SEPSIS

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Learning Objectives

- Define sepsis
- Review the pathophysiology of sepsis
- Consider general principles of sepsis management
  - Sepsis Six and Surviving Sepsis Guidelines 2016
- Consider antimicrobial treatment of sepsis

Identifying unwell patients (NEWS-2)

Physiological parameter	Score 3	2	1	0	1	2	3
Respiration rate (per minute)	≤8		9–11	12–20		21–24	≥25
SpO_2 Scale 1 (%)	≤91	92–93	94–95	≥96			
SpO_2 Scale 2 (%)	≤83	84–85	86–87	88–92 ≥93 on air	93–94 on oxygen	95–96 on oxygen	≥97 on oxygen
Air or oxygen?		Oxygen		Air			
Systolic blood pressure (mmHg)	≤90	91–100	101–110	111–219			≥220
Pulse (per minute)	≤40		41–50	51–90	91–110	111–130	≥131
Consciousness				Alert			CVPU
Temperature (°C)	≤35.0		35.1–36.0	36.1–38.0	38.1–39.0	≥39.1	

RCP 2017.

Identifying unwell patients (NEWS-2)

NEW score	Clinical risk	Response
Aggregate score 0–4	Low	Ward-based response
Red score Score of 3 in any individual parameter	Low–medium	Urgent ward-based response*
Aggregate score 5–6	Medium	Key threshold for urgent response*
Aggregate score 7 or more	High	Urgent or emergency response**

* Response by a clinician or team with competence in the assessment and treatment of acutely ill patients and in recognising when the escalation of care to a critical care team is appropriate.

**The response team must also include staff with critical care skills, including airway management.

RCP 2017.

Identifying sepsis (SEPSIS-3)

Life threatening
organ dysfunction from
dysregulated host response to
infection

Singer et al
JAMA
2016;315(8):801-810.

Organ dysfunction (SEPSIS-3)

Acute change in SOFA ≥ 2 points from infection

- Baseline SOFA score = 0
  where no preexisting organ dysfunction
- SOFA score ≥ 2 points = **10%** mortality risk

Singer et al
JAMA
2016;315(8):801-810.

SOFA (SEPSIS-3)

	Score				
System	0	1	2	3	4
Respiration					
Pao_2/Fio_2, mm Hg (kPa)	≥400 (53.3)	<400 (53.3)	<300 (40)	<200 (26.7) with respiratory support	<100 (13.3) with respiratory support
Coagulation					
Platelets, $\times 10^3/\mu L$	≥150	<150	<100	<50	<20
Liver					
Bilirubin, mg/dL (μmol/L)	<1.2 (20)	1.2-1.9 (20-32)	2.0-5.9 (33-101)	6.0-11.9 (102-204)	>12.0 (204)
Cardiovascular	MAP ≥70 mm Hg	MAP <70 mm Hg	Dopamine <5 or dobutamine (any dose)[b]	Dopamine 5.1-15 or epinephrine ≤0.1 or norepinephrine ≤0.1[b]	Dopamine >15 or epinephrine >0.1 or norepinephrine >0.1[b]
Central nervous system					
Glasgow Coma Scale score[c]	15	13-14	10-12	6-9	<6
Renal					
Creatinine, mg/dL (μmol/L)	<1.2 (110)	1.2-1.9 (110-170)	2.0-3.4 (171-299)	3.5-4.9 (300-440)	>5.0 (440)
Urine output, mL/d				<500	<200

Singer et al
JAMA
2016;315(8):801-810.

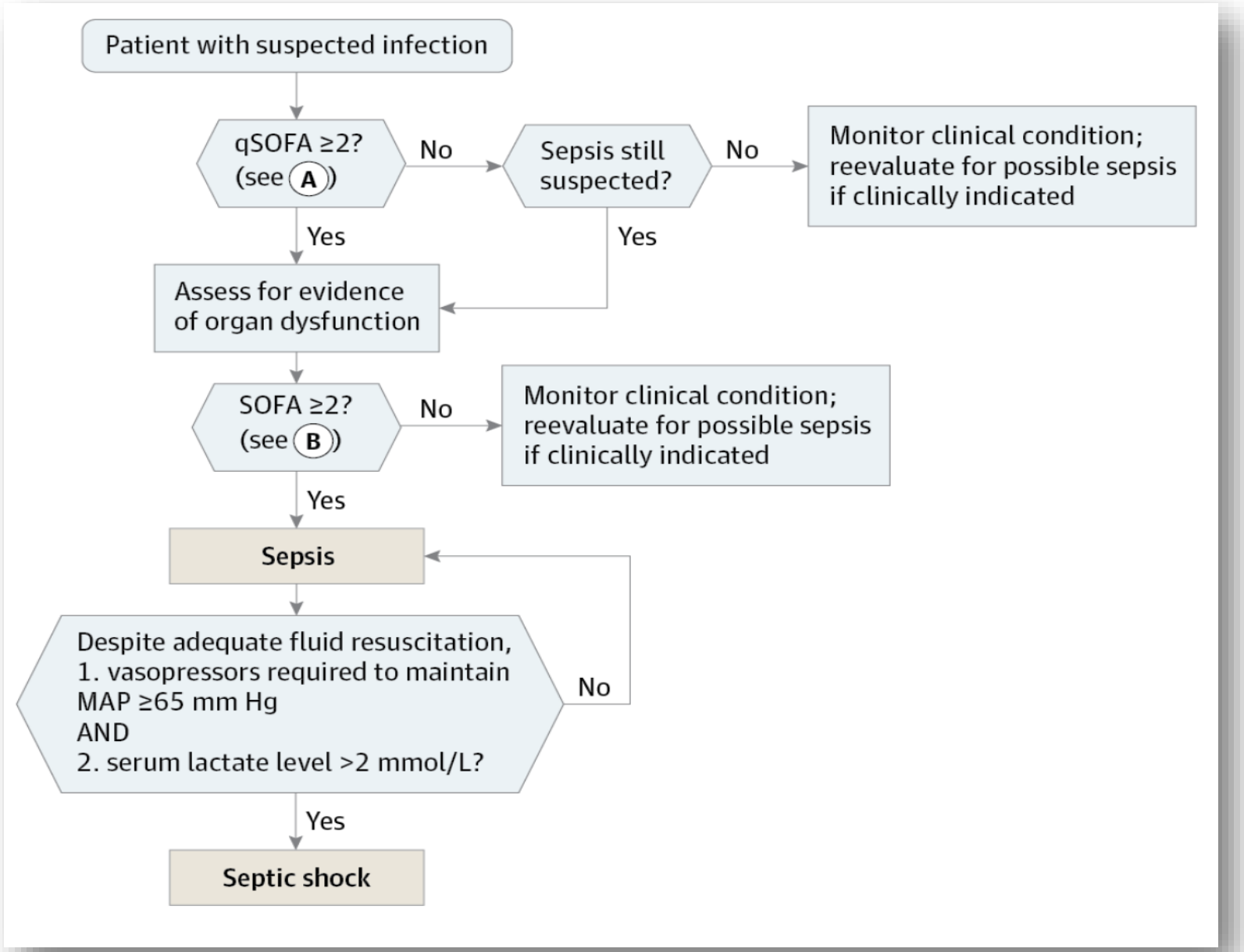
Septic shock (SEPSIS-3)

Sepsis + circulatory/metabolic abnormalities

- persisting hypotension requiring vasopressors to maintain MAP ≥ 65mmHg and
- serum lactate > 2mmol/L despite adequate volume resuscitation.
- increase mortality to **40%**

Singer et al
JAMA
2016;315(8):801-810.

Identifying sepsis (SEPSIS-3)



qSOFA (Quick SOFA) Criteria

Respiratory rate ≥22/min

Altered mentation

Systolic blood pressure ≤100 mm Hg

SOFA Variables

PaO_2/FiO_2 ratio

Glasgow Coma Scale score

Mean arterial pressure

Administration of vasopressors with type and dose rate of infusion

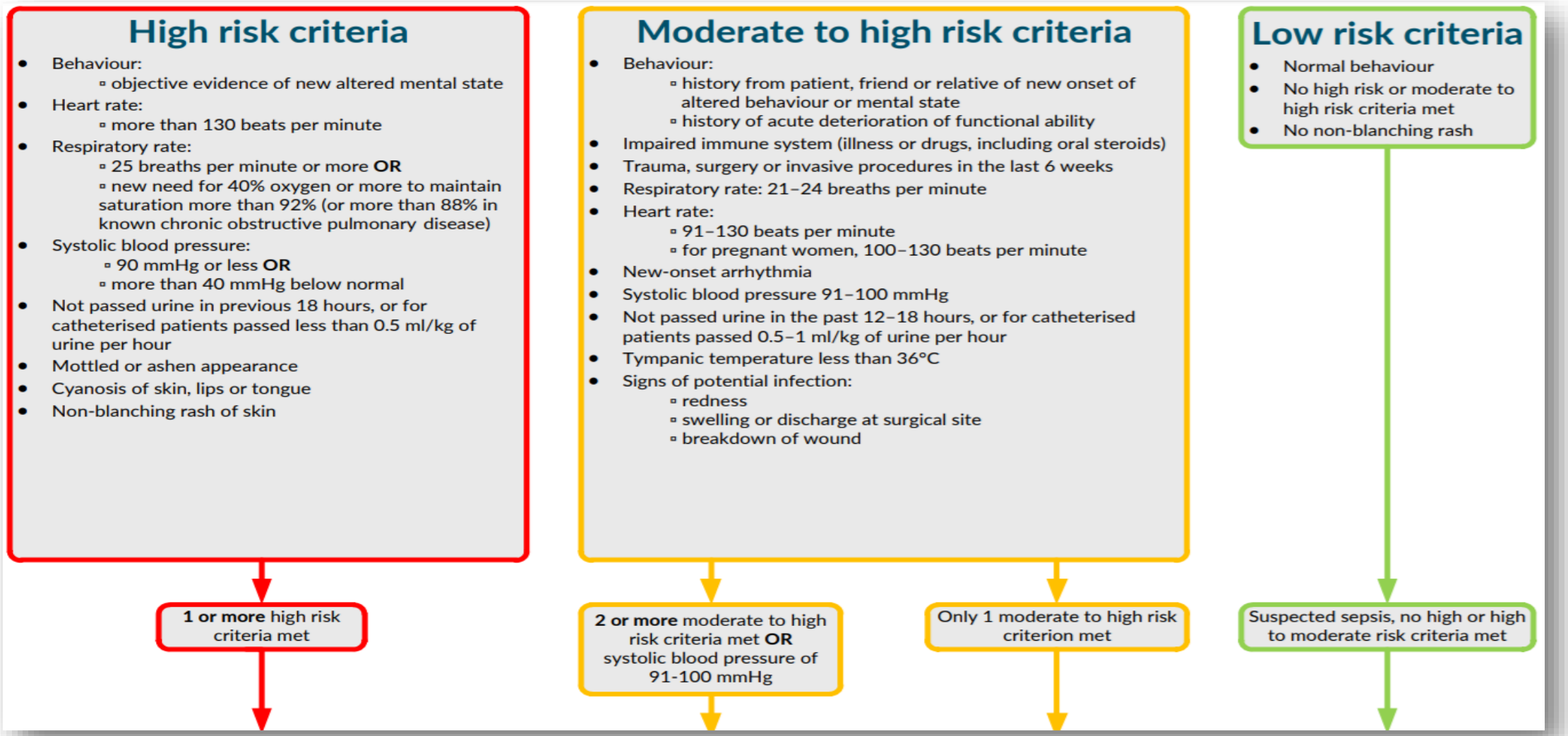
Serum creatinine or urine output

Bilirubin

Platelet count

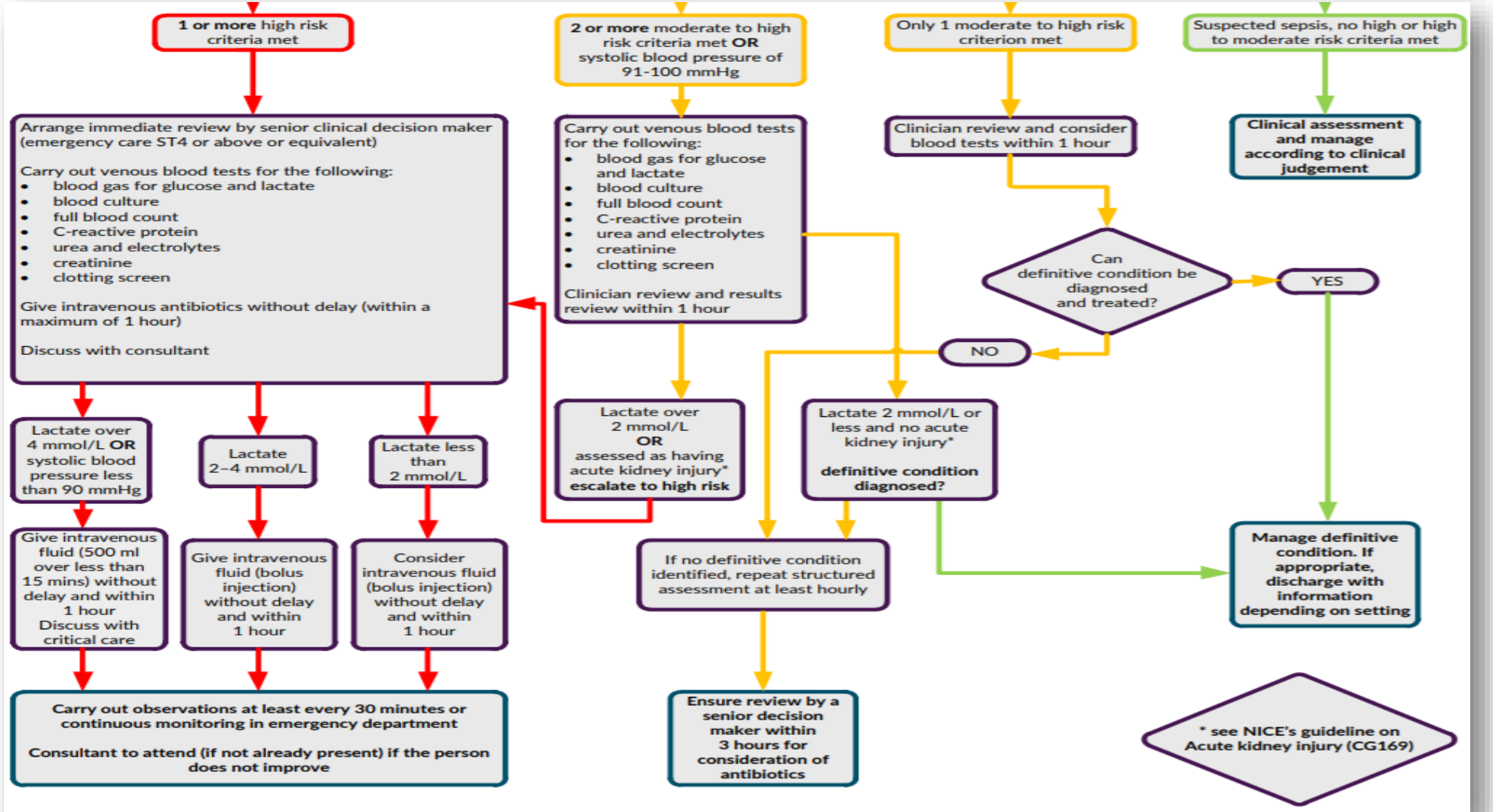
Singer et al
JAMA
2016;315(8):801-810.

Identifying sepsis (NICE)



NICE 2017.

Identifying sepsis (NICE)



NICE 2017.

Identifying sepsis (SEPSIS-3)

qSOFA (Quick SOFA) Criteria

Respiratory rate ≥22/min

Altered mentation

Systolic blood pressure ≤100 mm Hg

Singer et al
JAMA
2016;315(8):801-810.

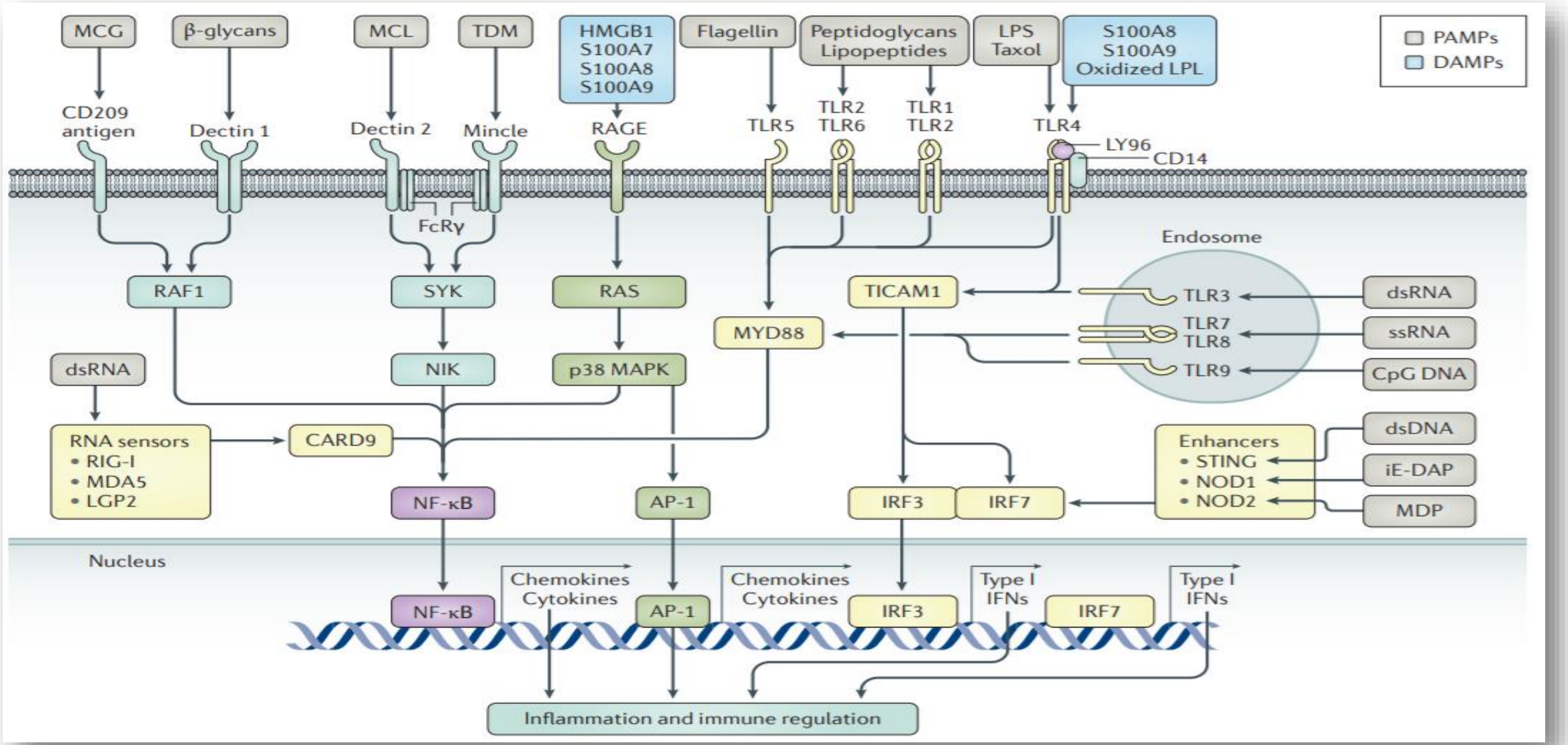
Identifying sepsis (SEPSIS-3)

- qSOFA does **not** define sepsis (but 2+ qSOFA predicts both increased mortality and ICU stays of >3 days)

- It is a **change** in baseline of total SOFA score of two or more points which represents organ dysfunction

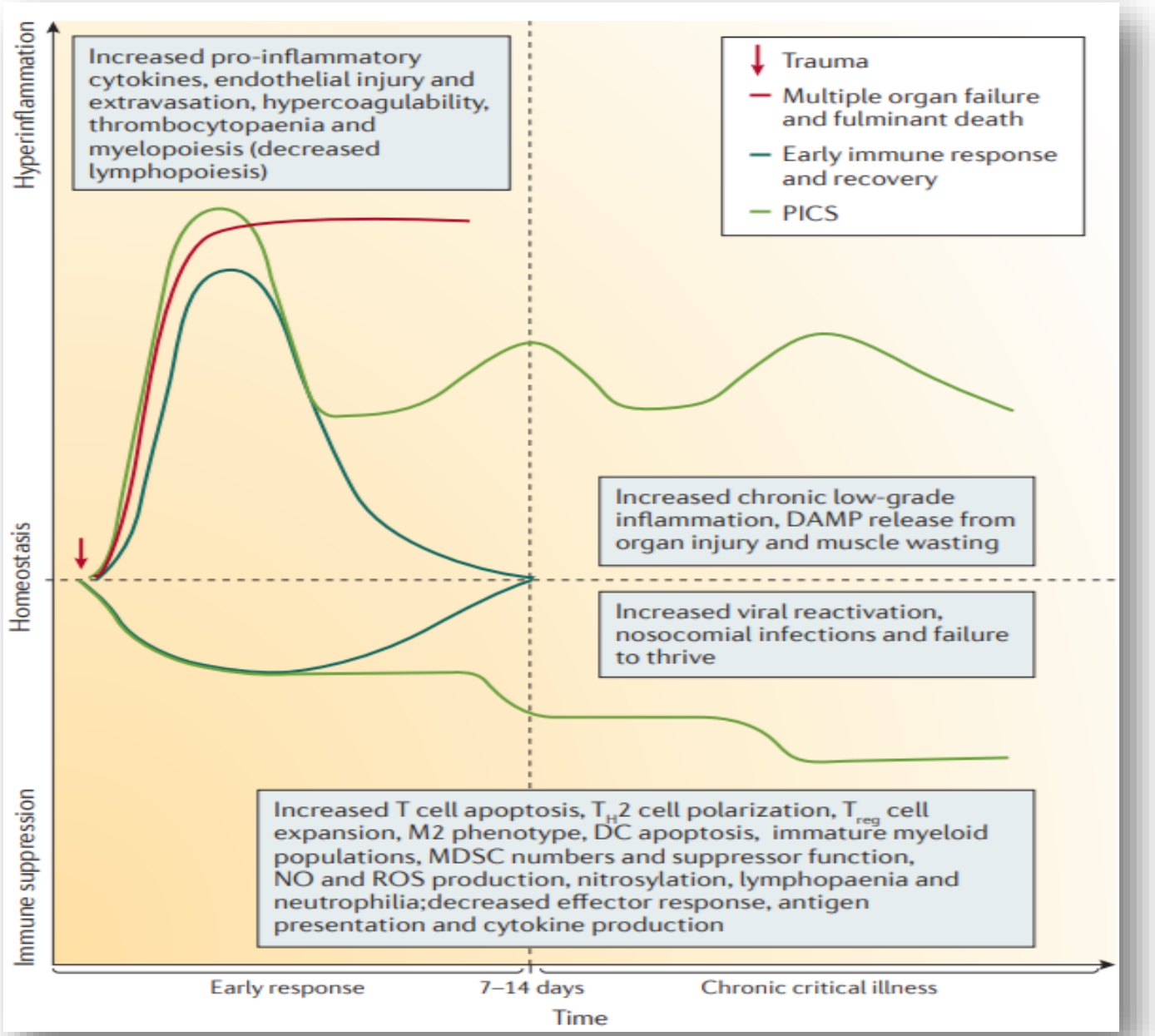
Singer et al
JAMA
2016;315(8):801-810.

Pathology of sepsis



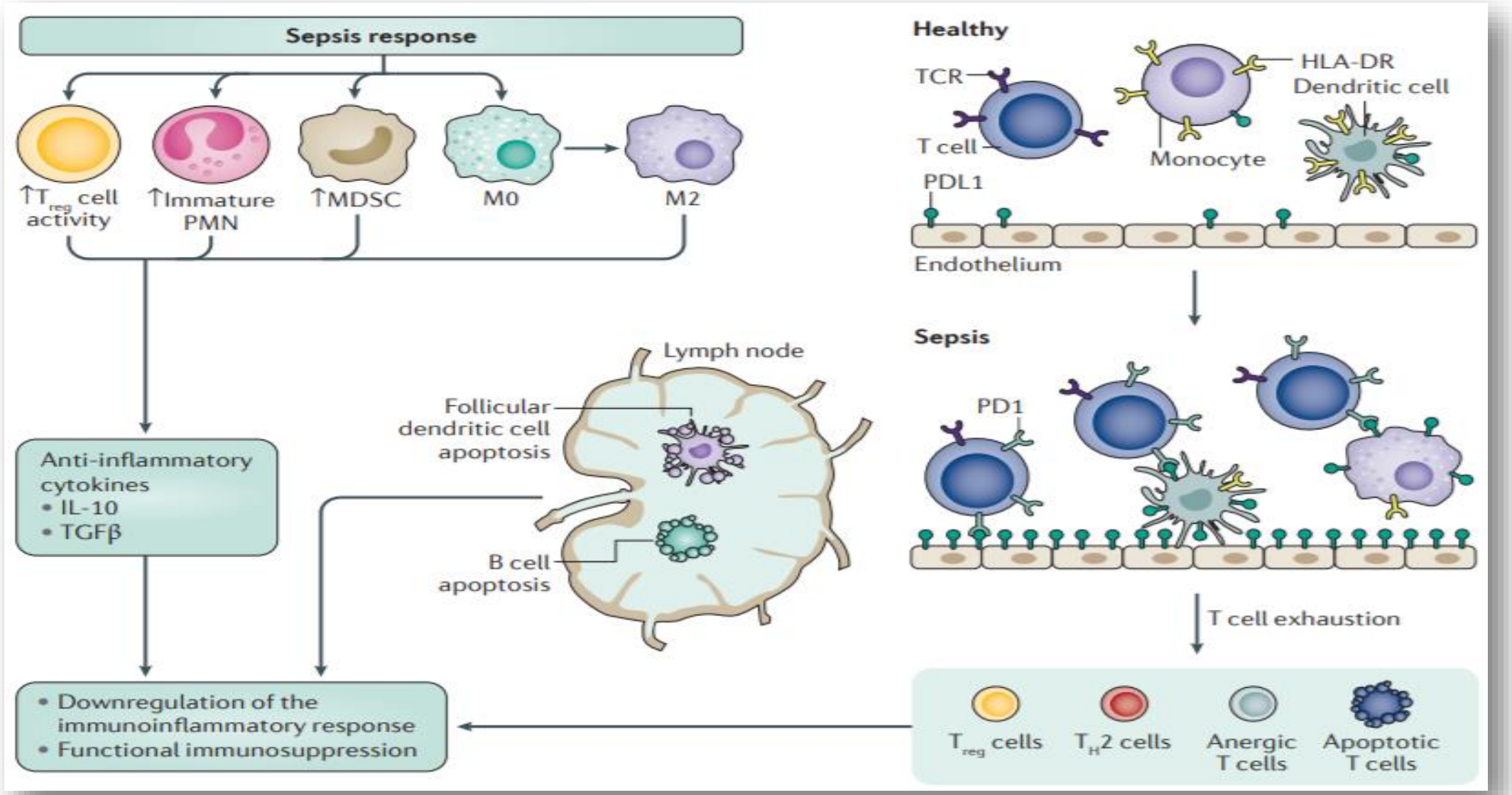
Hotchkiss et al
Nature Rev
2016;2:16045.

Pathology of sepsis – possible outcomes



Hotchkiss et al
Nature Rev
2016;2:16045.

Pathology of sepsis – late immunosuppession



Hotchkiss et al
Nature Rev
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General principles of sepsis management

Surviving Sepsis Campaign

Critical Care Medicine

Society of Critical Care Medicine

Articles & Issues | Collections | Podcasts | For Authors | Journal Info

Home > Published Ahead-of-Print > **Surviving Sepsis Campaign: International Guidelines for Man...**

< Previous Abstract | Next Abstract >

Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock: 2016.

Intensive Care Med
DOI 10.1007/s00134-017-4683-6

CONFERENCE REPORTS AND EXPERT PANEL

CrossMark

Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock: 2016

General principles of sepsis management

- Sepsis Six
  - Administer high flow oxygen
  - Take blood cultures
  - Give broad spectrum antibiotics
  - Give intravenous fluid challenges
  - Measure serum lactate and haemoglobin
  - Measure accurate hourly urine output

General principles of sepsis management

Fluids: **30mL/kg of IV crystalloid within 3 hours** with additional fluid based on frequent reassessment

EITHER

- Repeat focused exam (after initial fluid resuscitation): including vital signs, cardiopulmonary, capillary refill, pulse, and skin findings.

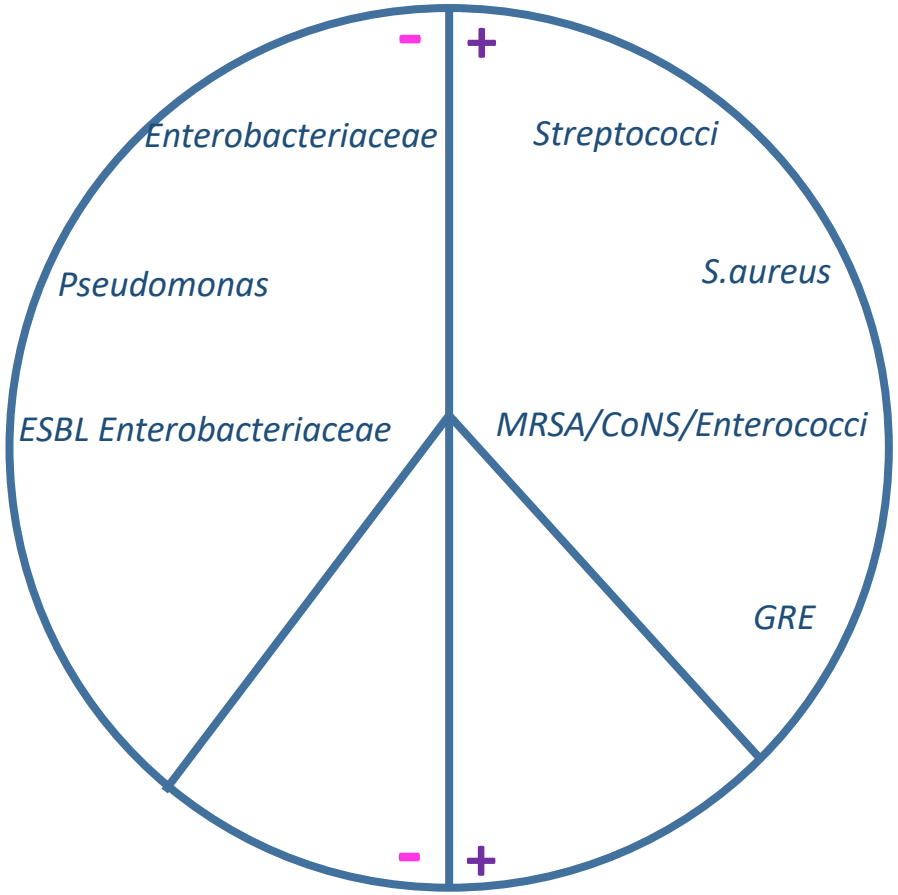
OR TWO OF

- Measure CVP
- Measure $ScvO_2$
- Bedside cardiovascular ultrasound
- Dynamic assessment of fluid responsiveness with passive leg raise or fluid challenge

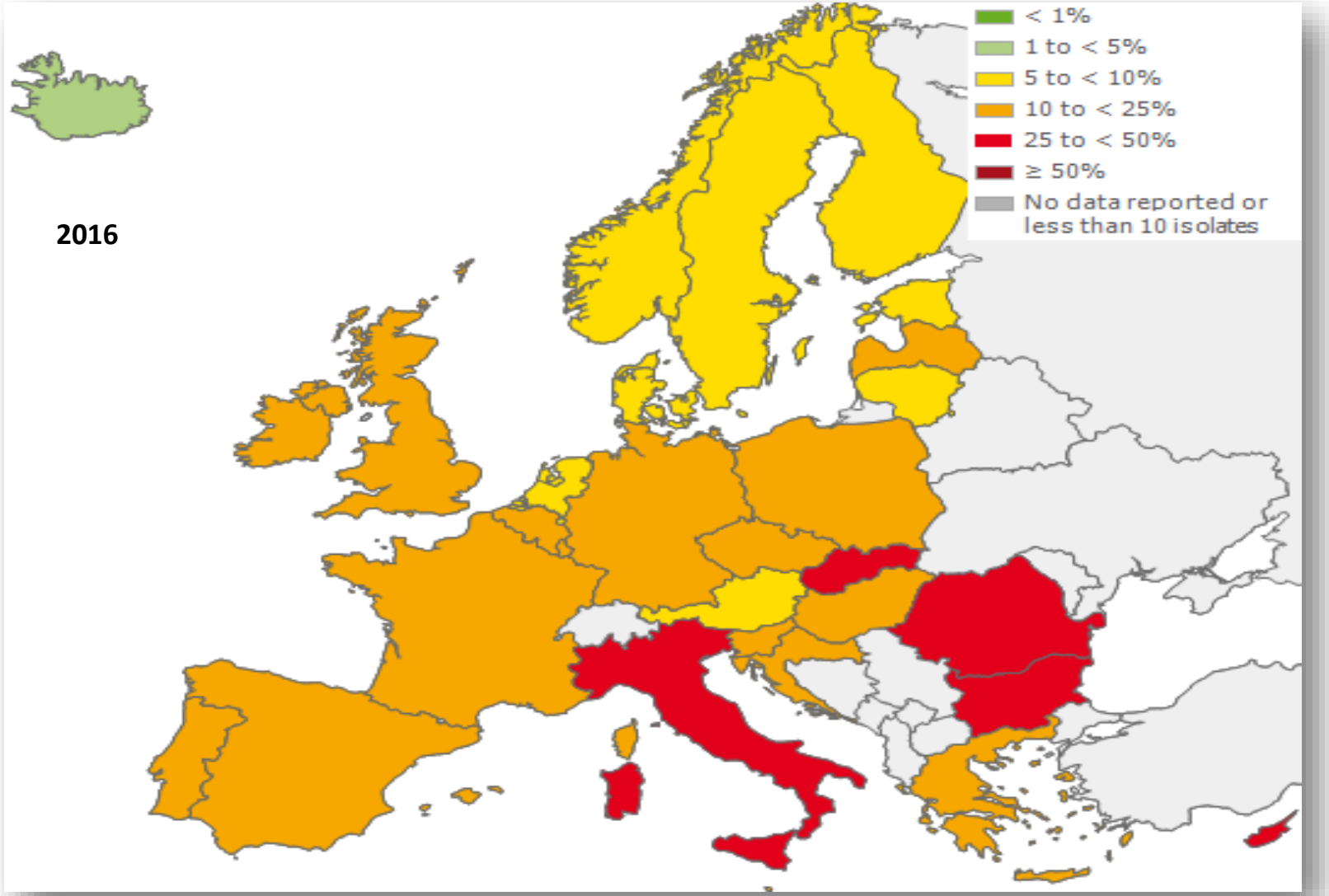
Specific management of sepsis – antimicrobials

- Spectrum
- PKPD
- Allergies

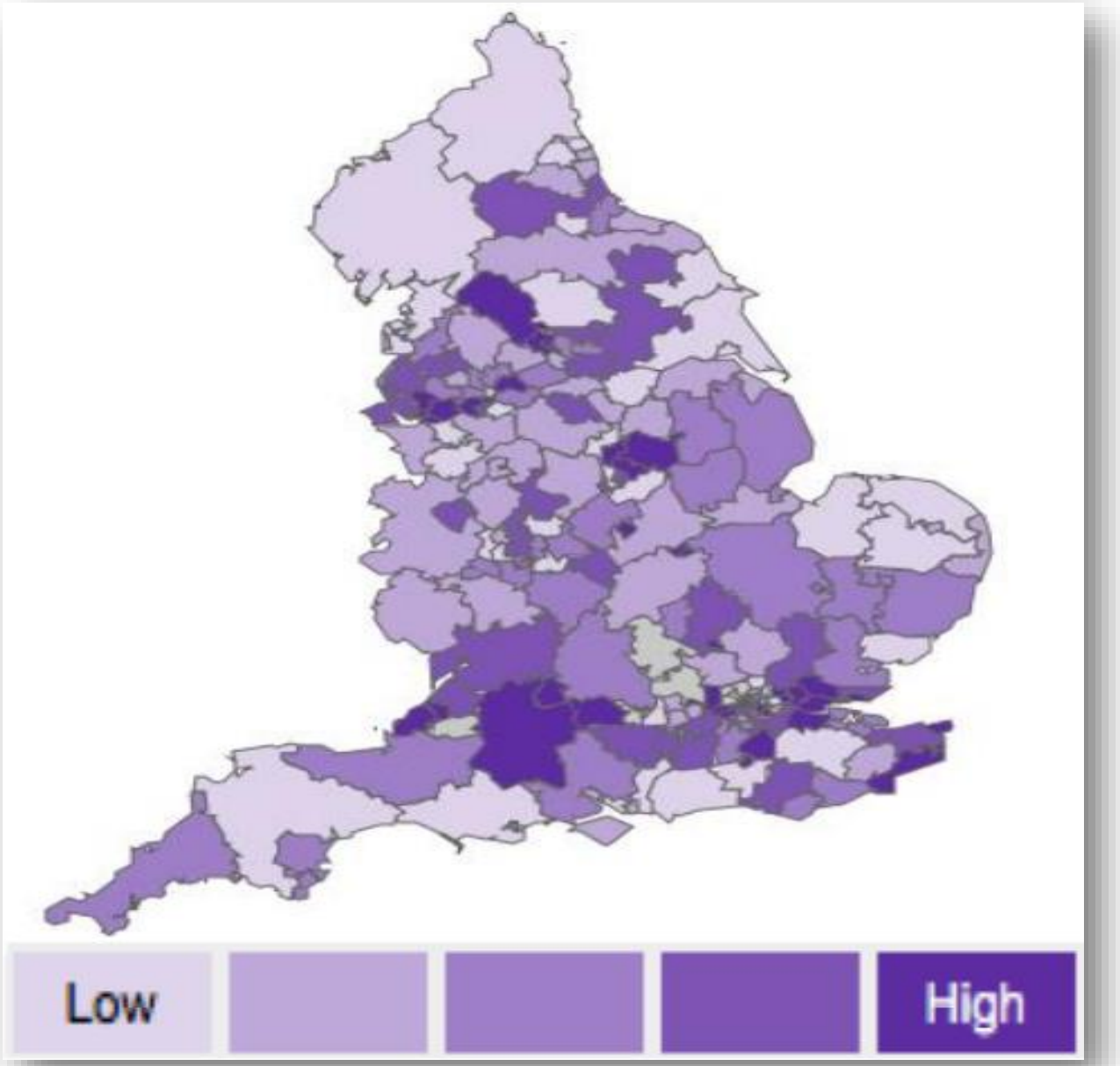
Spectrum


-
+
Enterobacteriaceae
Streptococci
Pseudomonas
S.aureus
ESBL Enterobacteriaceae
MRSA/CoNS/Enterococci
GRE
-
+

Enterobacteriaceae resistance to cephalosporins

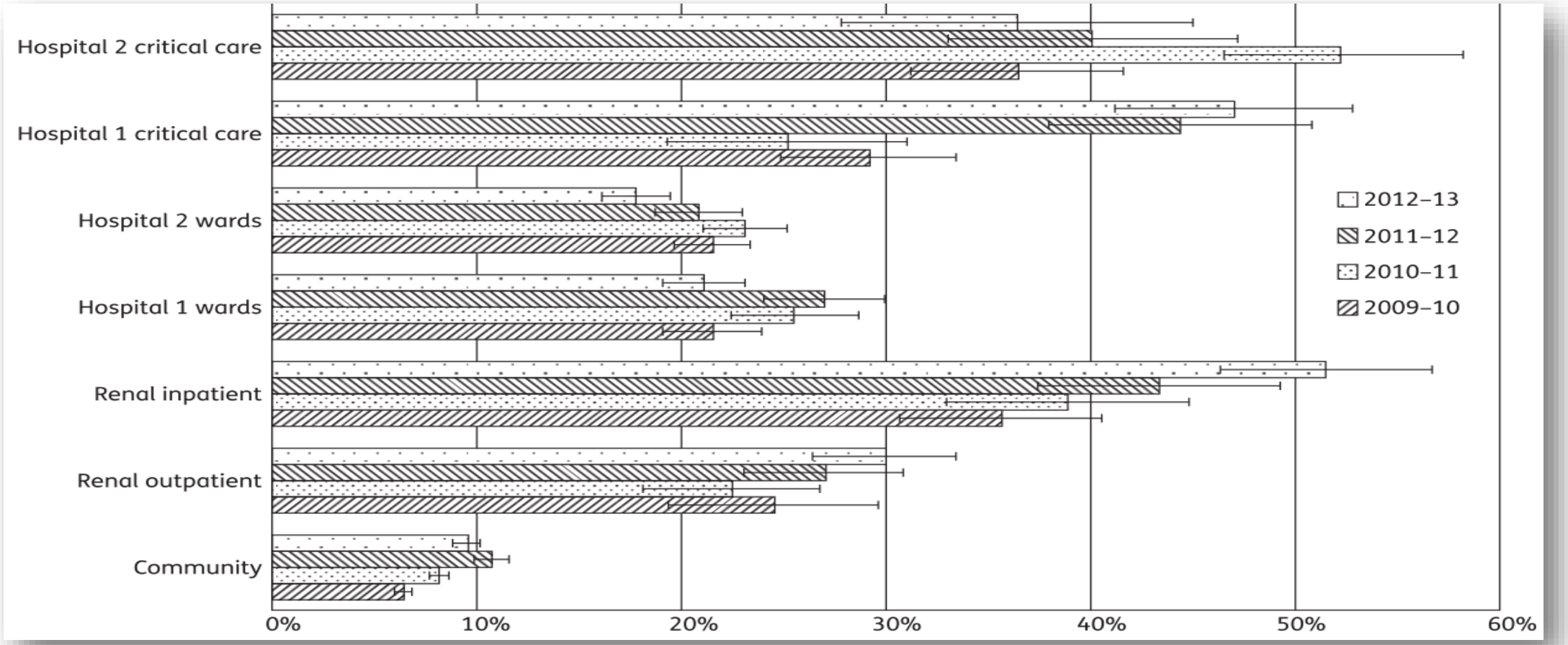


Enterobacteriaceae resistance to cephalosporins



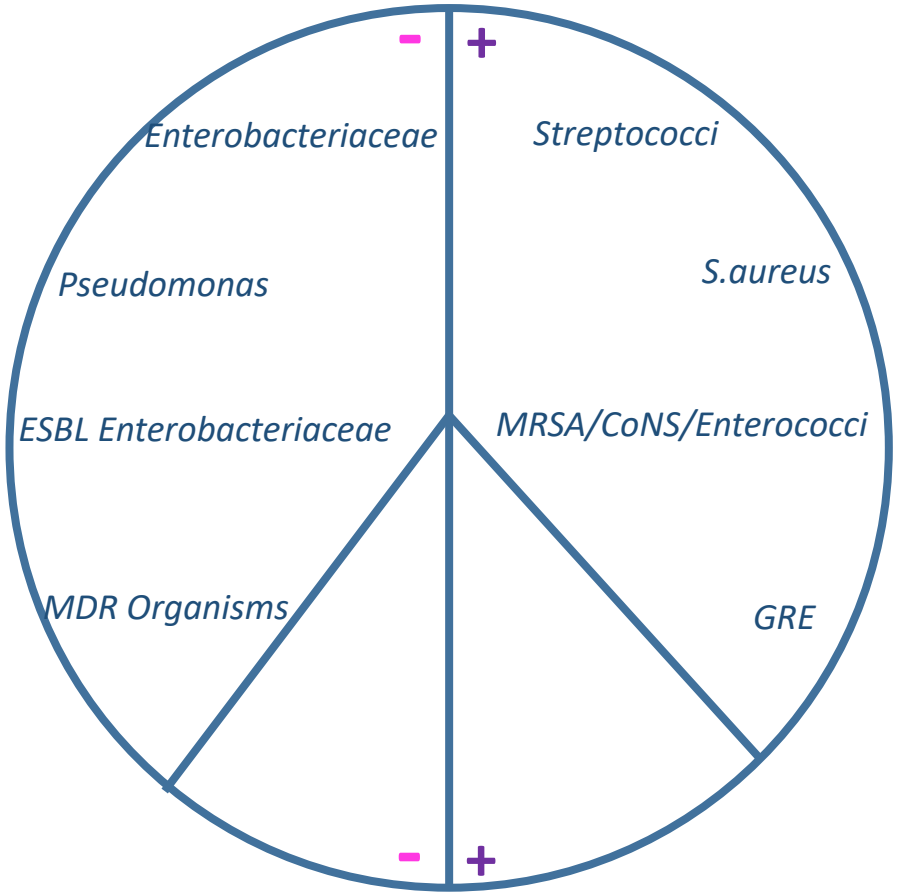
ESPAUR
2016

Enterobacteriaceae resistance to cephalosporins



Moore et al
J Antimicrob Chemo.
2014;69(12):3409-22

Spectrum

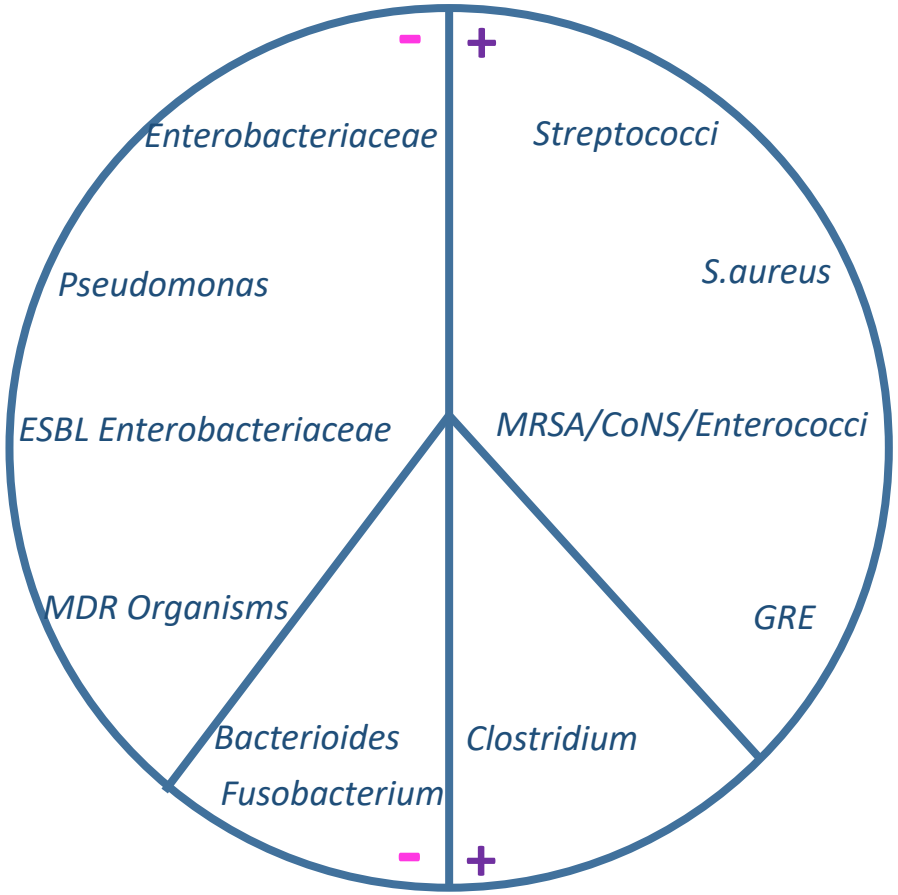

-
+
Enterobacteriaceae
Streptococci
Pseudomonas
S.aureus
ESBL Enterobacteriaceae
MRSA/CoNS/Enterococci
MDR Organisms
GRE
-
+

Enterobacteriaceae resistance to carbapenems

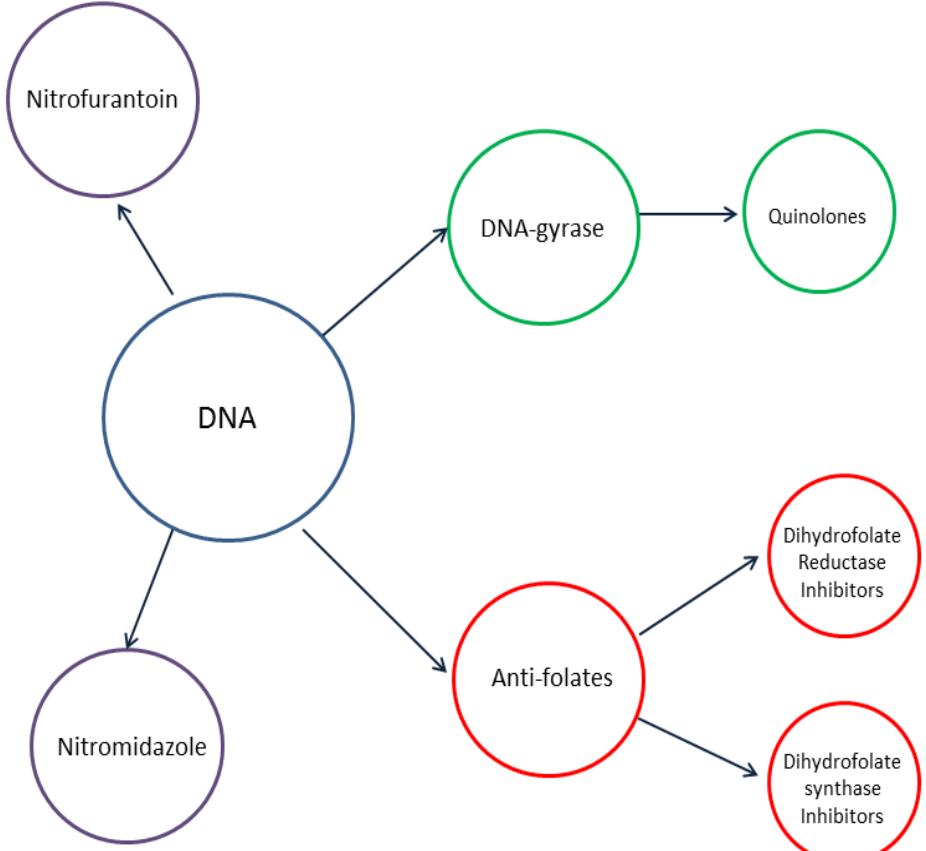
Clinical specialty	Proportion of carbapenem-resistant isolates, %	
	E. coli	*Klebsiella* spp.
Medicine	0.2	3.6
Surgery and Cancer	0.5	1.7
Specialist Services	2.3	6.5
Circulation Sciences and Renal Medicine	0.8	9.3
Clinical and Investigative Sciences	5.8	0
Private patients	2.5	5.9
Unknown	0	0

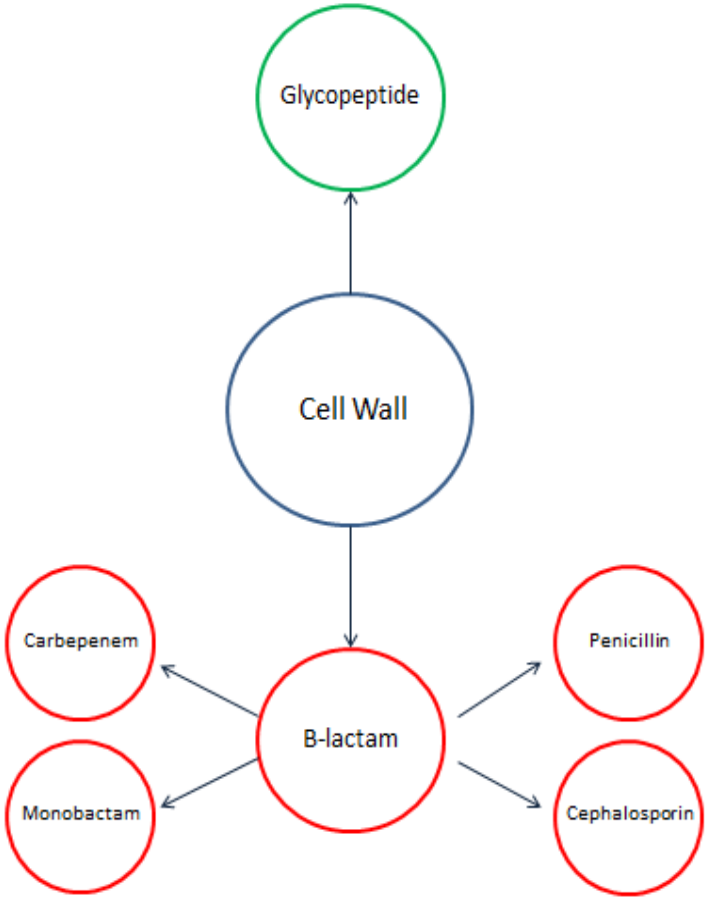
Freeman, Moore et al.
J Antimicrob Chemo.
2015;70(4):1212-8.

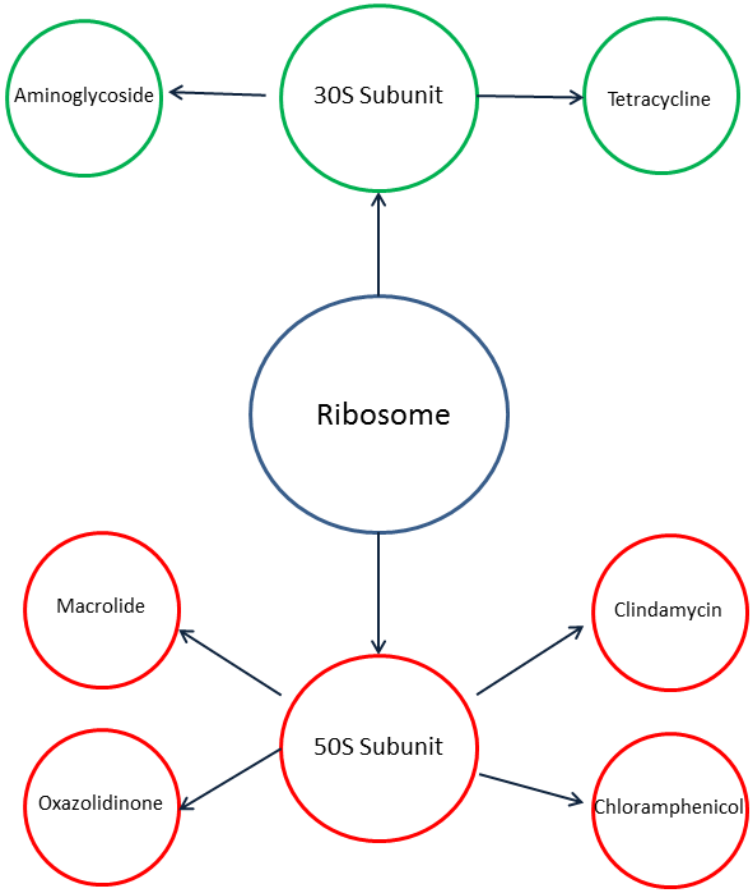
Spectrum


-
+
Enterobacteriaceae
Streptococci
Pseudomonas
S.aureus
ESBL Enterobacteriaceae
MRSA/CoNS/Enterococci
MDR Organisms
GRE
Bacterioides
Fusobacterium
Clostridium
-
+

Spectrum

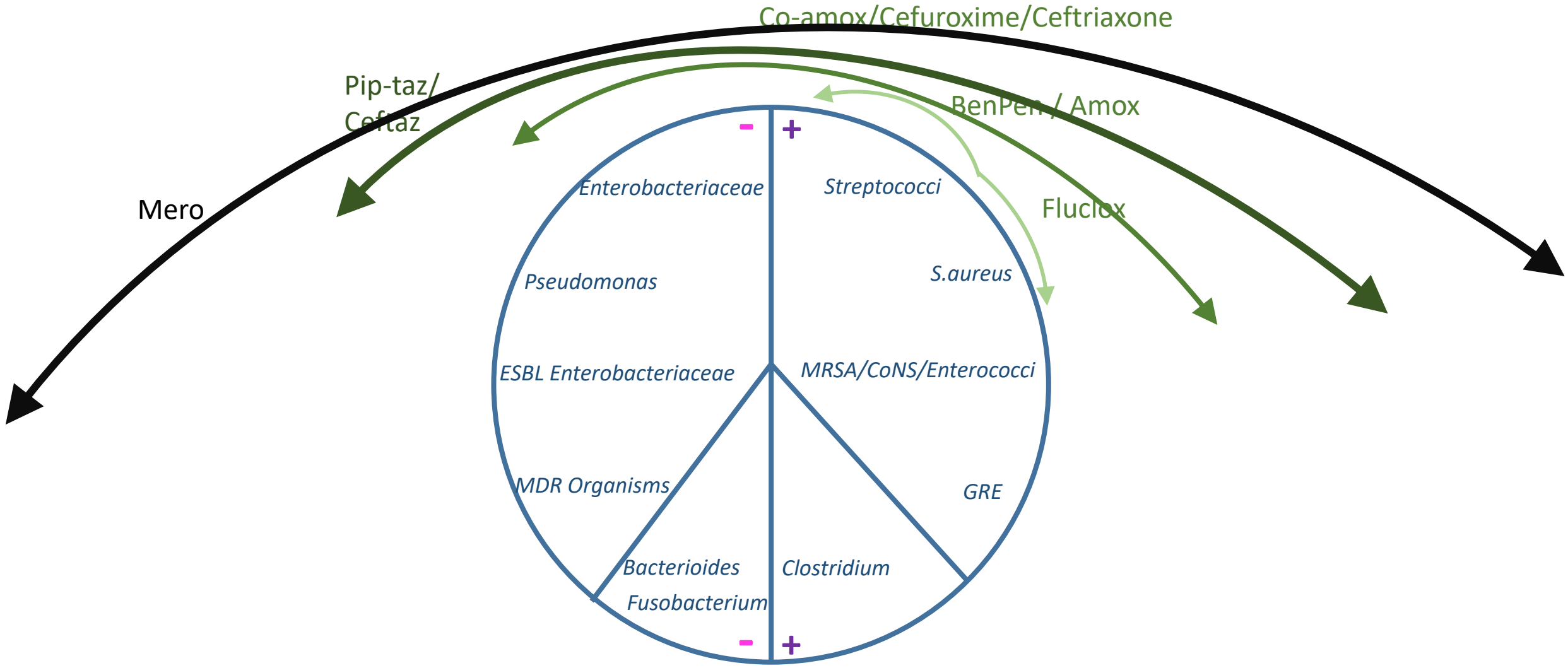






Personal correspondence, Tim Rawson

Spectrum


Co-amox/Cefuroxime/Ceftriaxone
Pip-taz/
Ceftaz
BenPen / Amox
Mero
Flucl
-
+
Enterobacteriaceae
Streptococci
Pseudomonas
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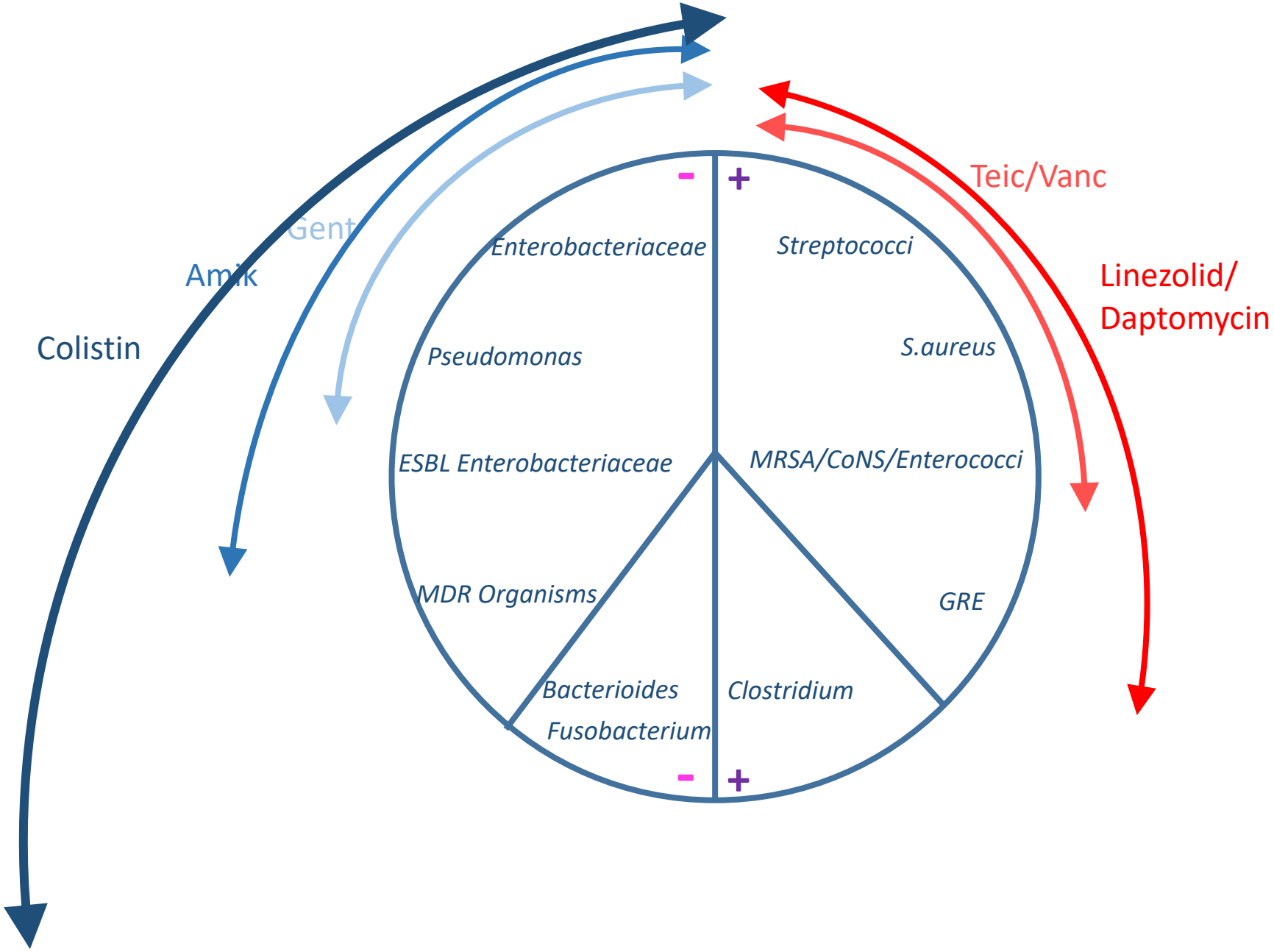
GRE
Bacterioides
Fusobacterium
Clostridium
-
+

Spectrum


Gent
Amik
Colistin
Teic/Vanc
Linezolid/
Daptomycin
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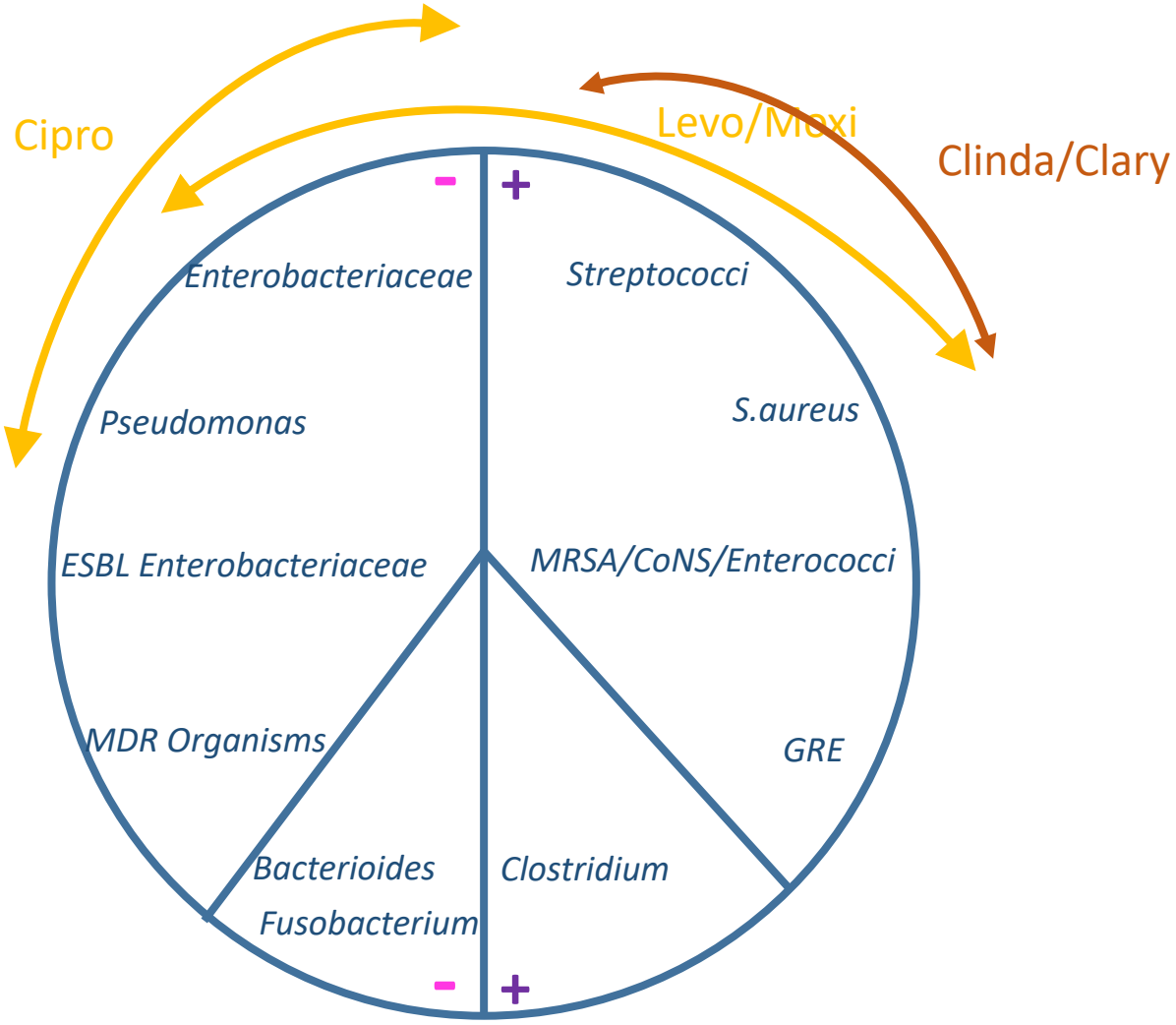
Enterobacteriaceae
Streptococci
Pseudomonas
S.aureus
ESBL Enterobacteriaceae
MRSA/CoNS/Enterococci
MDR Organisms
GRE
Bacterioides
Fusobacterium
Clostridium
-
+

Spectrum


Cipro
Levo/Moxi
Clinda/Clary
-
+
Enterobacteriaceae
Streptococci
Pseudomonas
S.aureus
ESBL Enterobacteriaceae
MRSA/CoNS/Enterococci
MDR Organisms
GRE
Bacterioides
Fusobacterium
Clostridium
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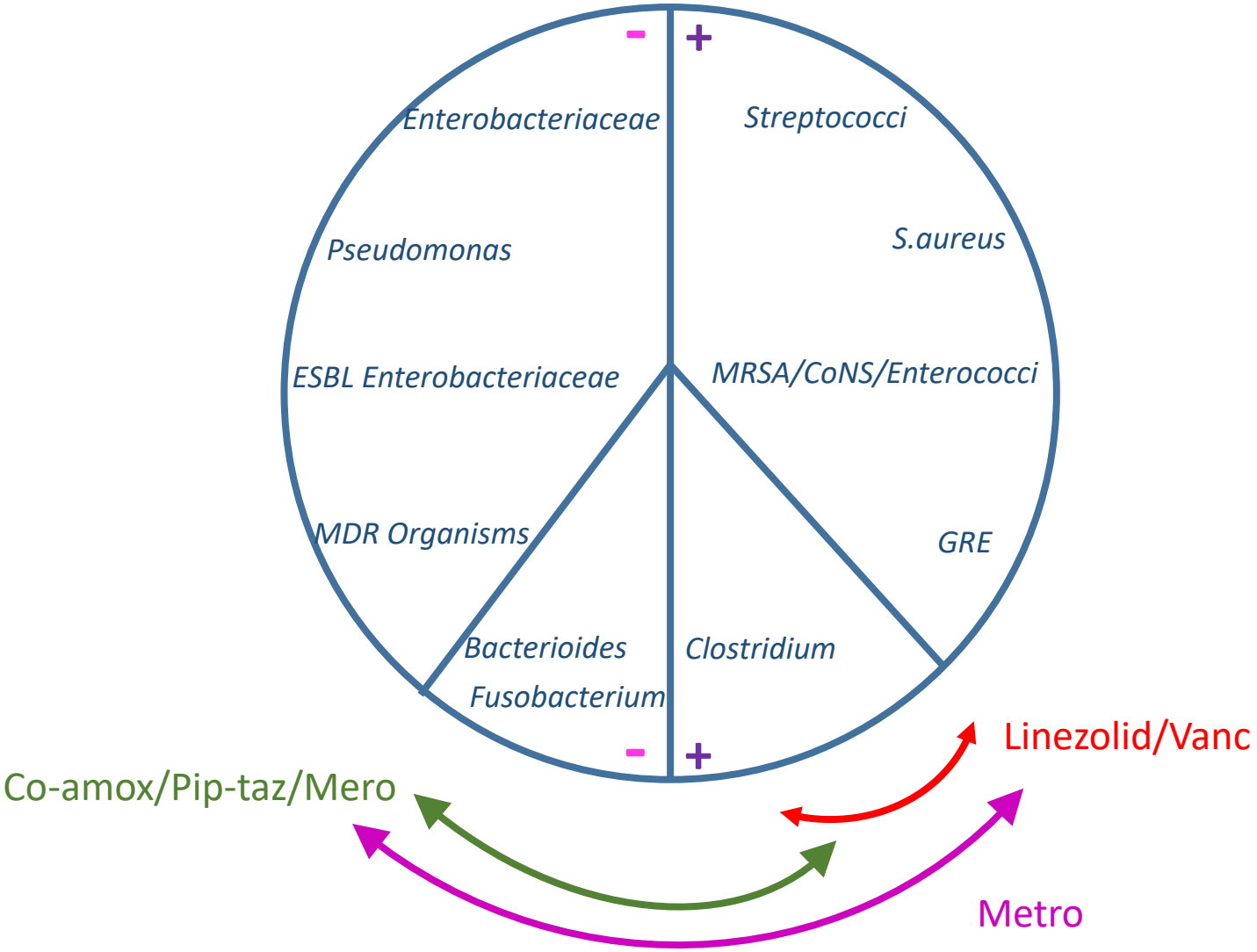
+

Spectrum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MRSA/CoNS/Enterococci
MDR Organisms
GRE
Bacterioides
Fusobacterium
Clostridium
-
+
Co-amox/Pip-taz/Mero
Linezolid/Vanc
Metro

PKPD

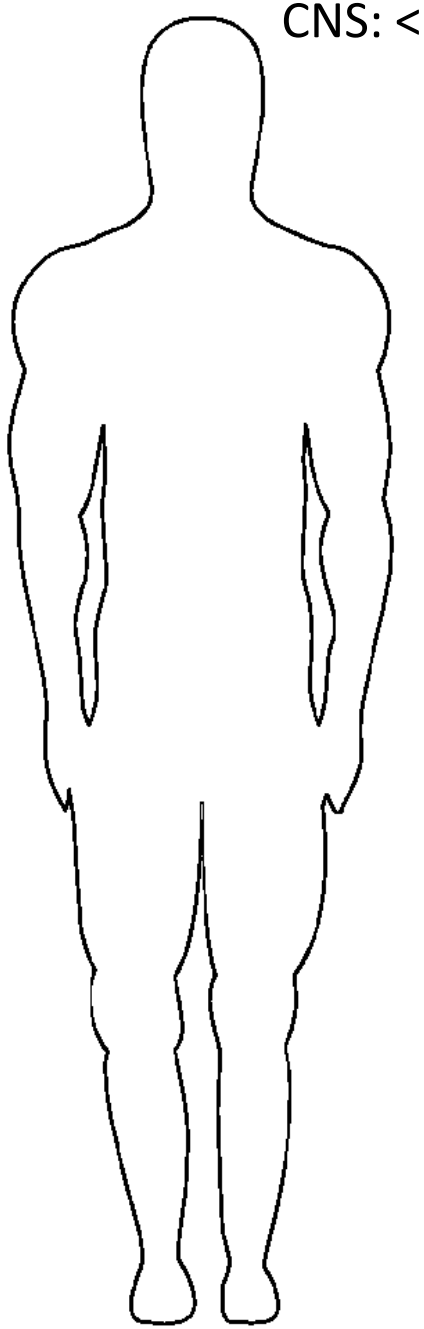
Vancomycin

CNS: <10%

Fat & muscle: 9-14%

Lung: 17-24%

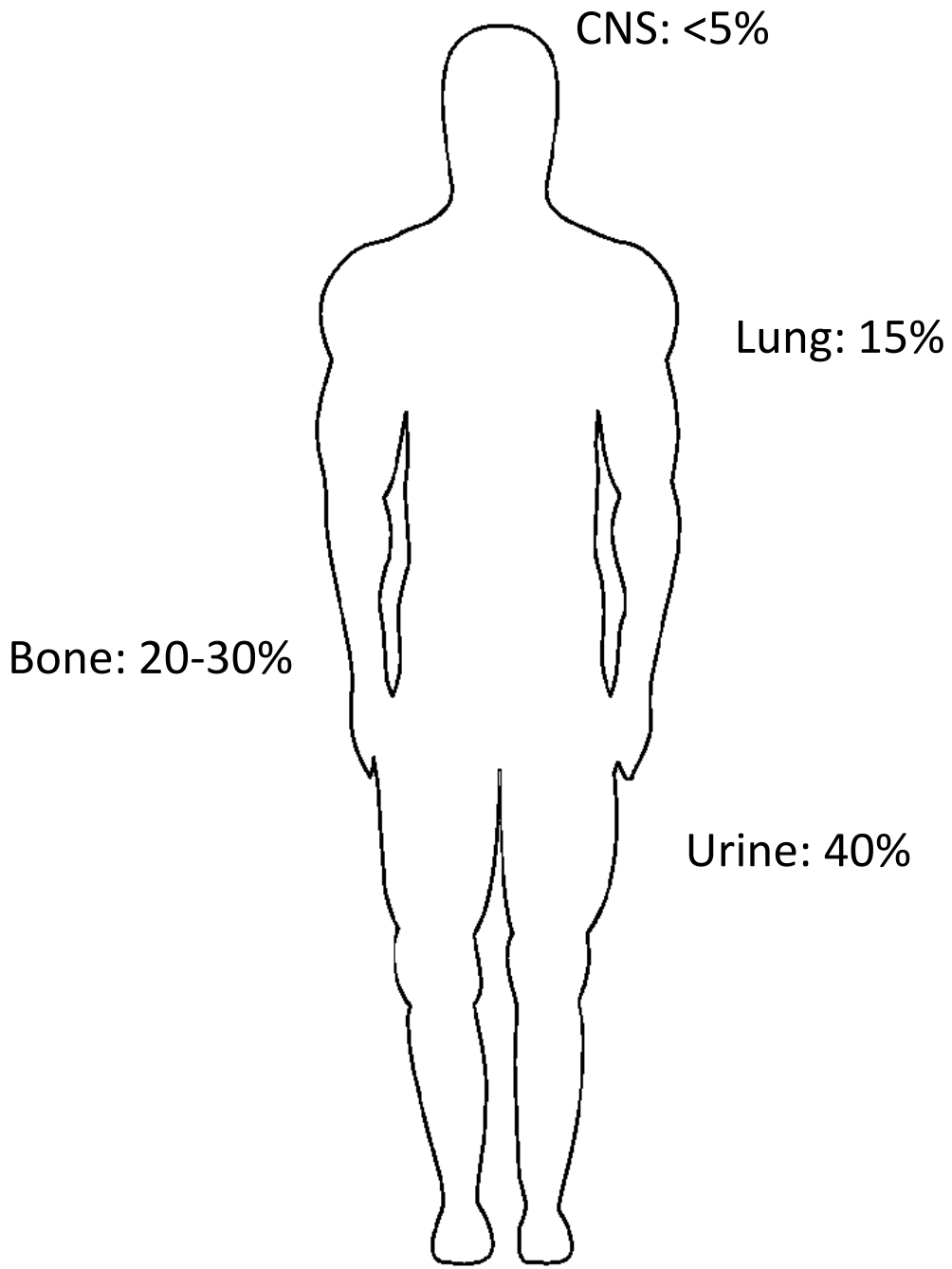
Bone: 7-13%



Kucers
2011

PKPD

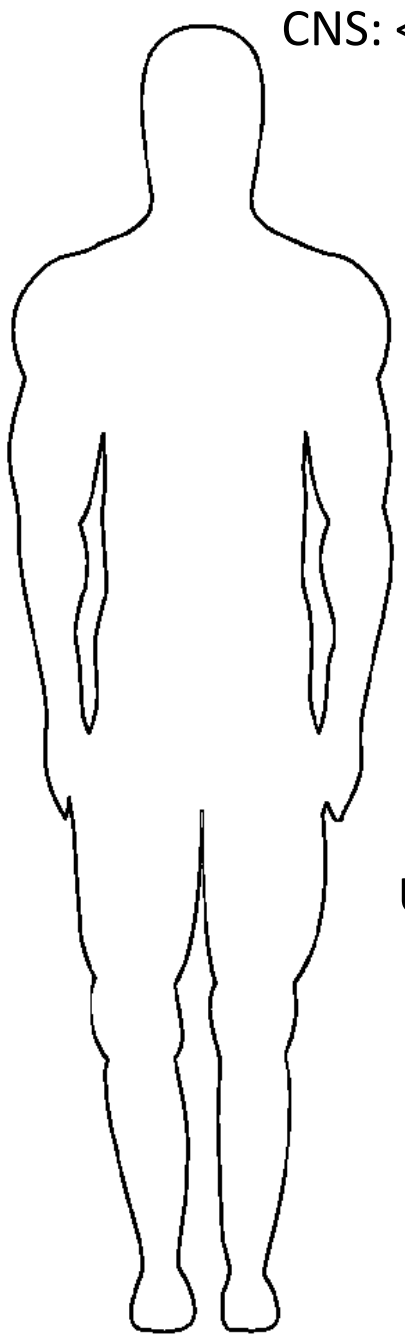
Cefuroxime



Kucers
2011

PKPD

Co-amoxiclav



CNS: <1%

Lung: 40%

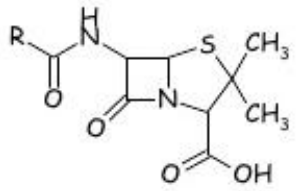
Peritoneal cavity: 66%

Urine: 38%

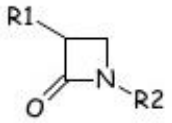
Kucers
2011

Allergies & Interactions

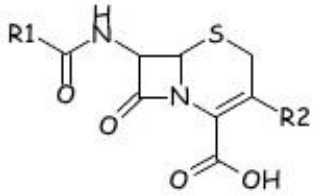
- Penicillins



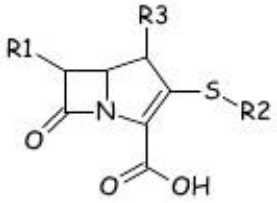
- Monobactams



- Cephalosporins



- Carbapenems



Antibiotic Class	Approximate Incidence of Seizures, %
Penicillins	2-20
Cephalosporins	3-17
Carbapenems	3-20
Higher risk with imipenem/cilastatin	
Fluoroquinolones	<1
Higher risk with ciprofloxacin	
Metronidazole	1-8
Isoniazid	0.2-1

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