The Royal College of Emergency Medicine

SEVERE SEPSIS AND SEPTIC SHOCK

CLINICAL AUDIT 2016/17

National Report

Contents

Foreword

Dr Taj Hassan, RCEM President

Sepsis continues to be a leading cause of death in patients admitted to hospital as an emergency. Indeed, mortality of severe sepsis is reported as being as much as five times higher than ST elevation MI or stroke. It is vital therefore that staff in the Emergency Department are able to rapidly assess, recognise, risk stratify and treat such patients with proven evidence based therapy. Studies have repeatedly shown the power of the Sepsis-Six resuscitation bundle in improving patient care if delivered in a timely fashion.

This year's excellent College clinical audit provides yet again powerful data that focusing on key parameters can highlight both positive trends and also areas where improvements need to be made.

Emergency Departments are of course complex places to work. We know that in situations where our departments are not crowded and we have the right staffing levels, we have the skills to be able to deliver high quality care.

We also know that good team working and constant calibration of care pathways can have real and positive influences in achieving consistency of delivery of the Sepsis-Six, despite some of the confounders and obstacles that face us.

I strongly recommend all emergency physicians and ED nursing staff to read this report.

More importantly, I encourage you all to review and improve the way in which you support your multidisciplinary ED Sepsis Team and your ED Sepsis Lead. Interpret your data well, dissect out the delays and make a true drive for quality care.

Only by engagement, involvement and enacting a constant drive to improve your sepsis pathway will you be able to produce the steady incremental change that is required to save lives in this horrible disease. With a Number Needed to Treat (NNT) of as little as 4.67, you have the potential to save a life at a very regular interval!

Dr Taj Hassan, RCEM President

Co-signed:

Dr Adrian Boyle, Chair of Quality in Emergency Care Committee

Dr Jeff Keep, Chair of Standards & Audit Subcommittee

Executive Summary

Overview

A total of 13,129 patients presenting to 196 Emergency Departments (ED) were included in this audit. This was the third time this audit has been conducted. The performance summary chart on the next page is a summary of the national performance against standards.

The purpose of the audit is to monitor documented care against the standards published in June 2016. The audit is designed to drive clinical practice forward by helping clinicians examine the work they do day-to-day and benchmark against their peers, and to recognise excellence. There is much good practice occurring and RCEM believes that this audit is an important component in sharing this and ensuring patient safety.

Organisational data

This was the first time that organisational data were analysed. Almost all EDs have a sepsis lead, a sepsis protocol and provide sepsis education (96%, 95% and 96% respectively). This is a great achievement and shows how responsive we are as a specialty to the many recommendations for improved organisation that have come from national reports. Patient information should be the next focus as it is currently provided by only 26% of EDs.

The new (Sepsis-3) definitions were published in early 2016 and 39% of EDs have started to use them.

Patient data

Due to changes of the standards, only five standards are directly comparable to previous audits, all of which are part of the Sepsis-Six and all measured within an hour of the patient's arrival to the ED.

There has been a steady improvement in the giving of **antibiotics** over the years and now **44%** of patients receive them within an hour of arrival. There has been a slight improvement in the giving of **IV fluids** from 40% to **43%**. The taking of **blood cultures** and the measurement of **lactate** in the first hour have both improved, up from 40% to **45%** and 49% to **60%** respectively. Documentation of **urine output** measurement is poor at only **18%**.

Documentation of a full set of **observations** including capillary blood glucose on arrival is currently at **69%** although this is achieved by the upper quartile in 91% of patients. The number is brought down significantly by including capillary blood glucose. **Senior review** of patients with sepsis is at **65%** and this could be an important factor affecting care.

RCEM recommends that all sepsis leads consider the following:

- Is everything being done to ensure that a full set of timely observations is performed on every patient?
- Is there a more senior doctor available to review patients with sepsis 24/7?
- Is oxygen considered part of the treatment for sepsis and how is this clearly documented?
- Is lactate measurement possible and simple in your department?
- Does your hospital give clear instructions on which antibiotics should be used?
- Does your protocol encourage urine output monitoring, especially if the patient does not require a catheter?

Key recommendations

1. All EDs should have a sepsis lead and a sepsis protocol

2. RCEM recommends that all sepsis leads consider the following:

   a) Is everything being done to ensure that a full set of timely observations is performed on every patient?

   b) Is there a more senior doctor available to review patients with sepsis 24/7?

   c) Is oxygen considered part of the treatment for sepsis and how is this clearly documented?

   d) Is lactate measurement possible and simple in your department?

   e) Does your hospital give clear instructions on which antibiotics should be used?

   f) Does your protocol encourage urine output monitoring, especially if the patient does not require a catheter?

3. Early recognition of sepsis is critical to the clinical outcome. All patients with suspected sepsis and a NEWS of 3 should undergo immediate screening for sepsis[vi].

4. Patient information should be provided to all patients, and/or relatives, admitted with sepsis.

5. Standardise pathways of care for patients fulfilling sepsis criteria to improve timely delivery of care and therefore outcomes

6. Education and training around these for wider team for early recognition and instigation of optimal care

Performance Summary

This graph shows the median national performance against standards for this audit
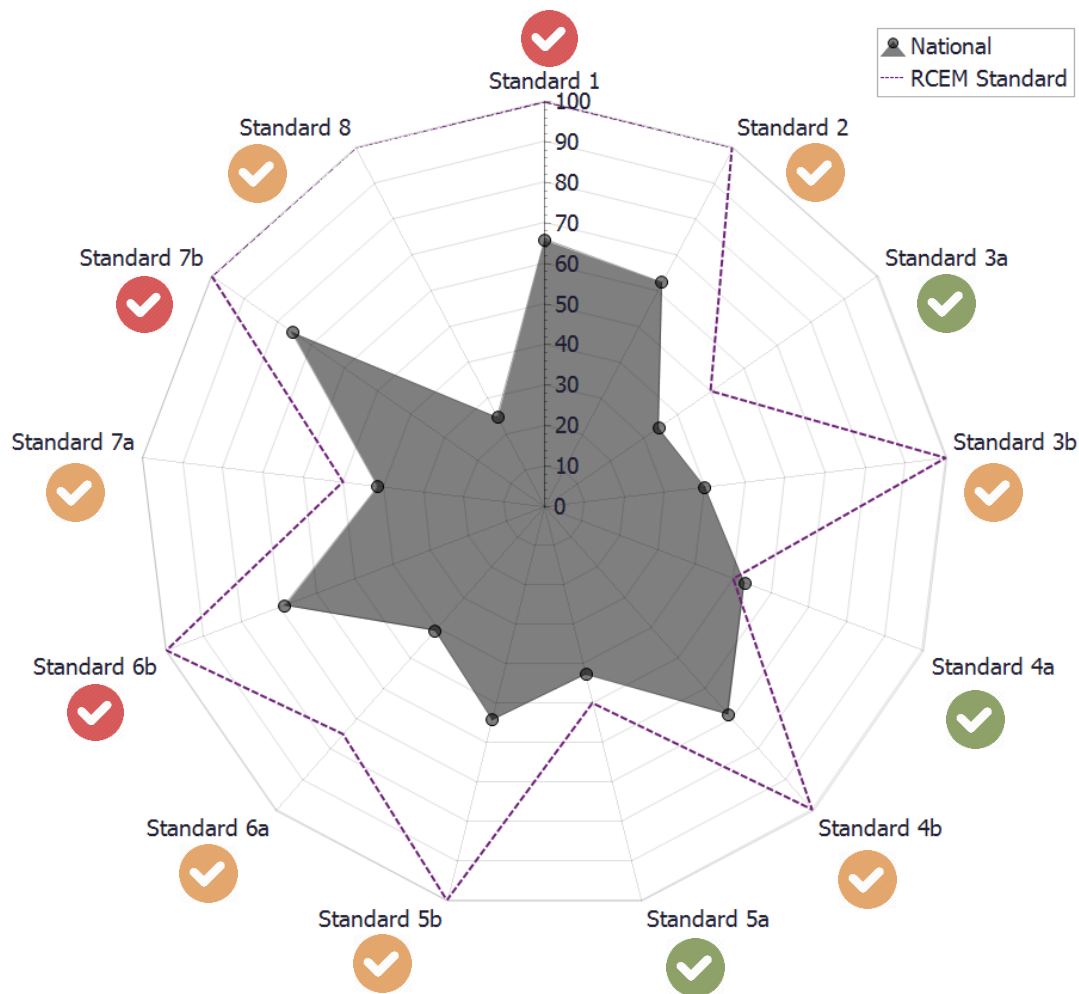
Standards:

✓ Fundamental   ✓ Developmental   ✓ Aspirational

↑ **Higher scores (e.g. 100%)** indicate higher compliance with the standards and better performance.

↓ **Lower scores (e.g. 0%)** indicate that your ED is not meeting the standards and may wish to investigate the reasons.

Summary of national findings

	RCEM Standard	National Results				
		2016/17 (13129 cases)			2013/14	2011/12
		Lower quartile	Median	Upper quartile	Median	Median
✓ **STANDARD 1**: Respiratory Rate, Oxygen Saturations (SaO$_2$), Supplemental Oxygen Requirement, Temperature, Blood Pressure, Heart Rate, Level of Consciousness (AVPU or GCS) and Capillary Blood Glucose recorded on arrival	100%	50%	69%	91%	-	-
✓ **STANDARD 2**: Review by a senior (ST4+ or equivalent) ED medic or involvement of Critical Care medic (including the outreach team or equivalent) before leaving the ED	100%	52%	65%	76%	-	-
STANDARD 3: O$_2$ was initiated to maintain SaO$_2$>94% (unless there is a documented reason not to):						
✓ **STANDARD 3a**: 50% within one hour of arrival	50%	10%	30%	59%	29%	33%
✓ **STANDARD 3b**: 100% within four hours of arrival	100%	11%	39%	68%	-	-
STANDARD 4: Serum Lactate measured within four hours of arrival:						
✓ **STANDARD 4a**: 50% within one hour of arrival	50%	37%	60%	72%	49%	47%
✓ **STANDARD 4b**: 100% within four hours of arrival	100%	60%	77%	89%	-	-
STANDARD 5: Blood Cultures obtained:						
✓ **STANDARD 5a**: 50% within one hour of arrival	50%	25%	45%	62%	40%	32%
✓ **STANDARD 5b**: 100% within four hours of arrival	100%	36%	59%	79%	-	-
STANDARD 6: Fluids – first intravenous crystalloid fluid bolus (up to 30mL/kg) given:						
✓ **STANDARD 6a**: 75% within one hour of arrival	75%	25%	43%	57%	40%	40%
✓ **STANDARD 6b**: 100% within four hours of arrival	100%	59%	78%	89%	-	-
STANDARD 7: Antibiotics administered:						
✓ **STANDARD 7a**: 50% within one hour of arrival	50%	28%	44%	58%	32%	27%
✓ **STANDARD 7b**: 100% within four hours of arrival	100%	70%	83%	91%	-	-
✓ **STANDARD 8**: Urine Output measurement/ Fluid Balance Chart instituted within four hours of arrival	100%	6%	18%	38%	-	-

Notes about the results

The **median** value of each indicator is that where equal numbers of participating EDs had results above and below that value. The median figures in the summary table may differ from other results quoted in the body of this report which are mean (average) values calculated over all audited cases.

The **lower quartile** is the median of the lower half of the data values.

The **upper quartile** is the median of the upper half of the data values.

Introduction

This report shows the results of an audit of adult patients who presented to Emergency Departments (ED) diagnosed with either severe sepsis or septic shock (Sepsis-2 definitions) or sepsis (Sepsis-3 definitions).

Since the last national audit in 2012/13, there has been a lot of work to bring sepsis high on the UK's national health agenda. RCEM has been represented and involved with the many projects and publications such as the APPG reports, UK Sepsis Trust Clinical Toolkits, the NCEPOD report, NHS England report and NICE Guidance.

New definitions for sepsis[i,ii,iii] and updated guidance from the Surviving Sepsis Campaign were published in 2016.

Many EDs will be involved in the new Commissioning for Quality and Innovation (nCQuIN) for sepsis which is set to continue in 2017/18.

In February 2017, the Cost of Sepsis Care in the UK report was published which shows that the estimated cost of sepsis in the UK is £7.76 billion, £830 million of which are direct costs.

A national audit of the management of sepsis therefore remains highly relevant to Emergency Medicine to drive up quality and save lives.

Background

RCEM clinical standards for severe sepsis and septic shock were first published in May 2009. The standards were based on the early resuscitation bundle published by the Surviving Sepsis Campaign. A national audit of the standards was undertaken for the first time in 2011/12. Following the audit, RCEM standards were revised in 2012 and 2016 and are based on the 'Sepsis-Six'.

The overall mortality rate for patients admitted with severe sepsis is 35% - approximately 5 times higher than for ST elevation myocardial infarction and stroke. Sepsis is responsible for approximately 44,000 deaths and 150,000 admissions[iv].

Severe sepsis is a time sensitive condition. In the most severe cases (septic shock), one study showed that for every hour appropriate antibiotic administration is delayed, there is an 8% increase in mortality[v]. The Sepsis-Six is an initial resuscitation bundle designed to offer basic interventions within the first hour; in a prospective observational study it was independently associated with survival, suggesting that if it alone were responsible for outcome differences, the number needed to treat (NNT) to prevent one death is 4.67. This compares to an NNT of 42 for aspirin in major heart attack and 45-90 for PCI in ST elevation myocardial infarction.

Case study on the recognition and treatment of sepsis in the ED

Although this audit only looks at the management of adults, sepsis awareness in ED staff is also applicable to children and EDs should ensure they have robust guidance and training in place. The case below, shared by a very grateful mother, highlights this.

This is an edited, anonymised case study on sepsis recognition in the ED and prompt initiation of the Sepsis-Six. The case study was produced in partnership with the patient's mother (name changed) and published with her permission.

On Saturday, two-year-old Mia had been unwell with a temperature not brought down by paracetamol and ibuprofen for four days and her mother called 111 for advice and visited an out of hours GP service. She enquired about an infection and the GP explained that there were no signs of an infection at this stage.

The next day, Sunday, Mia deteriorated; she was now finding it difficult to walk and her face was swollen and red. Mia's mother again called 111 and attended an out of hours GP service, enquiring about the possibility of meningitis.

On Monday, Mia had deteriorated further, now experiencing pain centred around her stomach area. She attended the ED and was discharged.

On Tuesday, Mia had become incoherent, was in and out of sleep, not urinating and now had a red rash on her stomach. Her mother called 999 and, on arrival at the hospital, Mia was in septic shock which was recognised by an ED nurse who promptly commenced the Sepsis-Six. She required

aggressive fluid resuscitation, antibiotics, inotropes, intubation and sedation and she was transferred to another hospital.

Mia spent four days sedated and ventilated, requiring IV Ig therapy alongside other treatments. She was discharged home after seven days and is now well.

Mia's mother contacted RCEM to share her story and feedback that Mia's life was saved by:

- prompt recognition of sepsis by the ED nurse, and
- prompt initiation of treatment in the ED.

Learning points from Mia's story include:

- a lack of awareness of sepsis in the public, meaning her mother was not primed to enquire about sepsis
- delays in recognising her sepsis lead to Mia arriving at the ED with septic shock and only a 50% chance of survival.

On December 15, 2016, the Department of Health, the UK Sepsis Trust and Public Health England with full support of RCEM launched its sepsis awareness campaign to help parents recognise the symptoms and signs of sepsis in children and to contact emergency services.

Aims

This audit was conducted for the third time to continue the work of the 2011/12 and 2013/14 data collections. It identifies current performance in EDs against RCEM clinical standards, shows the results in comparison with other departments, and also across time if there was previous participation in 2011/12 or 2013/14.

The objectives of this audit are:

1. To benchmark current performance in EDs against the standards
2. To allow comparison nationally and between peers
3. To identify areas in need of improvement
4. To compare against previous performance in 2011/12 and 2013/14
5. To collect sepsis-related organisational data

Methodology

Participation summary

Nationally, **13,129** cases from **196** EDs were included in the audit.

Country	Number of relevant EDs	Number of cases
National total	196/233 (84%)	13,129
England	171/179 (96%)	11,598
Scotland	6/26 (23%)	471
Wales	9/13 (69%)	430
Northern Ireland	8/9 (89%)	530
Isle of Man /Channel Islands	2/3 (67%)	100

Pilot methodology

A pilot of the audit was carried out prospectively from 13th July 2016 to 29th July 2016, with the help of 12 sites. The pilot period was used to test the audit questions and the quality of data collected.

Pilot sites

We are grateful to contacts from the following Trusts for helping with the development of the audit:

- Airedale General Hospital, Airedale NHS Foundation Trust
- Barnsley Hospital, Barnsley Hospital NHS Foundation Trust
- Blackpool Victoria Hospital, Blackpool Teaching Hospitals NHS Foundation Trust
- Doncaster Royal Infirmary, Doncaster and Bassetlaw Hospitals
- Peterborough City Hospital, Peterborough and Stamford Hospitals NHS Foundation Trust
- Queens Medical Centre, Nottingham University Hospitals NHS Trust
- Royal Blackburn Hospital, East Lancashire Hospitals NHS Trust
- Royal Gwent Hospital, Aneurin Bevan University Health Board
- Royal Lancaster Infirmary, University Hospitals of Morecambe Bay NHS Foundation Trust
- Royal Victoria Hospital, Belfast Health and Social Care Trust
- Southampton General Hospital, University Hospital Southampton NHS Foundation Trust
- Wexham Park Hospital, Frimley Health NHS Foundation Trust

Audit history

All EDs in the UK were invited to participate in July 2016. Data were collected using an online data collection tool. The audit is included in the NHS England Quality Accounts for 2016/2017.

Participants were asked to collect data from ED patient records on consecutive cases who presented to the ED between 1st January 2016 and 31st December 2016.

Sample size

RCEM recommended auditing a different number of cases depending on the number of patients seen within the data collection period. If this was an area of concern, EDs were able to submit data for more cases for a more in-depth look at their performance.

Basing the audit sample size on the number of cases in this way increased the reliability of your ED's audit results.

Audited cases were recommended to be collected consecutively during the data collection period (1 January 2016 to 31 December 2016).

Expected number of cases	Recommended audit sample
< 50	All eligible cases
50-250	50 consecutive cases
>250	100 consecutive cases

Standards

The audit asked questions against standards published by RCEM in June 2016:

Standard	Standard type
1. Respiratory Rate, Oxygen Saturations (SaO_2), Supplemental Oxygen Requirement, Temperature, Blood Pressure, Heart Rate, Level of Consciousness (AVPU or GCS) and Capillary Blood Glucose recorded on arrival	✓ **Fundamental**
2. Review by a senior (ST4+ or equivalent) ED medic or involvement of Critical Care medic (including the outreach team or equivalent) before leaving the ED	✓ **Developmental**
3. O_2 was initiated to maintain SaO_2>94% (unless there is a documented reason not to):	
a. 50% within one hour of arrival	✓ **Aspirational**
b. 100% within four hours of arrival	✓ **Developmental**
4. Serum Lactate measured within four hours of arrival	
a. 50% within one hour of arrival	✓ **Aspirational**
b. 100% within four hours of arrival	✓ **Developmental**
5. Blood Cultures obtained	
a. 50% within one hour of arrival	✓ **Aspirational**
b. 100% within four hours of arrival	✓ **Developmental**
6. Fluids – first intravenous crystalloid fluid bolus (up to 30mL/kg) given:	
a. 75% within one hour of arrival	✓ **Developmental**
b. 100% within four hours of arrival	✓ **Fundamental**
7. Antibiotics administered:	
a. 50% within one hour of arrival	✓ **Developmental**
b. 100% within four hours of arrival	✓ **Fundamental**
8. Urine Output measurement/ Fluid Balance Chart instituted within four hours of arrival	✓ **Developmental**

Understanding the different types of standards

✔ **Fundamental**: need to be applied by all those who work and serve in the healthcare system. Behaviour at all levels and service provision need to be in accordance with at least these fundamental standards. No provider should provide any service that does not comply with these fundamental standards, in relation to which there should be zero tolerance of breaches.

✔ **Developmental**: set requirements over and above the fundamental standards.

✔ **Aspirational**: setting longer term goals.

For definitions on the standards, refer to appendix.

QIP   **Quality Improvement Project**

This symbol identifies an area that would be a good topic nationally for a QIP. Local QIP priorities may vary depending on performance.

About this report

Understanding the charts

There are different types of charts within this report to present the data. The example graphs below show the type of charts you will encounter.

Time and date
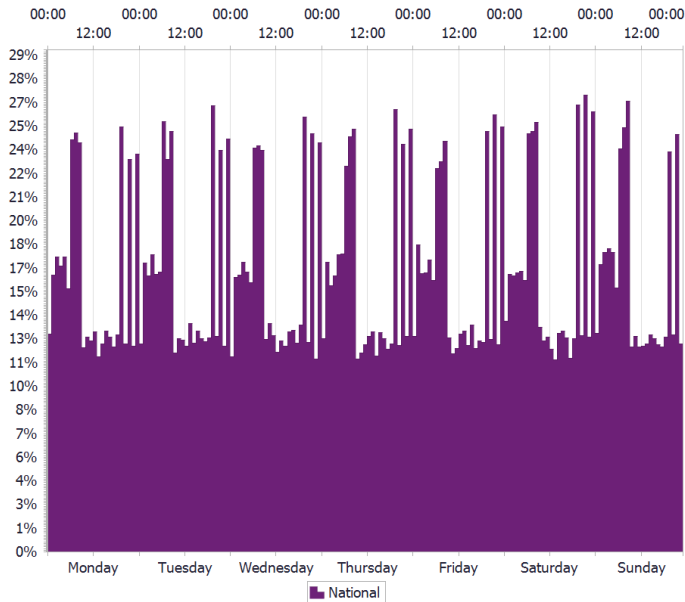
This chart shows the day and time of patient arrivals. Higher bars show when a lot of patients are arriving in the ED, whereas lower bars show quieter arrival times.

Sorted Bar Chart
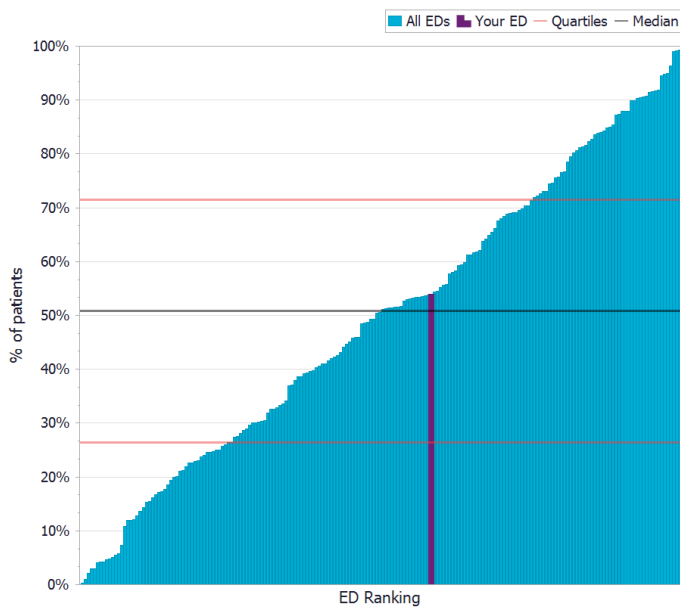
Sorted bar charts show the national performance, where each bar represents the performance of an individual ED. The horizontal lines represent the median and upper/lower quartiles.

Stacked Bar Chart
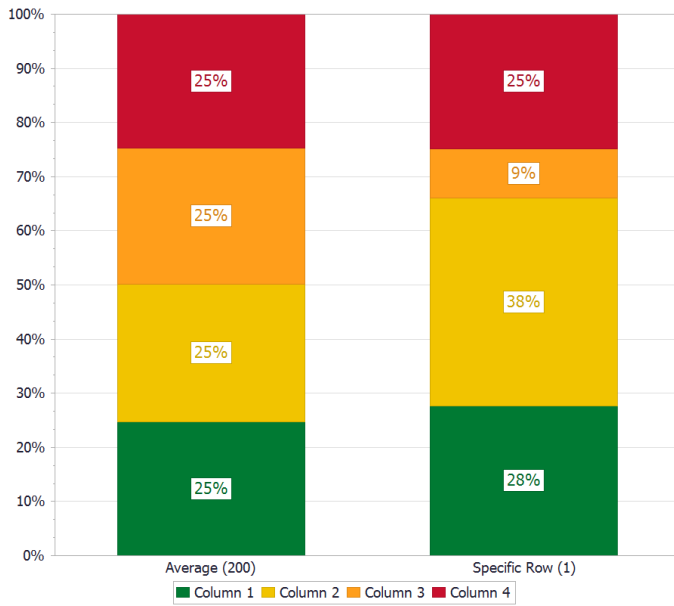
Stacked bar charts show the breakdown of a group nationally. These are used when it will be helpful to compare two groups side by side, for example comparing local data with the national data.

Stacked sorted bar chart
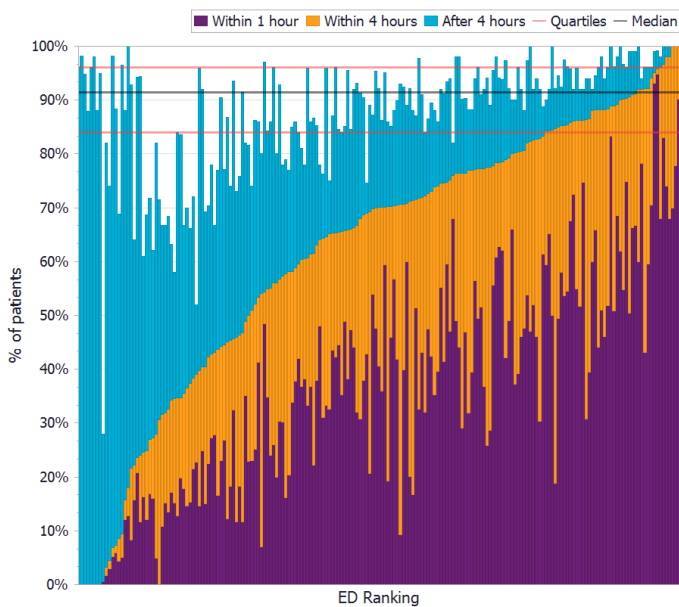
These charts are similar to the sorted bar charts, but like stacked bar charts, they show the breakdown of a group for each ED. These are used when it will be helpful to compare two or more variables for each ED in the sample.

Section 1: Organisational audit

Results of the organisational audit conducted in 196 EDs.

Q1a-f: Organisational features
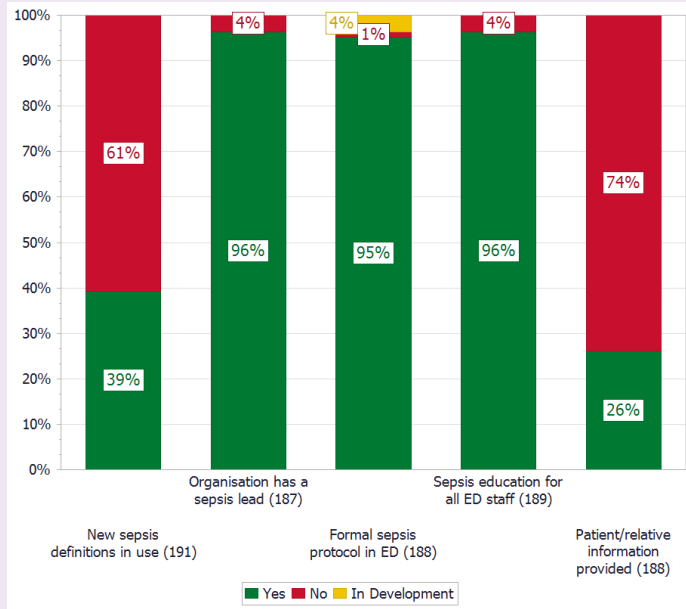
Sample: all EDs

This was the first time that organisational data were analysed. Almost all EDs have a sepsis lead, a sepsis protocol and provide sepsis education (96%, 95% and 96% respectively). This is a great achievement and shows how responsive we are as a specialty to the many recommendations for improved organisation that have come from national reports. Patient information should be the next focus, as currently only 26% of EDs provide it.

The new (Sepsis-3) definitions were published in early 2016 and 39% of EDs have started to use them.

Q1d: If the ED has a protocol, does it include guidance on:
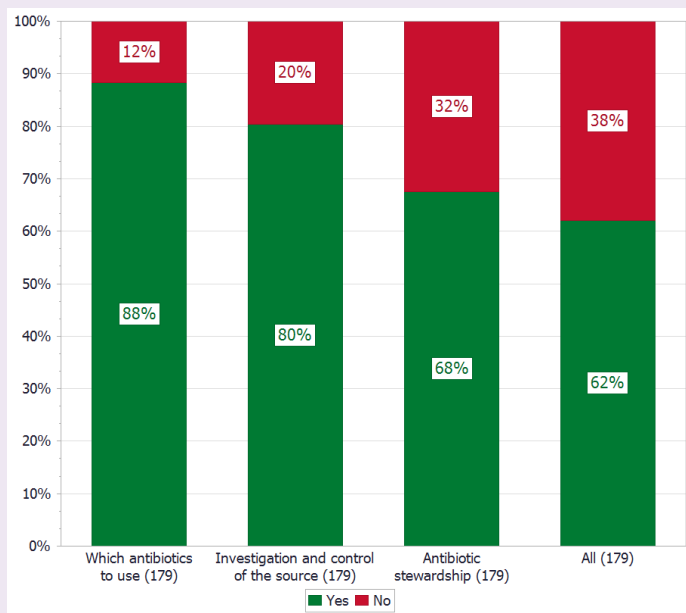
Sample: Q1c = yes

The key elements of a sepsis protocol should assist the treating clinician in patient management. As well as assisting with the diagnosis, ED sepsis leads should review their protocol and ensure that it covers the choice of antibiotic for the local population, how to investigate and control the source of the infection and highlight the importance of good antibiotic stewardship.

Section 2: Casemix

National casemix and demographics of the patients

Q3&4: Date and time of arrival
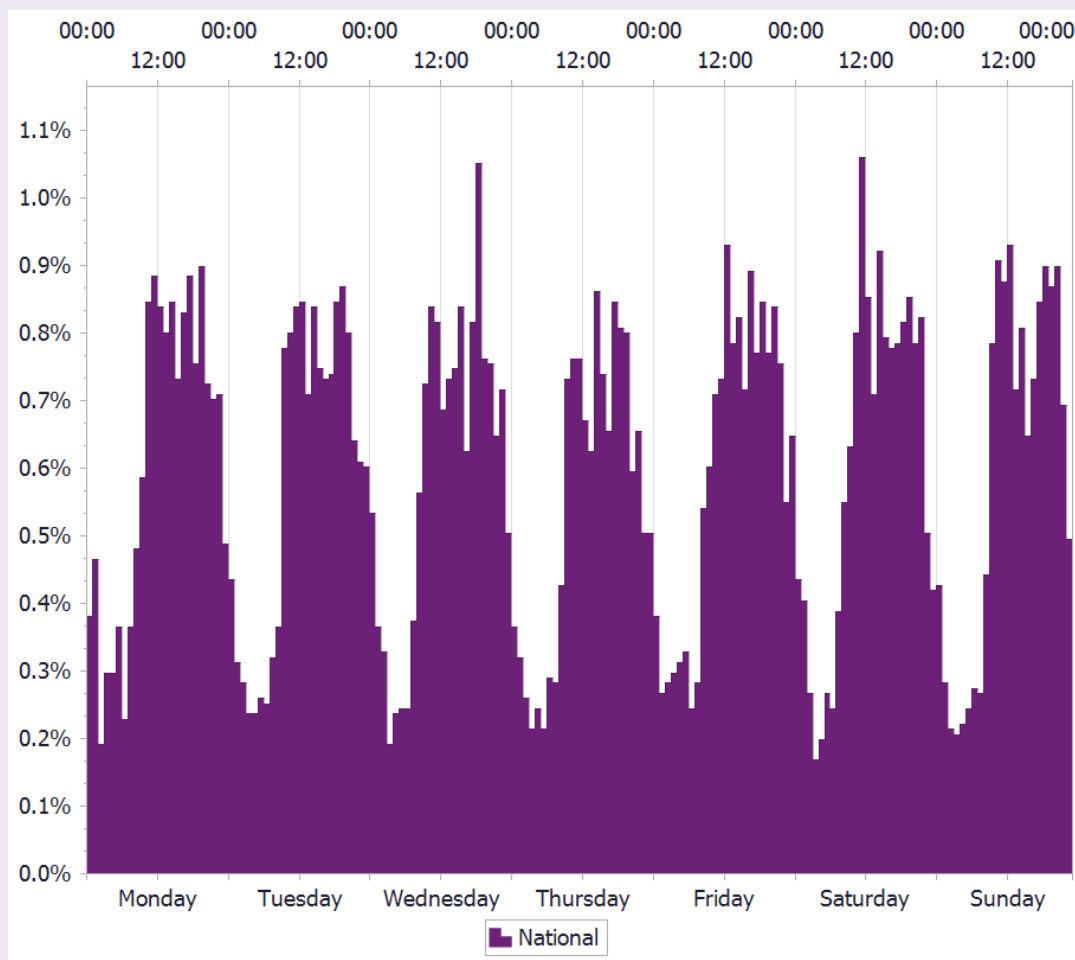
Sample: all patients

The time and day of presentation follows a normal pattern of ED attendances during the day, with no reduction over the weekend and increased attendance on Mondays and Tuesdays.

Section 3: Audit results

Vital sign monitoring

Q5: Were the following vital signs recorded on arrival: respiratory rate, oxygen saturations (SaO2), supplemental oxygen requirement, temperature, blood pressure, heart rate, level of consciousness (AVPU or GCS) and capillary blood glucose?
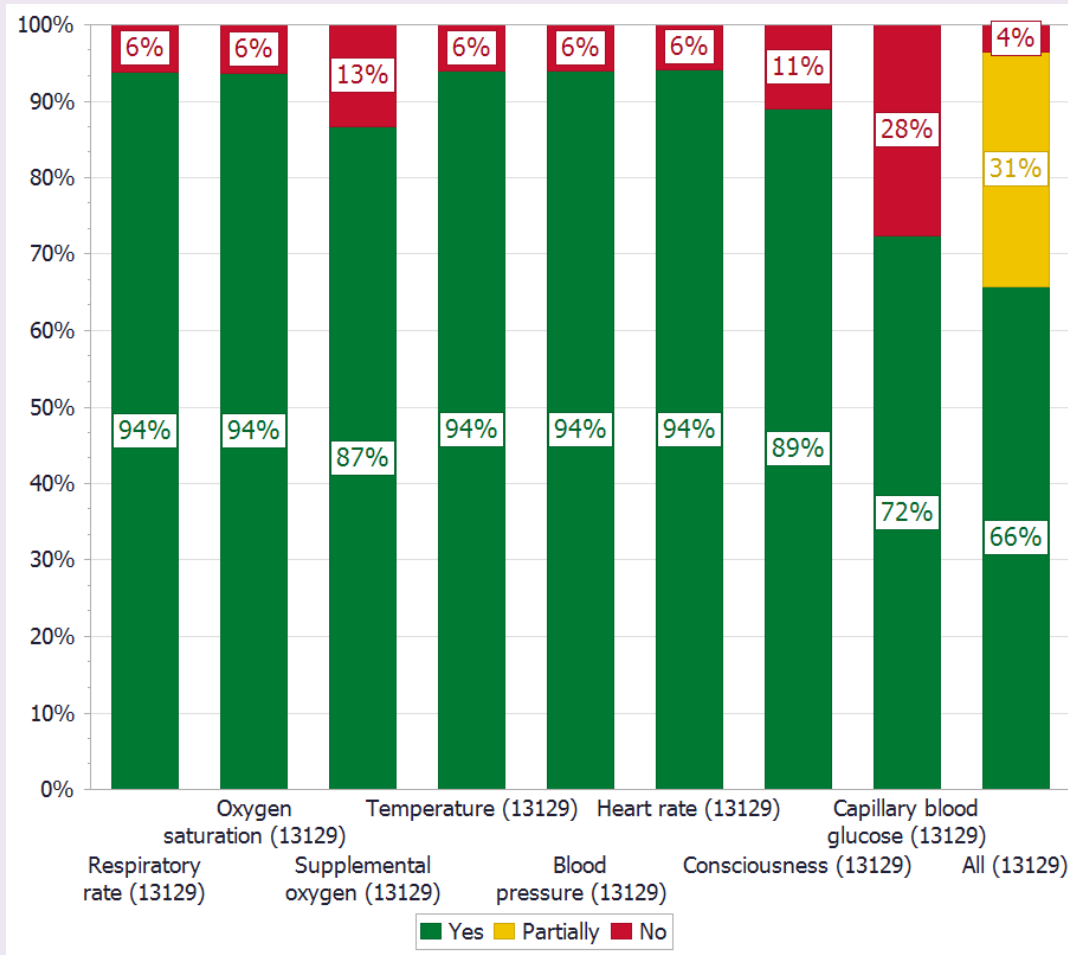
✅ **STANDARD 1:** Respiratory Rate, Oxygen Saturations (SaO2), Supplemental Oxygen Requirement, Temperature, Blood Pressure, Heart Rate, Level of Consciousness (AVPU or GCS) and Capillary Blood Glucose recorded on arrival

Sample: all patients

Early recognition of sepsis is critical to the clinical outcome. Using the national Early Warning Score (NEWS) in the ED is increasingly common and has been shown to rapidly identify patients with sepsis. All patients with suspected sepsis and a NEWS of 3 should undergo immediate screening for sepsis[vi].

Systematic Inflammatory Response Syndrome (SIRS) criteria are still used in some EDs and includes the capillary blood glucose. In future audits during the transition to the Sepsis-3 definitions, capillary blood glucose will be reported separately.

Conscious level, supplemental oxygen requirement and capillary blood glucose are the weak points in recording patient observations. Efforts should be made to ensure that staff are supported in recording all observations and, if required, accurately calculating the patient's NEWS.

Red Flag Sepsis

Due to diagnostic delays that occur in the ED, especially with the introduction of the Sepsis-3 definitions, it is acceptable to start the Sepsis-Six in the presence of any 'Red Flags' in suspected sepsis cases. Following publication of the NICE guidance, the Red Flags are:

- Responds only to Voice, Pain or Unresponsive

- Systolic blood pressure ≤90mmHg

- Heart rate >130

- Respiratory rate >25

- Needs oxygen to maintain SaO_2 >92%

- Non-blanching rash/ mottled/ cyanotic

- Has not passed urine in the last 18 hours

- Urine output <0.5mL/kg/hr

- Lactate ≥2mmol/L

- Recent chemotherapy

If any one of the above is present, RCEM supports the recommendation to commence the Sepsis-Six immediately, ideally within one hour of the patient's attendance to the ED.

All vital signs monitored: variation in median performance across all EDs
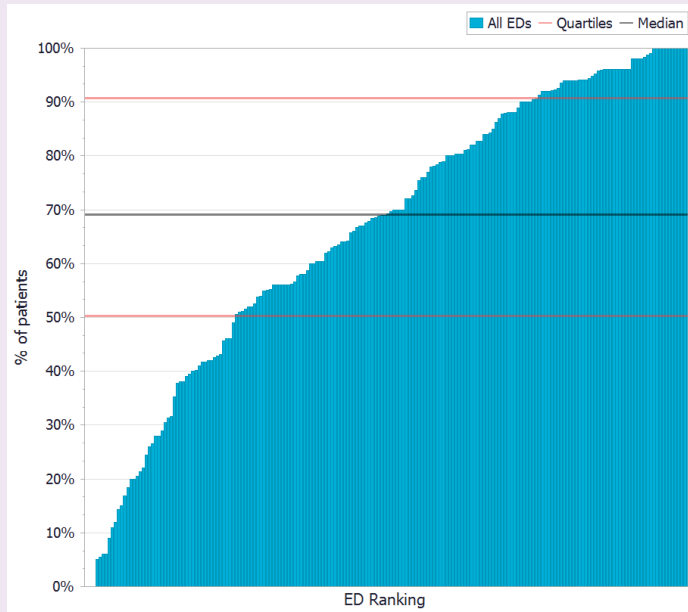
✅ **STANDARD 1:** Respiratory Rate, Oxygen Saturations (SaO2), Supplemental Oxygen Requirement, Temperature, Blood Pressure, Heart Rate, Level of Consciousness (AVPU or GCS) and Capillary Blood Glucose recorded on arrival

Sample: all patients

There appears to be vast differences between EDs across the UK which suggests that we should look in more detail at the observations that we do and do not record.

Vital signs monitoring compared to previous years
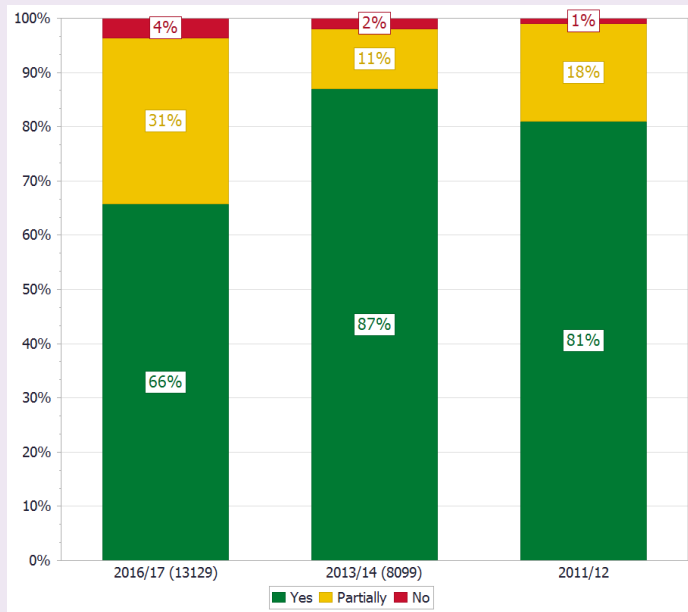
Sample: all patients

This audit looked at more vital signs than previous audits and it is therefore not possible to draw any conclusions as this is not a direct comparison of performance.

Individual EDs should routinely monitor their performance against those vital signs which they measure to ensure the early identification of patients with sepsis.

Senior clinician involvement in care

Q6a: Was the patient reviewed by a senior (ST4+ or equivalent) ED medic or Critical Care medic (including the outreach team or equivalent) involved in the patient's care before leaving the ED?
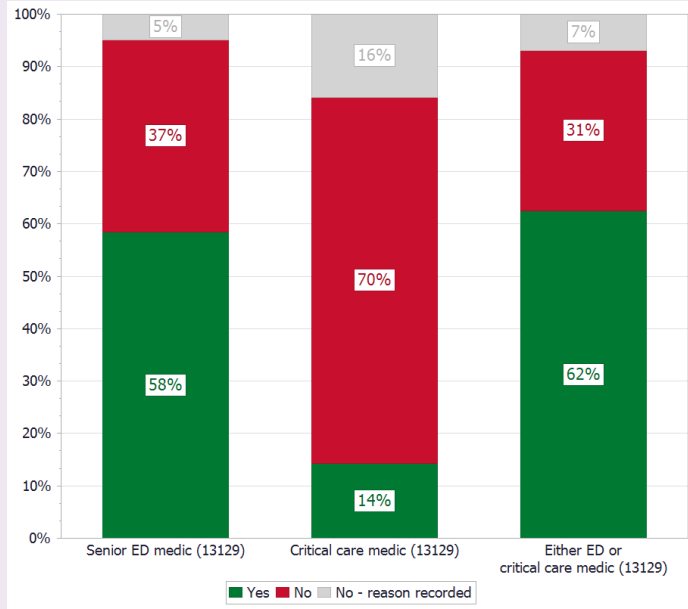
STANDARD 2: Review by a senior (ST4+ or equivalent) ED medic or involvement of Critical Care medic (including the outreach team or equivalent) before leaving the ED

Sample: all patients

The mortality from sepsis is high. All patients with this diagnosis should be discussed with a senior ED medic or Critical Care medic (including the outreach team or equivalent) to plan the best possible management for the patient.

Treatment times

Q7-12: Were the following elements of the Sepsis-Six done?
- Oxygen initiated to maintain SaO2>94% within 1 or 4 hours
- Serum lactate measurement obtained within 1 or 4 hours
- Blood cultures obtained within 1 or 4 hours
- The first intravenous crystalloid fluid bolus (up to 30ml/kg) given within 1 or 4 hours
- Antibiotics administered in the ED within 1 or 4 hours
- Urine output measurement/ Fluid Balance Chart instituted within 4 hours
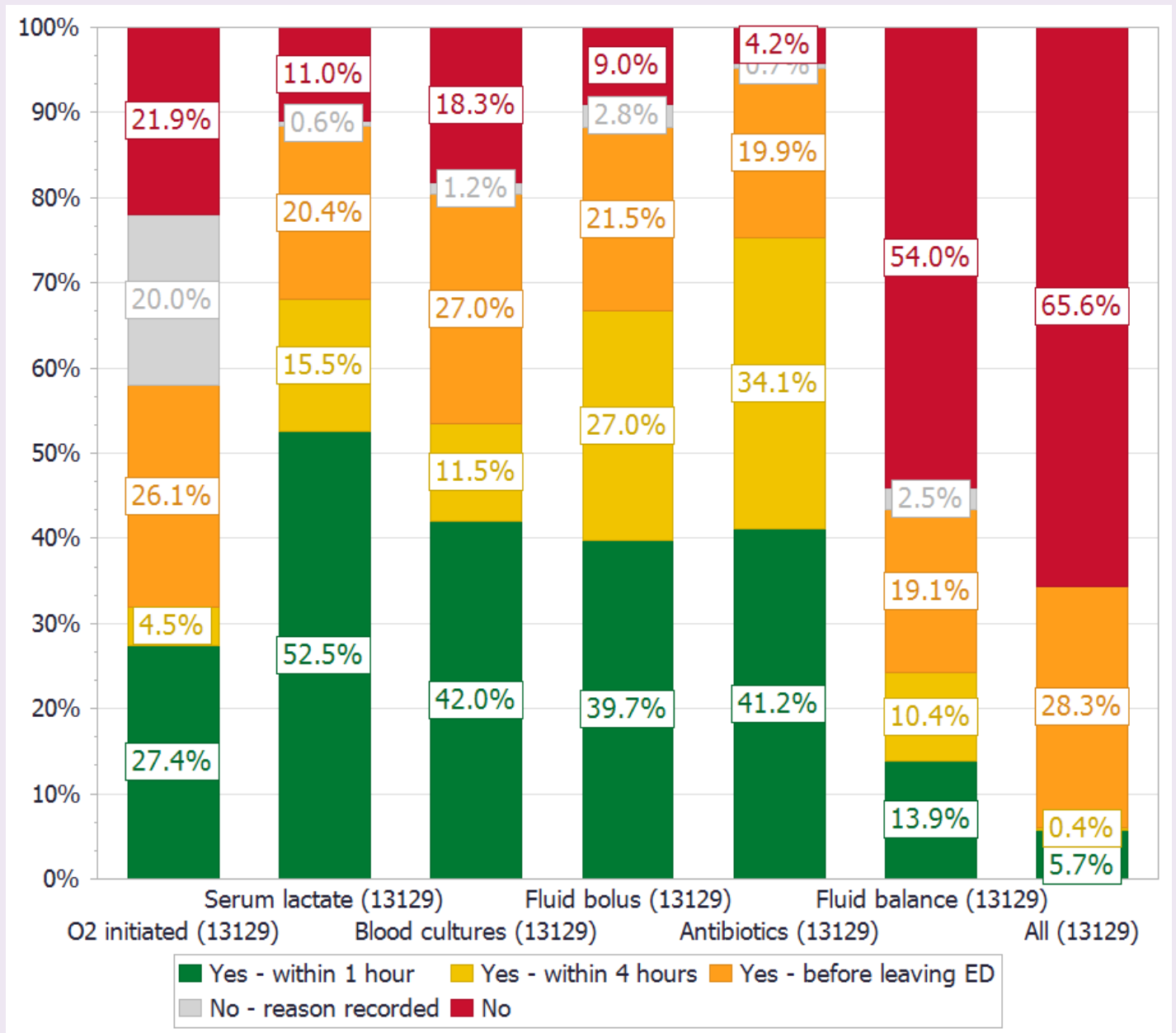
Sample: all patients

Treatment before leaving ED

Q7-12: All elements of the Sepsis-Six done before leaving the department
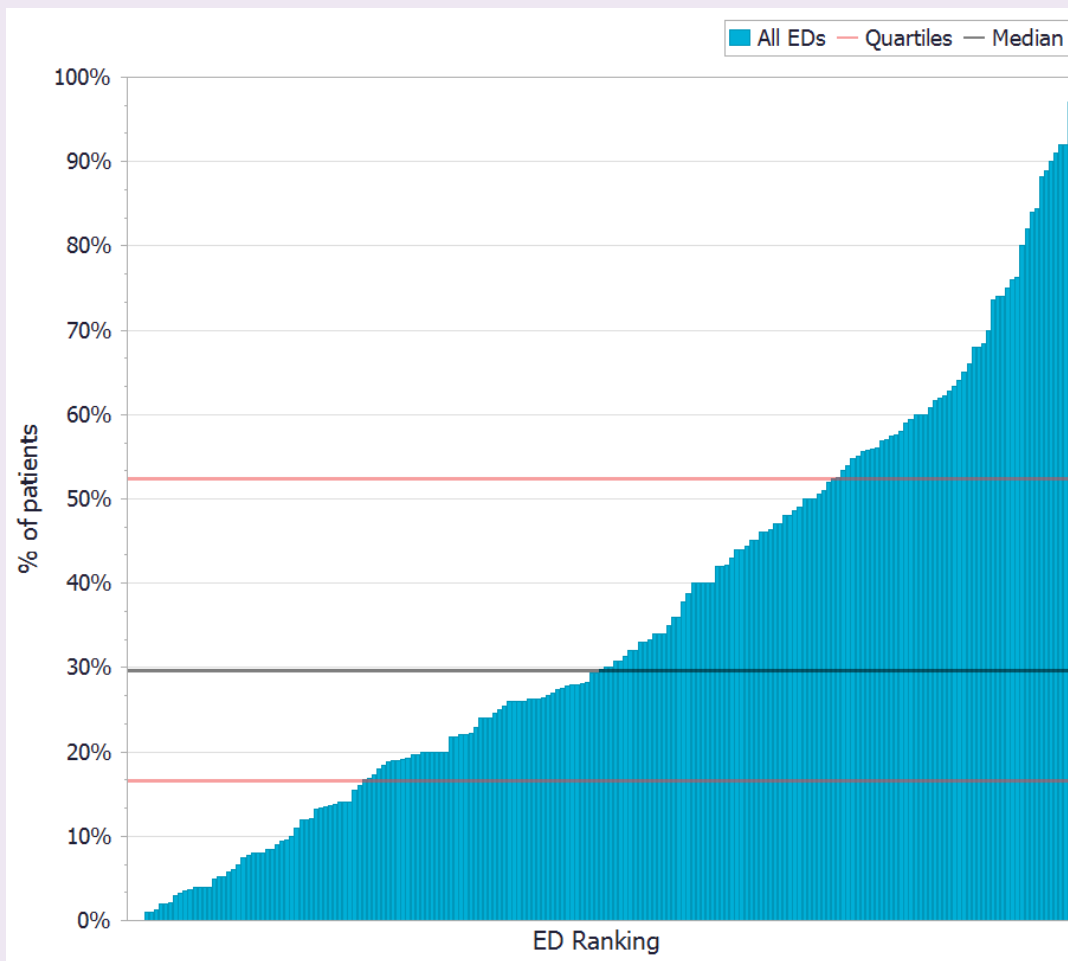
Sample: all patients

Q7. Was oxygen initiated to maintain SaO$_2$>94%

O2 was initiated to maintain SaO2>94% (unless there is a documented reason not to)

STANDARD 3a: 50% within 1 hour of arrival

STANDARD 3b: 100% within 4 hours of arrival

Sample: all patients excluding Q7 = 'no – reasons recorded'
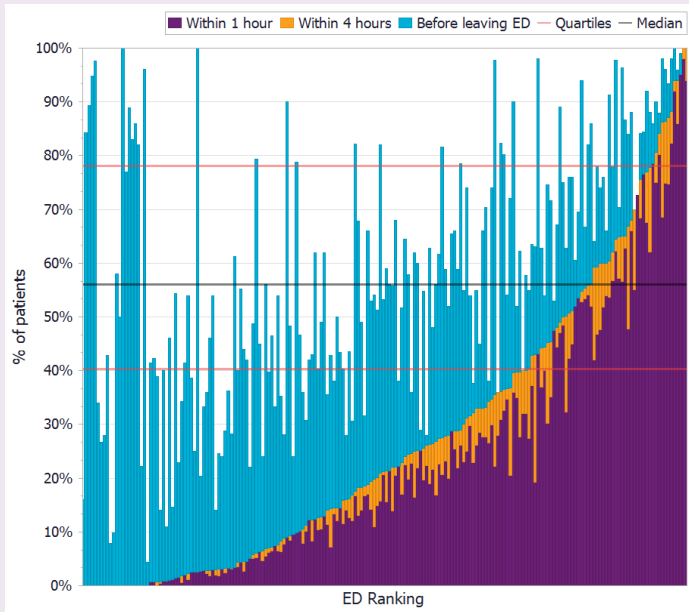
Oxygen initiated compared to previous years

The presence of hypoxia is easily detected in EDs due to the availability of oxygen saturation monitors. Where appropriate, correction of hypoxia with supplemental oxygen to maintain SaO$_2$ >94% is simple.

Individual departments should look at how they can improve as these results indicate that hypoxic patients are not being recognised or treated in a timely manner.

Q8. Was serum lactate measurement obtained prior to leaving the ED?

Serum Lactate measured within four hours of arrival

✔ **STANDARD 4a:** 50% within 1 hour of arrival

✔ **STANDARD 4b:** 100% within 4 hours of arrival

Sample: all patients excluding Q8 = 'no – reasons recorded'

Serum lactate initiated compared to previous years
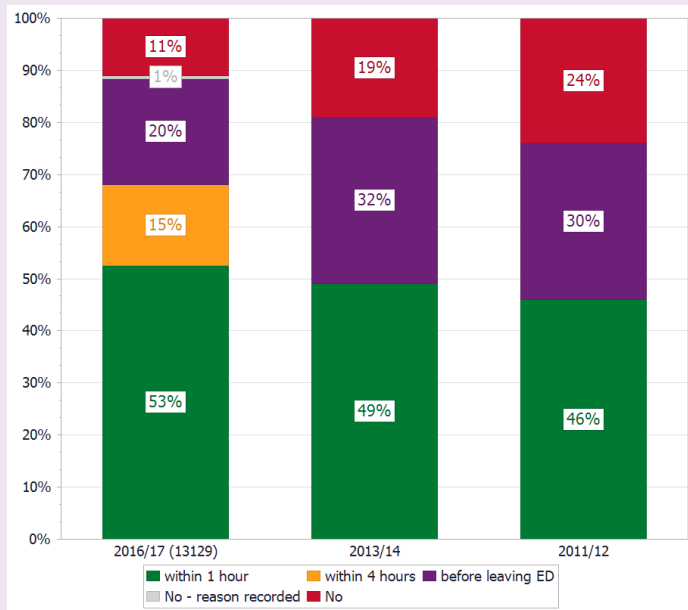
It is encouraging to see that the measurement of lactate is becoming faster and more widely available to patients in the ED.

High lactate remains part of the new definition of septic shock and is an important measure of the effectiveness of resuscitation.

Q9. Were blood cultures obtained prior to leaving the ED?
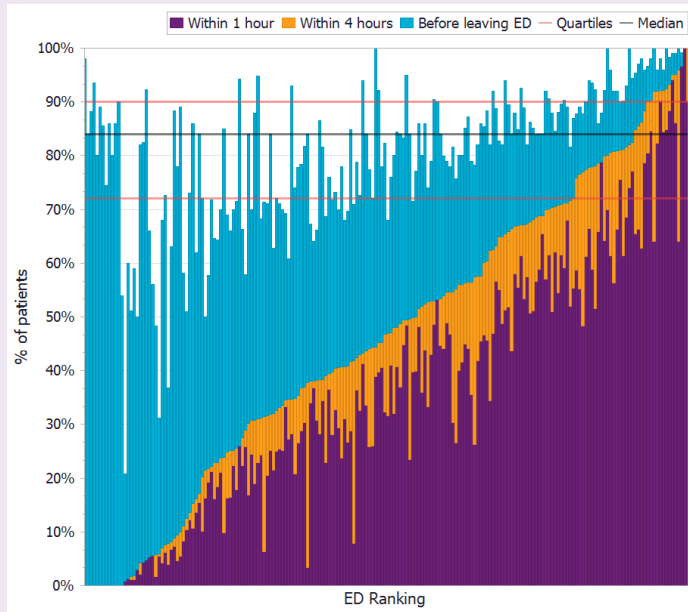
Blood Cultures obtained

✓ **STANDARD 5a:** 50% within 1 hour of arrival

✓ **STANDARD 5b:** 100% within 4 hours of arrival

Sample: all patients excluding Q9 = 'no – reasons recorded'

Blood cultures compared to previous years
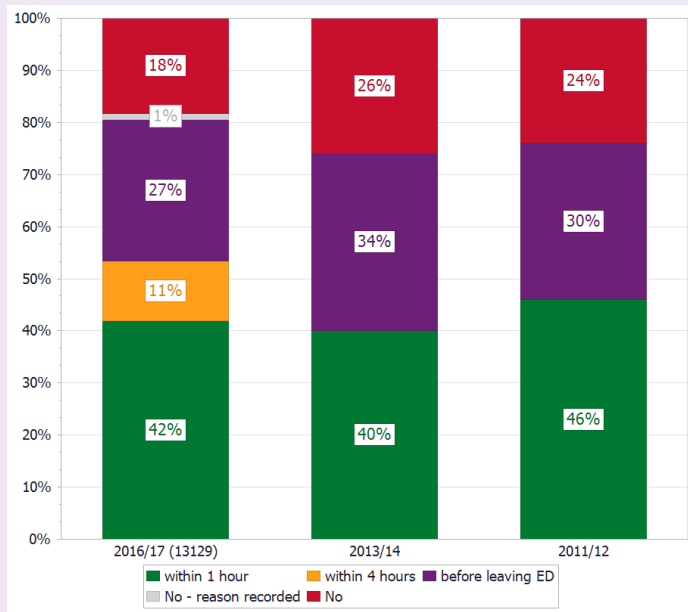
The blood culture result may be the only indication of the causative organism and which antibiotics the patient needs.

It is vital that blood cultures as well as other samples such as sputum and urine are collected as soon as possible to help identify the cause of the patient's sepsis.

These results are encouraging after the dip in the previous audit.

Q10. Was the first intravenous crystalloid fluid bolus (up to 30ml/kg) given in the ED?
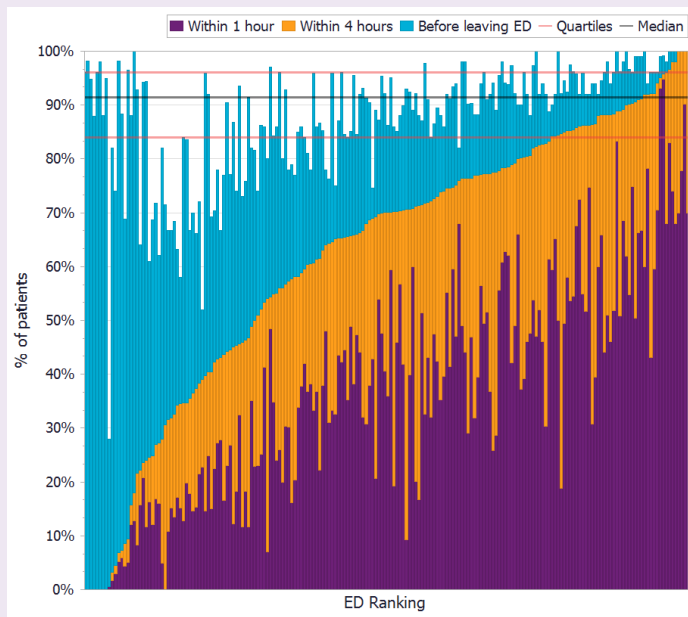
Fluids – first intravenous crystalloid fluid bolus (up to 30mL/kg) given

QIP

✓ **STANDARD 6a:** 75% within 1 hour of arrival

✓ **STANDARD 6b:** 100% within 4 hours of arrival

Sample: all patients excluding Q10 = 'no – reasons recorded'

Intravenous crystalloid fluid bolus initiated compared to previous years
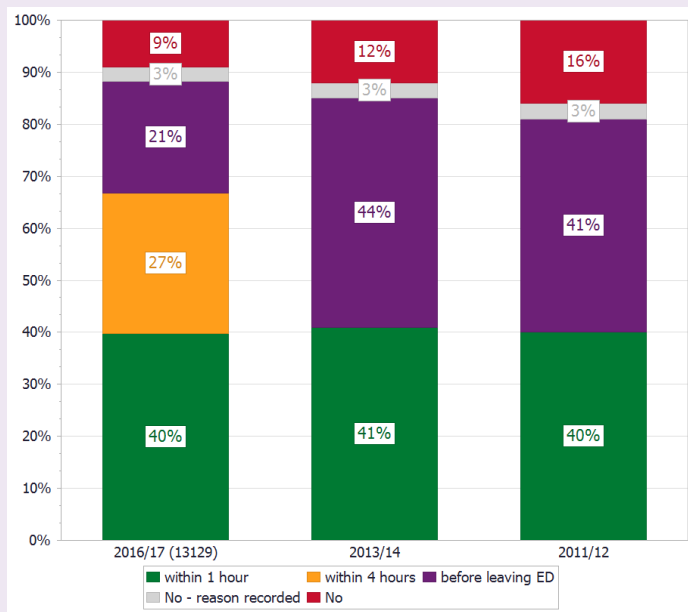
An initial bolus of fluid is an important part of resuscitation in sepsis. The volume given will depend on each patient and the patient's fluid status will need to be carefully monitored thereafter to ensure adequate fluid maintenance.

Recognition of the importance of fluid resuscitation has improved since the first audit and the simplicity of fluid administration makes it surprising that we do not achieve this in a more timely manner compared to the other standards.

Q11. Were antibiotics administered in the ED?

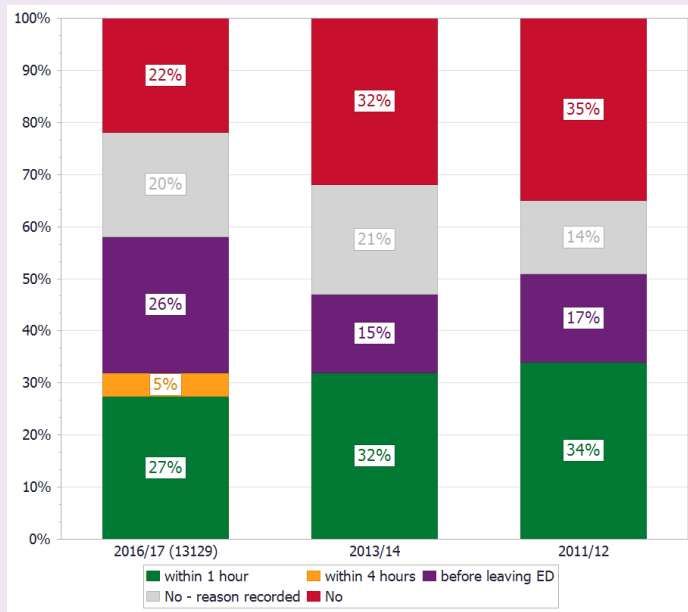Antibiotics administered

QIP
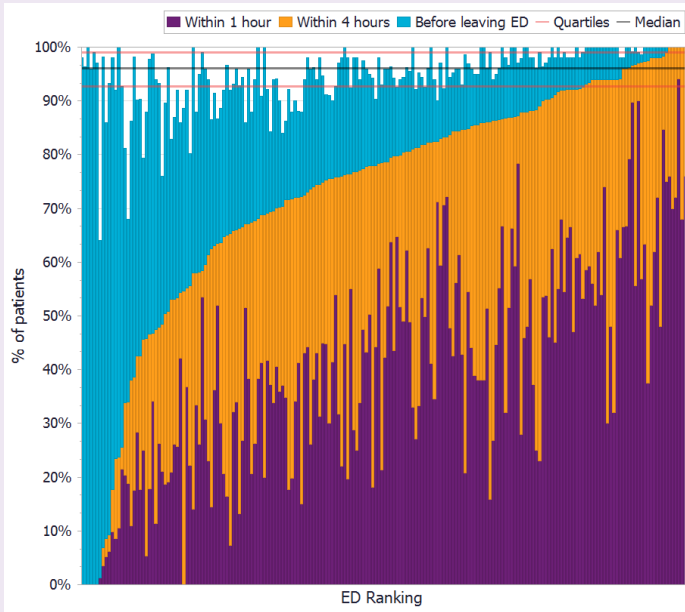
✓ **STANDARD 7a:** 50% within 1 hour of arrival

✓ **STANDARD 7b:** 100% within 4 hours of arrival

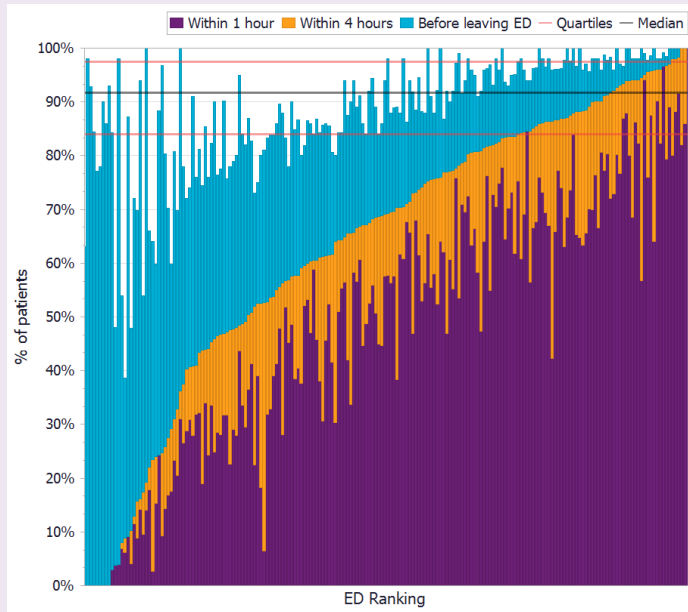*Sample: all patients excluding Q11 = 'no – reasons recorded'*

Antibiotics administered compared to previous years
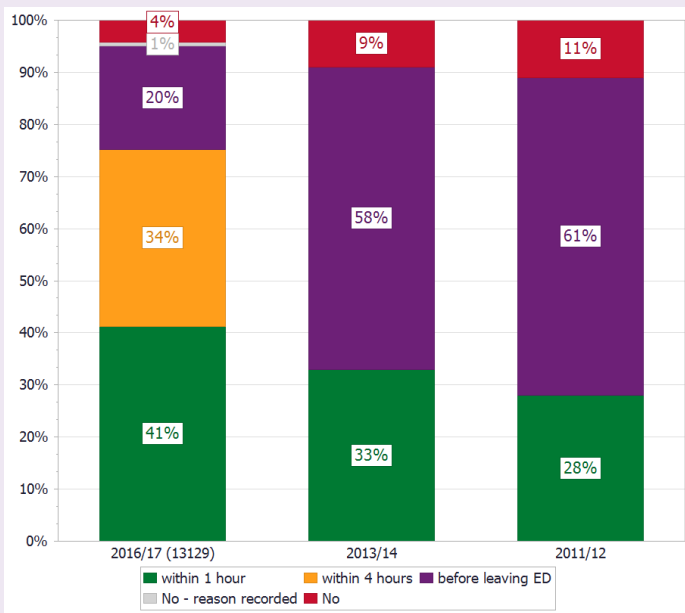
The steady improvement in door-to-antibiotic times in sepsis is testament to a lot of hard work and dedication by ED staff all over the UK.

This has been a very challenging target for many and there is still work to be done to fully achieve the RCEM standards but these results are very promising.

Q12. Was urine output measurement/ Fluid Balance Chart instituted prior to leaving the ED?
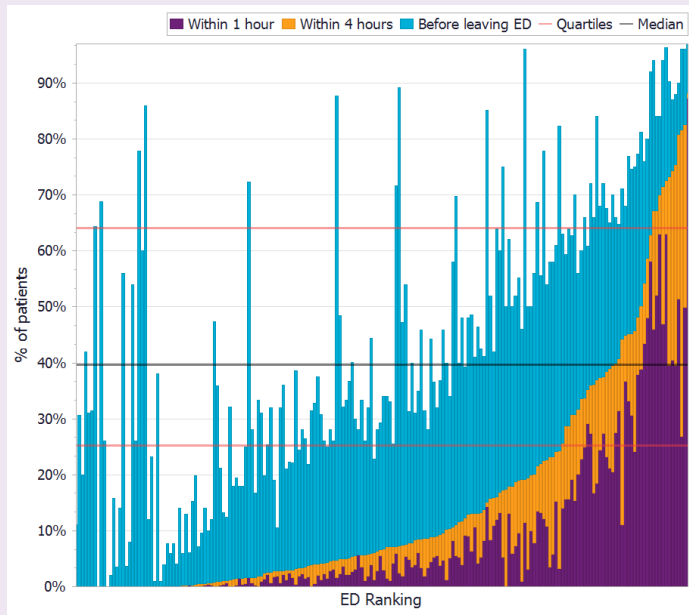
STANDARD 8a: Urine Output measurement/ Fluid Balance Chart instituted within four hours of arrival

Sample: all patients excluding Q12 = 'no – reasons recorded'

Fluid resuscitation is important but cannot be determined universally. All patients must receive adequate fluids which can only be monitored using the patient's urine out measurement/ fluid balance charts. This allows specific fluid therapy to be calculated for each individual patient.

Urine output measurement/ Fluid Balance Chart instituted compared to previous years
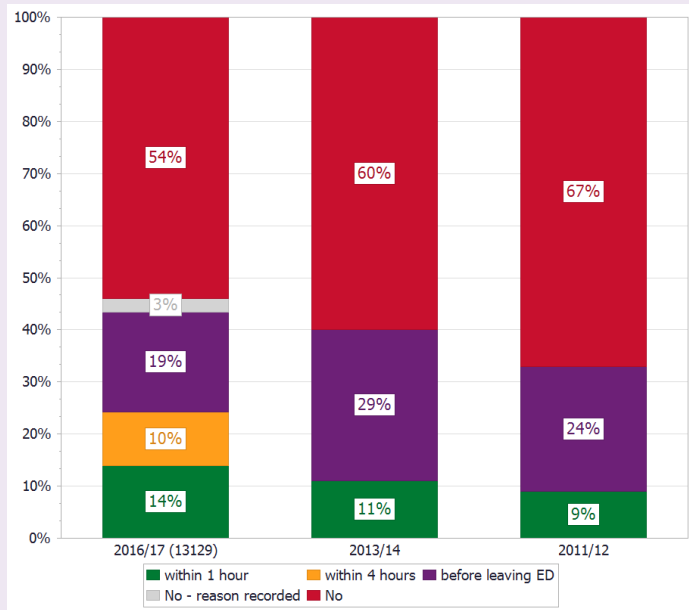
The results show steady improvement over the years although this is the weakest area of the management of sepsis. It is possible that this is due to poor documentation but sepsis leads should all be mindful of the importance of ongoing fluid requirements in patients with sepsis.

Analysis

Organisational data

This was the first time that organisational data were analysed. Almost all EDs have a sepsis lead, a sepsis protocol and provide sepsis education (96%, 95% and 96% respectively). This is a great achievement and shows how responsive we are as a specialty to the many recommendations for improved organisation that have come from national reports. Patient information should be the next focus, as currently only 27% of EDs provide it.

The new (Sepsis-3) definitions were published in early 2016 and only 39% of EDs have started to use them.

Patient data

Due to changes of the standards, only five standards are directly comparable to previous audits, all of which are part of the Sepsis-Six and all measured within an hour of the patient's arrival to the ED.

There has been a steady improvement in the giving of **antibiotics** over the years and **44%** of patients will receive them within an hour of arrival. There has been a slight improvement in the giving of **IV fluids** from 40% to **43%**. The taking of **blood cultures** and the measurement of **lactate** in the first hour have both improved, up from 40% to **45%** and 49% to **60%** respectively. Documentation of **urine output** measurement is poor at only **18%**.

Documentation of a full set of observations including capillary blood glucose on arrival is currently at 69% although this is achieved by the upper quartile in 91% of patients. The number is brought down significantly by including capillary blood glucose. Senior review of patients with sepsis is at 65% and this could be an important factor affecting care.

Limitations

For the purposes of this audit, the following patient populations were excluded:

- Patients aged 17 or under
- Patients not diagnosed with severe sepsis or septic shock
- Patients with hypoperfusion (high lactate) or a persistently low blood pressure without evidence of sepsis or infection
- Patients diagnosed with sepsis or septic shock after being discharged from the ED

Summary of recommendations

1. All EDs should have a sepsis lead and a sepsis protocol

2. RCEM recommends that all sepsis leads consider the following:
   a) Is everything being done to ensure that a full set of timely observations is performed on every patient?
   b) Is there a more senior doctor available to review patients with sepsis 24/7?
   c) Is oxygen considered part of the treatment for sepsis and how is this clearly documented?
   d) Is lactate measurement possible and simple in your department?
   e) Does your hospital give clear instructions on which antibiotics should be used?
   f) Does your protocol encourage urine output monitoring, especially if the patient does not require a catheter?

3. Early recognition of sepsis is critical to the clinical outcome. All patients with suspected sepsis and a NEWS of 3 should undergo immediate screening for sepsis[vi].

4. Patient information should be provided to all patients, and/or relatives, admitted with sepsis.

5. Standardise pathways of care for patients fulfilling sepsis criteria to improve timely delivery of care and therefore outcomes

6. Education and training around these for wider team for early recognition and instigation of optimal care

Using the results of this audit to improve patient care

The results of this audit should be shared with all staff, including doctors and nurses, who have responsibility for looking after patients diagnosed with severe sepsis or septic shock.

Discussing the results of this audit with colleagues is a good way of demonstrating the ED's commitment to improving care. Engaging staff in the action planning process will lead to more effective implementation of the plan.

EDs may wish to consider using a rapid cycle audit methodology and/or a Quality Improvement Project, which can be used to track performance against standards, as a tool to implement the action plan. For further resources, please visit the RCEM Quality Improvement webpage.

Further Information

Thank you for taking part in this audit. We hope that you find the results helpful.

If you have any queries about the report please e-mail audit@rcem.ac.uk or phone 020 7400 6108.

Details of the RCEM Clinical Audit Programme can be found under the Current Audits section of the RCEM website.

Feedback

We would like to know your views about this report and participating in this audit. Please let us know what you think by completing our feedback survey: www.surveymonkey.co.uk/r/RCEMaudit16

We will use your comments to help us improve our future audits and reports.

Useful Resources

- Site-specific report – available to download from the clinical audit website
- Site-specific PowerPoint presentation developed to help you disseminate your site-specific audit results easily and efficiently – available to download from the clinical audit website for registered users
- Local data file – a spreadsheet that allows you to conduct additional local analysis using your site-specific data for this audit. Available to download from the clinical audit website for registered users
- National data file - you can also access data from other EDs to customise your peer analysis
- RCEM Learning modules on sepsis
- Patient information leaflet (Sepsis Trust)

Report authors and contributors

This report is produced by the Standards and Audit Committee subgroup of the Quality in Emergency Care Committee, for the Royal College of Emergency Medicine.

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Endorsements

This report is endorsed by

Appendices

Appendix 1: Audit questions

Organisational audit			
Only one response per ED is required for questions Q1a-f			
Q1a	Has your department started to use the new definitions of sepsis (Sepsis-3)?	Yes No	
Q1b	Does your Trust/ organisation have a sepsis lead?	Yes No	
Q1c	Does your department have a formal protocol for the early identification and immediate management of patients with sepsis?	Yes In development No	
Q1d	If yes, does the protocol include guidance on: (tick all that apply)	Which antibiotics to use	
		Investigation and control of the source	
		Antibiotic stewardship	
Q1e	Does your department/ Trust/ organisation provide sepsis education for all ED staff?	Yes No	
Q1f	Does your department provide patient information for patients and/or relatives admitted with sepsis?	Yes No	

Patient audit

Q2	Patient reference	
Q3	Date of arrival *(dd/mm/yyyy)*	dd/mm/yyyy
Q4	Time of arrival *(Use 24 hour clock e.g. 11.23pm = 23:23)*	HH:MM

Tick appropriate response

Q5	Were the following vital signs recorded on arrival: Respiratory Rate, Oxygen Saturations (SaO$_2$), Supplemental Oxygen Requirement, Temperature, Blood Pressure, Heart Rate, Level of Consciousness (AVPU or GCS) and Capillary Blood Glucose	Yes, all	
		Partially (tick all that apply):	
		-Respiratory Rate	
		-Oxygen Saturations (SaO$_2$)	
		-Supplemental Oxygen Requirement	
		-Temperature	
		-Blood Pressure	
		-Heart Rate	
		-Level of Consciousness (AVPU or GCS)	
		-Capillary Blood Glucose	
		Not recorded	

Q6a	Was the patient reviewed by a senior (ST4+ or equivalent) ED medic before leaving the ED?	Yes	
		No – reasons recorded	
		Not recorded	
		Time seen	HH:MM
Q6b	Was the Critical Care medic (including the outreach team or equivalent) involved in the patient's care before leaving the ED?	Yes	
		No – reasons recorded	
		Not recorded	
		Time seen	HH:MM

		Yes	Time (leave blank if unknown)	Date (for use if different to date of admission)	No – reasons recorded (e.g. done pre-hospital)	No / not recorded
Q7	Was oxygen initiated to maintain SaO$_2$>94%		HH:MM	dd/mm/yyyy		
Q8	Was serum lactate measurement obtained prior to leaving the ED?		HH:MM	dd/mm/yyyy		
Q9	Were blood cultures obtained prior to leaving the ED?		HH:MM	dd/mm/yyyy		
Q10	Was the first intravenous crystalloid fluid bolus (up to 30ml/kg) given in the ED?		HH:MM	dd/mm/yyyy		
Q11	Were antibiotics administered in the ED?		HH:MM	dd/mm/yyyy		

| Q12 | Was urine output measurement/ Fluid Balance Chart instituted prior to leaving the ED? | | HH:MM | dd/mm/yyyy | | |

Notes

Appendix 2: Participating Emergency Departments

Aberdeen Royal Infirmary
Addenbrooke's Hospital
Aintree University Hospital
Airedale General Hospital
Alexandra Hospital
Altnagelvin Area Hospital
Antrim Area Hospital
Arrowe Park Hospital
Barnet Hospital
Barnsley Hospital
Basildon University Hospital
Basingstoke and North Hampshire Hospital
Bassetlaw Hospital
Bedford Hospital
Blackpool Victoria Hospital
Bradford Royal Infirmary
Bristol Royal Infirmary (Adults)
Bronglais General Hospital
Broomfield Hospital
Calderdale Royal Hospital
Causeway Hospital
Charing Cross Hospital
Chelsea & Westminster Hospital
Cheltenham General Hospital
Chesterfield Royal Hospital
City Hospital (Birmingham)
Colchester General Hospital
Conquest Hospital
Countess of Chester Hospital
County Hospital Stafford
Craigavon Area Hospital
Croydon University Hospital
Daisy Hill Hospital
Darent Valley Hospital
Darlington Memorial Hospital
Derriford Hospital
Diana, Princess Of Wales Hospital
Doncaster Royal Infirmary
Dorset County Hospital
Dr Gray's Hospital
Ealing Hospital
East Surrey Hospital
Eastbourne District General Hospital
Epsom General Hospital
Fairfield General Hospital
Forth Valley Royal Hospital
Friarage Hospital

Frimley Park Hospital
Furness General Hospital
George Eliot Hospital
Glan Clwyd Hospital
Glangwili General Hospital
Gloucestershire Royal Hospital
Good Hope Hospital
Grantham & District Hospital
Hairmyres Hospital
Harrogate District Hospital
Heartlands Hospital
Hereford County Hospital
Hillingdon Hospital
Hinchingbrooke Hospital
Homerton University Hospital
Horton Hospital
Huddersfield Royal Infirmary
Hull Royal Infirmary
Ipswich Hospital
James Paget Hospital
John Radcliffe Hospital
Kettering General Hospital
King George Hospital
Kings College Hospital
King's Mill Hospital
Kingston Hospital
Leeds General Infirmary
Leicester Royal Infirmary
Leighton Hospital
Lincoln County Hospital
Lister Hospital
Luton and Dunstable University Hospital
Macclesfield District General Hospital
Maidstone District General Hospital
Manchester Royal Infirmary (Adults)
Manor Hospital
Medway Maritime Hospital
Milton Keynes Hospital
Morriston Hospital
Musgrove Park Hospital
New Cross Hospital
Newham General Hospital
Noble's Hospital
Norfolk & Norwich University Hospital
North Devon District Hospital
North Manchester General Hospital
North Middlesex University Hospital

Northampton General Hospital
Northern General Hospital
Northumbria Specialist Emergency Care Hospital
Northwick Park Hospital
Peterborough City Hospital
Pilgrim Hospital
Pinderfields Hospital
Poole General Hospital
Princess Alexandra Hospital
Princess of Wales Hospital
Princess Royal University Hospital
Queen Alexandra Hospital, PO
Queen Elizabeth Hospital (Birmingham)
Queen Elizabeth Hospital (Gateshead)
Queen Elizabeth Hospital (Woolwich)
Queen Elizabeth The Queen Mother Hospital
Queen's Hospital (Burton)
Queen's Hospital, Romford
Queen's Medical Centre, Nottingham
Rotherham District General Hospital
Royal Albert Edward Infirmary
Royal Berkshire Hospital
Royal Blackburn Hospital
Royal Bolton Hospital
Royal Bournemouth General Hospital
Royal Cornwall Hospital
Royal Derby Hospital
Royal Devon and Exeter Hospital (Wonford)
Royal Free Hospital
Royal Gwent Hospital
Royal Hampshire County Hospital
Royal Infirmary of Edinburgh
Royal Lancaster Infirmary
Royal London Hospital (The)
Royal Oldham Hospital
Royal Preston Hospital
Royal Shrewsbury Hospital
Royal Stoke University Hospital
Royal Surrey County Hospital
Royal Sussex County Hospital
Royal United Hospital
Royal Victoria Hospital - Belfast
Royal Victoria Infirmary
Russells Hall Hospital
Salford Royal Hospital

Salisbury District Hospital
Sandwell General Hospital
Scarborough General Hospital
Scunthorpe General Hospital
South Tyneside District General Hospital
South West Acute Hospital
Southampton General Hospital
Southend Hospital
Southmead Hospital
Southport & Formby District General Hospital
St George's
St Helier Hospital (Adult)
St Mary's Hospital
St Marys Hospital (Newport, IOW)
St Peter's Hospital
St Richard's Hospital (Chichester)
St Thomas' Hospital
Stepping Hill Hospital
Stoke Mandeville Hospital
Sunderland Royal Hospital
Tameside General Hospital
The Cumberland Infirmary
The Great Western Hospital
The James Cook University Hospital
The Princess Elizabeth Hospital
The Princess Royal Hospital
The Queen Elizabeth Hospital (King's Lynn)
The Royal Liverpool University Hospital
Torbay District General Hospital
Tunbridge Wells Hospital
Ulster Hospital
University College Hospital
University Hospital Lewisham
University Hospital Of North Durham
University Hospital Of North Tees
University Hospital, Coventry
Victoria Hospital
Warrington Hospital
Warwick Hospital
Watford General Hospital
West Cumberland Hospital
West Middlesex University Hospital
West Suffolk Hospital
Weston General Hospital
Wexham Park Hospital
Whipps Cross University Hospital
Whiston Hospital

Whittington Hospital
William Harvey Hospital
Withybush General Hospital
Worcestershire Royal Hospital
Worthing Hospital

Wrexham Maelor Hospital
Wythenshawe Hospital
Yeovil District Hospital
York Hospital
Ysbyty Gwynedd

Appendix 3: Definitions

Standards definitions:

Standard	Term	Definition
Inclusion criteria	Sepsis or septic shock	Please see the references for detailed definitions of sepsis, organ system dysfunction and high lactate. If your organisation has not yet begun using the new 2016 definitions, please use the older 2012 ones for the purpose of this audit.
	Organ system dysfunction	
	High lactate	

Question and answer definitions:

Term	Definition
Q1c. Formal protocol for the early identification and immediate management of patients with sepsis	This may include a screening tool
Q7. Was oxygen initiated to maintain $SaO_2 > 94\%$	If the patient's normal SaO_2 are less <94% (e.g. COPD), was oxygen initiated to maintain their target range?
Q10. Was the first intravenous crystalloid fluid bolus (up to 30ml/kg) given in the ED?	If the first bolus was given pre-hospital, please tick 'no – reason recorded'
Q11. Were antibiotics administered in the ED?	If antibiotics were administered pre-hospital, please tick 'no – reason recorded'
Q12. Was urine output measurement/ Fluid Balance Chart instituted prior to leaving the ED?	Please enter the time urine output was measured

Appendix 4: Calculations

STANDARD	GRADE	Analysis sample	Analysis plan – conditions for the standard to be met
1. Respiratory Rate, Oxygen Saturations (SaO2), Supplemental Oxygen Requirement, Temperature, Blood Pressure, Heart Rate, Level of Consciousness (AVPU or GCS) and Capillary Blood Glucose recorded on arrival	F	All	**Fully met**: Q5 = 'yes, all' OR Q5 = all vital signs ticked **Partial**: Q5 = 'partially' AND/OR Q5 = some vital signs ticked **No**: Q5 = 'not recorded' OR Q5 = no vital signs ticked
2. Review by a senior (ST4+ or equivalent) ED medic or involvement of Critical Care medic (including the outreach team or equivalent) before leaving the ED	D	All	**Met**: Q6a = 'yes' AND/OR Q6b = 'yes' **Not met**: all other cases
3. O2 was initiated to maintain SaO2>94% (unless there is a documented reason not to)			
3a. 50% within one hour of arrival	A	All excluding q7a = 'no – reasons recorded'	**Met**: Q7 = 'yes' AND Time </= 60 mins after arrival **Not met**: Q7 = 'no/not recorded' OR Time > 61 minutes OR Time is blank
3b. 100% within four hours of arrival	D	All excluding q7a = 'no – reasons recorded'	**Met**: Q7 = 'yes' AND Time </= 4 hours after arrival **Not met**: Q7 = 'no/not recorded' OR Time > 4 hours OR Time is blank
4. Serum Lactate measured within four hours of arrival			
4a. 50% within one hour of arrival	A	All excluding 'no – reasons recorded	**Met**: Q8 = 'yes' AND Time </= 60 mins after arrival **Not met**: Q8 = 'no/not recorded' OR Time > 61 minutes OR Time is blank

4b. 100% within four hours of arrival	D	All excluding 'no – reasons recorded	**Met**: Q8 = 'yes' AND Time </= 4 hours after arrival **Not met**: Q8 = 'no/not recorded' OR Time > 4 hours OR Time is blank
5. Blood Cultures obtained			
5a. 50% within one hour of arrival	A	All excluding 'no – reasons recorded	**Met**: Q9 = 'yes' AND Time </= 60 mins after arrival **Not met**: Q9 = 'no/not recorded' OR Time > 61 minutes OR Time is blank
5b. 100% within four hours of arrival	D	All excluding 'no – reasons recorded	**Met**: Q9 = 'yes' AND Time </= 4 hours after arrival **Not met**: Q9 = 'no/not recorded' OR Time > 4 hours OR Time is blank
6. Fluids – first intravenous crystalloid fluid bolus (up to 30mL/kg) given:			
6a. 75% within one hour of arrival	D	All excluding 'no – reasons recorded	**Met**: Q10 = 'yes' AND Time </= 60 mins after arrival **Not met**: Q10 = 'no/not recorded' OR Time > 61 minutes OR Time is blank
6b. 100% within four hours of arrival	F	All excluding 'no – reasons recorded	**Met**: Q10 = 'yes' AND Time </= 4 hours after arrival **Not met**: Q10 = 'no/not recorded' OR Time > 4 hours OR Time is blank
7. Antibiotics administered:			

7a. 50% within one hour of arrival	D	All excluding 'no – reasons recorded	**Met**: Q11 = 'yes' AND Time </= 60 mins after arrival **Not met**: Q11 = 'no/not recorded' OR Time > 61 minutes OR Time is blank
7b. 100% within four hours of arrival	F	All excluding 'no – reasons recorded	**Met**: Q11 = 'yes' AND Time </= 4 hours after arrival **Not met**: Q11 = 'no/not recorded' OR Time > 4 hours OR Time is blank
8. Urine Output measurement/ Fluid Balance Chart instituted within four hours of arrival	D	All excluding 'no – reasons recorded	**Met**: Q12 = 'yes' AND Time </= 4 hours after arrival **Not met**: Q12 = 'no/not recorded' OR Time > 4 hours OR Time is blank

Appendix 5: Inclusion and exclusion criteria

Inclusion criteria

- Adult patients aged 18 and over
- Patients who were diagnosed with either severe sepsis or septic shock in the ED, as defined below:
  - Severe sepsis - The presence of one or more organ system dysfunctions in the context of sepsis defines severe sepsis
  - Septic Shock - Patients who have evidence of hypoperfusion (high lactate) or a persistently low blood pressure after initial fluid resuscitation in the context of sepsis have septic shock

Please see the references for detailed definitions of sepsis, organ system dysfunction and high lactate. If your organisation has begun using the new definitions[i], please use them for the purpose of this audit.

The ICD 10 codes below can be used to help initially identify potential cases. This is not an exhaustive list, other search terms can be used but all potential patients should then be reviewed to check they meet the definitions & selection criteria before inclusion in the audit.

- Septicaemia: A41
- Septic Shock: A40
- Meningococcal sepsis: A39

If sepsis coding is poor in your organisation, you may wish to expand your search by identifying patients with infection and reviewing the notes for sepsis. Some relevant infection terms include, but are not limited to: meningitis, respiratory tract infection, urinary tract infection and pyelonephritis.

Exclusion criteria

- Patients aged 17 or under
- Patients not diagnosed with severe sepsis or septic shock
- Patients with hypoperfusion (high lactate) or a persistently low blood pressure without evidence of sepsis or infection
- Patients diagnosed with sepsis or septic shock after being discharged from the ED

Appendix 6: References

[i] Singer M et al. The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). *JAMA*. 2016;315(8):801-810. doi:10.1001/jama.2016.0287.

[ii] Shankar-Hari M, Phillips G, Levy ML, et al Assessment of definition and clinical criteria for septic shock. *JAMA*.doi:10.1001/jama.2016.0289

[iii] Seymour CW, Liu V, Iwashyna TJ, et al Assessment of clinical criteria for sepsis. *JAMA*. doi:10.1001/jama.2016.0288.

[iv] The UK Sepsis Trust. Our statistics and why it matters. *The UK Sepsis Trust* 2016 http://sepsistrust.org/our-statistics-and-why-it-matters-march-2016/

[v] Kumar A, Roberts D, Wood KE et al. Duration of hypotension prior to initiation of effective antimicrobial therapy is the critical determinant of survival in human septic shock. *Crit Care Med* 2006; 34: 1589–96

[vi] National early warning score at Emergency Department triage may allow earlier identification of patients with severe sepsis and septic shock: a retrospective observational study Keep, J., Messmer, A., Sladden, R., Burrell, N., Pinate, R., Tunnicliff, M., Glucksman, E. Emerg. Med. J. 2016 33: p. 37-41