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Advances in bloodstream infection diagnostics

A hospital perspective decision model to determine the clinical and economical effectiveness of the new Accelerate PhenoTest™ BC Kit

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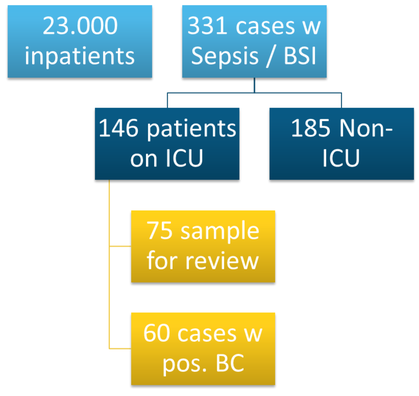
Introduction and Purpose

- Severe infections require early optimization of antibiotic therapy. The rate of inadequate initial antibiotic therapy (IIAT) is of high relevance for the outcome of patients
- Since 2016, antibiotic susceptibility results with minimum inhibitory concentrations (MIC) direct from positive blood cultures are available in less than eight hours using a new diagnostic system
- Within the framework of DRG-based modelling, theoretical savings of 1,539€ per case could already be demonstrated with 94.1% test success [1], a possible LOS reduction of 3.7 days and a IIAT rate of 25.4%. A total of 209 DRGs with >100,000 potential cases were simulated [2]
- The PHENO Medical EcoNOmic EvaluatioN (PHENOMENON) study will evaluate in 3 hospitals whether the theoretically determined savings can also be achieved in clinical practice

Methods

- Determination of the potential based on a case review of a historical cohort
- From 146 sepsis patients (house 1) with ICU stay a sample of 75 cases was drawn to check the necessity of a therapy change in case of a positive test result (66 cases would have been necessary for 95% certainty of results)
- Case review based on medical records
- All cases with positive BK (n=60, 68%) were evaluated as potential test cases
- From the results of the microbiology it was determined whether an adjustment of the therapy was necessary or not
- Therapy changes could either be adjustment due to IIAT or De-Escalation
- Savings were calculated by deriving a realistic no. of days that could be saved on ICU and on normal ward
- All reviews were conducted by 2 reviewers independently

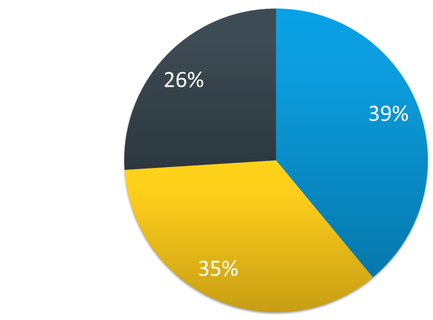
Patient Selection



Results of the Historic Cohort

- In the historical case review 68% of the selected cases showed a positive BK
- In 60% of the examined cases an adjustment of the therapy would have been necessary
  - In 35% we found IIAT (initial antimicrobial agent was resistant to pathogen)
  - In 26% we found a chance for De-Escalation (narrower spectrum)
- For these patients (extrapolated: n=99/146), there were possible savings of 122,112.00€, i.e. 2,035.20€ per case, after deduction of the costs for the test

Therapeutic Adjustments



Model Overview

Model Input data (partly derived from Review)

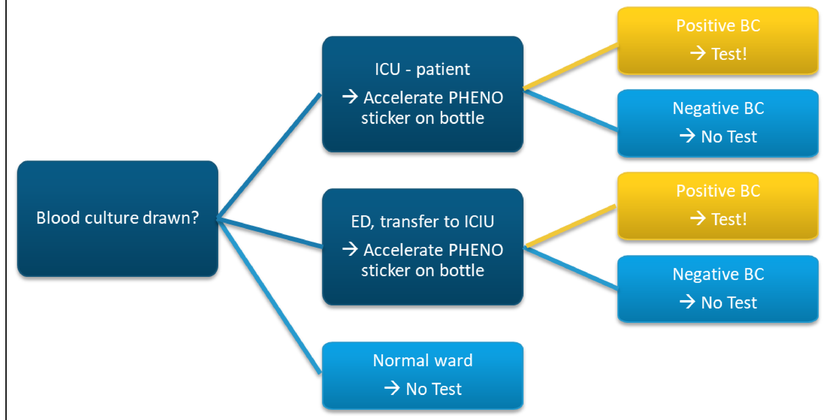
Cost area	Costs	Model parameter	Value	Area	LOS-reduction (days)
Costs normal ward / day	350 €	Cases w pos. BC	68%	Normal ward	1
Costs ICU / day	1.100 €	Cases benefit from PHENO	61%	ICU	2
Costs per Test	312 €	Tests / case	1		

Model result

Severity	Cases (n)	Cases w pos. BC	Costs PHENO	Cases benefit PHENO	Savings	Balance
Sepsis on ICU w shock	41	28	8.736,00 €	17	43.350,00 €	34.614,00 €
Sepsis on ICU w/o shock	105	71	22.152,00 €	43	109.650,00 €	87.498,00 €
Total	**146**	**99**	**30.888,00 €**	**60**	**153.000,00 €**	**122.112,00 €**

Possible Prospective Decision Workflow

- With the results of the economic model a hospital individual decision is possible
- The model primarily is effective if patients on ICU are tested
- A possible prospective workflow is shown below



Summary

- The economic model showed substantial savings of € 122.000.- if 99 patients per year profit from the test
- The case review showed that the combination of IIAT and option to de-escalate leads to more than 50% (here 61%) chances to optimize antimicrobial therapy well before Standard-of-care results are available
- A simulation showed that already 0.5 days LOS-savings in the ICU would lead to a break-even of the new Accelerate Pheno™ system

Conclusions

- The model that was derived from the literature and then used in a hospital allows hospitals to validate the economic impact of rapid ID+AST testing with comparatively low efforts
- Main drivers are the rate of IIAT and the no. of patients with chances to de-escalate
- Due to high costs on an ICU already little shortening of the LOS can lead to a positive economic balance
- Hospitals can use such models to evaluate the economic efficiency of introducing rapid ID+AST testing tools

Disclosures

This study was sponsored by Accelerate Diagnostics Inc. Tucson, USA. W. Heinlein is an employees and M. Wilke is an employee and shareholder of inspiring-health GmbH, which was contracted by Accelerate. K. Worf and T. Kast were formerly employees of inspiring-health GmbH. W. K.F. Bodmann acted as a consultant to Accelerate, and has received lecture honoraria from Accelerate. T. Wassermann is an employee of Accelerate Diagnostics Inc.

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References

1] Pancholi P et al. Multicenter Evaluation of the Accelerate PhenoTest™ BC Kit for Rapid Identification and Phenotypic Antimicrobial Susceptibility Testing Using Morphokinetic Cellular Analysis. Journal of clinical microbiology. 2018;56(4). DOI: 10.1128/JCM.01329-17.

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