L’apport du diagnostique rapide à la gestion des infections à l’hôpital

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CONTENU

1. Innovations diagnostiques et infections à l'hôpital

2. Focus sur l'apport de l'identification rapide MALDI-TOF

INFECTIONS IN HOSPITAL: A BURDEN MORE THAN EVER

For both the patient and hospital community: other patients and healthcare personnel

- External risk = at hospital presentation:
  - infection of not ?
  - Acute respiratory-, urinary-, gastro-intestinal infections, AMR additional burden
  - Not explicitely quantified
  - Burden: management of the patient flow at emergency department (flu season, lack of resources,…)
- Emerging risk Inside = Hospital-Acquired Infections (HAIs):
  - hundreds of millions of patients worldwide annually (WHO 2010).
  - 4.8 millions in Europe (ECDC 2024)
  - Low- and middle-income countries experience a several-fold higher burden of HAIs compared to high-income countries
  - Exacerbated by AMR

Adverse outcomes include:

- Prolonged hospital stays
- Unnecessary deaths
- Ward outbreaks
- Long-term disability
- Increased resistance of microorganisms to antimicrobials
- High costs for patients and their families
- Additional costs for health systems

INFECTIONS IN HOSPITAL: A BURDEN MORE THAN EVER

- Diagnostic is key to support the patient management
  - Clinical examination + diagnostic testing: biochemistry & microbiology
- But it takes time:
  - clinical specimen sampled,
  - sent to lab,
  - Sample processing
  - information sent to the clinician,
  - information translated into clinical action
- What if diagnostic was more rapid ?

WHERE INNOVATIVE RAPID DIAGNOSTICS* BENEFIT

*coupled to organizational change

ADMISSION

DISCHARGE

1. BETTER PATIENT FLOW

- Admission/occupancy

2. BETTER PATIENT CARE

- Antimicrobial therapy
- Better resource use

3. SAFER CARE FOR ALL (patients & HCPs)

- Infection Prevention & Control

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BETTER PATIENT FLOW

OBJECTIVE

Children with infectious bloody diarrhea are at an increased risk for developing hemolytic uremic syndrome (HUS). Early intervention may improve outcomes. **This study evaluated the impact of a clinical pathway designed to identify those at risk for HUS**, guide initial management, and provide decision support regarding patient disposition.

STUDY DESIGN

- retrospective cohort study of children 4 months to 19 years of age
- presenting with the acute onset of bloody diarrhea or other HUS risk factors to the pediatric emergency department (ED)
- **pre-post: SOC (culture + some PCR) *versus* a rapid syndromic stool PCR** in the frame an existing clinical pathway for HUS risk

RESULTS

- 305 patients included (109 pre-/196 post-)

Hospitalization

- 20% avoided admission
- No change in length of stay, ED return visits, hosp. readmissions, patients with STEC , AKI or HUS

Cost reduction

- $918 saved per case after pathway implementation

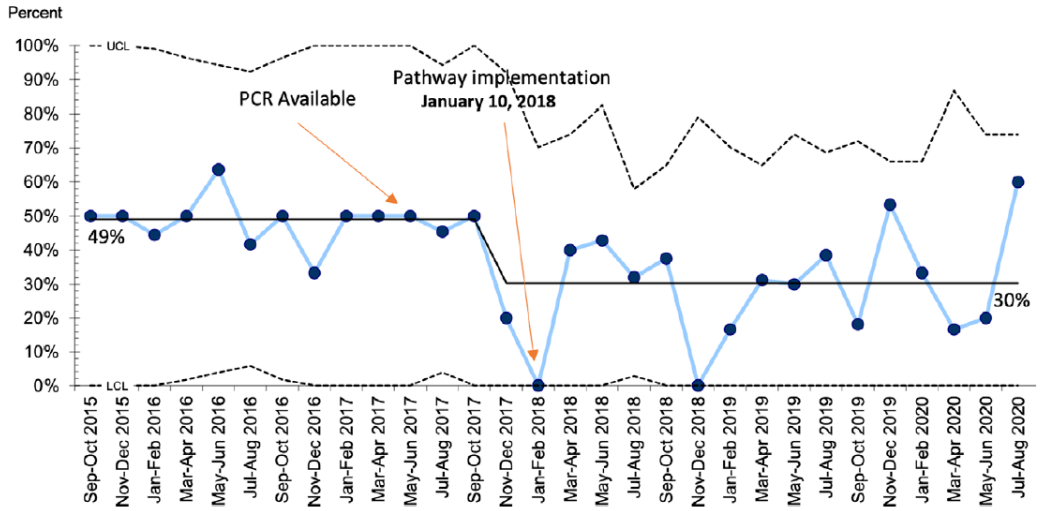

Fig. 2. Proportion of patients with bloody diarrhea admitted from the ED over time (P chart).

"introduction of a rapid stool PCR test and clinical pathway correlated with decreased hospitalizations and overall costs without adverse clinical outcomes"

Burns. Epidemiology and Prevention of Hemolytic Uremic Syndrome in Children. (2012.)

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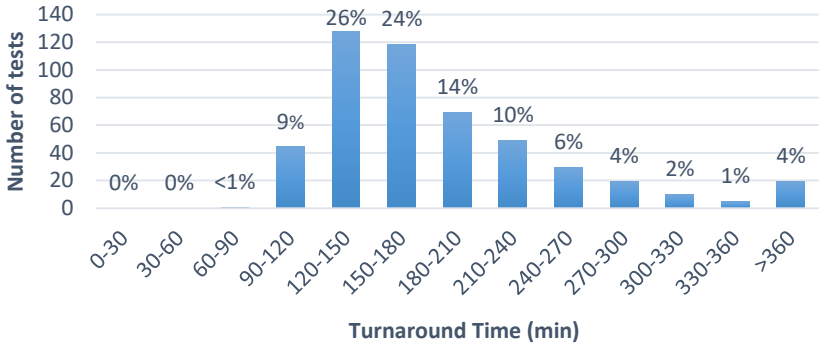
BETTER PATIENT FLOW & SAFER CARE FOR ALL

The purpose of this study was to create an optimal diagnostic policy for patients with **respiratory viral infections at the emergency department (ED) of a tertiary care hospital in the Netherlands.** The improved diagnostic policy consisted of three main steps, oriented to reduce turnaround time (TAT): 1. Early sample collection; 2. Implementation of the BioFire® FilmArray® Respiratory (RP) Panel **in a lab next to ED**; 3. Extension of the diagnostic service to 7 days/week from 8:30 am-10 pm. Adult patients presenting at the ED with suspected respiratory viral infection were included.

Results

- The BioFire RP Panel detected 215 pathogens in 207 (42%) samples; including **60% of non-influenza pathogens** and 8 co-detections:
  - 4 human rhinovirus/enterovirus (HRV/EV) and Influenza A H3N2
  - 2 Coronavirus (CoV)-NL63 and CoV-OC43
  - 1 CoV-229E and HRV/EV
  - 1 human metapneumovirus and HRV/EV
- 436/492 (89%) results were available while patients were still at the ED
- Median TAT from admission to test result was 165 min (IQR:138-214)
- No antibiotics were prescribed in 94/207 (45%) patients who tested positive for a virus
- Of the 330 patients admitted, 185 patients were negative for any virus (56%) thus were admitted without the need for isolation 1/2 days
- The value-based measure, expressed in euro–hour (€hr), increased by tenfold compared with the previous policy



Euro-hour (€hr) approach					
Perspective	Policy	Costs/ result (€)	TAT (hr)	€hr	Impact new vs. Former policy
Diagnostic lab (clinical virology)	Former PCR	200-240	19	3800-4560	6.2-9.0
	New (RP Panel)	250-300	2.03	508-609	
Diagnostic lab and ED	Former PCR	200-240	36	7200-8640	7.4-10.7
	New (RP Panel)	250-300	3.23	808-969	

"An optimal policy is essential for patient management, by providing timely, reliable diagnostics"

Poelman et al; Future Microbiology. 2020 May; 15(8): 623–632.

WHERE INNOVATIVE RAPID DIAGNOSTICS* BENEFIT

*coupled to organizational change

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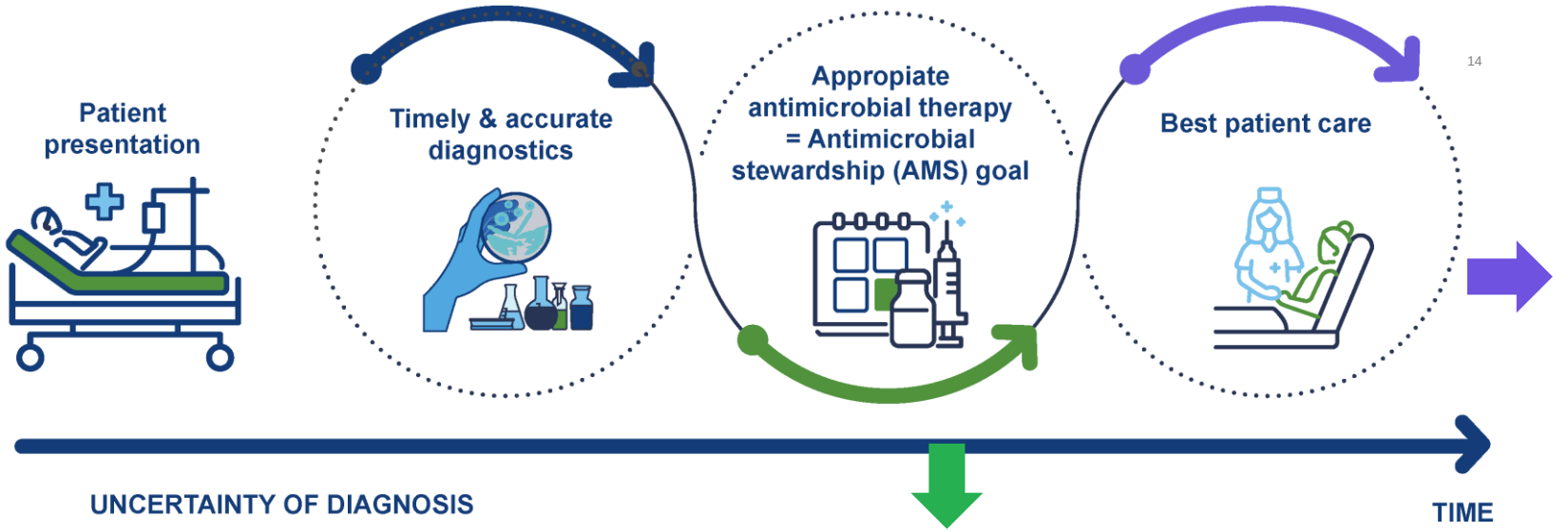
DIAGNOSTICS CONTRIBUTE TO HIGHER MEDICAL VALUE LEADING TO BETTER PATIENT CARE



PATIENT OUTCOMES [15,16]

- Clinical resolution/cure rate
- Hospital length of stay (LOS)
- Morbidity
- 30-day (d) mortality
- Time to discharge
- Re-admission at 30 d
- Patient safety
- AE [healthcare-associated infections (HAIs), *Clostridioides difficile (C difficile)*, acute kidney injury]
- Quality of life post-care

ANTIMICROBIAL PRESCRIBING INDICATORS [15,16]

- Antibiotic therapy initiation rate
- Time to appropriate therapy
- Proportion of appropriate antibiotic therapy
- Antibiotic exposure
- Length of therapy
- De-escalation/escalation
- Time to oral switch
- Reduction in antimicrobial use: days of therapy (DOT), defined daily dose (DDD)

An opportunity for dialogue between the lab and the clinician

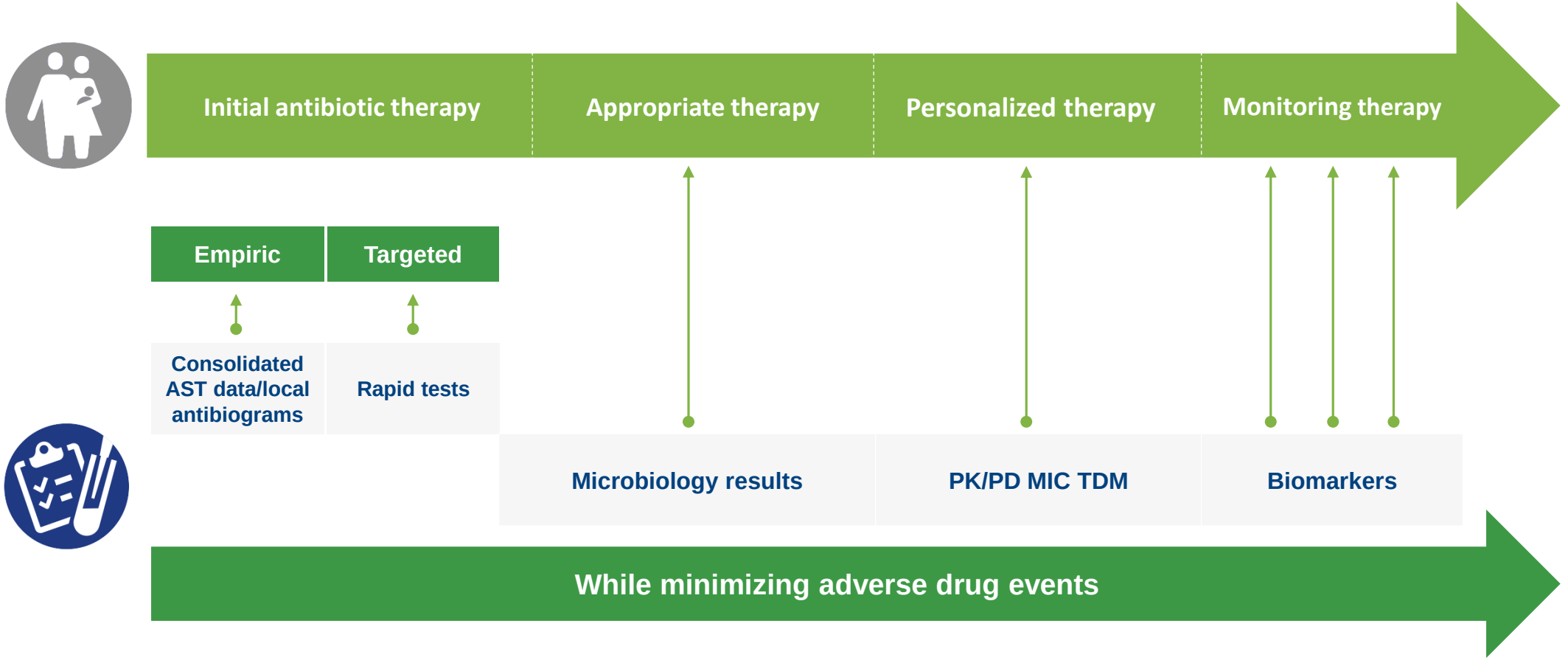
Adapted from bioMérieux S.A.. Available at https://www.biomerieux.com/content/dam/biomerieux-com/medical-affairs/amr/educational-materials/evidence-based-diagnostics-for-ams-offered-by-biomerieux.pdf. bioMérieux SA property

AE, adverse event; **AMS**, antimicrobial stewardship; ***C difficile***, *Clostridioides difficile*; **d**, day; **DDD**, defined daily dose; **DOT**, days of therapy; **HAI**, healthcare-associated infection; **LOS**, length of stay.

References **13-16** are available in the References Section.

LET'S FOCUS ON THE PATIENT'S ANTIMICROBIAL THERAPY PATHWAY

The patient antibiotic therapy should be adapted as soon as diagnostic information is more complete



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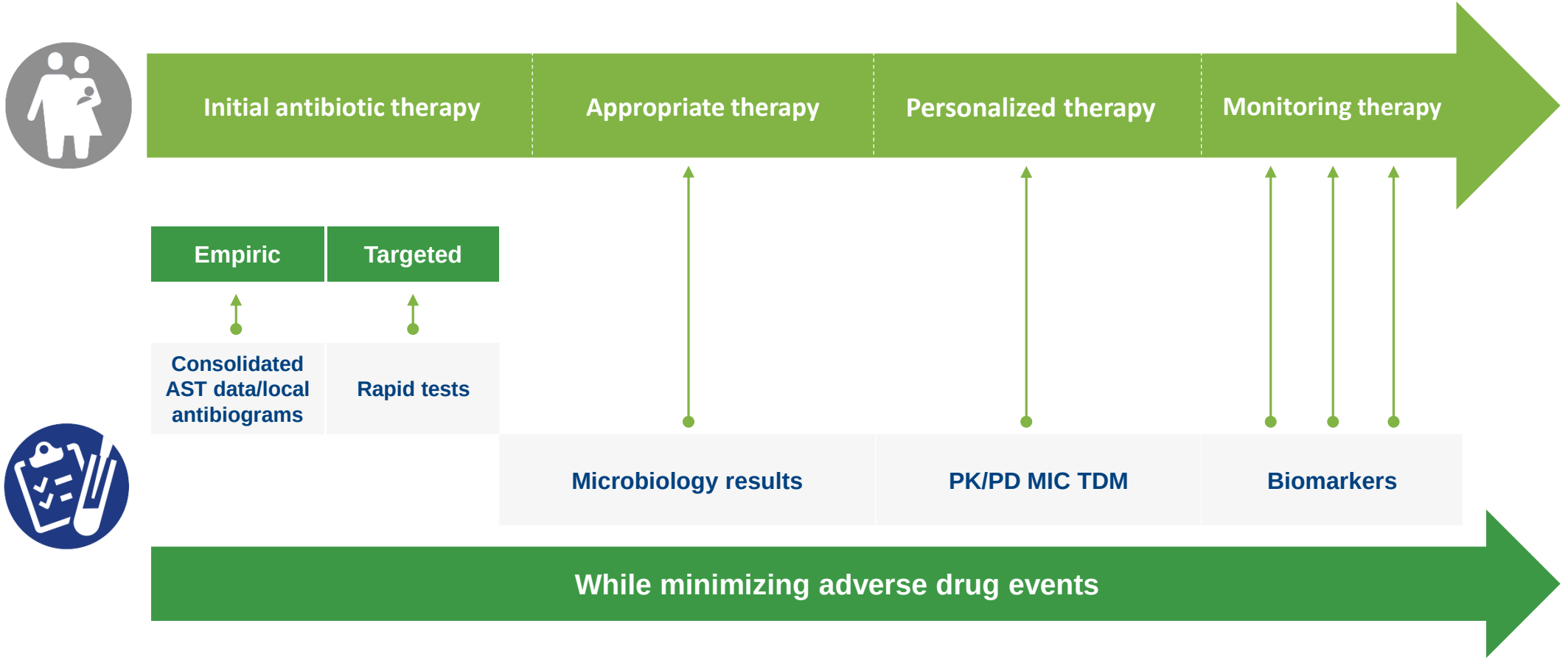


COMPLIANCE OF EMPIRIC PRESCRIPTION WITH GUIDELINES FAVOURS A REDUCTION OF MORTALITY OF 35%

Improve Patient Outcomes and Safety

A meta-analysis of 37 studies

Effect on mortality of prescribing empirical antimicrobial therapy according to guidelines

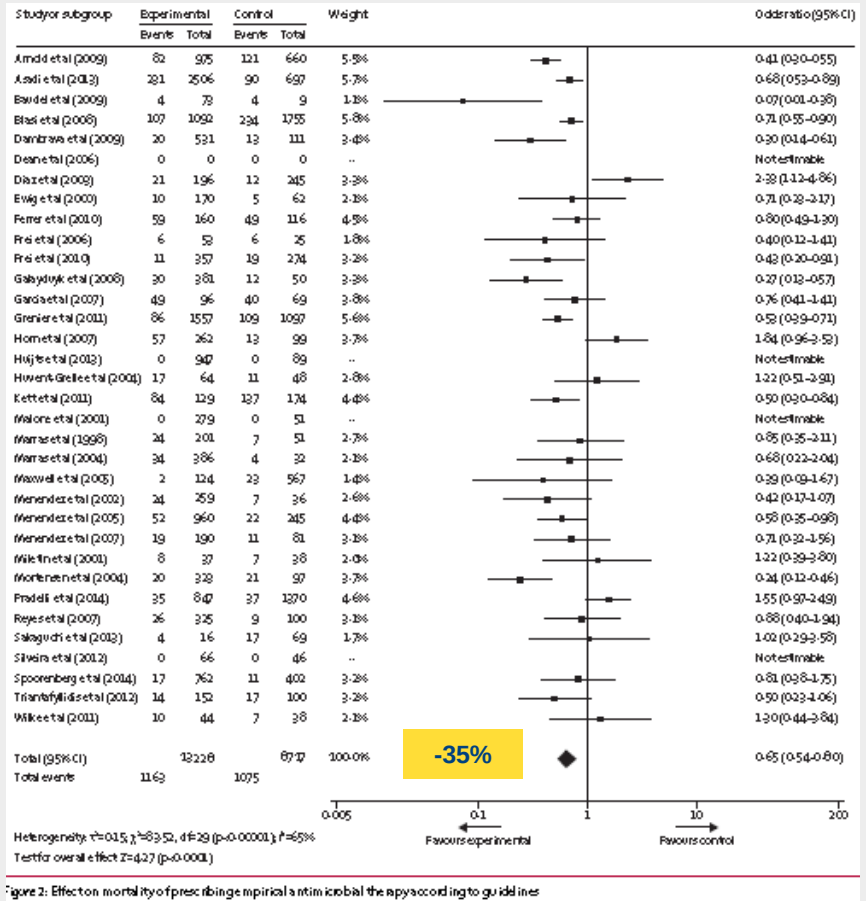
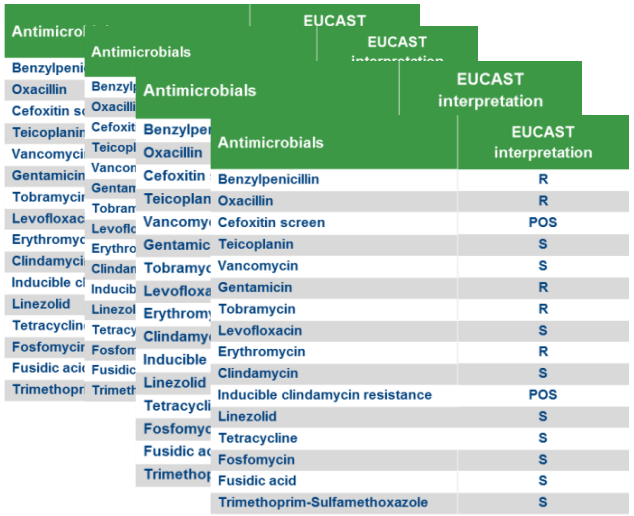


Figure 2: Effect on mortality of prescribing empirical antimicrobial therapy according to guidelines

THE LABORATORY FEEDS THE LOCAL PRESCRIPTION GUIDELINES



Consolidation of AST results

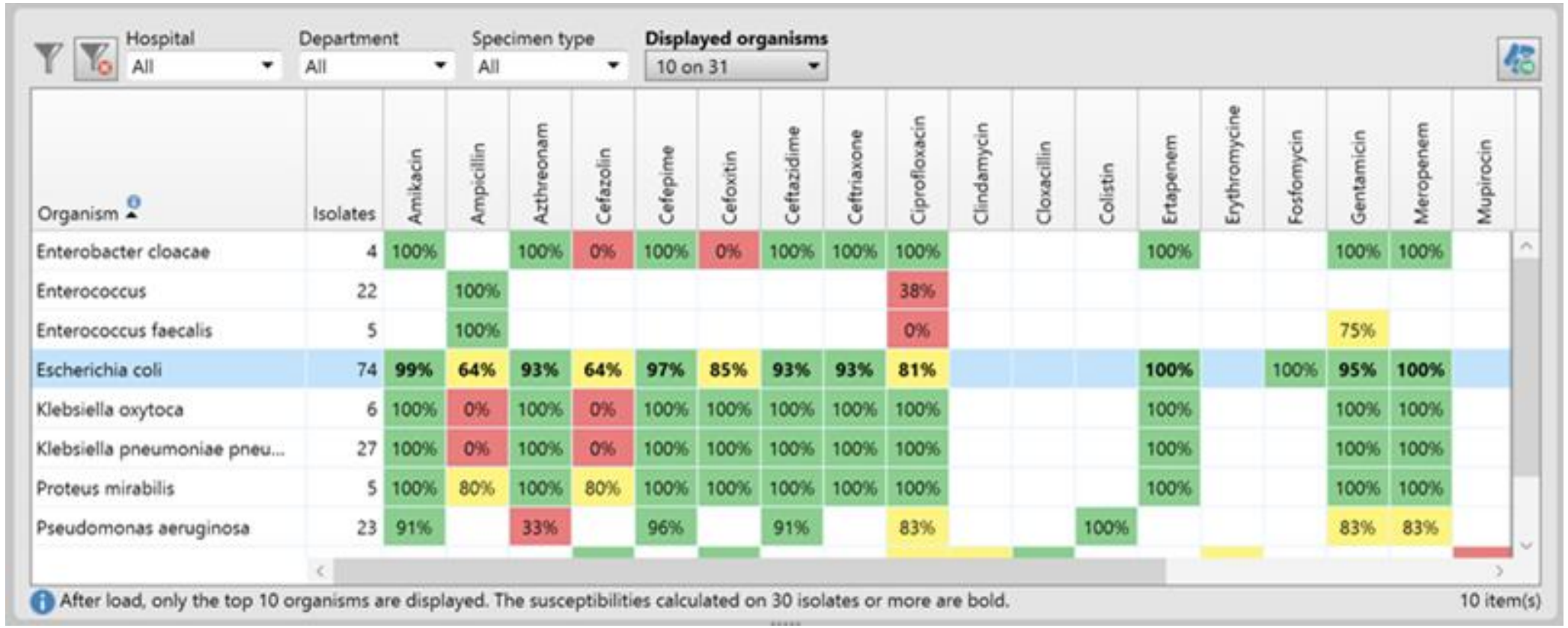
Monitoring of resistance trends over time in a specific ward, hospital, country etc..

Define and update antibiotic therapy policies

Empiric antibiotic therapy

KNOW YOUR PLACE: LAB SOFTWARES FACILITATE DETERMINATION OF THE LOCAL RESISTANCE *I.E.* CUMULATIVE ANTIBIOGRAM (S/I/R) :

Local ecology by wards, specimen types and organisms

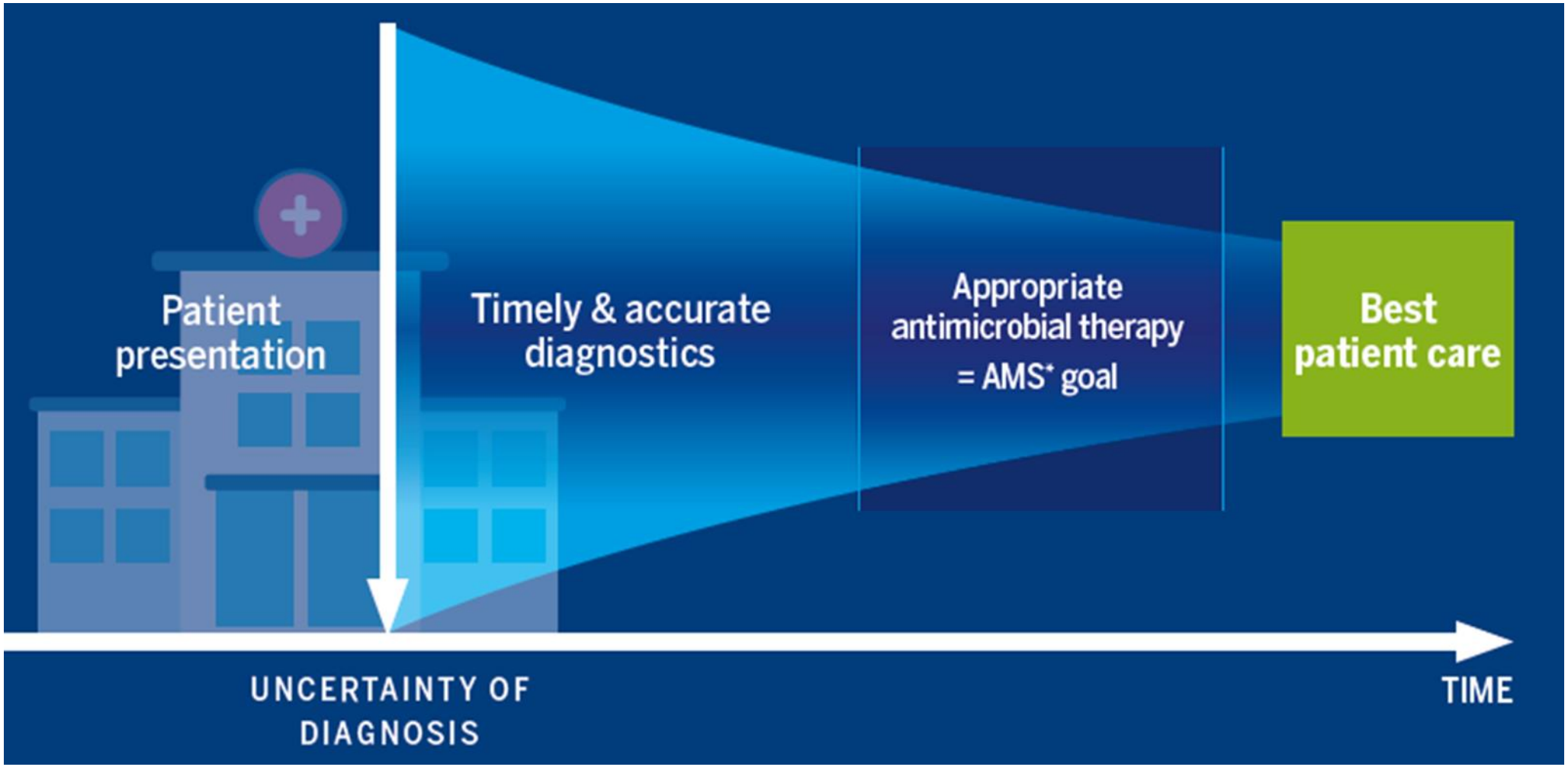


Organism	Isolates	Amikacin	Ampicillin	Aztreonam	Cefazolin	Cefepime	Cefoxitin	Ceftazidime	Ceftriaxone	Ciprofloxacin	Clindamycin	Cloxacillin	Colistin	Ertapenem	Erythromycine	Fosfomycin	Gentamicin	Meropenem	Mupirocin
Enterobacter cloacae	4	100%		100%	0%	100%	0%	100%	100%	100%				100%			100%	100%	
Enterococcus	22		100%							38%									
Enterococcus faecalis	5		100%							0%							75%		
Escherichia coli	74	**99%**	**64%**	**93%**	**64%**	**97%**	**85%**	**93%**	**93%**	**81%**				**100%**		100%	**95%**	**100%**	
Klebsiella oxytoca	6	100%	0%	100%	0%	100%	100%	100%	100%	100%				100%			100%	100%	
Klebsiella pneumoniae pneu...	27	100%	0%	100%	0%	100%	100%	100%	100%	100%				100%			100%	100%	
Proteus mirabilis	5	100%	80%	100%	80%	100%	100%	100%	100%	100%				100%			100%	100%	
Pseudomonas aeruginosa	23	91%		33%		96%		91%		83%			100%				83%	83%	

After load, only the top 10 organisms are displayed. The susceptibilities calculated on 30 isolates or more are bold.

10 item(s)

EMPIRIC THERAPY IS NICE, APPROPRIATE THERAPY IS BETTER !



DIAGNOSTICS IS VITAL TO INFORM THE APPROPRIATE THERAPY FOR BEST PATIENT CARE

* AMS: Antimicrobial Stewardship

INAPPROPRIATE INITIAL ANTIBIOTIC THERAPY LEADS TO EXCESS MORTALITY

Retrospective cohort study

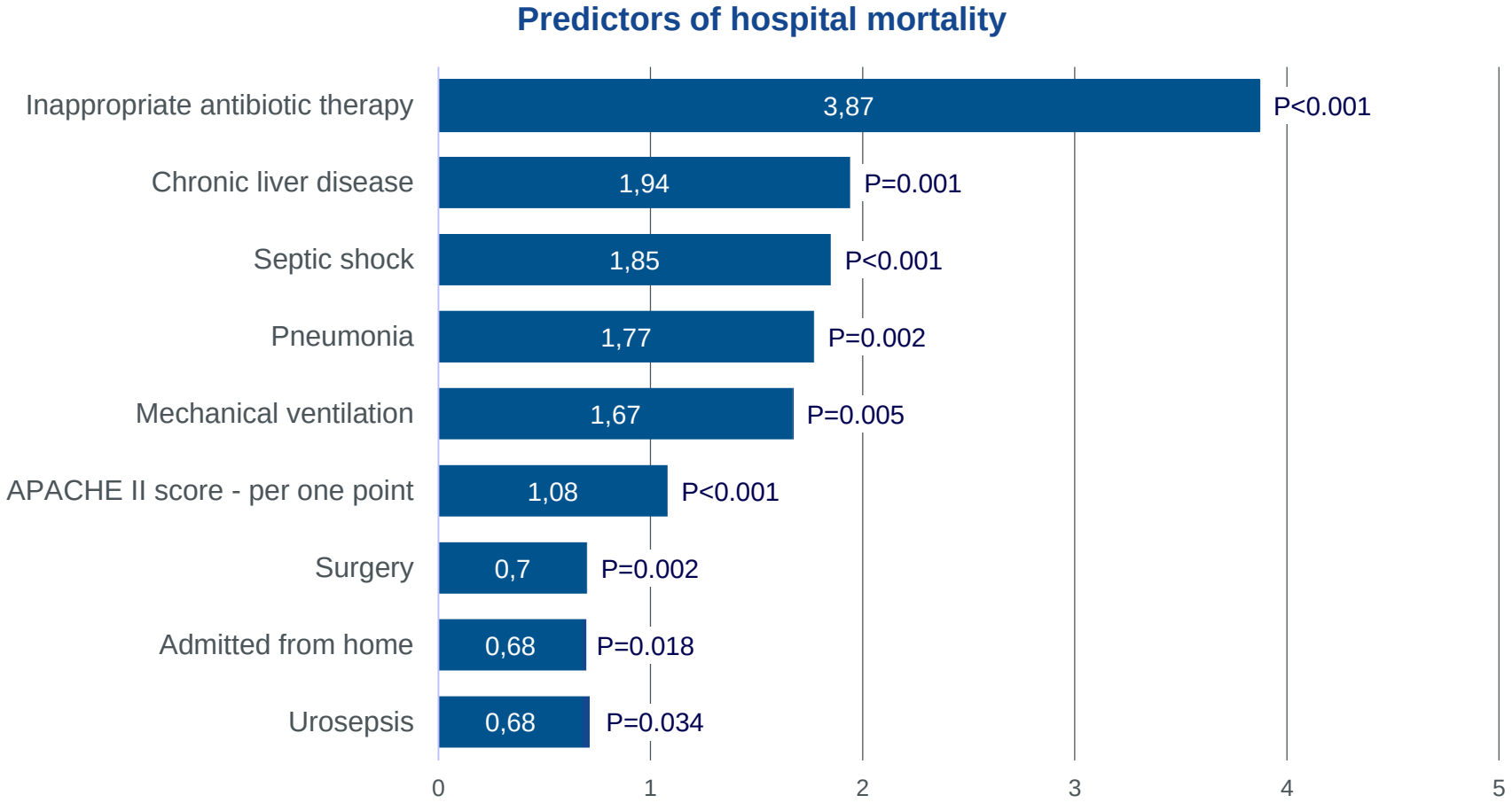
Patients with GNR bacteremia resulting in severe sepsis/septic shock

N=1064

E. coli: 26%,

K. pneumoniae: 20%,

P. aeruginosa: 16%



Inappropriate initial antibiotic therapy is a modifiable risk factor for mortality

APACHE, Acute Physiology And Chronic Health Evaluation; GNR, Gram-negative resistant.
Adapted from: Zilberberg MD, et al. *Crit Care*. 2014;18(6):596.

MDR pathogens are the most important predictor of inappropriate initial therapy

Retrospective cohort study

Patients with GNR bacteremia resulting in severe sepsis/septic shock

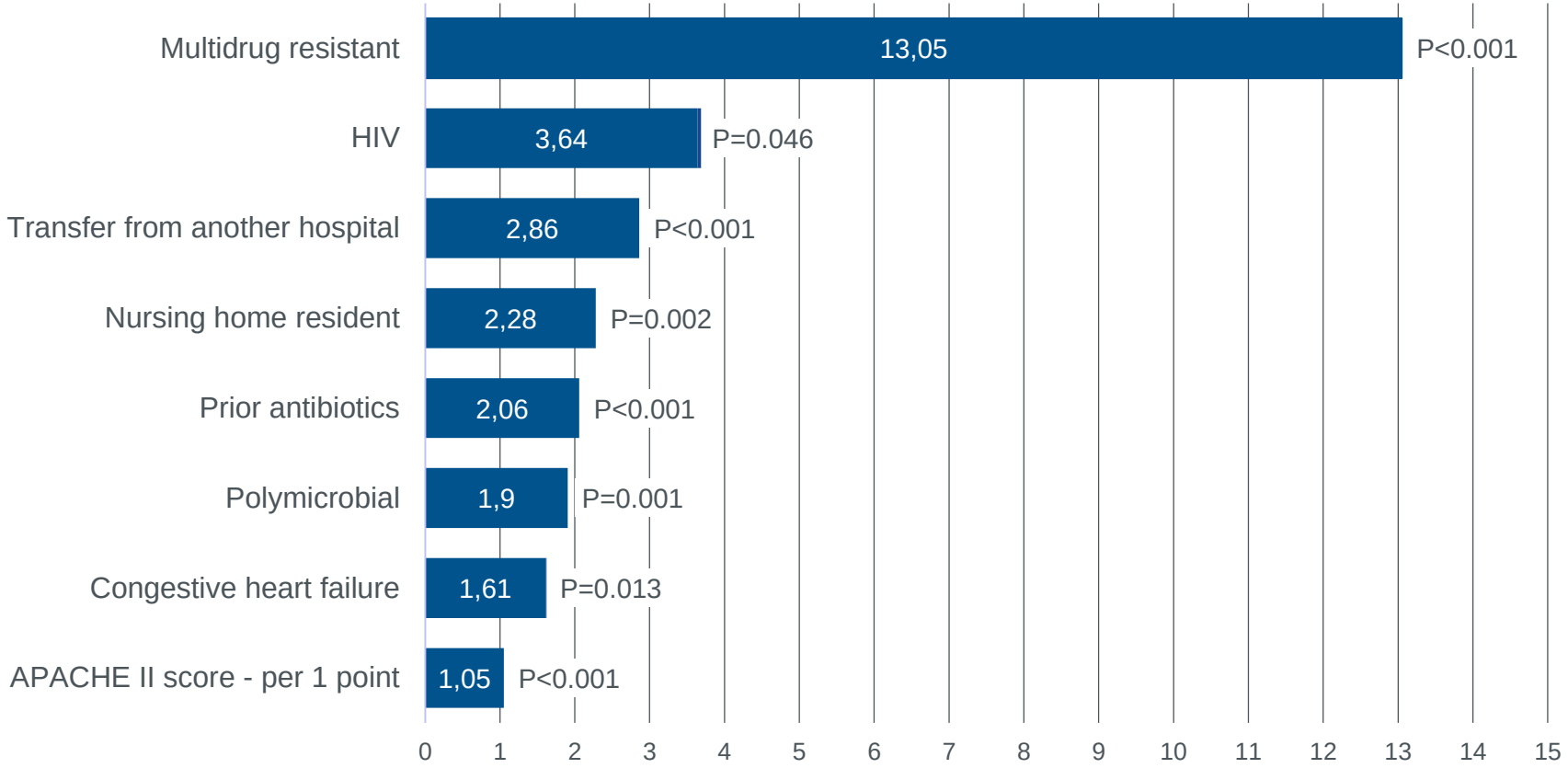
N=1064

E. coli: 26%,

K. pneumoniae: 20%,

P. aeruginosa: 16%

Predictors of receiving initially inappropriate antibiotic therapy



MDR pathogens elevate non-IAAT risk, impacting mortality in GNR sepsis

APACHE, Acute Physiology And Chronic Health Evaluation; GNR, Gram-negative resistant; HIV, human immunodeficiency virus; IAAT, inappropriate initial antibiotic therapy; MDR, multidrug resistant.
Adapted from: Zilberberg MD, et al. Crit Care. 2014;18(6):596.

DELAYED APPROPRIATE THERAPY IS DETRIMENTAL TO PATIENT OUTCOMES

- Retrospective analysis on n=56,357 patients with serious Gram- bacteria infections (cUTIs, cIAIs, HAPs and BSIs), stratified by antibiotic susceptibility to index pathogens (resistant, n = 6,055; susceptible, n = 50,302), to examine the clinical and economic burdens associated with **delayed administration of appropriate therapy (> 2 days of the index date**)

- Delayed appropriate therapy was received by 2,800 (46.2%) patients with resistant and 16,585 (33.0%) patients with susceptible infections

TABLE 2. Association of delayed appropriate therapy vs. timely appropriate therapy with infection-related outcomes.

Outcome[a]	Serious infections due to resistant pathogens (CRE, CRP, MDRP or ESBL)		Serious infections due to susceptible pathogens	
	Delayed appropriate therapy (*n* = 2,800)	Timely appropriate therapy (*n* = 3,255)	Delayed appropriate therapy (*n* = 16,585)	Timely appropriate therapy (*n* = 33,717)
Mean (95% CI) duration of antibiotic therapy, days	12.7 (12.4-13.0)[b]	8.2 (8.0-8.4)	11.3 (11.2-11.4)[b]	6.4 (6.4-6.5)
Mean (95% CI) LOS, days	13.6 (13.3-14.0)[b]	8.7 (8.5-9.0)	12.1 (12.0-12.2)[b]	6.6 (6.5-6.6)
Mean (95% CI) total in-hospital costs to hospital to render care, $	32,518 (31,491-33,579)[b]	21,010 (20,348-21,695)	21,852 (21,648-22,058)[b]	12,345 (12,231-12,460)
Multivariate OR (95% CI)				
Discharged home	0.7 (0.6-0.8)		0.7 (0.6-0.7)	
In-hospital death or discharged to hospice	1.2 (1.1-1.3)		1.2 (1.2-1.3)	

- + 4.5 days of AB exposure
- + 4.9 days of LOS
- + $11.508 of hospital costs
- 31% lower chance of being discharged
- 16% increase in risk of hospital mortality

- Same order of magnitude for <u>susceptible</u> pathogens

Bonine NG. et al. Impact of Delayed Appropriate Antibiotic Therapy on Patient Outcomes by Antibiotic Resistance Status From Serious Gram-negative Bacterial Infections.*Am J Med Sci 2019*;357(2):103−110.

TARGETED THERAPY: THE VALUE OF TIMELY RESULTS

RAPID IDENTIFICATION ASSAYS

Direct on specimen

- **GRAM staining:** rough but rapid information, still valuable [56-59]
- **Rapid test (lateral flow immunoassay) [79]:**
  Confirm the bacterial (e.g., Group A Strep) or viral (e.g., Flu) or parasite (Malaria) etiology of infection
- **Rapid multiplex PCR tests [80]:**
  Identify the causative organism (s) in a panel of most common bacteria, virus or yeasts encountered in a given clinical specimen, following a syndromic approach
- **Host response biomarkers (CRP, PCT)** [81-83]
  Help distinguish patients with bacterial infection from those with viral infection or no infection

From culture isolates [55]

- **Automation of identification (and AST)**
- **Rapid test (lateral flow immunoassay, strip) [78,79]:**
  Identify rapidly the antibiotic resistance mechanisms to adapt the therapy
- **Mass spectrometry (MALDI-TOF) [72]:**
  - From colonies
  - Direct from positive BC
  - From short incubation (3-4 h)

AST, antimicrobial susceptibility testing; **BC**, blood culture; **CRP,** C-reactive protein; **Group A Strep**, Group A *Streptococcus*; **h,** hour; **MALDI-TOF**, Matrix-assisted laser desorption/ionization-time of flight; **PCT,** procalcitonin.

References **55-59,72,78-83** are available in the References Section.

Key considerations for the choice of rapid diagnostics[1]

Clinical and economical value of test

- Multidisciplinary combination of sensitivity, specificity, PPV and NPV considered
- Variability in patient presentations considered
- Severity considered
- Risk for MDR pathogens and local epidemiology considered
- Cost of test to healthcare centre/laboratory considered

Indication and timing of RDT testing

- Under which clinical circumstances patient testing (if any) to be considered
- When to request RDTs considered
- Chosen RDTs incorporated into unit-specific diagnostic algorithms
- RDTs integrated into laboratory and clinical workflow

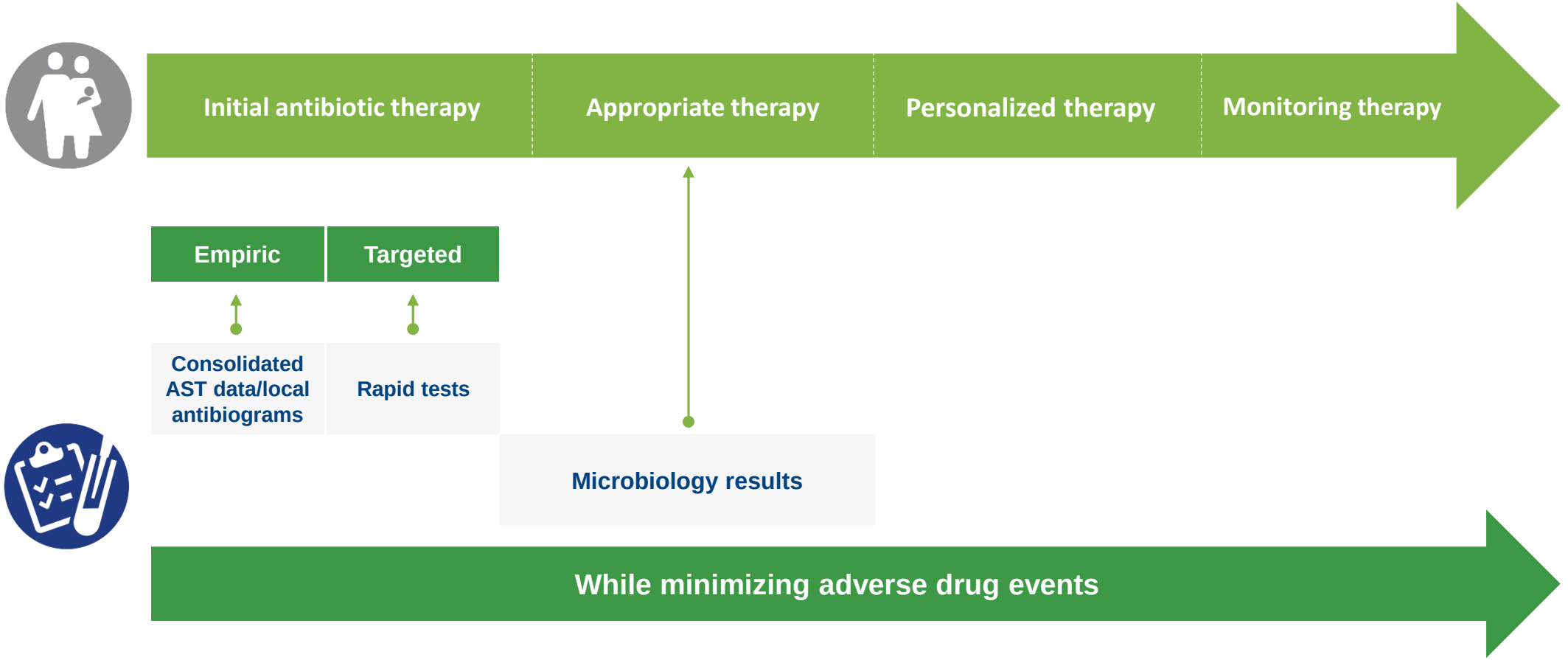
Interpretation and feedback

- Interpretation by whom and when considered
- Communication and AMS interventions defined

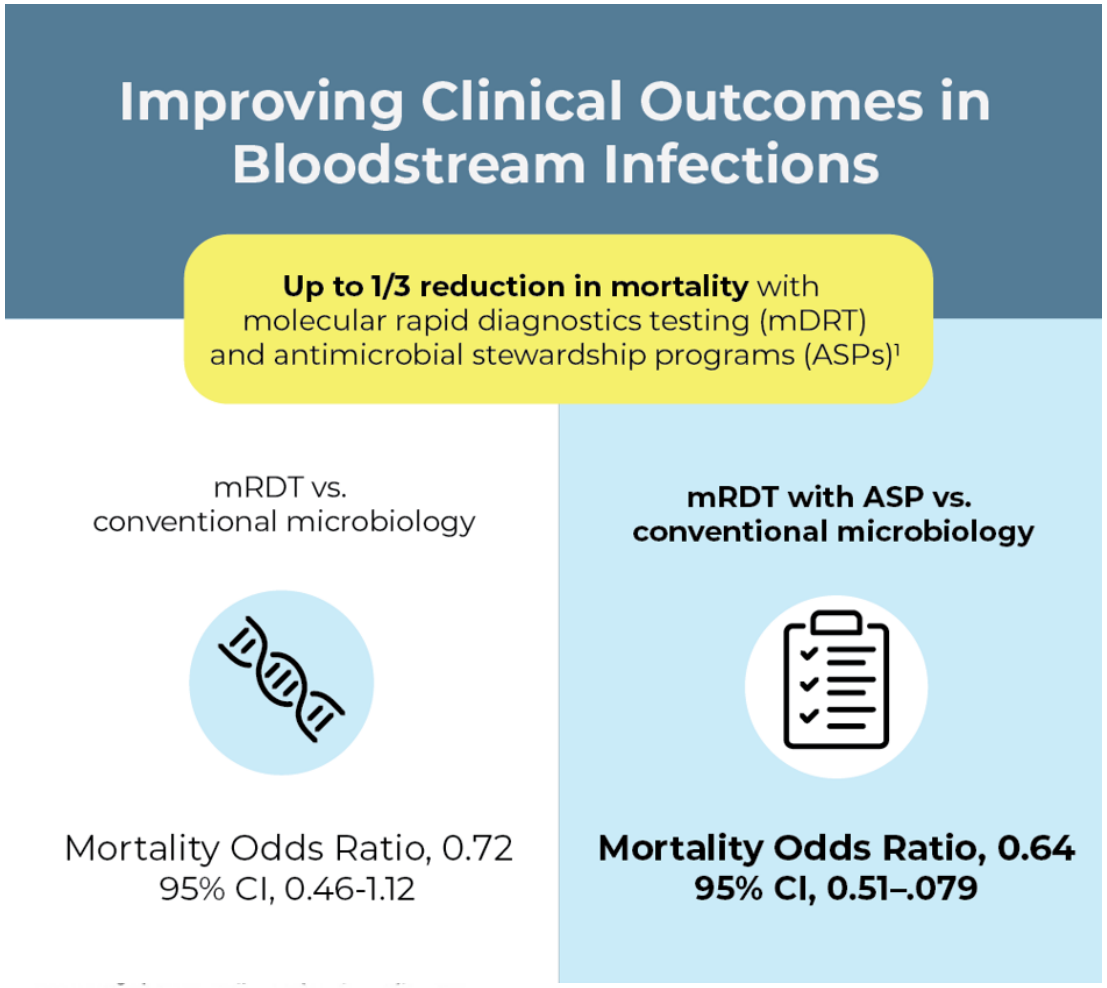
AMS, antimicrobial stewardship, **MDR**, multidrug resistant; **NPV**, negative predictive value. **PPV**, positive predictive value; **RDT**, rapid diagnostic test

[1] **Brink 2022.** Microbiology assessments in critically ill patients. Semin Respir Crit Care Med. 43(1):75–96

THE PATIENT ANTIBIOTIC THERAPY SHOULD BE ADAPTED AS SOON AS DIAGNOSTIC INFORMATION IS MORE COMPLETE



IMPACT OF RAPID DIAGNOSTIC TESTING (RDT) + AMS IN BLOOD STREAM INFECTIONS



- **Systematic Review & Meta analysis of 31 pub., 5 900 patients**
- **Using mRDT* in association with AMS *versus* without AMS significantly associated with decreased mortality for BSIs**
  - **time to effective therapy decreased by 5 hours *vs* conventional testing**
  - **length of stay decreased by nearly 2.5 days.**

"In BSI patients, mRDT should be considered as part of the standard care"

***TTR < 24 hours, mostly MALDI-TOF & PCR**

Adapted from Timbrook TT, et al. Clinical Infectious Diseases 2017;64(1):15-23

MALDI-TOF MS CAN GREATLY IMPROVE OUTCOMES AND MAY ALSO BE COST-EFFECTIVE IN PATIENTS WITH BSI YO ET AL. 2022

Background

- **Meta-analysis of 21 comparative studies with 14,515 patients** compared matrix-assisted laser desorption/ionization time-of-flight mass spectrometry (MALDI-TOF MS) with conventional phenotypic methods. 9 countries, all HICs (EU US Asia)

- **Objective:** To determine the effectiveness of MALDI-TOF MS-based pathogen identification, with or without antibiotic stewardship, in improving the efficiency of microbiology reports and clinical outcomes

Key findings

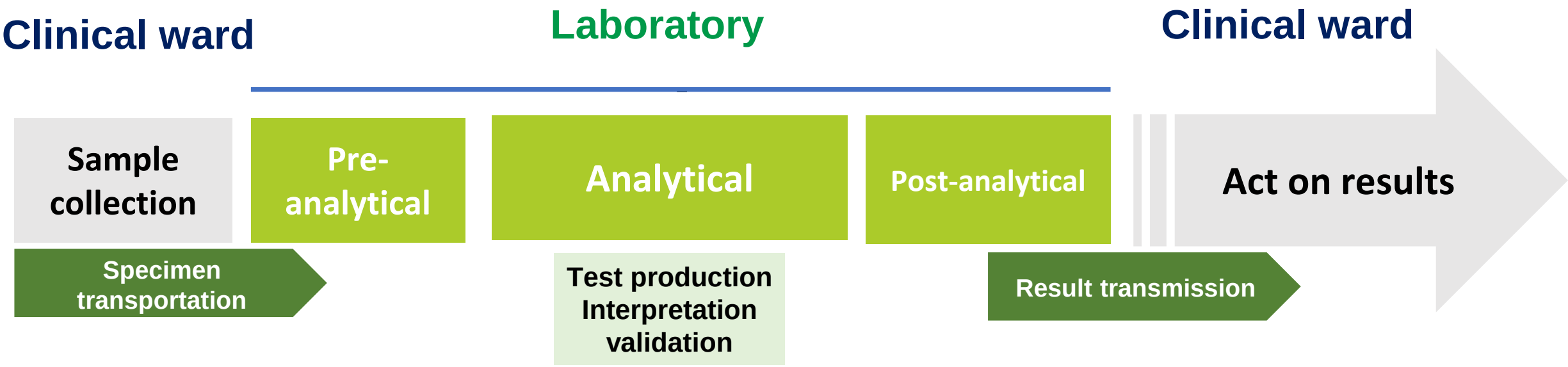
- MALDI-TOF MS was associated with:
  - **22.86 hour decrease in time to identify microorganisms** (95% CI -23.99 to -21.74)
  - **5.07 hour decrease in time to effective antibiotic therapy** (95% CI -5.83 to -4.31) **= KEY DRIVER**
    - 1h delay associated to 8% increase in mortality in septic shock- Kumar
  - **23% decrease in mortality** (risk ratio 0.77, 95% CI 0.66 to 0.90)
  - **0.73-day decrease in hospital stay** (95% CI -1.30 to -0.16)
  - **US$ 4 140 savings in direct hospitalization cost** (95% CI $-8166.75 to $-113.60)

- **No significant incremental value** of antibiotic stewardship program to rapid pathogen identification by MALDI-TOF However, the **mortality decrease** tended to be **more noteworthy** when analysis was restricted to adult studies or co-implemented **with AMS** (35% reduction *vs*. 23% above; RR 0.65, 95% CI 0.49 to 0.86; 6 studies)

AMS, antibiotic stewardship; **BSI**, bloodstream infection; **CI**, confidence interval; **MALDI-TOF MS**, matrix assisted laser desorption ionization-time of flight mass spectrometry; **RR**, risk ratio.

Yo CH, Shen YH, Hsu WT, Mekary RA, Chen ZR, Lee WT, et al. MALDI-TOF mass spectrometry rapid pathogen identification and outcomes of patients with bloodstream infection: A systematic review and meta-analysis. Microb Biotechnol. 2022;15:2667-82.

RAPID TESTING DEMANDS TO RETHINK THE INFORMATION FLOW FOR ACTIONABLE RESULTS



A lot depends also on Hospital and Lab organization:

- **People (results validation at lab, opening hours, availability of clinician., behaviour..)**
- **Process (AMS team, referent, reviews, audit...)**
- **Tools (phone call, IT tools: LIS, EMR, electronic notification…)**

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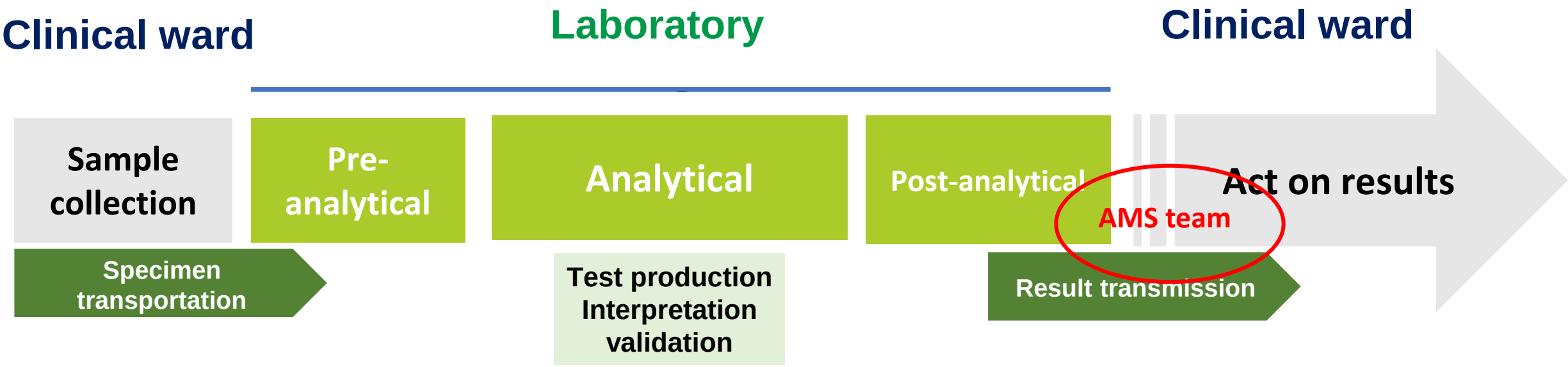

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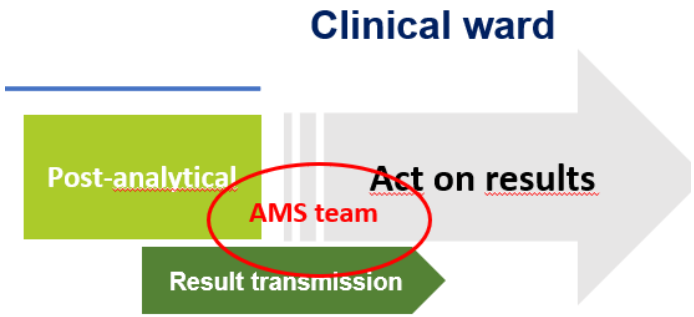
BUT IT IS WORTH IT…



Fidalgo 2023, Spain

Clinical Infectious Diseases

MAJOR ARTICLE

Information Delay of Significant Bloodstream Isolates and Patient Mortality: A Retrospective Analysis of 6225 Adult Patients With Bloodstream Infections

Berta Fidalgo,[1] Laura Morata,[2,3] Celia Cardozo,[2,3] Ana del Río,[2,3] Javier Morales,[1] Mariana Fernández-Pittol,[1] José Antonio Martínez,[2,3,4] Josep Mensa,[2,3] Jordi Vila,[1,5,4] Alex Soriano,[2,3,4] and Climent Casals-Pascual[1,5,4]

[1]Department of Clinical Microbiology, CDB, Hospital Clínic de Barcelona. Universitat de Barcelona, Departament de Fonaments Clínics, Facultat de Medicina, Barcelona, Spain; [2]Institut d'Investigacions Biomèdiques Agust Pi i Sunyer, Barcelona, Spain; [3]Department of Infectious Diseases, Hospital Clínic of Barcelona—University of Barcelona, Barcelona, Spain; [4]CIBER de Enfermedades Infecciosas, Instituto Salud Carlos III, Madrid, Spain; and [5]Institute for Global Health, Barcelona, Spain

OBJECTIVE

impact of real-time communication of microbiological information on the clinical and prognostic outcomes of adult patients with bloodstream infections (BSIs).

STUDY DESIGN

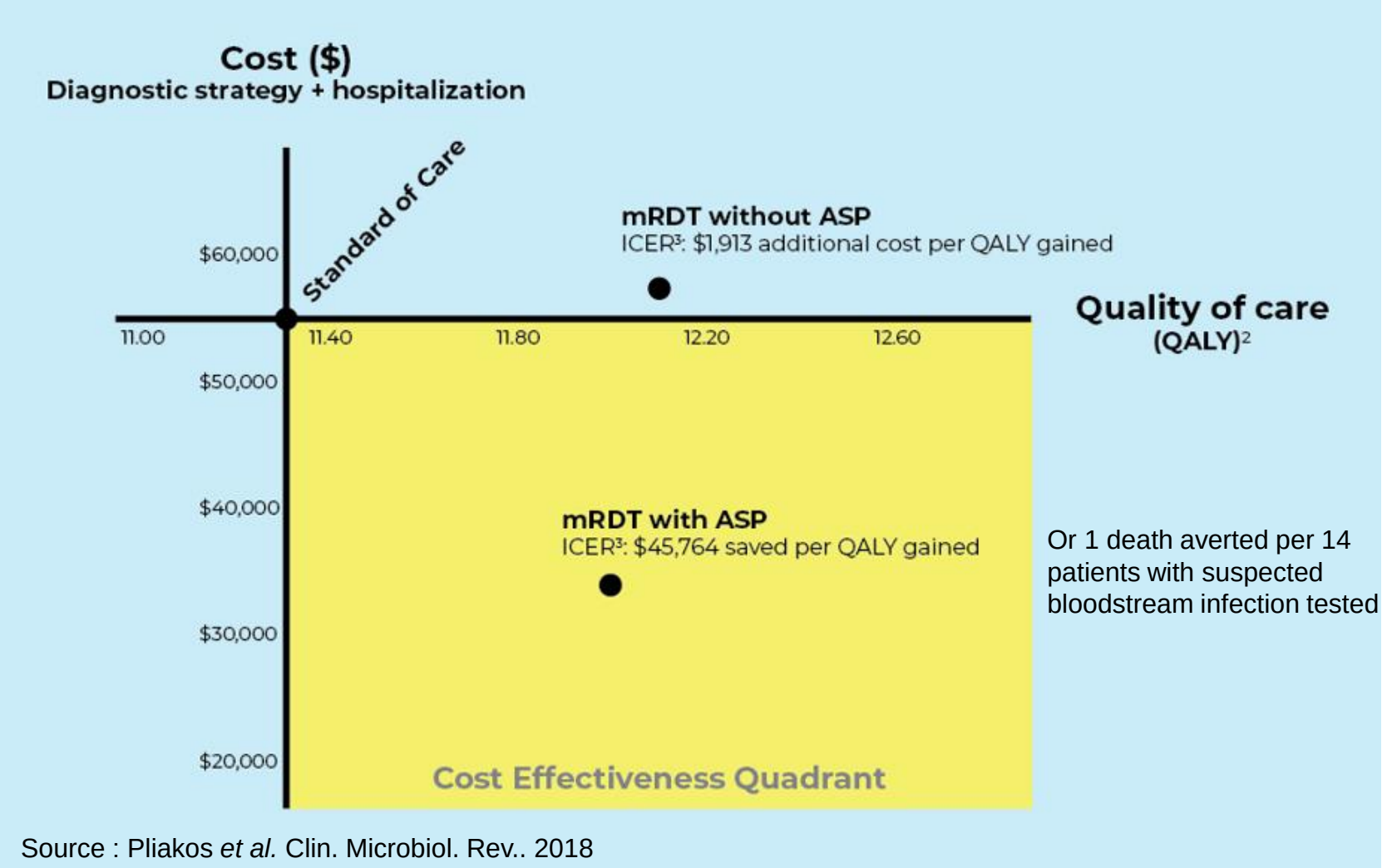
- Observational, monocentric analysis of all clinical episodes of bacteremia
- **Compared** bacteremia-associated **mortality when blood culture results were communications to the ID specialist** in real-time, typically within 1 hour (from positivity to MALDI-TOF ID) (during daytime working hours) and when results were delayed by 8 hours or more (reported the following morning).

RESULTS

- 625 patients (10%) died at 30 days.
  - (**30.8%**) when BC positive **during daytime working**
  - (**69.2%**) when BC became positive during **night-time hours**.
- **all pathogens did not reveal an association** between mortality and delayed information report (**odds ratio [OR], 1.18**; 95% confidence interval [CI, 0.99–1.42).
- **However**, information delay of BSIs caused by **Enterobacterales** was associated with a **significant increase in the odds of death** at **30 days** (**OR, 2.22**; 95% CI,1.50–3.30) , **14 days** and **7 days**.

"INFORMATION DELIVERED IN REAL TIME HAS PROGNOSTIC RELEVANCE AND IS LIKELY TO IMPROVE SURVIVAL OF PATIENTS WITH DOCUMENTED BSI_S."

RAPID DIAGNOSTICS COUPLED TO ANTIMICROBIAL STEWARDSHIP TO TREAT BLOOD STREAM INFECTIONS PROVIDE BETTER CARE FOR LESS MONEY



Or 1 death averted per 14 patients with suspected bloodstream infection tested

Source : Pliakos *et al.* Clin. Microbiol. Rev.. 2018

- **Cost-modelling study in the USA: tbd elsewhere**
- **Reducing the time to effective therapy is beneficial to both medical and economic outcomes:**

"… the use of rapid diagnostic tests was a cost-effective strategy that was associated with high therapeutic effectiveness and healthcare cost savings."

mRDT (TTR < 24 hours) **:** aggregation of several technologies, PCR, MALDI-TOF, PNA-FISH, DNA microarray,

SAME DATA, BUT DETAILING BY RAPID DIAGNOSTIC TECHNIQUES

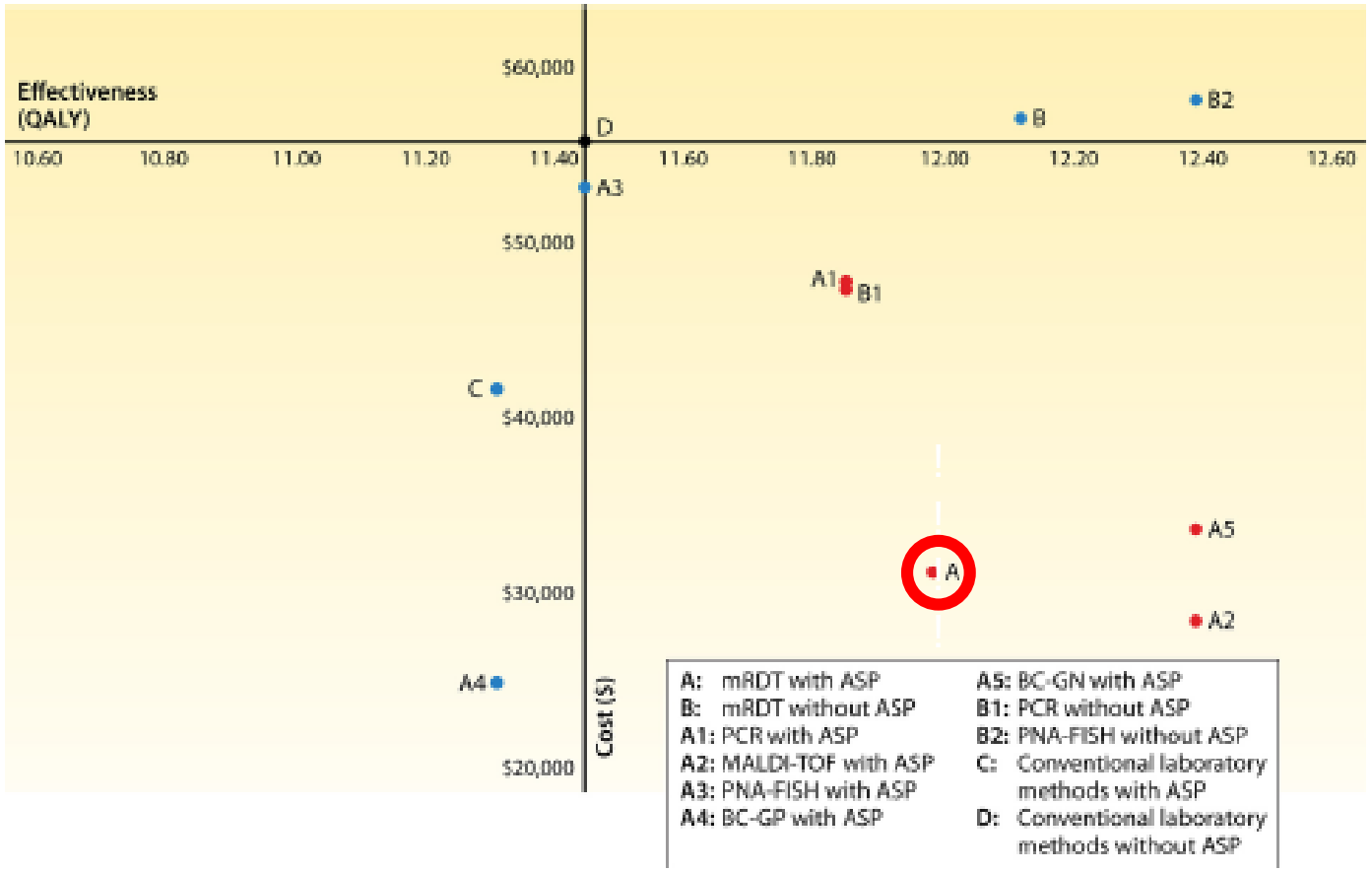


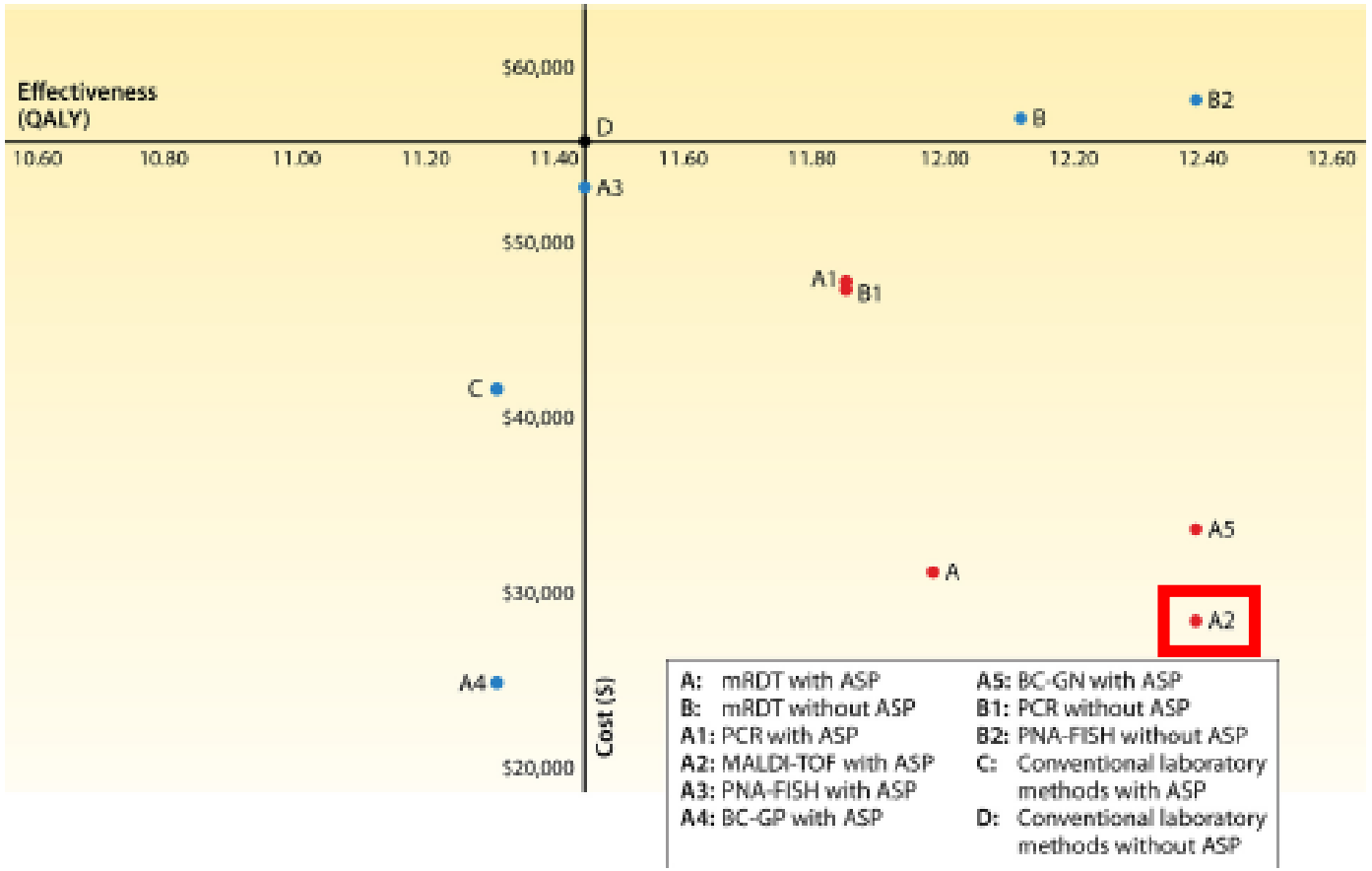
FIG 3 Cost-effectiveness plane for all of the strategies. The *y* axis represents the average cost of a strategy, while the *x* axis represents the average effectiveness of a strategy. Cost-effective strategies are depicted with red markers, the baseline strategy is depicted with a black marker, and the remaining strategies that are suboptimal or not cost-effective are indicated with blue markers.

- **And the winner is …**

Source : Pliakos *et al.* Clin. Microbiol. Rev.. 2018

mRDT: aggregation of several technologies, PCR, MALDI-TOF, PNA-FISH, DNA microarray

SAME DATA, BUT DETAILING BY RAPID DIAGNOSTIC TECHNIQUES



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MALDI-TOF + ASP!

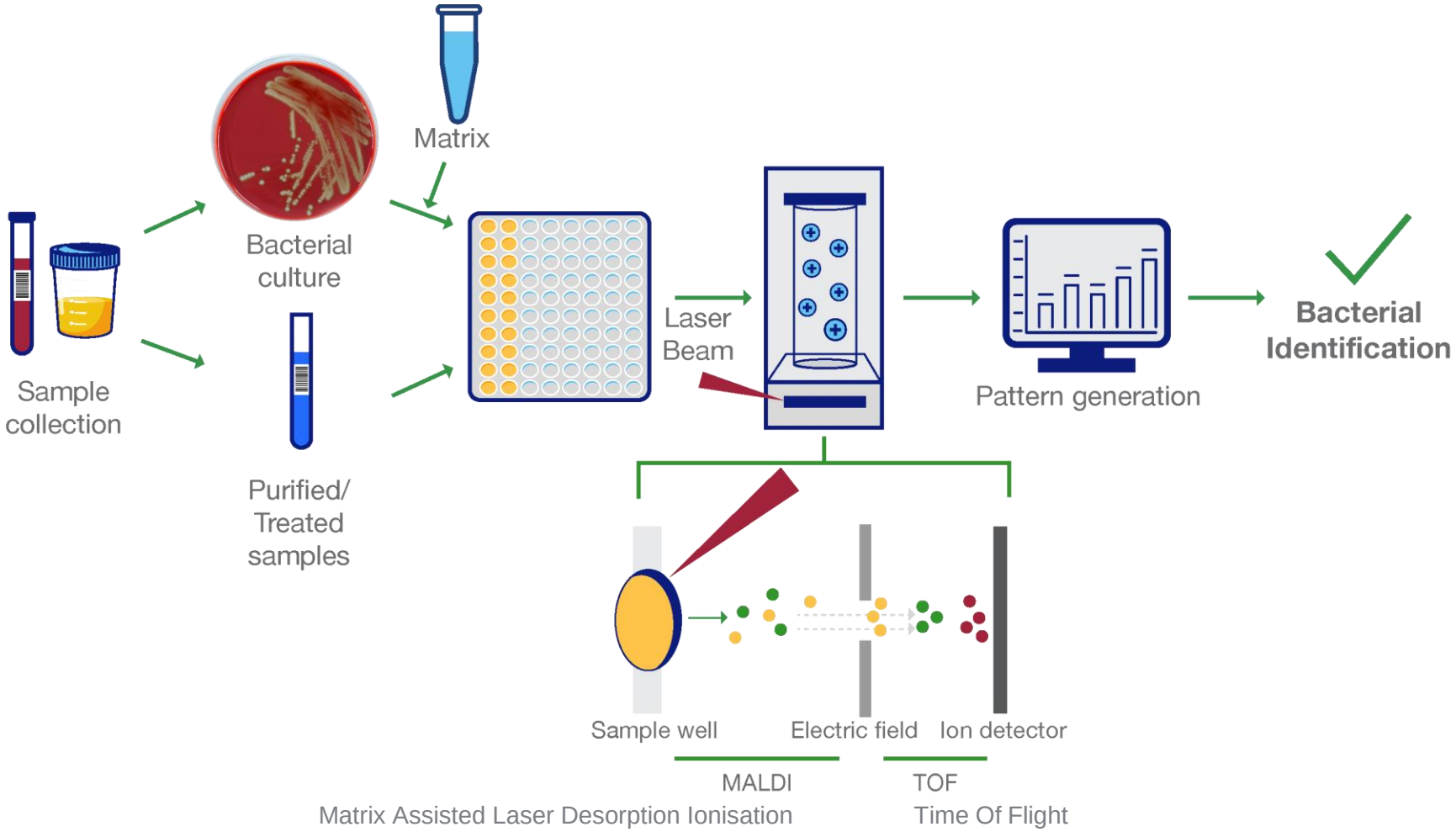
- **Δ costs***
  (MALDI-TOF + ASP) – SOC = $27,537 hospital / payer savings
- **Δ probability of survival**
  = 0.92 *vs*. 0.85
- **Δ QALYs**
  = 12.39 *vs*. 11.45 healthcare system gain

***cost =**
cost of blood culture
+ cost of diagnostics
+ cost of ASP resources
+ cost of hospitalization

Source : Pliakos *et al.* Clin. Microbiol. Rev.. 2018

mRDT: aggregation of several technologies, PCR, MALDI-TOF, PNA-FISH, DNA microarray

IDENTIFICATION OF MICROBIAL PATHOGENS WITH MALDI-TOF



Adapted from Maugeri G, *et al*. Biotechnol J. 2019;14(1):e1700750.

THE POWER OF COMBINATION

Appropriate Therapy

USA 400 beds hospital
Pre - post study on 377 - 77 patients with
Blood stream infection
Respiratory infection
Urinary infection

MALDI-TOF ID

VITEK MS

+

Automated susceptibility testing

VITEK 2

=

A 20 hrs faster time to ID/AST results

+

AMS team

Versus **Microscan Walkaway and no AMS**

rapid AMS interventions & reporting

21.5 hrs time to appropriate therapy

2.1 days therapy duration (p=0.036)

7 days of LOS in ICU (p<0.001)

+ 17% clinical resolution (81% to. 98.7%- p<0.001)

Cavalieri et al. 2019 Diagnostic Microbiology and Infectious Disease. 95:208-211

REQUIREMENTS THAT MAKES SENSE FOR A MALTI-TOF SOLUTION

Beyond the pre-requisites of analytical performances

- **Superior workflow efficiency**
  - *e.g.* easy and fast sample prep., captured from multiple benches, automated continous load & go, urgent slide prioritization, results review from any networked PC, results automated release, automated on-demand calibration
  - Resulting in increased time-to-ID and sample capacity
- **Seamless connection with complementary ID & AST solutions, and lab middleware**
- **Robust and evolving database reflecting the global strains variability**
  - *bonus:* free access and update
- **Reduced footprint (integrated PC)**
- **A committed service partner (technical support, logistics, education, consultancy)**

UNLOCKING THE RDT POTENTIAL OF MALDI-TOF WITH WORKFLOW OPTIMIZATION

OBJECTIVE

Enhancing positive blood culture workflows (TAT),by **combining lab automation and streamlined processes**: an example of a **MALDI-TOF** instrument integration, optimized by application of **"lean worklow " principles**

STUDY DESIGN

- French private lab treating 80 positive blood cultures monthly
- Intervention : conversion of a VITEK MS MALDI-TOF to a VITEK MS PRIME (automatic and continuous loading of up to16 slides) coupled with lean management principles (Lab consultancy service).

RESULTS

- Over 9 months

KPI Summary*	BEFORE CIE	TARGET CIE	AFTER CIE	% Achieved improvement
TAT positives – BLOOD CULTURE	53,9 h	*48,4h*	43,3 h	20%
IQ RANGE IMPROVEMENT	30,3 h	-	23,7 h	22%

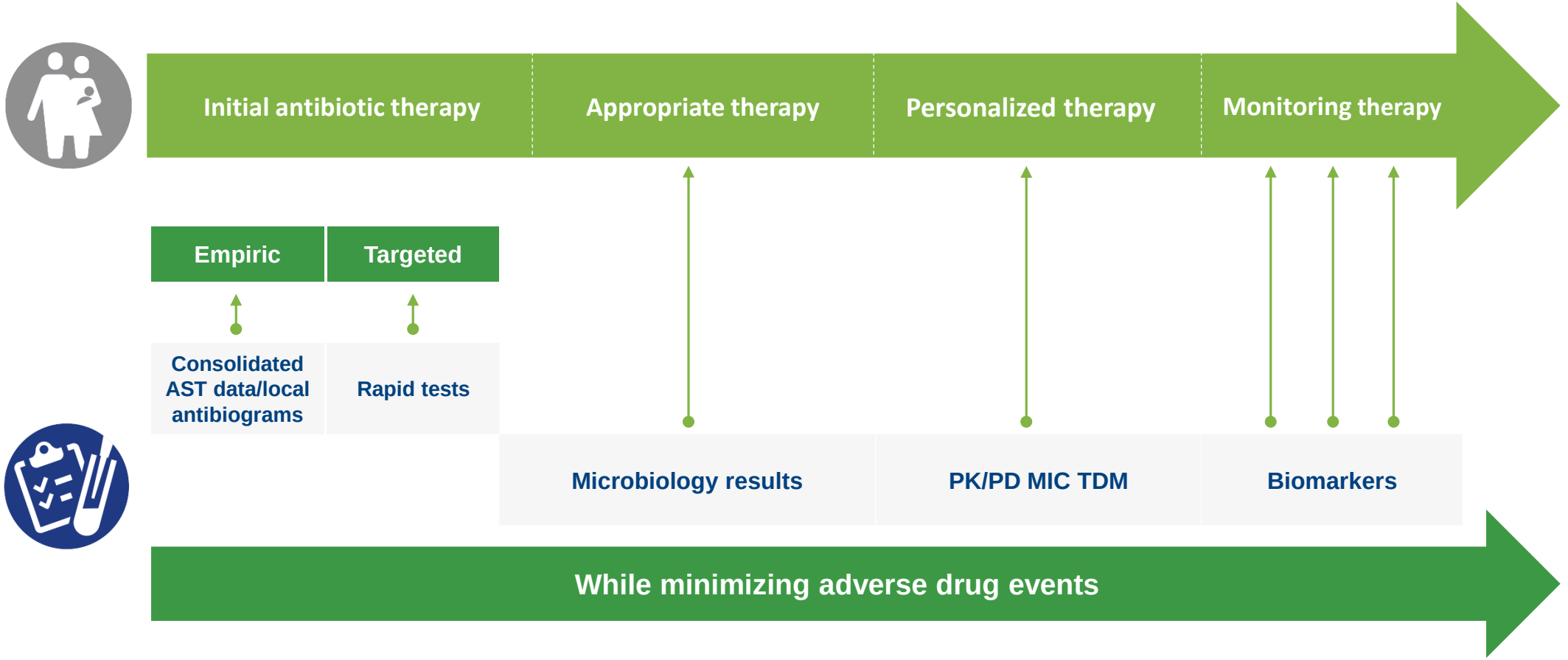
IQR: Inter Quartile Range: reflects the variability in time to report results

Continuous improvement Event (CIE) with 'lean principles'

"a significant reduction in positive blood culture turn-around time was achieved: faster identification of causative pathogens have a positive impact in the management of BSI and sepsis."

Duquesnoy et al. 2023 ECCMID poster. Enhancing positive blood culture workflows by combining lab automation and streamlined processes: an example of VITEK®MS PRIME integration, optimized by application of lean principles at the Biopath Laboratories, Coquelles, France

THE PATIENT ANTIBIOTIC THERAPY SHOULD BE ADAPTED AS SOON AS DIAGNOSTIC INFORMATION IS MORE COMPLETE



THERAPY CESSATION:

PCT GUIDANCE SIGNIFICANTLY REDUCES DURATION AND EXPOSURE TO ANTIBIOTICS FOR ICU PATIENTS WITH SEPSIS



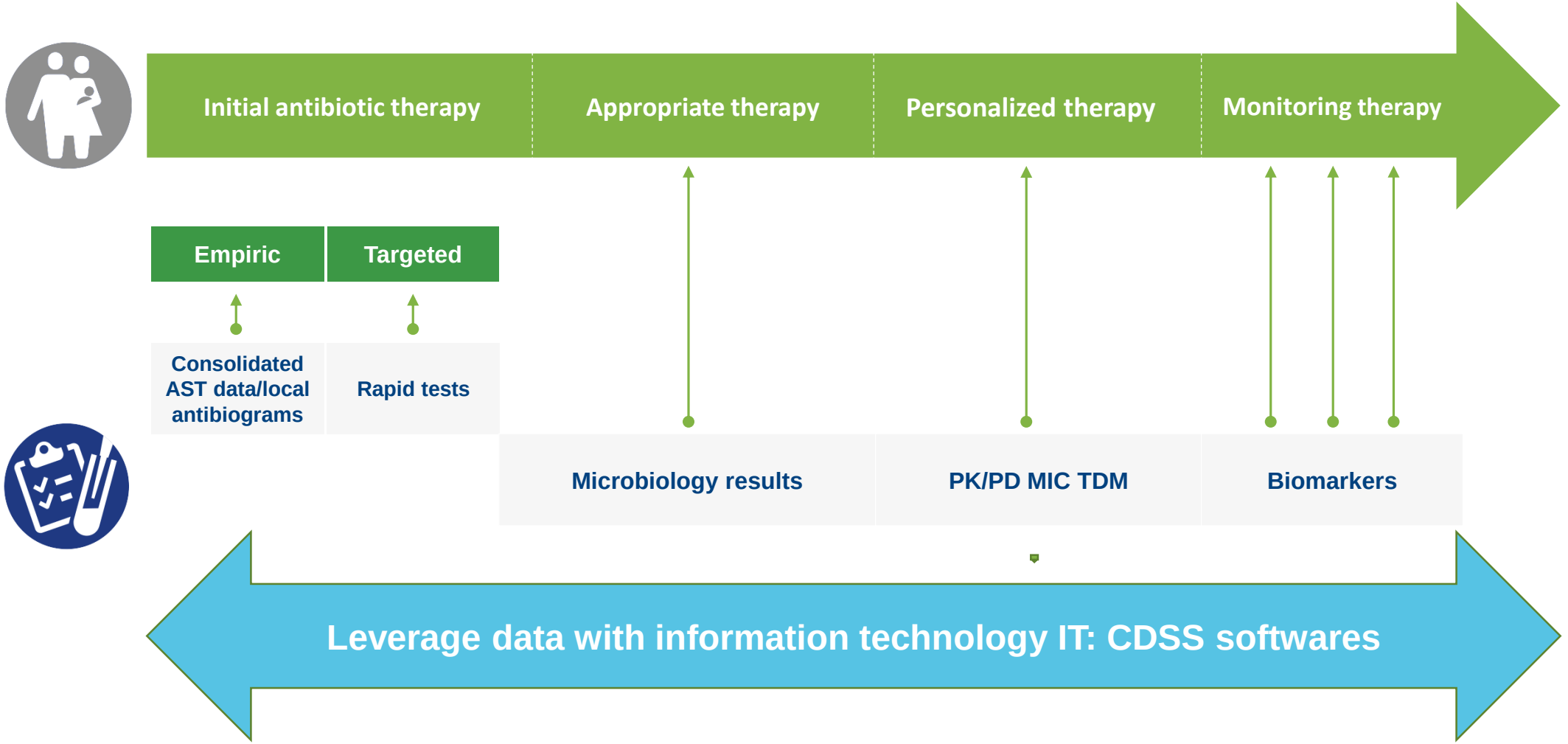


Monitoring

Meta-Analysis	# of RCTs	# of Patients	reduction of Abx exposure using PCT	ABX duration in days (IC95%; p<0.001)	Patient Outcome	Odd ratio (95%CI)
Iankova *et al*., 2018	10	3,489	**-1.49 days**	7.35 vs 8.85 (-2.27;-0.71)	No adverse impact	0.90, (0.79-1.03) *p*=0.114
Wirz *et al*., 2018	11	4,482	**-1.19 days**	9.3 vs 10.4 (-1.73;-0.66)	Decreased mortality	0.89 (0.8-0.99) *p*=0.03
Pepper *et al*.,2019	16	5,158	**-1.31 days**	(-2.27;-0.35)	Decreased mortality (low certainty of evidence)	0.89 (0.83-0.97) *p*=0.007

- Similar or decrease mortality rate, similar length of ICU stay and hospital stay compared to Control

THE PATIENT ANTIBIOTIC THERAPY SHOULD BE ADAPTED AS SOON AS DIAGNOSTIC INFORMATION IS MORE COMPLETE



USING IT TO OPTIMIZE TO ANTIBIOTIC PRESCRIBING : CDSS

- Clinician non-compliance with guidelines largely due to their high volume of information, and the consequent time and clinical workflow constraints

- CDSS (Clinical Decision Support Systems) aggregate prescription guidelines with clinical / patient and lab / bug observations

- personalization through IT (then AI ?)

- A meta-analysis of 57 studies, including RCTs, by Laka et al. (2020) in hospital and primary care setting

Source : Laka *et al.* JAC 2020

USING IT TO OPTIMIZE TO ANTIBIOTIC PRESCRIBING : CDSS

CDSS-guided prescribing is associated with

- **2x increase in appropriate prescribing, *i.e.* compliant with guidelines or antibiotic susceptibility test results**
- **Reduction of antibiotic use (volume and cost)**
- **Reduction of antibiotic exposure**
- **Reduction of length of stay**
- **Reduction in mortality (18%)**

Source : Laka *et al.* JAC 2020

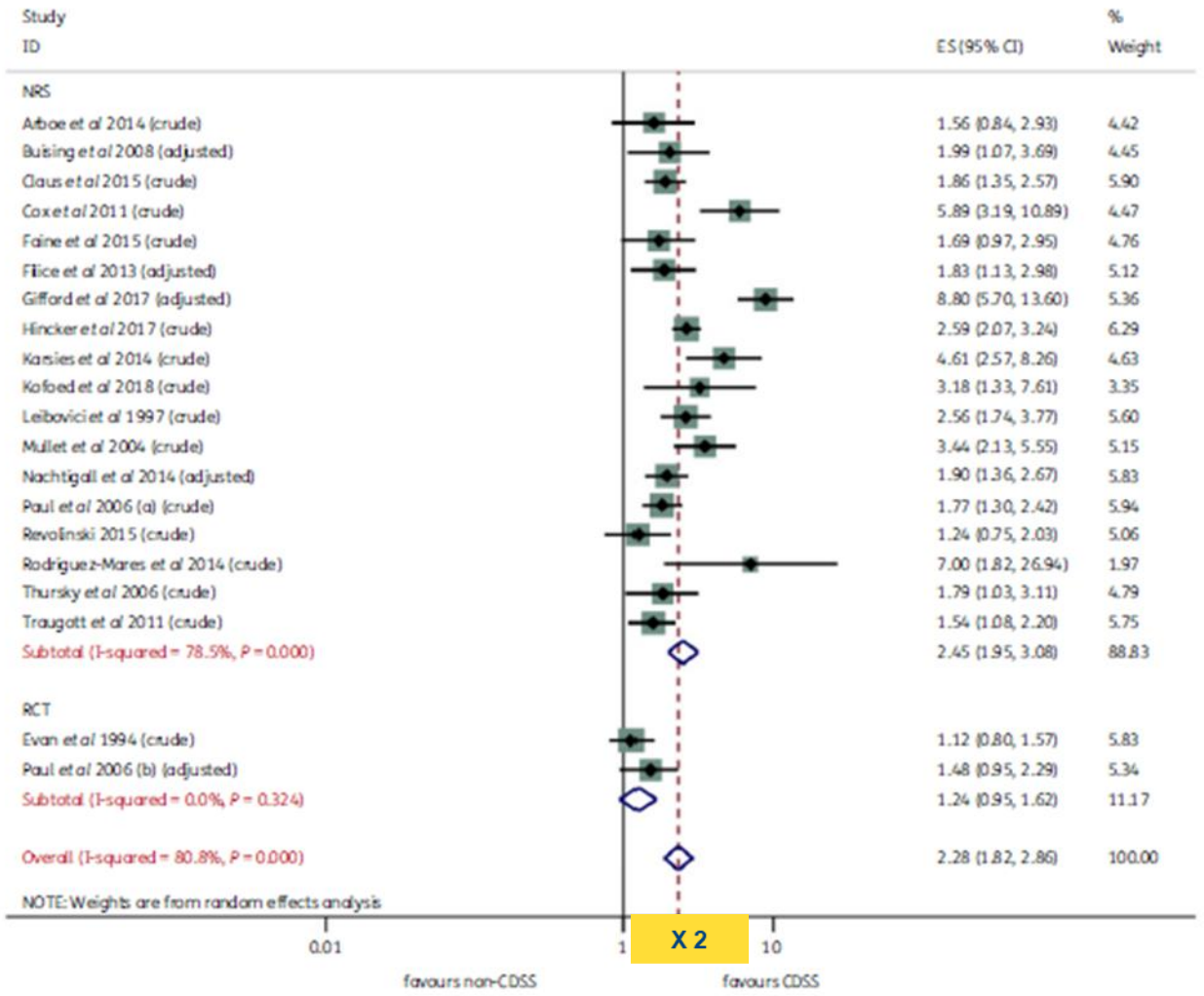


Figure 3. Effect of a CDSS on appropriateness of antibiotic therapy, by study design (RCTs and NRSs). This figure appears in colour in the online version of *JAC* and in black and white in the printed version of *JAC*.

KEY-MESSAGES

- **Innovation in Rapid Diagnostics Testing (RDT) is gradually impacting the infection management in hospital at different levels. Beyond clinical value, economic benefits are increasingly revealed.**

- **Careful selection of the right RDT technology solution is necessary, depending on the local resources In order to achieve the best return on investment (medical and economic),**

- **Especially important, its implementation needs to include processes & behavioral change to deliver its full potential (*e.g.* lab optimization, information flow, multidisciplinary collaboration,…)**

- **The solution provider should be a committed service partner to enable a reliable and constant quality of results**