infection-related variables)
Case study AUSL Romagna
- One of the largest microbiology laboratories in Europe

Setting:
- Large regional laboratory serving 7 hospitals in Emilia-Romagna (1-2 million inhabitants/tourists)
- Approx. 80,000 blood culture sets per year
- Approx. 30,000 positive bottles per year
- Access to a limited set of clinical chemistry results (4-5 parameters)
- High resistance area (ESBL>70%, carbapenemase endemic)

Current practice:
- All samples through conventional microbiology
- 80%+ have additional species ID through MALDI-TOF
- Cepheid MRSA, Cepheid Carba R, FilmArray BSI panel also available although not fully utilised
- Only ICU/ID physicians may request rapid diagnostics
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Goal (pilot study end 2017 – lab-based):
• Reduce the use of MALDI-TOF for very low risk patients, freeing up technician time
• Guide choice of rapid diagnostics based on risk level and gram stain/morphology

Goal (future parallel clinical installation):
• Selection of patients for rapid diagnostics direct on primary blood samples
Initial study design before installation

- Primary blood diagnostics

Design:
• Retrospective comparison with prospective clinical selection of high risk patients

Data material:
• 1264 BC encounters eligible for a trial of IRIDICA PCR-ESI-MS (Abbott)
• Clinicians prospectively selected 244 high-risk patients (Sepsis-3 criteria)
• SepsisFinder CPN retrospectively selected the 244 patients with highest probability of bacteremia

Outcomes:
• Bacteremia rate
• Iridica positive rate
• 30-day mortality
Results of the initial study
– Primary blood diagnostics

Key findings:
• SepsisFinder’s high-risk group had a significantly higher:
  • Bacteremia: 45,5% vs. 30,2%
  • 30d mortality: 27,8% vs. 14,0%
• Of the clinical selection, both the rate of bacteraemia and positive Iridica samples were higher among those that were also selected by SepsisFinder
  • Bacteremia: 45,2% vs. 25,0%
  • Iridica: 51,6% vs. 30,0%

Conclusions:
• SepsisFinder improved patient selection for rapid diagnostic testing by “enriching” the test population and selecting those most at risk of death
• SepsisFinder’s risk assessment was more effective than clinicians
Design:
• Prospective study of SepsisFinder’s risk-based stratification
• Implementation of decision support software in clinical practice

Expected outcomes (lab):
• 10% highest risk patients for rapid workflows
• ~30% savings on MALDI-TOF

Safety/Performance
• No mortality increase among low-risk patients
• Reduction in time to appropriate treatment among high-risk patients
We need software tools supporting diagnostic stewardship in the fight against the super bugs
... risk stratification and population enrichment are necessary

Save resources on the diagnostic workup for low risk patients
... we don’t have to blood culture every patient

Save lives by directing the saved resources towards the patients who will benefit most
... we have to combine risk stratification with the use rapid diagnostics