Sepsis Diagnostics

A fast and accurate diagnostic test for severe sepsis using kernel classifiers

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Problem: Treat sepsis within 6 hours

**SEPSIS = ORGAN FAILURE +
INFLAMMATION + INFECTION**

Brain
Lungs
Heart
Liver
Kidney
Blood

ICU:

11–15% incidence
30–60% mortality
\$17B USD annual cost

Cause of death:

2nd in the ICU
10th in the USA

Aim: Insulin sensitivity (SI) may be a useful real-time sepsis biomarker

Insulin &
Nutrition

Glucose

Method: Develop a classifier using joint real-time retrospective data

patients	sepsis	non-sepsis	prevalence
36	213 hours	5858 hours	3.5%

Classification: What is the probability the data is sepsis?

Results: The test identifies the majority of sepsis and non-sepsis hours

	negative test	positive test	cutoff 0.32
sepsis 213 (3.5%)	FN = 13 (0.2%)	TP = 200 (3.3%)	94% SENSITIVITY
non-sepsis 58589 (96.5%)	TN = 5531 (91.1%)	FP = 327 (5.4%)	94% SPECIFICITY
	100% NPV	38% PPV

Predictive values are dependent on prevalence

Results: Likelihood ratios show the test often provides useful information

	Sensitivity	Specificity	LHR+ (> 5)	LHR- (< 0.2)	DOR (> 20)
Out-of-sample	69%	75%	3	0.4	7
In-sample	94%	94%	17	0.06	260

Best:
Alter clinical decisions

Worst:
Better than useless

Results: The AUC shows the test performs with good to high accuracy

$$\text{AUC} = 0.78\text{--}0.99$$

Comparison: The test is faster and more accurate than existing sepsis tests

	clinical biomarker	standard culture	molecular biomarker
time to results	hour-to-hour	48 hours	< 6 hours
accuracy	good–high	high?	low

Conclusions: Drowning in data and searching for knowledge

Novel biomarker

Real-time diagnostics

Good to high accuracy