Alder Hey Children's NHS
NHS Foundation Trust

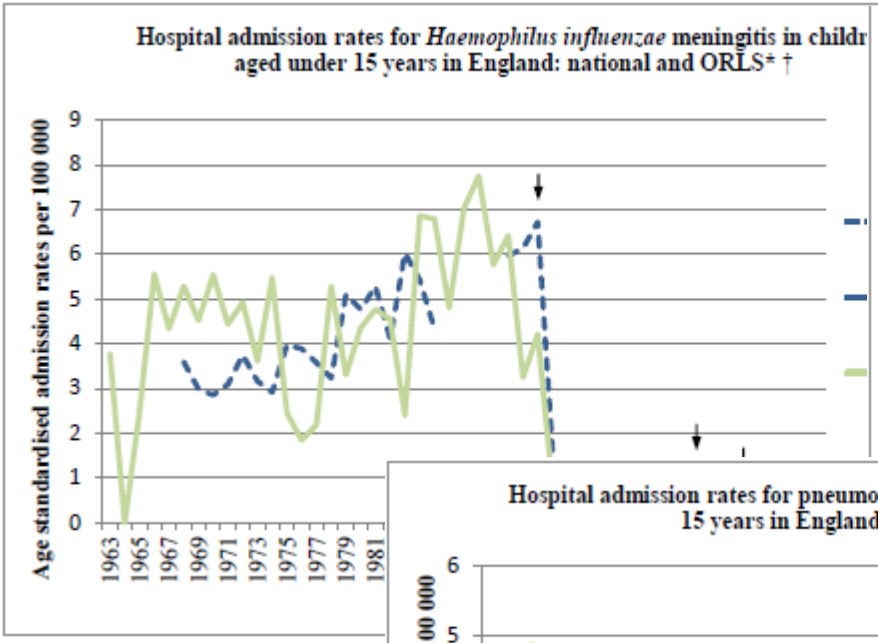
Complexities in the early recognition and treatment of meningitis and septicaemia:

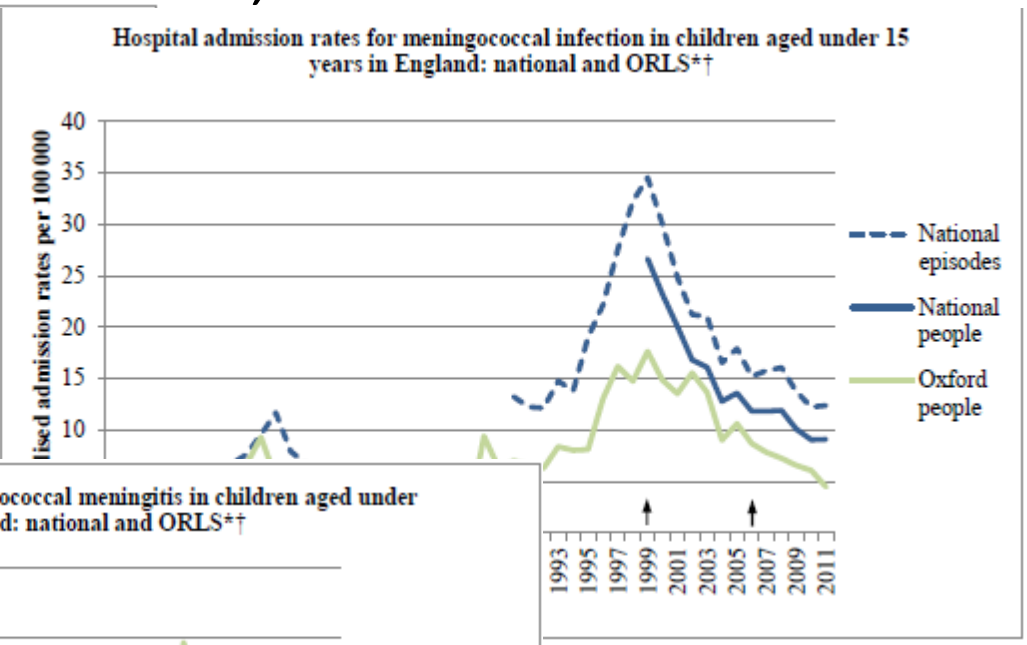
The unstoppable force of sepsis hitting the immovable object of antibiotic resistance?

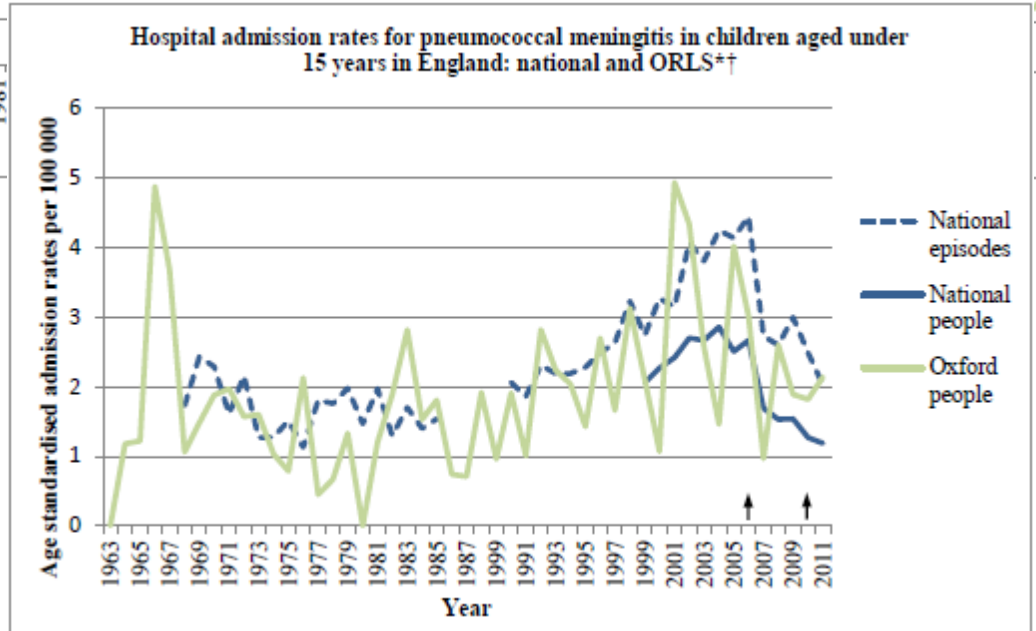
Inspired by Children

Decreasing admissions for meningitis and septicaemia.

Lancet Infect Dis. 2014;14:397-405

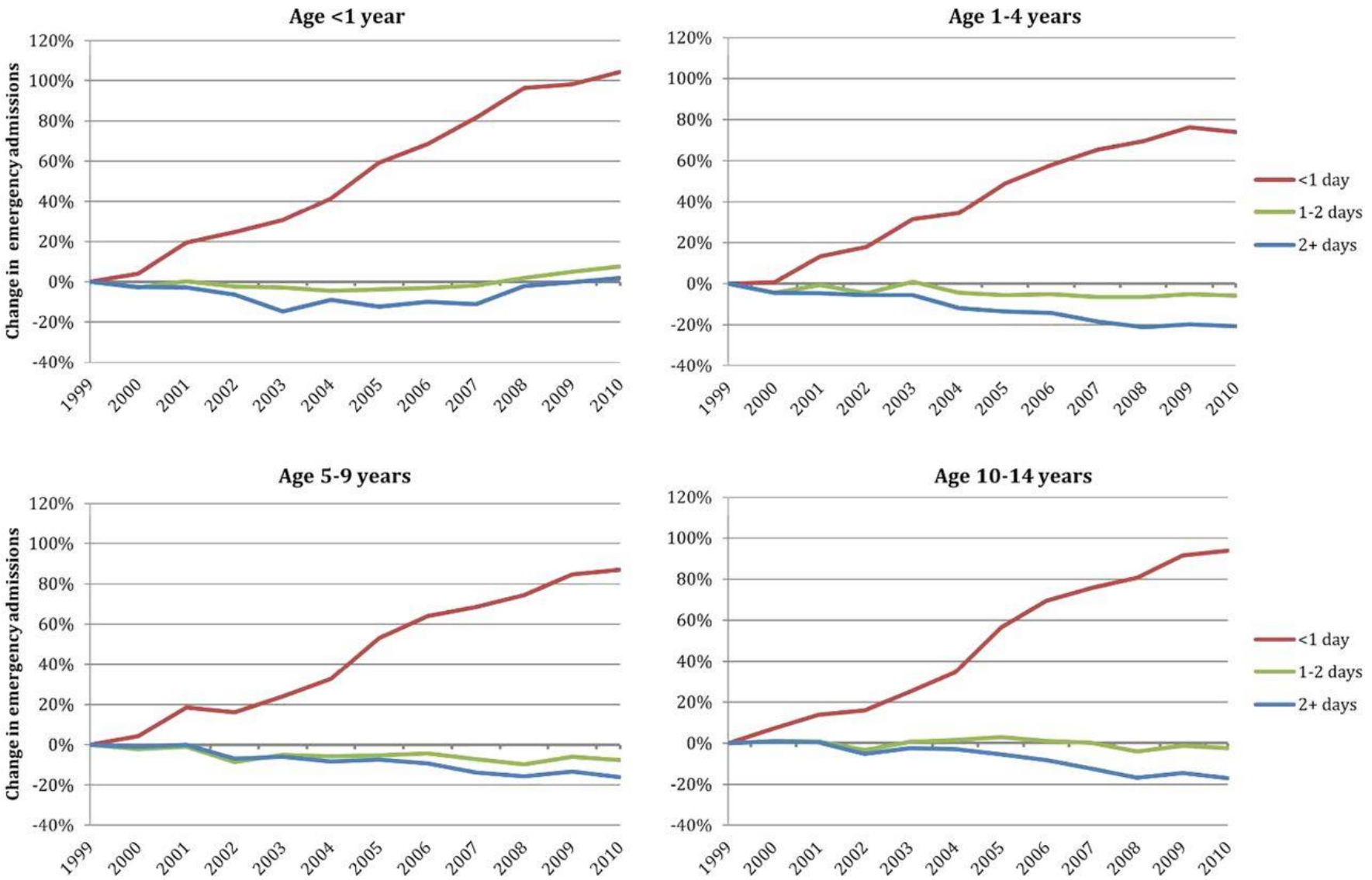






Increasing hospital admissions for children.

Arch Dis Child. 2013;98:328-34

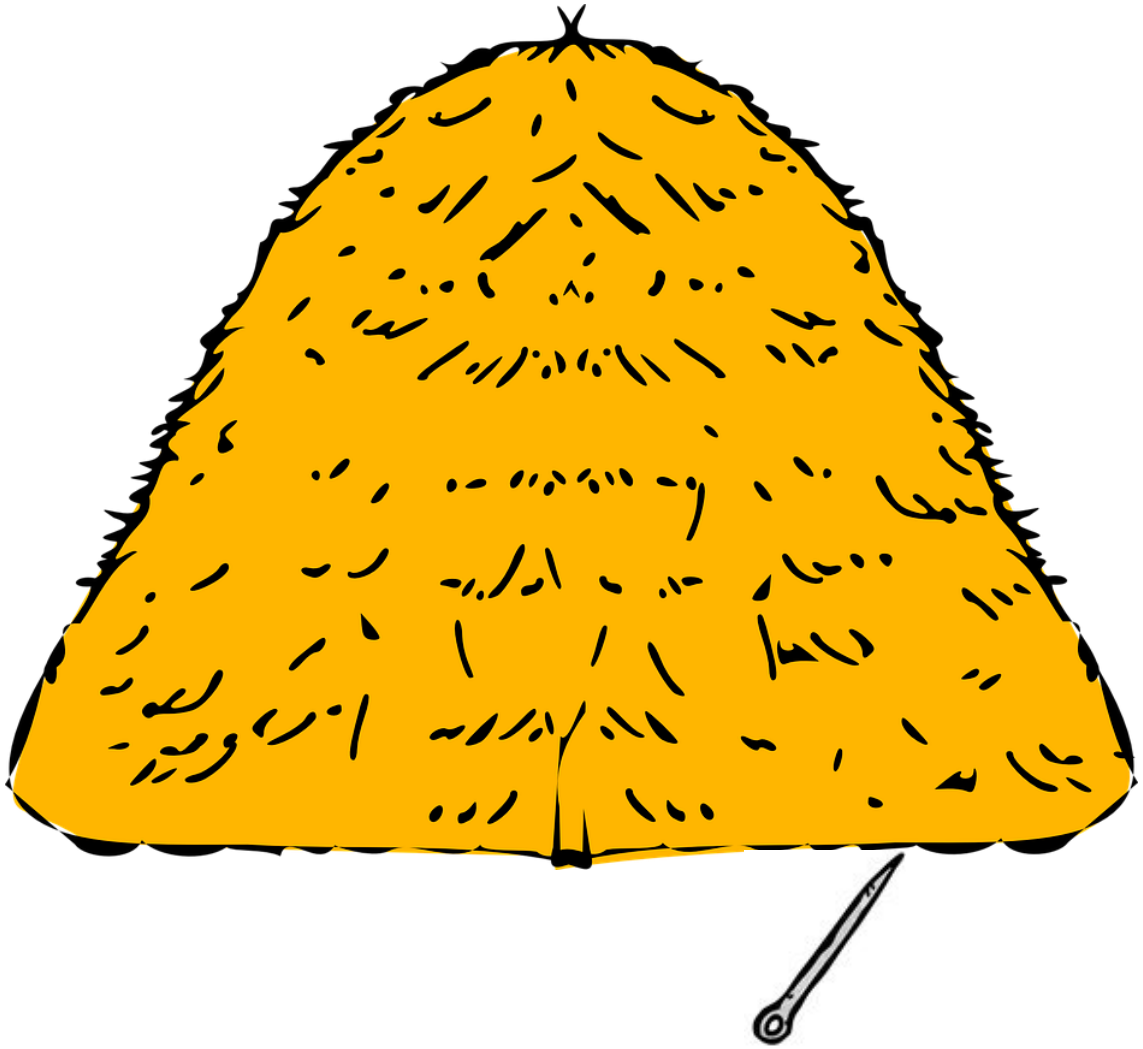


Very low rates of culture-confirmed invasive bacterial infections.

Arch Dis Child. 2014;99:526-31

- 5 Hospitals in SW London, over 3 years
- 46,039 admissions
- Blood/CSF cultures obtained during 45% of admissions
- 2.4% (504) clinically significant
- 1.1% of hospital admissions
- Incidence of community-acquired invasive bacterial infection only 6.4/100 000

Finding a needle in a haystack?



NHS
National Institute for
Health and Clinical Excellence

Feverish illness in children

Assessment and initial management in children younger than 5 years

NICE clinical guideline 160

	LOW RISK	INTERMEDIATE RISK	HIGH RISK
Colour	Normal colour of skin lips or tongue	Pallor reported by parent / carer	Pale / mottled / ashen / blue
Activity	Responds normally to social cues Content / smiles Stays awake or awakens quickly Strong normal cry / not crying	Not responding normally to social cues Wakes only with prolonged stimulation Decreased activity No smile	No response to social overtures Ill appearing to a healthcare professional Unable to rouse or if roused does not stay awake Weak / high pitched /continuous cry
Re			
Other	AND NONE OF THE AMBER OR RED SYMPTOMS OR SIGNS	Swelling of a limb or joint Non weight bearing limb/ not using an extremity Rigors	Non blanching rash Bulging fontanelle Neck stiffness Focal neurological signs Focal seizures
		Fever for >= 5 days Age 3-6months Temp >=39° C	Age 0-3months Temp >=38° C

Give immediate parenteral antibiotics to children if they are:

- shocked
- unrousable
- showing signs of meningococcal disease.

TIME TO ACT

Seve
and

What we found

The registrar missed two factors that should have alerted her to the possibility that Child B was seriously ill. First, the long duration of her illness was not typical of a simple viral illness. Secondly, although Child B's temperature had come down, her pulse remained very rapid. This suggested sepsis. The registrar should have paid more attention to these factors and carried out further investigations, which might reasonably have included blood tests. The registrar's assessment of Child B was inadequate, and her diagnosis did not explain all the clinical findings.

NHS England

Patient Safety Alert

Stage Two: Resources

Resources to support the prompt recognition of sepsis and the rapid initiation of treatment

2 September 2014

Alert reference number: NHS/PSA/R/2014/015

Alert stage: Two - Resources

This patient safety alert applies to all patient age groups

Sepsis is a time-critical medical emergency, which can occur as part of the body's response to infection. The resulting inflammatory response adversely affects tissues and organs. Unless treated quickly, sepsis can progress to severe sepsis, multi-organ failure, septic shock and ultimately death. Septic shock has a 50% mortality rate[1].

Sepsis is almost unique among acute conditions in that it affects all age groups and can present in any clinical area and health sector. Over 70% of cases arise in the community[2]. However, sepsis can be easily treated through timely intervention and basic, cost-effective therapies.
Recent epidemiological studies[3],[4] and data from the Intensive Care National Audit and Research Centre (ICNARC)[5], estimate that 35,000 people die from sepsis in England each year. We are lacking in recent data,

Actions

Who: Chief Executives of NHS Trusts, Foundation Trusts, Ambulance Trusts & General Practitioners

When: To commence immediately and by no later than 31 October 2014 have a robust action plan developed to achieve compliance

WHAT IS SEPSIS?

Sepsis is when the body's response to infection injures its own tissues and organs.

Sepsis is a life-threatening condition arising when the body' abnormal, or 'dysregulated', immune response to an infection causes organs to begin to fail.

Sepsis can be triggered by any infection, but most commonly occurs in response to bacterial infections of the lungs, urinary tract, abdominal organs or skin and soft tissues.

Caught early, outcomes are excellent. Left unchecked, the patient is likely to spiral to multi-organ failure, septic shock and death.

44,000

People lose their lives to sepsis every year.

£2 BILLION

Is the estimated amount that sepsis costs the NHS annually.

Sepsis: recognition, diagnosis and early management

NICE guideline [NG51] Published date: July 2016 Last updated: September 2017 Uptake of this guidance

Guidance | Tools and resources | Information for the public | Evidence | History

Guidance

Share Download

NICE interactive flowchart - Sepsis Quality standard - Sepsis

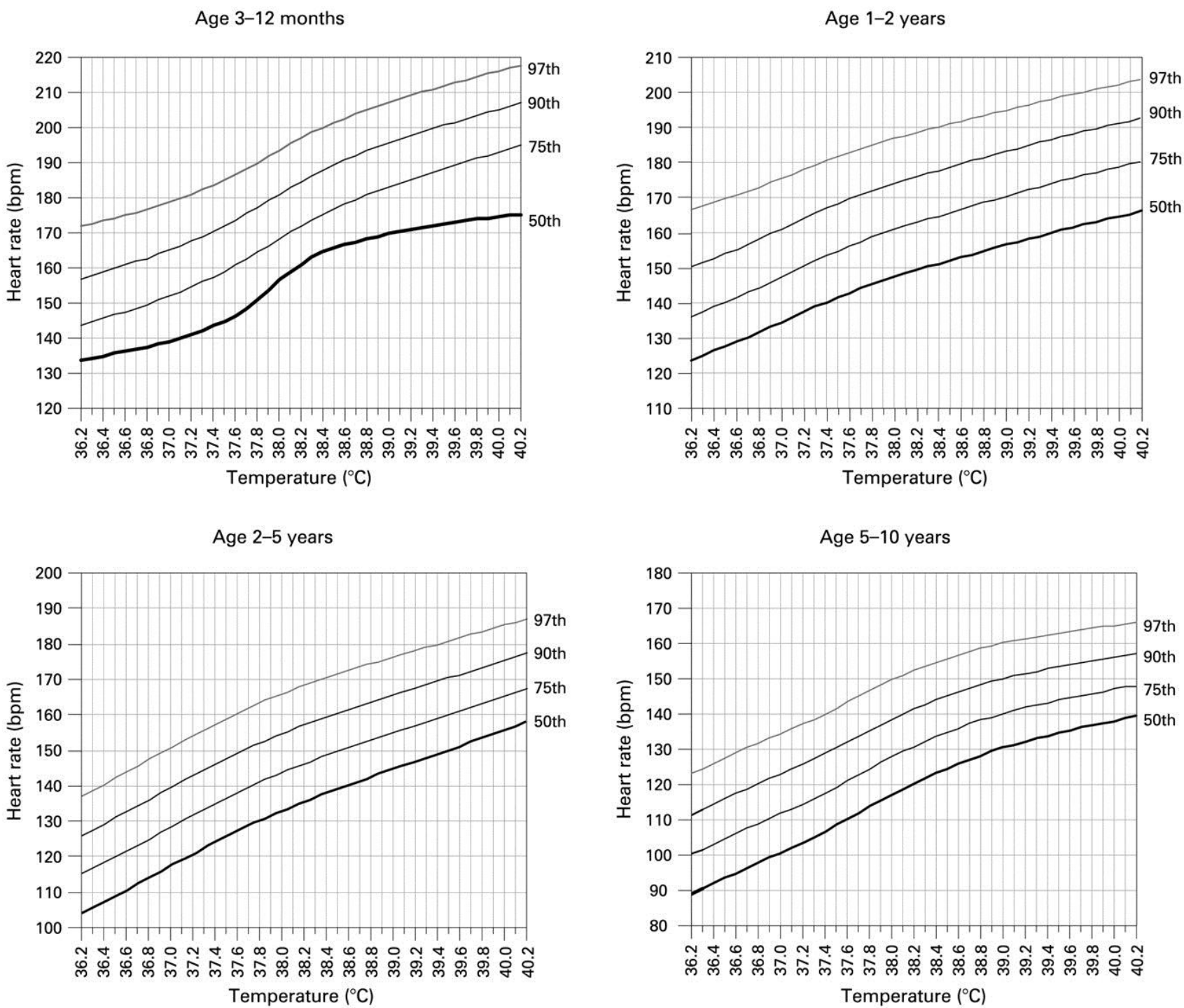
Next

This guideline covers the recognition, diagnosis and early management of sepsis for all populations. The guideline committee identified that the key issues to be included were: recognition and early assessment, diagnostic and prognostic value of blood markers for sepsis, initial treatment, escalating care, identifying the source of infection, early monitoring, information and support for patients and carers, and training and education.

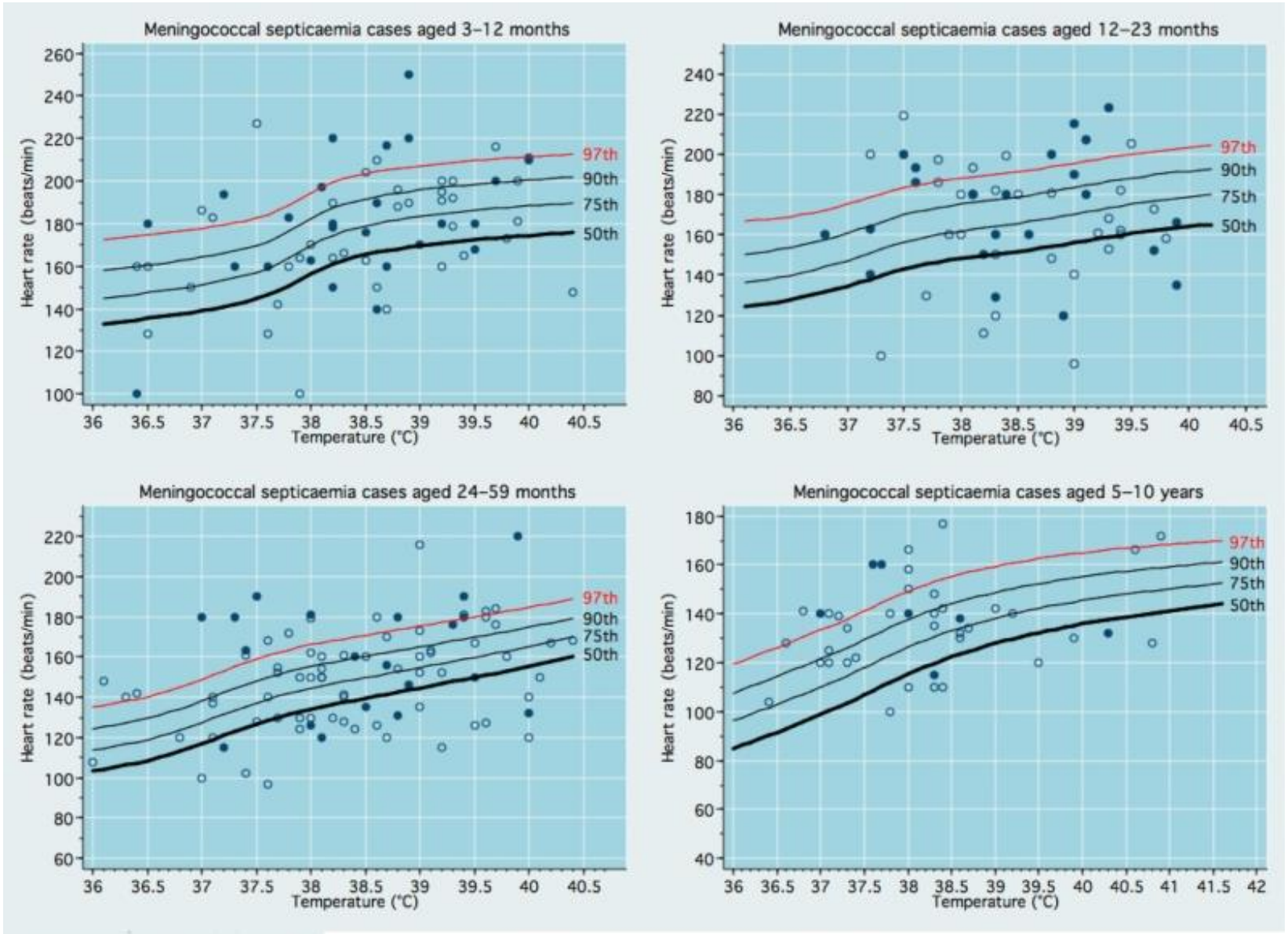
	LOW RISK	INTERMEDIATE RISK	HIGH RISK
Colour	Normal colour of skin lips or tongue	Pallor reported by parent / carer	Pale / mottled / ashen / blue
Activity	Responds normally to social cues Content / smiles Stays awake or awakens	Not responding normally to social cues Wakes only with prolonged stimulation	No response to social overtures Ill appearing to a healthcare professional Unable to rouse or if roused does not stay awake Weak / high pitched /continuous cry
			Grunting Apnoea Tachypnoea: RR >50bpm age 6-12 months RR >40bpm age >12 months Oxygen saturation < 90% in air
			Reduced Skin turgor Tachycardia: > 160 beats/minute, age < 1 year > 150 beats/minute, age 1-2 years > 140 beats/minute, age 2-5years < 60 beats/minute, any age
Other	AND NONE OF THE AMBER OR RED SYMPTOMS OR SIGNS	Swelling of a limb or joint Non weight bearing limb/ not using an extremity Rigors	Non blanching rash Bulging fontanelle Neck stiffness Focal neurological signs Focal seizures
		Fever for >= 5 days Age 3-6months Temp >=39° C	Age 0-3months Temp >=38° C Any age Temp <36° C

For children aged under 5 years who have suspected sepsis and 1 or more high risk criteria:

- give a broad-spectrum antimicrobial at the maximum recommended dose within 1 hour


Age 3–12 months
Heart rate (bpm)
220
210
200
190
180
170
160
150
140
130
120
97th
90th
75th
50th
36.2 36.4 36.6 36.8 37.0 37.2 37.4 37.6 37.8 38.0 38.2 38.4 38.6 38.8 39.0 39.2 39.4 39.6 39.8 40.0 40.2
Temperature (°C)
Age 1–2 years
Heart rate (bpm)
210
200
190
180
170
160
150
140
130
120
110
97th
90th
75th
50th
36.2 36.4 36.6 36.8 37.0 37.2 37.4 37.6 37.8 38.0 38.2 38.4 38.6 38.8 39.0 39.2 39.4 39.6 39.8 40.0 40.2
Temperature (°C)
Age 2–5 years
Heart rate (bpm)
200
190
180
170
160
150
140
130
120
110
100
97th
90th
75th
50th
36.2 36.4 36.6 36.8 37.0 37.2 37.4 37.6 37.8 38.0 38.2 38.4 38.6 38.8 39.0 39.2 39.4 39.6 39.8 40.0 40.2
Temperature (°C)
Age 5–10 years
Heart rate (bpm)
180
170
160
150
140
130
120
110
100
90
80
97th
90th
75th
50th
36.2 36.4 36.6 36.8 37.0 37.2 37.4 37.6 37.8 38.0 38.2 38.4 38.6 38.8 39.0 39.2 39.4 39.6 39.8 40.0 40.2
Temperature (°C)

Pulse in children with meningococcal septicaemia



Arch Dis Child. 2011; 96: 368–373.

NICE Sepsis guideline in use.

Arch Dis Child. 2018. pii: archdischild-2018-314865

- Paediatric Emergency Dept; Feb - May 2017.
- 4322 children attended
- 216 (5%) had one or more high-risk criterion.

  159 children (73%) tachycardia.
- Senior decision-making doctor gave 17 (7.8%) intravenous antibiotics
- 1 child had bacteraemia

Every action has an equal and opposite reaction

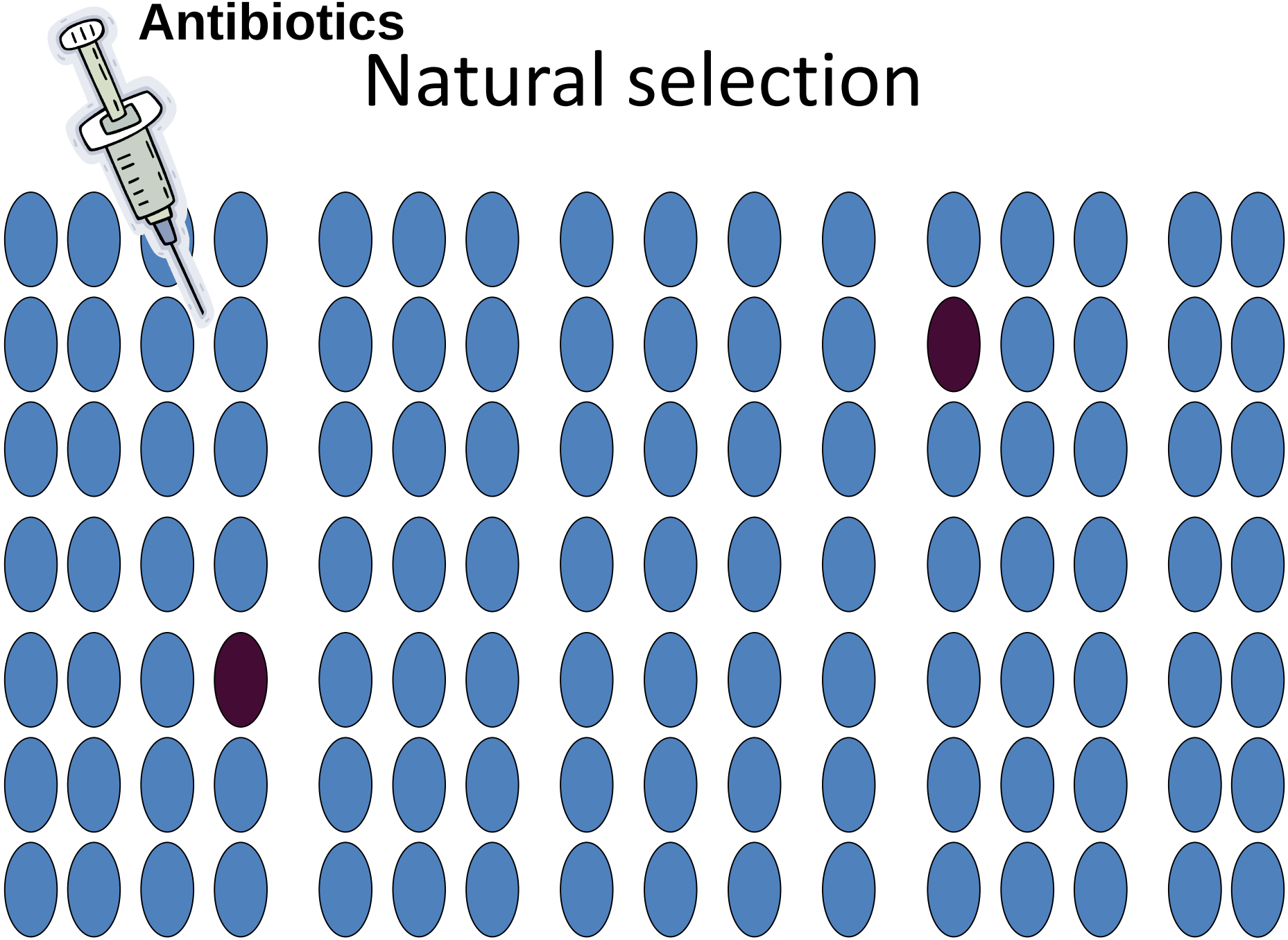
Britain could face 'post-antibiotic apocalypse' warns top doctor

The Telegraph

Prof Dame Sally called for swift global action to cut needless use of drugs CREDIT: PA

Antibiotics

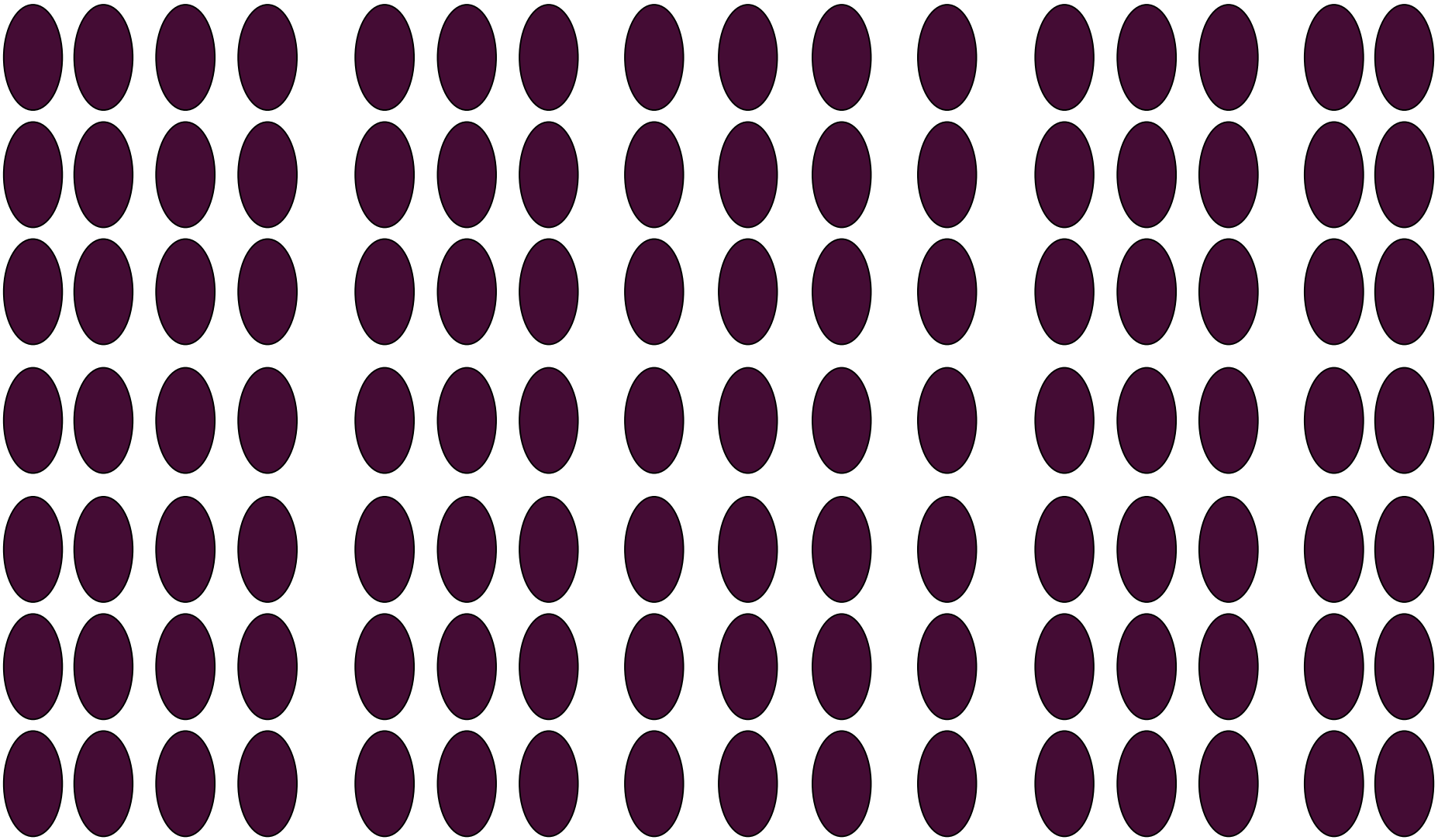
Natural selection



Antibiotics

Natural selection

Natural selection



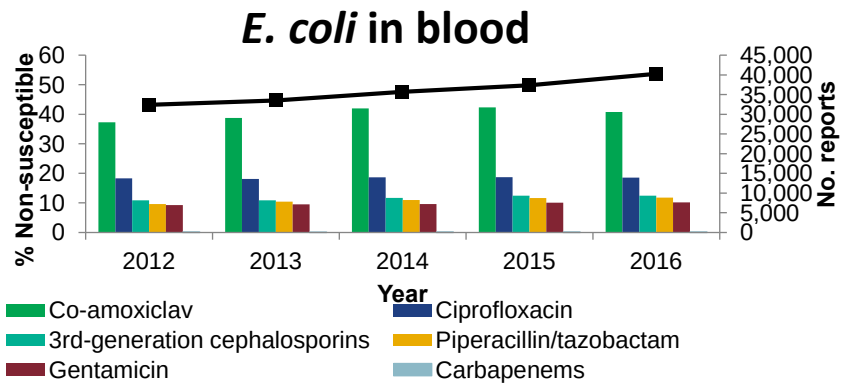


Figure 2.1 Number of bloodstream isolates of *E. coli* reported to the mandatory surveillance scheme and the proportions non-susceptible to indicated antibiotics

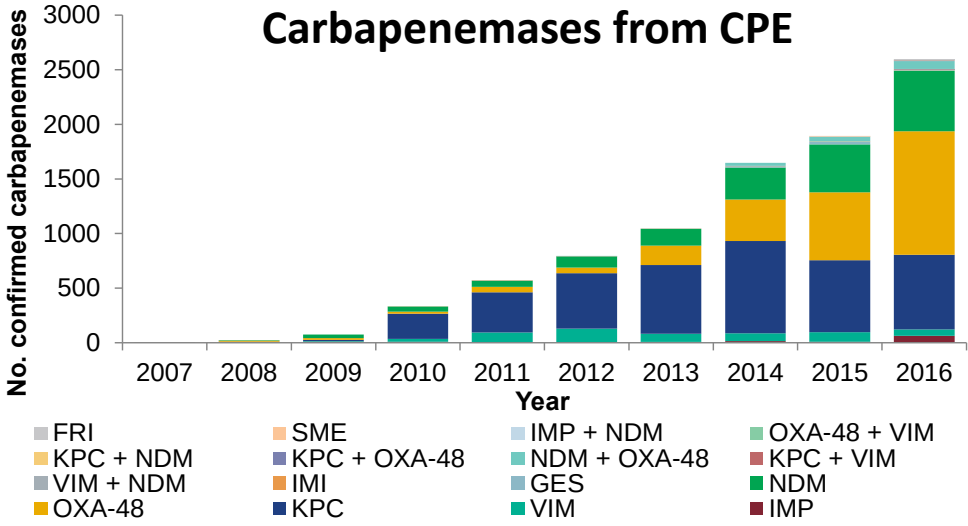


Figure 2.10 Carbapenemases produced by CPE referred to the PHE AMRHAI Reference Unit

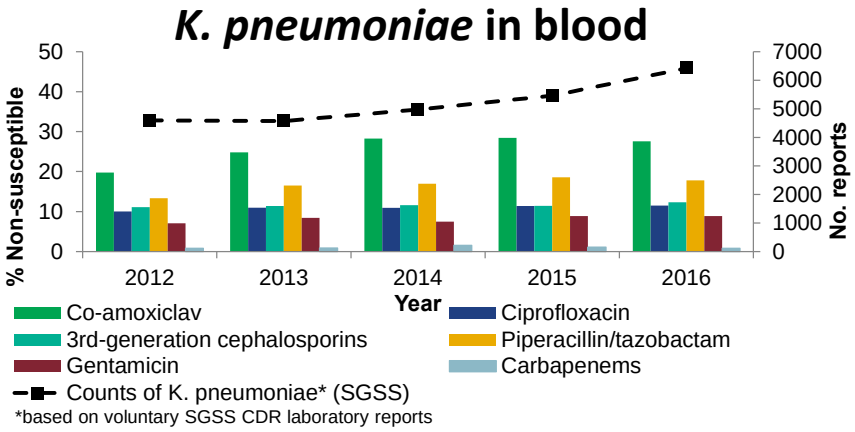


Figure 2.3 Number of bloodstream isolates of *K. pneumoniae* reported to SGSS and the proportions non-susceptible to indicated antibiotics

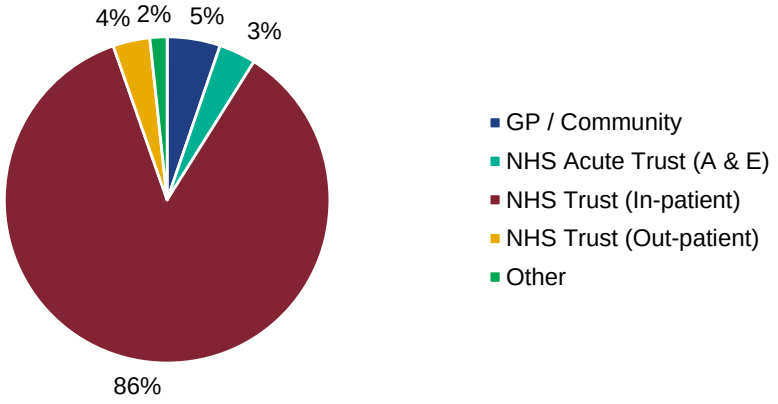


Figure 2.13 Location of patient recorded on ERS with confirmed CPE (May 2015 – May 2017)

What about new antibiotics?

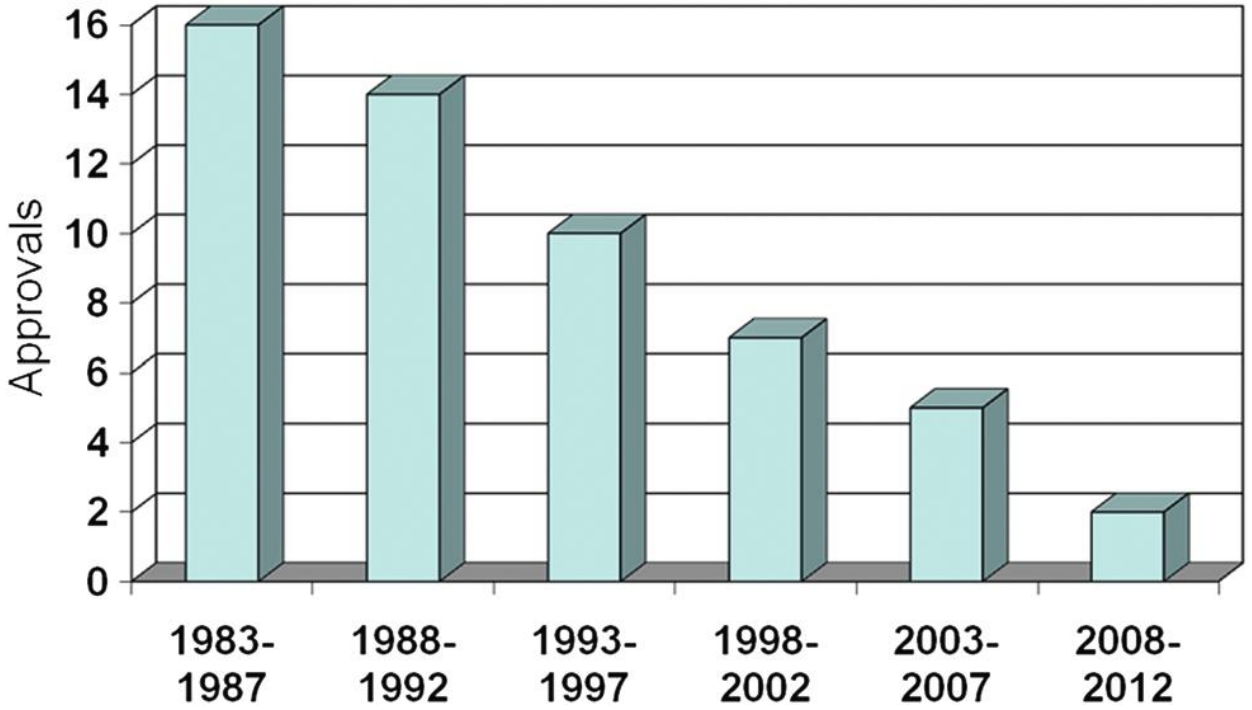


Figure 1. New systemic antibacterial agents approved by the US Food and Drug Administration per 5-year period, through 2012. Modified from Spellberg 2004 [23].

Boucher, Clin Inf Dis, 2013

Public Health England

NHS

Patient Safety Alert

Stage Two: Resources

Addressing antimicrobial resistance through implementation of an antimicrobial stewardship programme

18 August 2015

Alert reference number:	NHS/PSA/Re/2015/007
Alert stage:	Two - Resources

Antimicrobial resistance (AMR) has risen alarmingly over the last 40 years and inappropriate use of antimicrobials is a key driver[1]. From 2010 to 2013, total antibiotic prescribing in England increased by 6%, comprised of a 4% rise in general practice and a 12% increase in hospital inpatient prescribing[2].

The consequences of AMR include increased treatment failure for common infections and decreased treatment options where antibiotics are vital, such as during certain cancer treatments[3]. Antimicrobial stewardship is key to combating AMR and is an important element of the UK Five Year Antimicrobial Resistance Strategy[4].

Antimicrobial stewardship embodies an organisational and system-wide approach to promoting and monitoring the judicious use of antimicrobials by:

- optimising therapy for individual patients;
- preventing overuse and misuse; and
- minimising the development of resistance at patient and community levels.

Actions

Who: All organisations providing NHS funded care where antibiotics are prescribed, dispensed or administered

When: To commence immediately and be completed by 31 March 2016

NICE National Institute for Health and Care Excellence

NICE guideline

Antimicrobial stewardship: systems and processes for effective antimicrobial medicine use

- only prescribe antimicrobials when clinically appropriate
- review intravenous antimicrobial prescriptions at 48–72 hours

CQUINs

National CQUIN targets for Antimicrobial Prescribing in 2017/18 to 2018/19

CQUIN = Commissioning for Quality and Innovation (CQUIN) payments

CQUINs
Commissioning for Quality and Innovation payments

"The CQUIN scheme is intended to deliver clinical quality improvements and drive transformation change. These will impact on reducing inequalities in access to services, the experiences of using them and the outcomes achieved."

NHS England

CQUINs

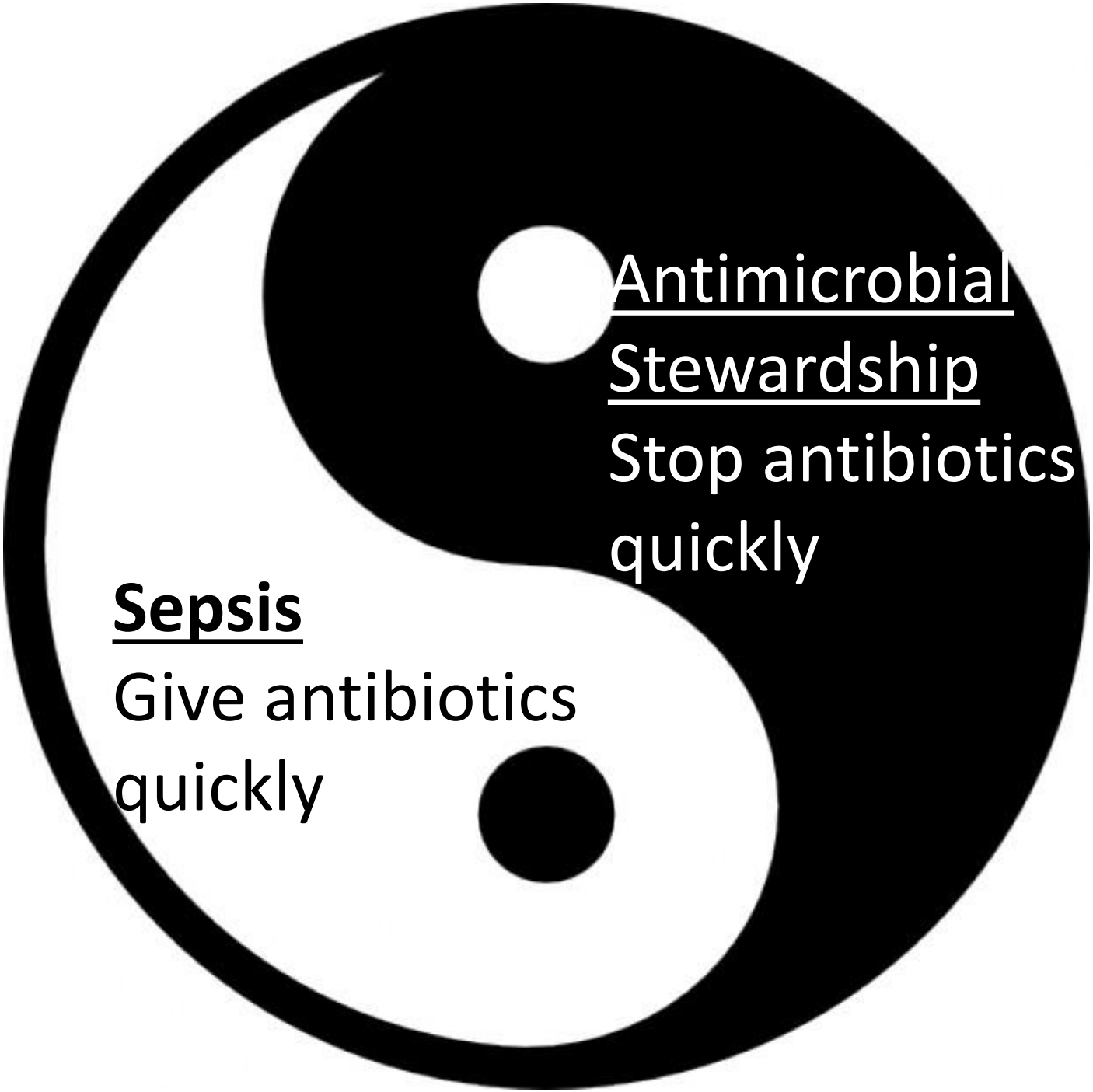
National CQUIN	Indicator	Indicator weighting (% of CQUIN scheme available)
CQUIN 2a	Timely identification of sepsis in emergency departments and acute inpatient settings	25% of 0.25% (0.0625%)
CQUIN 2b	Timely treatment for sepsis in emergency departments and acute inpatient settings	25% of 0.25% (0.0625%)
CQUIN 2c	Antibiotic review	25% of 0.25% (0.0625%)
CQUIN 2d	Reduction in antibiotic consumption per 1,000 admissions	25% of 0.25% (0.0625%)

ABIOT

ABIOT

Worth approx. £120,000/year


Antimicrobial Stewardship
Sepsis


Antimicrobial Stewardship
Stop antibiotics quickly
Sepsis
Give antibiotics quickly