The College of Emergency Medicine

Clinical Audits

Severe Sepsis & Septic Shock

Report of the Clinical Audit 2013-14

Contents

Executive Summary

The 2013 audit has shown that the management of severe sepsis and septic shock in Emergency Departments (ED) has improved since 2011. Each section is summarised throughout this document. ED staff should be commended for their efforts in achieving an overall improvement in the management of sepsis since the previous audit. The College urges staff and organisations to continue to seek improvement in the timeliness of measuring vital signs and administering treatments where performance does not meet the desired standards.

There is an increasing focus on sepsis from health and political organisations. The College hopes that EDs across the UK will be supported by their Trusts to improve upon these results further and would like to take this opportunity to advise members and fellows of recent activity.

In September 2013, the parliamentary health service ombudsman published her first clinical report, *Time to Act,* which focussed on the care of patients with sepsis. It made various recommendations which can be found on page 50[1].

2013 also saw the formation of the All Party Political Group (APPG) on Sepsis. To assist this group, a Clinical Advisory Group for sepsis (sepsis CAG) was formed which has College representation. The APPG sent a freedom of information (FoI) request to every Trust in the UK in early 2014. The findings can be seen in a special report[2] and news commentary[3] which explains what the APPG is and what it aims to achieve.

In response to the recommendations from the APPG, the UK Sepsis Trust has collaborated with various organisations, including the College of Emergency Medicine, to produce various 'Toolkits' to assist with the early identification and treatment of sepsis.

The document, 'Sepsis: a toolkit for Emergency Departments' was launched on the same day as these audit results at a special function at the House of Commons. It describes the problems that EDs face and offers practical solutions, specifically in EDs, to tackle the problem of sepsis recognition, diagnosis and treatment.

We recommend reading this report together with the toolkit which is available on the College website at: http://www.collemergencymed.ac.uk/Shop-Floor/Clinical Standards/Sepsis

Future developments

National Confidential Enquiry into Patient Outcome and Death (NCEPOD) is currently undertaking a review of sepsis[4]. It is due to publish its findings in November 2015. The College is well represented in the panel of expert reviewers and aims to highlight areas of care that could have been improved.

National Institute for Health and Care Excellence (NICE) have already published sepsis guidelines such as neutropaenic sepsis and sepsis in neonates and maternal health, and they have begun to review sepsis in the general patient population. These are unlikely to be published until 2016.

Introduction

This report shows the results from an audit of the treatment of severe sepsis and septic shock against the clinical standards published by the College of Emergency Medicine (CEM) Quality in Emergency Care Committee (QEC) and based on the guidelines and care bundles published by the UK Sepsis Trust. This report compares all Emergency Departments (EDs) that made audit returns and with the results of the previous audit conducted in 2011/12. Individual reports will be sent to participating EDs.
Overall, 8,099 cases were submitted from 180 EDs across the UK.

Audit history

All EDs in the UK were invited to participate in May 2013. Data was collected using a new online data collection tool.

Participants were asked to collect data from ED/hospital records of 50 cases of adults (18 years of age or older) who were diagnosed with either severe sepsis or septic shock between 1st August 2013 and 31st March 2014. EDs that did not see 50 eligible patients within the timescale were able to include cases from before 1st August 2013.

2013/14 is the second time the College has conducted a clinical audit on severe sepsis and septic shock. The first audit was conducted in 2011/12.

The clinical standards were revised following the 2011 audit.

Format of this report

The table overleaf shows the overall results per quartile in comparison with the results from the previous audit in 2011.

By showing the lower and upper quartiles of performance as well as the median values, the table indicates the variations in performance between departments.

More detailed information about the distribution of audit results can be obtained from the charts on subsequent pages of the report. Please bear in mind the comparatively small sample sizes when interpreting the charts and results.

Participating EDs will receive a site specific version of this report.

Analysis notes

During this audit, date and time of patient arrival were collected along with various other treatment and observation times, without dates. The latter were all expected to be later than the arrival time (allowing inferral of those dates not collected), however a small number of records appear to have been entered with one or more treatment or observation times that were before patient arrival in the ED (or almost a day after, which was assumed not to be the case).

To address this, any treatment or observation time that could instead be interpreted as being up to thirty minutes before the stated arrival time was used as the actual arrival time for the purposes of further calculation, on the assumption that the stated arrival time had been entered incorrectly (or that the patient's registration was logged after observations/treatments had started).

In addition, any time that was more than twelve hours after the arrival time (taking the above into consideration) was interpreted to have been entered incorrectly and was treated as being 'not recorded'.
If an ED submitted over 50 cases, only first 50 submitted were included in this analysis.

Summary of results

Question			CEM Standard	Overall Results					
				Lower quartile		Median *		Upper quartile	
				2013	2011	2013	2011	2013	2011
Q3	Were vital signs measured & recorded in the ED as per CEM standards?	Fully ≤15 mins of arrival	100%	**46%**	-	**62%**	-	**76%**	-
		Fully	100%	**80%** ↑	70%	**94%** ↑	87%	**98%** ↑	97%
		Fully / partially		**97%** ↓	100%	**100%** -	100%	**100%** -	100%
Q4	Was capillary blood glucose measured & recorded in the ED?	Yes (within 15/20 mins of arrival)#	100%	**26%** #	47%	**38%** #	60%	**42%** #	77%
		Yes		**64%** ↓	66%	**76%** ↓	81%	**91%** ↓	93%
Q5	Was high flow O_2 initiated in the ED?	Before leaving ED	100%	**32%** ↓	40%	**45%** ↓	50%	**58%** ↓	63%
		≤2 hours of arrival		**18%** ↓	23%	**33%** ↓	37%	**48%** ↓	50%
		≤ 1 hour of arrival		**16%** ↓	22%	**29%** ↓	33%	**42%** ↓	46%
		No, reasons recorded		**6%** ↑	3%	**14%** ↑	10%	**34%** ↑	20%
		Not recorded		**10%** ↓	20%	**28%** ↓	33%	**52%** ↑	47%
Q8	Was first intravenous crystalloid fluid bolus given in the ED?	Before leaving ED	100%	**80%** ↑	74%	**88%** ↑	83%	**92%** ↑	91%
		≤ 2 hours of arrival		**51%** ↑	49%	**63%** ↑	60%	**74%** ↑	72%
		≤1 hour of arrival	75%	**31%** ↑	27%	**40%** -	40%	**52%** ↑	51%
		No, given before arrival		**0%** -	0%	**2%** ↑	0%	**4%** ↑	3%
		Not recorded		**6%** ↓	7%	**10%** ↓	13%	**16%** ↓	20%
Q6	Was serum lactate measurement obtained prior to leaving the ED?	At any time	100%	**74%** ↑	67%	**84%** ↑	80%	**94%** ↑	90%
		≤ 2 hours of arrival		**50%** -	50%	**67%** ↑	60%	**80%** ↑	77%
		≤1 hour of arrival		**37%** ↑	29%	**49%** ↑	47%	**66%** ↑	60%
Q7	Were blood cultures obtained prior to leaving the ED?	Before leaving ED	100%	**62%** ↓	63%	**77%** -	77%	**87%** ↑	83%
		≤ 2 hours of arrival		**30%** ↑	27%	**50%** -	50%	**70%** ↓	71%
		≤ 1 hour of arrival		**23%** ↑	18%	**40%** ↑	32%	**56%** ↑	50%
	Were blood cultures obtained prior to antibiotic administration?	Yes		**26%** ↓	38%	**45%** ↓	59%	**63%** ↓	77%
		Not known		**26%** ↑	9%	**50%** ↑	22%	**68%** ↑	48%
		No		**2%** ↓	4%	**5%** ↓	9%	**10%** ↓	18%
Q9	Were antibiotics administered in the ED?	Before leaving ED	100%	**88%** ↑	83%	**94%** ↑	90%	**97%** -	97%
		≤2 hours of arrival		**52%** ↑	43%	**62%** ↑	57%	**73%** ↑	70%
		≤ 1 hour of arrival	50%	**20%** ↑	17%	**32%** ↑	27%	**44%** ↑	37%
Q10	Were urine output measurements instituted in the ED?	Before leaving ED	100%	**26%** ↑	17%	**38%** ↑	30%	**53%** ↑	47%
		≤ 2 hours of arrival		**6%** ↑	3%	**14%** ↑	10%	**26%** ↑	23%
		≤1 hour of arrival		**2%** ↑	0%	**7%** ↑	3%	**14%** ↑	10%

See overleaf for notes and legend

Notes about overall results

* The median value of each indicator is that where equal numbers of participating EDs had results above and below that value.

 # The results for measurement of capillary blood glucose in 2013 and 2011 are not directly comparable.
In 2011, the result is for those who arrived within 20 minutes. The standard was changed to 15 minutes before the 2013 audit.

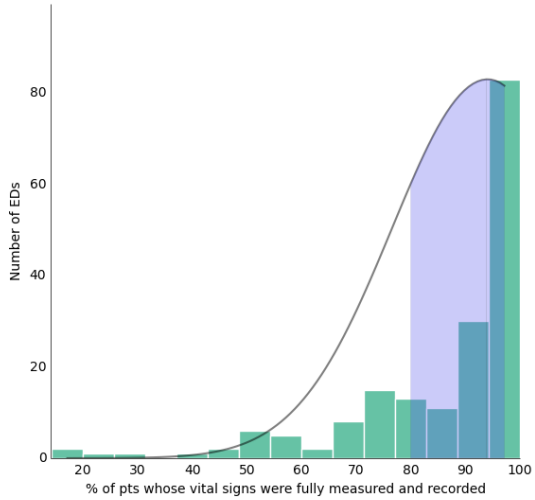
Legend

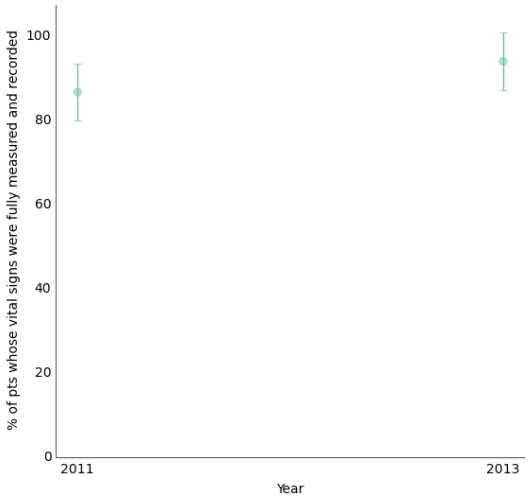
↓ = Red arrow denotes deterioration in performance since previous audit

↑ = Green arrow denotes improvement in performance since previous audit

Types of chart in this report

Two types of chart are used throughout this report, **histograms** and **trend charts**.





Histogram charts are used to show the distribution and frequency of results. Each histogram shows the number of EDs per % of patients as the height of each block.

The light purple area shows the interquartile range. The grey line in this area shows the median.

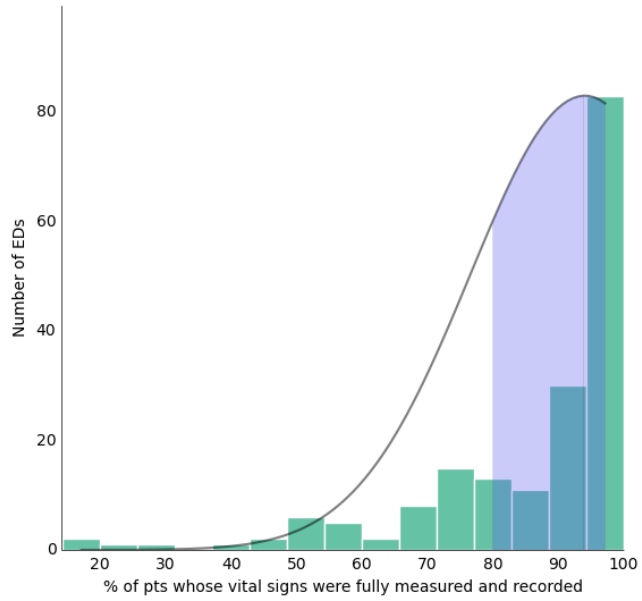
The curved line shows the normal distribution of data.

Trend charts show the median for all EDs as a dot, with 95% confidence level indicated by the green line. The median for each audit year is indicated.

SECTION 1: Were appropriate vital signs recorded on arrival in ED?

Q3. Were the patient's vital signs measured and recorded in the ED?

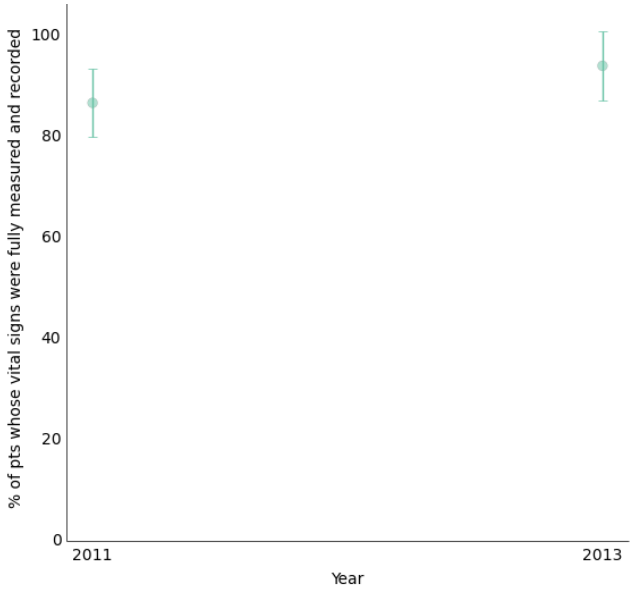
Chart 1: Histogram of patients whose vital signs were fully measured and recorded for all EDs, showing quartiles



42 EDs met the College standard for measuring and recording temperature, pulse rate, respiratory rate, blood pressure, oxygen saturation and mental status in all patients (23% of participating EDs).

99 EDs measured and recorded at least one or more vital signs for all patients (55% of participating EDs).

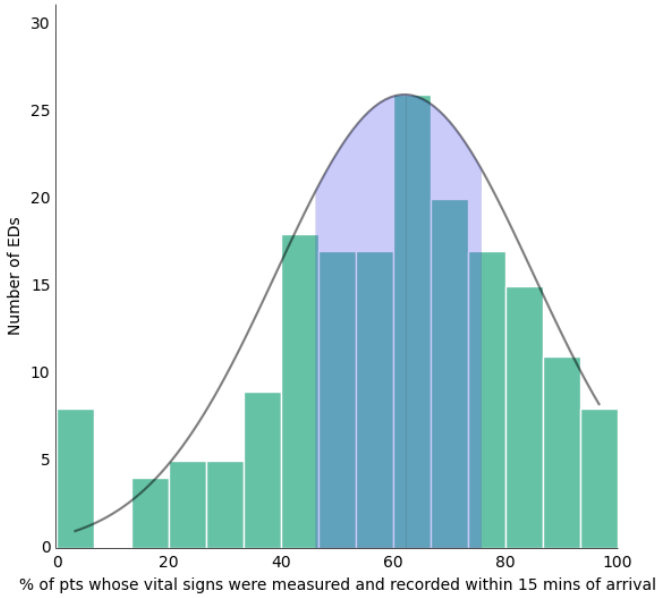
Chart 2: Historical trend of patients whose vital signs were fully measured and recorded, showing overall median with 95% confidence interval



There has been an improvement in the measuring and recording of all patient vital signs, with the median rising from 87% in 2011 to 94% in 2013.

Upper quartile performance has remained similar, with the lowest quartile rising from 70% in 2011 to 80% in 2013.

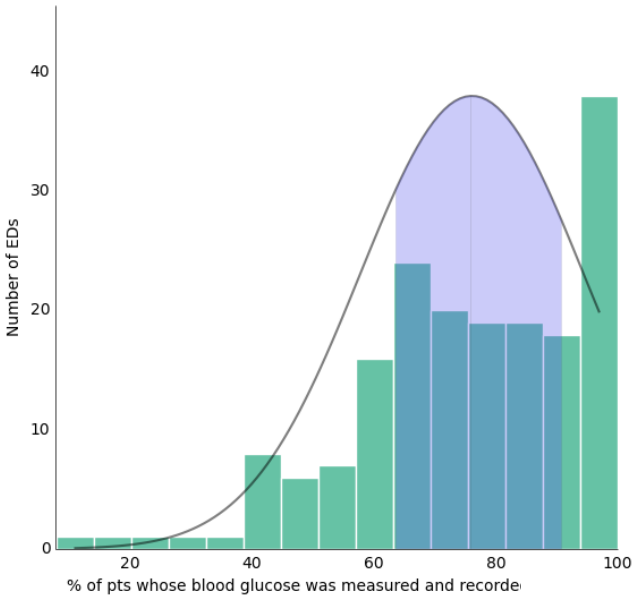
Chart 3: Histogram of patients whose vital signs were fully measured and recorded within 15 minutes of arrival for all EDs, showing quartiles



Two EDs managed to achieve the CEM standard of fully measuring and recording vital signs for all patients within 15 minutes of arrival in the ED.

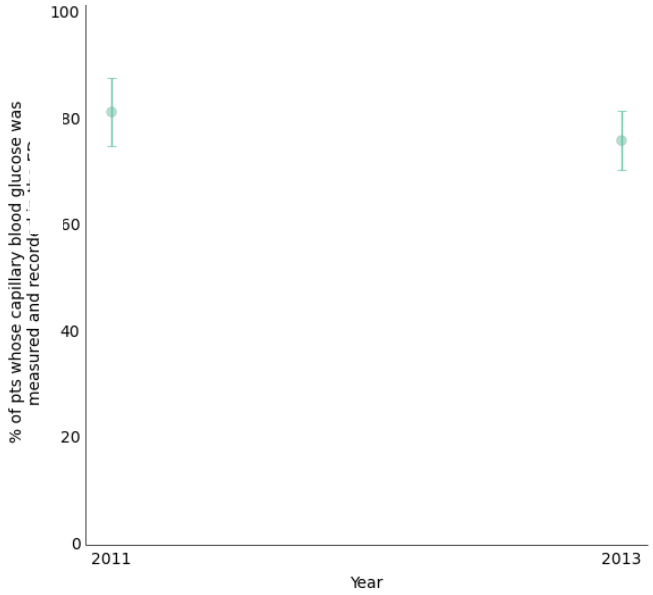
Q4. Was the patient's capillary blood glucose measured and recorded in the ED?

Chart 4: Histogram of patients whose capillary blood glucose was measured and recorded for all EDs, showing quartiles



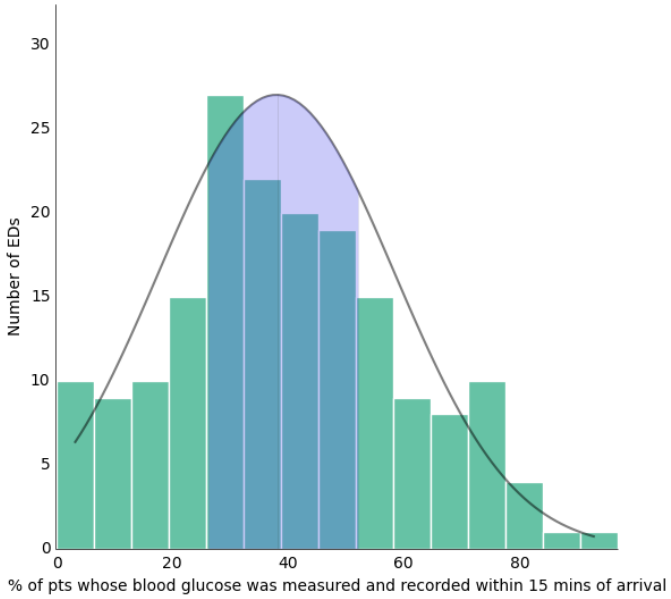
The maximum achieved by any ED was to measure and record capillary blood glucose in 100% of patients. The minimum achieved by any ED was 8%.

Chart 5: Historical trend of patients whose capillary blood glucose was measured and recorded, showing overall median with 95% confidence interval



The overall results are similar to the previous audit, the median for departments dropping from 81% in 2011 to 76% in 2013.

Chart 6: Histogram of patients whose capillary blood glucose was measured and recorded within 15 minutes of arrival for all EDs, showing quartiles



Following the 2011 audit, the College revised the standards from within 20 minutes of arrival to within 15 minutes of arrival in order to be consistent with other standards.

No ED met the College standard of 100%, with the maximum achieved by any ED was to measure and record capillary blood glucose in 97% of patients within 15 minutes of arrival.

Vital signs - commentary and recommendations

Systemic Inflammatory Response Syndrome – SIRS

Early identification of sepsis is critical to the clinical outcome. Earlier treatment increases survival and, in septic shock, mortality increases by 7.6% for every hour's delay in giving antibiotics. It is therefore of utmost importance that all patients are assessed quickly with a full set of vital signs taken as soon as possible. These vital signs & blood glucose will identify the presence of SIRS:

- Temperature >38.3 or <36.0oC
- Heart Rate >90/minute
- Respiratory Rate >20/minute
- New onset of confusion/ drowsiness
- Blood Glucose >7.7mmol/L

The other SIRS criterion is the white cell count (>12.0 or <4.0 x 109/L)

Vital signs are also essential to the recognition of severe sepsis. In the presence of sepsis, only one of the following criteria is needed to diagnose severe sepsis and begin immediate treatment:

- Systolic Blood Pressure <90mmHg or >40mmHg fall from baseline
- Mean Arterial Pressure <65mmHg

Red Flag Sepsis

Due to diagnostic delays that occur in many EDs and the need to treat sepsis as early as possible, it is acceptable to start treatment in the presence of any Red Flag Sepsis criteria.

- Heart Rate >130/minute
- Respiratory Rate >25/minute
- AVPU = V, P or U

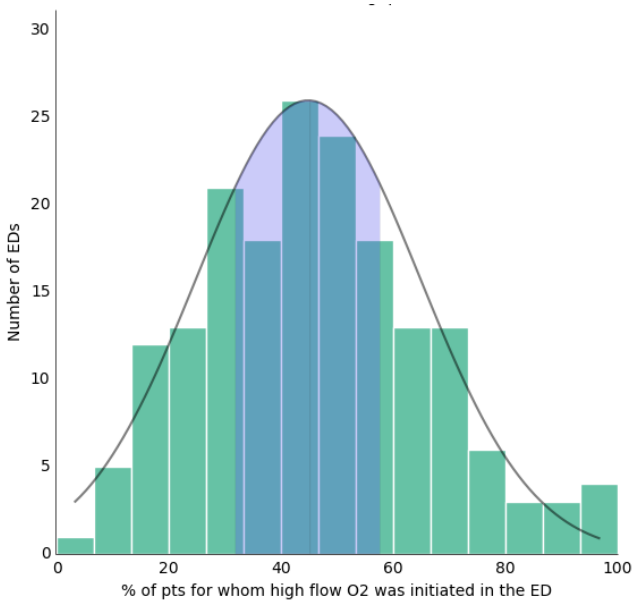
National Early Warning Score – NEWS

Many EDs are calculating NEWS (or equivalent) and using the score to risk-stratify patients, certainly with respect to how quickly they are seen. It is therefore essential that all patients have a complete set of vital signs in order for accurate calculation of NEWS and subsequent clinical management decisions. A NEWS score of 3 or 4 or more appears to have a high positive likelihood ratio for Severe Sepsis or Septic Shock and it is recommended that these patients should all be screened for sepsis early on.

SECTION 2: Oxygen and fluids

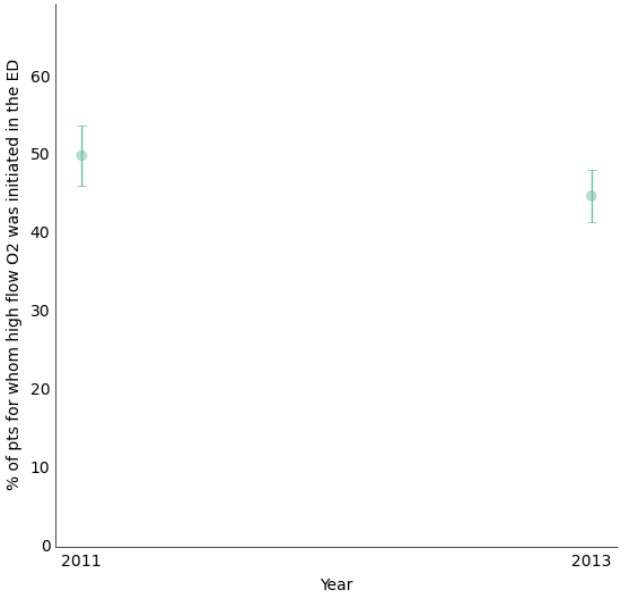
Q5. Was high flow oxygen initiated in the ED?

Chart 7: Histogram of patients for whom high flow O_2 was initiated in the ED for all EDs, showing quartiles



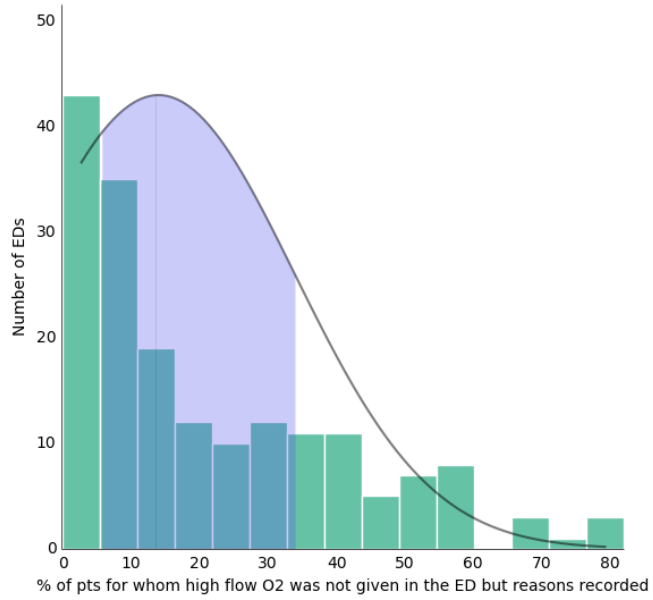
The CEM standard is that in all cases there should be evidence in the notes that high flow O2 via a non-rebreathe mask was initiated in the ED unless there is a documented reason to the contrary (see chart 9).

Chart 8: Historical trend for whom high flow O_2 was initiated in the ED, showing overall median with 95% confidence interval



The median performance was 5% lower than in 2011, falling from 50% to 45%. However there was a rise in the cases where high-flow oxygen was not given and the reasons were recorded, see following charts.

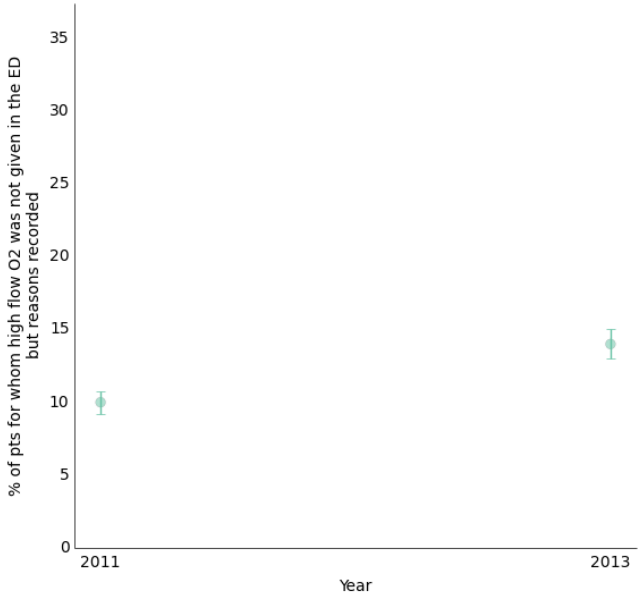
Chart 9: Histogram of patients for whom high flow O_2 was **NOT** given in the ED but the reasons were recorded for all EDs, showing quartiles



Nine EDs recorded that high flow O_2 was not given and the reasons recorded for over 75% of patients.

One ED specifically commented that they have a standing policy of providing low flow O_2 as standard.

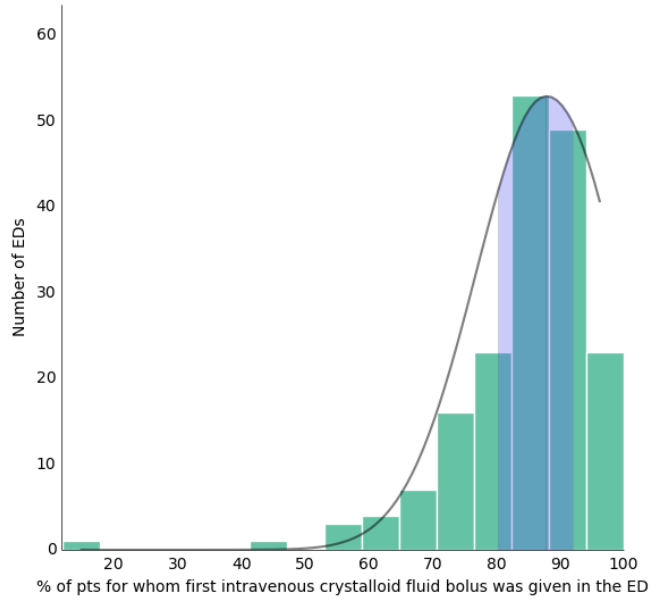
Chart 10: Historical trend for whom high flow O_2 was **NOT** given in the ED but the reasons were recorded, showing overall median with 95% confidence interval



There has been a rise across all quartiles for not providing high flow O_2 but recording why.

Q8 Was first intravenous crystalloid fluid bolus given in the ED?

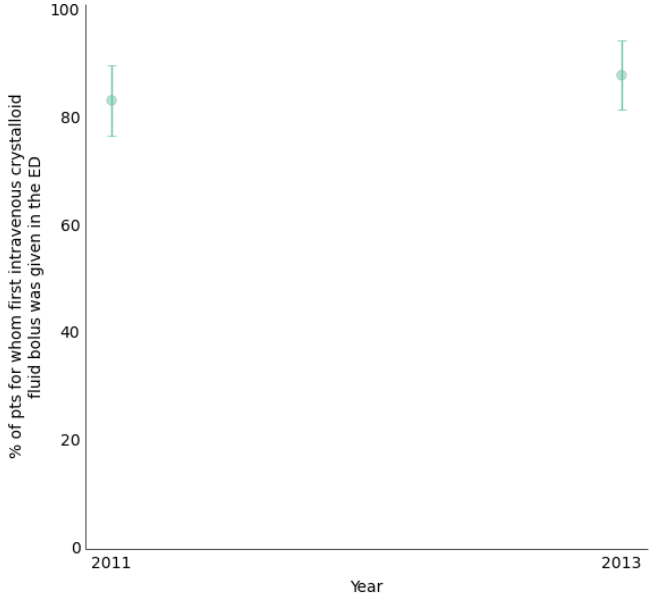
Chart 11: Histogram of patients for whom the first intravenous crystalloid fluid bolus was given in the ED for all EDs, showing quartiles



Eight EDs met the standard of giving a fluid bolus to all patients before they left the ED.

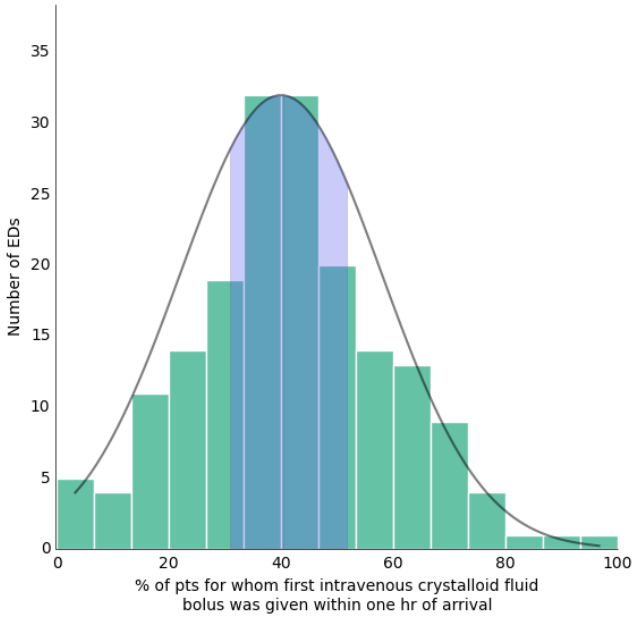
Most departments gave fluids in the majority of cases, with 155 EDs administering fluids in at least 75% of cases.

Chart 12: Historical trend for whom the first intravenous crystalloid fluid bolus was given in the ED, showing overall median with 95% confidence interval



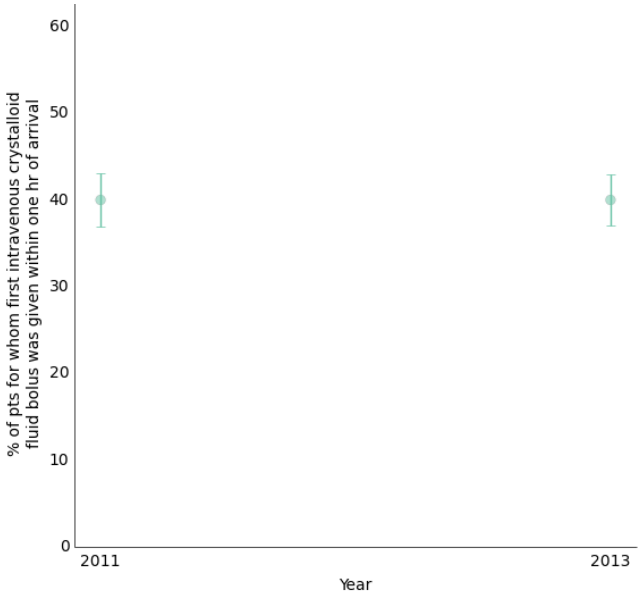
Overall the provision of fluids prior to leaving the ED has improved since the 2011 audit, with the median rising from 83% to 88%.

Chart 13: Histogram of patients for whom the first intravenous crystalloid fluid bolus was given **within one hour of arrival** for all EDs, showing quartiles



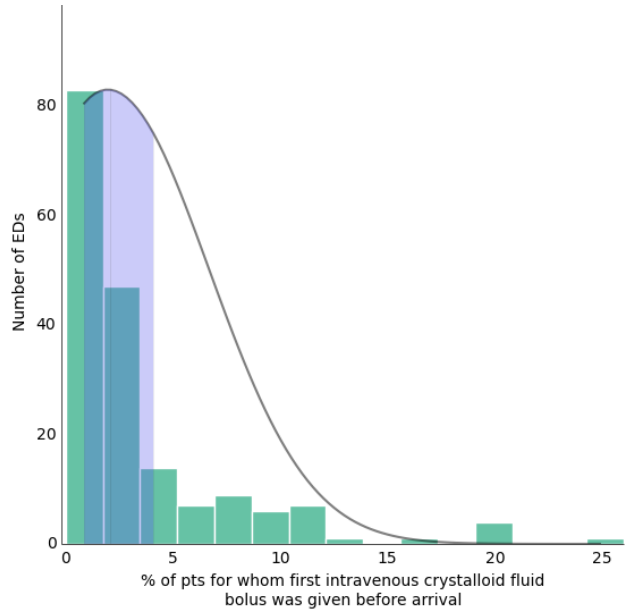
Six EDs met the standard of giving a fluid bolus to 75% of patients within one hour of arrival.

Chart 14: Historical trend for whom the first intravenous crystalloid fluid bolus was given **within one hour of arrival**, showing overall median with 95% confidence interval



The median is unchanged from 2011 at 40%.

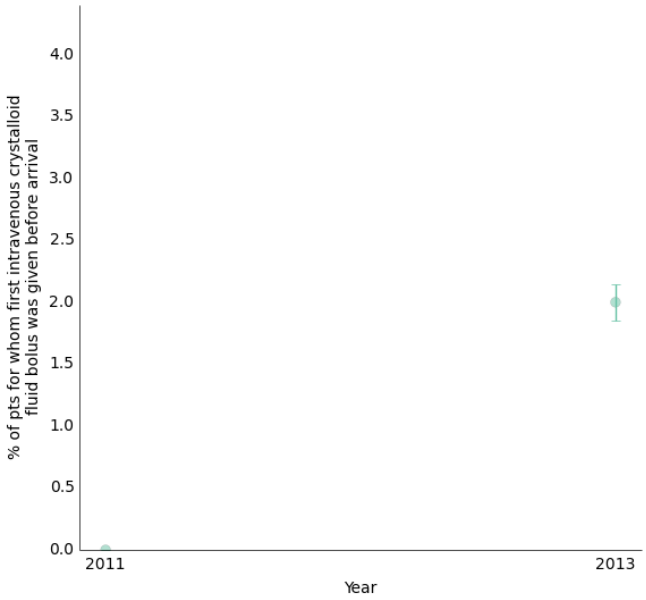
Chart 15: Histogram of patients for whom the first intravenous crystalloid fluid bolus was given **before arrival** for all EDs, showing quartiles



The number of cases where fluids were given prior to arrival in the ED remains very low. 83 EDs reported no cases of fluids pre-arrival.

One department recorded pre-arrival fluids for 26% of cases.

Chart 16: Historical trend for whom the first intravenous crystalloid fluid bolus was given **before arrival**, showing overall median with 95% confidence interval



The median has very slightly risen to 2%.

Oxygen and fluids - commentary and recommendations

By definition, patients with severe sepsis and septic shock have hypoperfusion which causes organ dysfunction. Optimizing oxygen delivery to the tissues is a key role of Emergency Physicians and its importance in sepsis must not be understated. There has been a decrease in documented administration of high flow oxygen from a median of 50% to 45% and an increase in documented reasons for not giving high flow oxygen from a median of 10% to 14%; relative stability in the numbers. This is likely to be a reflection of the slow cultural change towards oxygen prescribing and the interpretation of the British Thoracic Society (BTS) guidelines[6] relating to supplemental oxygen in severe sepsis and septic shock. The evidence and guidelines will be reviewed by the College and this audit standard will be updated.

Oxygen

Multi-organ failure from hypoxia occurs quickly in sepsis. The suspected sepsis patient should receive supplementary oxygen to increase their O_2 saturations in accordance with guidelines from the BTS. Where sepsis is strongly suspected or a diagnosis of severe sepsis or septic shock has been made **HIGH FLOW OXYGEN** should be delivered in accordance with the BTS guidelines. Once stable, usually after completion of the 'Sepsis Six', supplementary oxygen can be decreased to maintain O_2 saturations at 94-98%.

CO_2 Retention

Hypoxia will kill sooner than hypercapnia. There is a small group of patients at risk of hypercapnia when high flow O_2 is administered:

- Some patients with Chronic Obstructive Pulmonary Disease (COPD)
- Patients with neuromuscular problems that affect their breathing
- Patients with chest wall/ spinal deformities
- Very obese patients
- Patients with bronchiectasis, including cystic fibrosis

These patients, when presenting with sepsis, should receive high flow O_2 initially and be assessed early to detect hypercapnia and acidosis. The highest tolerated O_2 flow should be sought. Should hypercapnia occur senior help should be sought to control it i.e. non-invasive or invasive ventilation, such that O_2 saturations can be maintained at 94-98%.

Fluids

An essential part of resuscitation, fluid delivery within the first hour of ED attendance has remained static at a median of 40% but the lower quartile has improved from 27% to 31% showing improvement overall but falling short of the standard of 75%. Fluids given at any time in the ED have improved from a median of 83% to 88%.

The patient with severe sepsis requires fluid to improve oxygen delivery to the tissues and prevent multi-organ failure. Hypovolaemia in sepsis is caused by lack of fluid intake and/or increased losses, a vasodilated circulation, and blood vessels which become leaky due to the action of cytokines. Hypovolaemia may be obscured early on during 'warm sepsis' - the clinician may be fooled that their patient is well perfused because they are pink and warm but this is due to vasodilatation and compensatory mechanisms. Without

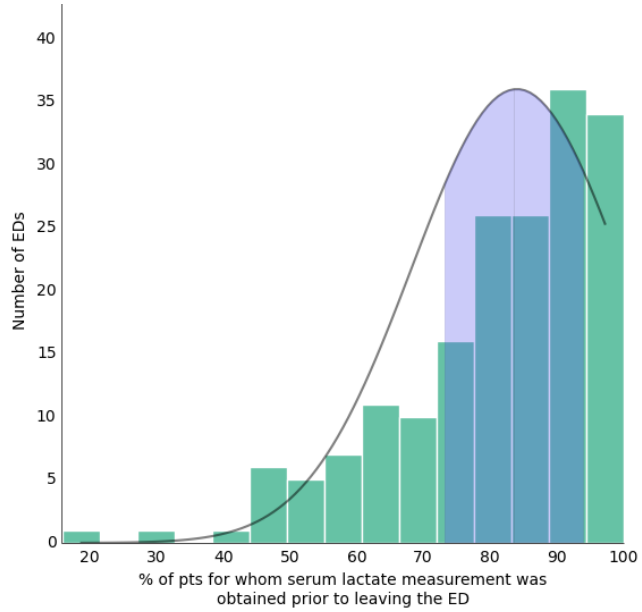
adequate resuscitation the patient is likely to deteriorate rapidly once compensatory mechanisms become exhausted.

Individual fluid requirements are challenging and it is therefore recommended that all sepsis patients receive up to 30mL/kg of crystalloids in 500mL boluses as soon as severe sepsis or septic shock is identified. After every bolus, the patient should be reassessed for signs of improvement and for signs of fluid overload.

SECTION 3: Serum lactate and blood cultures

Q6. Was serum lactate measurement obtained prior to leaving the ED?

Chart 17: Histogram of patients for whom serum lactate was obtained prior to leaving the ED for all EDs, showing quartiles

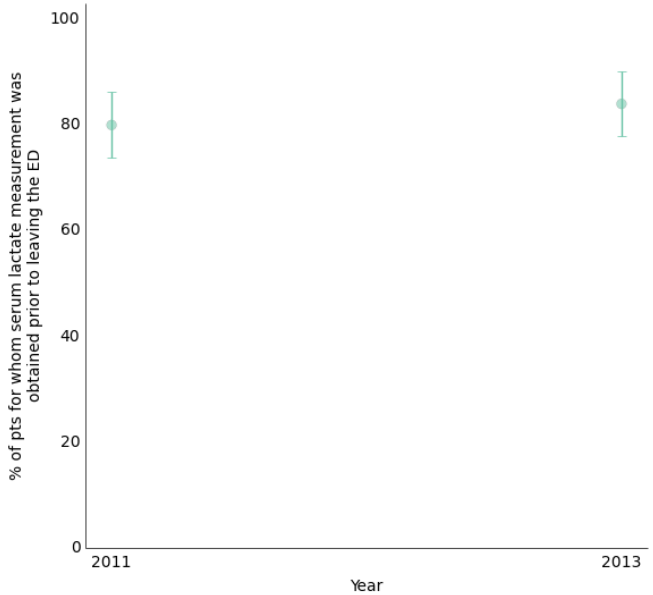


Twelve EDs achieved the standard of measuring serum lactate before the patient left the ED in all cases.

The median performance overall was 84%.

Nine departments measured serum lactate in less than 50% of cases.

Chart 18: Historical trend of patients for whom serum lactate was obtained prior to leaving the ED, showing overall median with 95% confidence interval

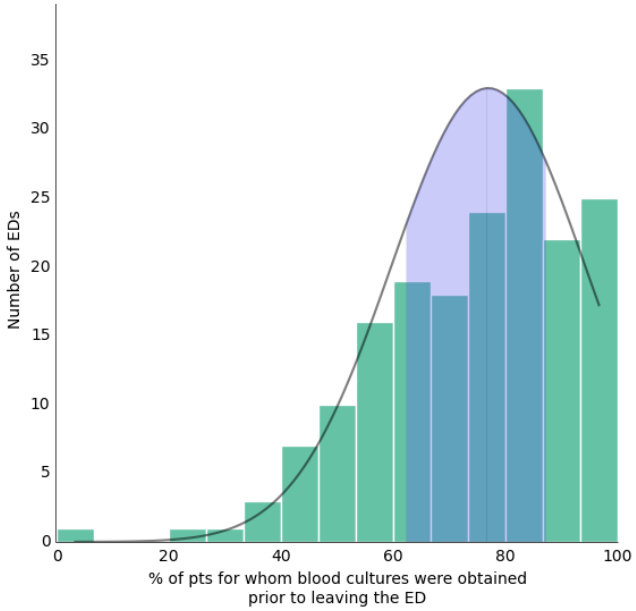


The results improve on the 2011 findings in all quartiles of performance, with the median rising to 84% in 2013 from 80% in 2011.

The timeliness of measurement was also improved with the median for measurement within 2 hours of arrival rising from 60% in 2011 to 67% (not shown left).

Q7. Were blood cultures obtained prior to leaving the ED?

Chart 19: Histogram of patients for whom blood cultures were obtained prior to leaving the ED for all EDs, showing quartiles

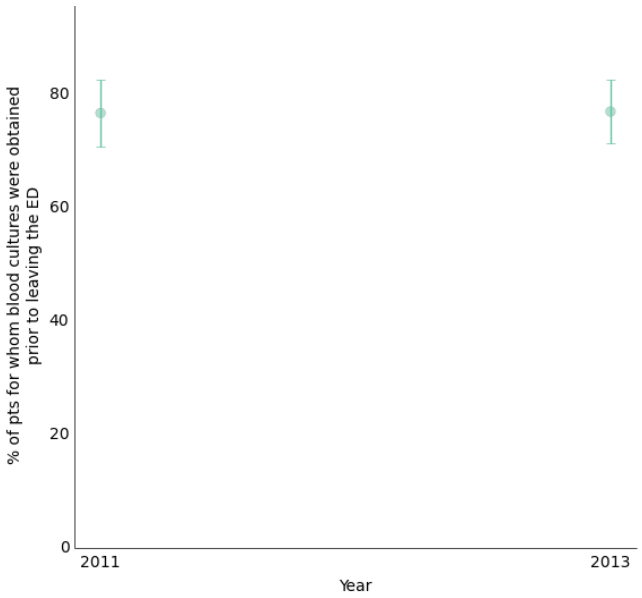


The CEM standard states that blood cultures should be obtained for all patients prior to leaving the ED.

Two EDs met this standard.

Fourteen EDs obtained blood cultures in less than half of all patients.

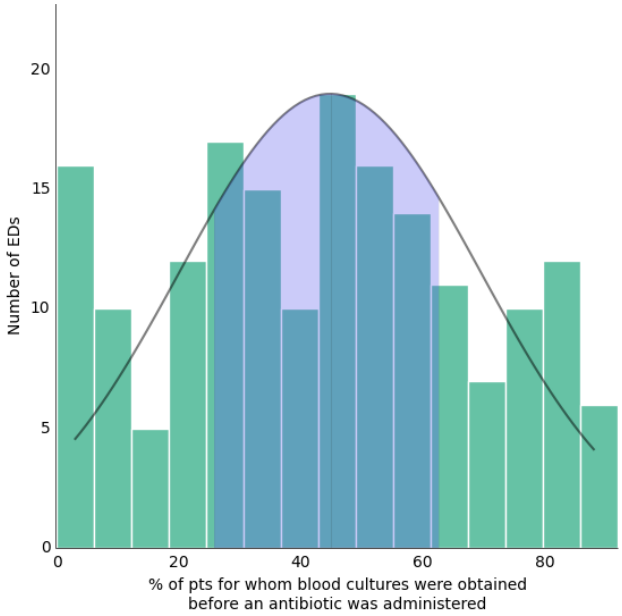
Chart 20: Historical trend of patients for whom blood cultures were obtained prior to leaving the ED, showing overall median with 95% confidence interval



There is no change in the overall median performance since 2011.

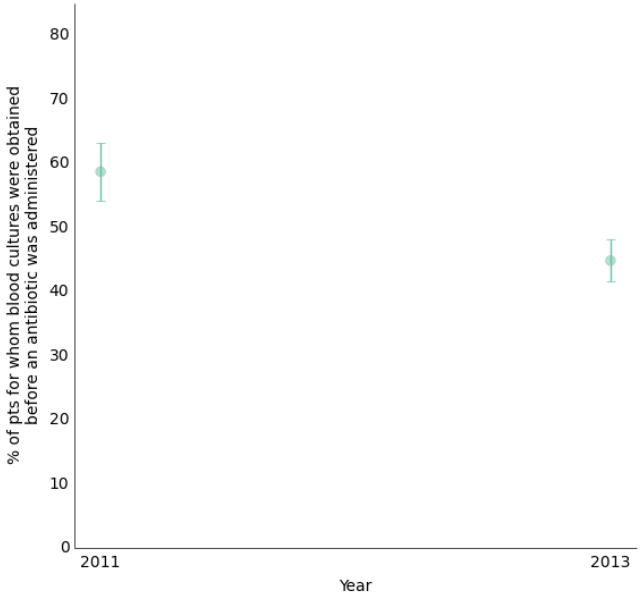
Were blood cultures obtained prior to antibiotic administration?

Chart 21: Histogram of patients for whom blood cultures were obtained before an antibiotic was administered for all EDs, showing quartiles



The results showed a significant variation between departments.

Chart 22: Historical trend of patients for whom blood cultures were obtained before an antibiotic was administered, showing overall median with 95% confidence interval



The median performance dropped distinctly from 59% in 2011 to 45% in 2013.

There was a significant rise in the number of EDs reporting that they were unable to identify whether blood cultures were obtained prior to antibiotic administration.

Serum lactate and blood cultures – commentary and recommendations

Lactate

Lactate is a marker of anaerobic respiration. In sepsis, lactate is important because it can rise due to problems with the macrocirculation (heart, lungs and fluid) or the microcirculation (capillary beds). Lactate is useful in sepsis for three reasons:

1. As a diagnostic marker in sepsis; >2mmol/L identifies severe sepsis, and >4mmol/L identifies 'Cryptic Shock' in the presence of normal blood pressure.
2. As a predictor of mortality and the need for critical care; the higher the lactate, the higher the mortality.
3. As a guide to therapy; a falling lactate after treatment with the Sepsis Six, indicates that problems in the macrocirculation are being addressed. No change is worrying and implies that the problem is in the microcirculation and the patient requires critical care input.

Early (<1 hour) measurement of lactate in the ED has improved slightly and the median for measurement at any time has increased from 80% to 84%. The importance of measuring lactate in sepsis must be appreciated further and should aid its documentation as part of the patient's management plan.

Blood cultures and other cultures

Documented evidence that blood cultures were taken in the ED has remained static at a median of 77%. The role of the ED is primarily to resuscitate patients with sepsis but the taking of blood cultures and other samples for culture is an essential part of management,

Cultures are essential to identify the causative organism and rationalise treatment. Ideally, they should be taken before giving antibiotics but **MUST NOT DELAY THE ANTIBIOTICS**.

Important points to remember:

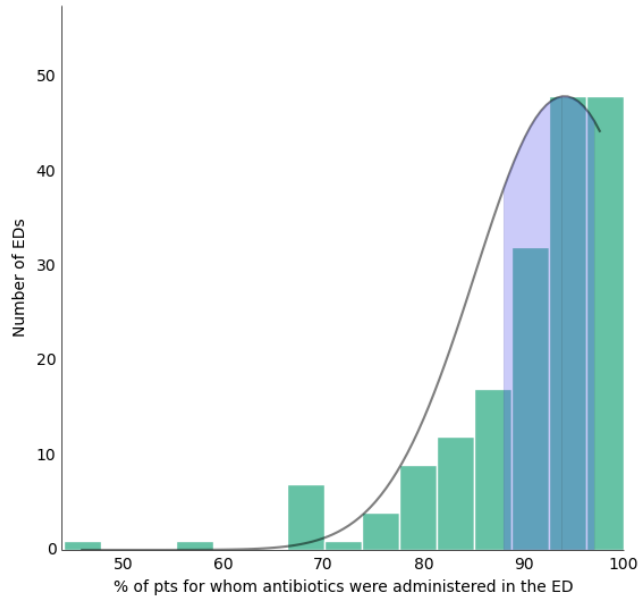
- Yield is higher with more blood – approximately 3% increase per mL of blood
- If not much blood available, fill the aerobic bottle first as the majority of organisms will grow in it
- Give antibiotics IMMEDIATELY in the presence of purpura fulminans, the characteristic rash seen in meningococcal and streptococcal disease

Other samples should also be sent e.g. urine, sputum, skin swabs, CSF.

SECTION 4: Were antibiotics administered appropriately in the ED?

Q9. Were antibiotics administered in the ED?

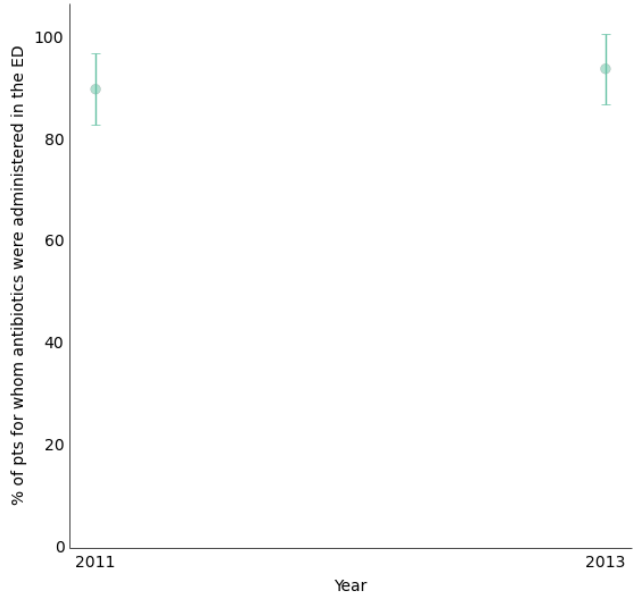
Chart 23: Histogram of patients for whom antibiotics were administered in the ED, showing quartiles



The CEM standard is that in 100% of cases antibiotics should be administered before the patient leaves the ED.

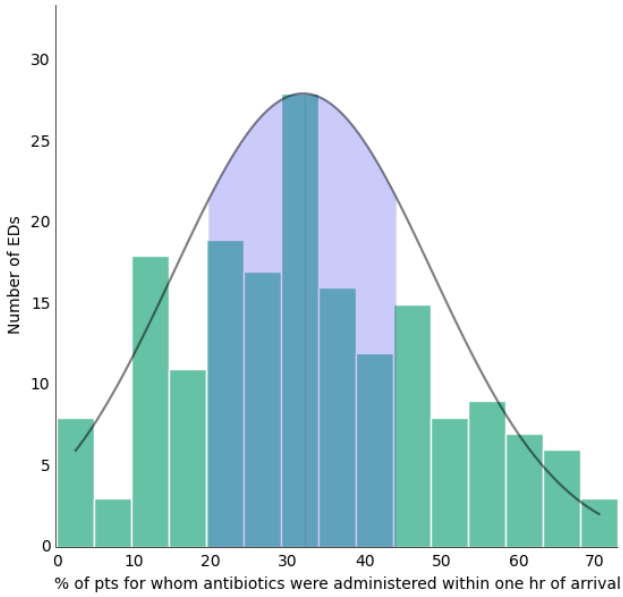
Overall, the median for antibiotic administration was 94%. Twenty-six EDs met the standard of giving antibiotics before leaving the ED in all cases.

Chart 24: Historical trend of patients for whom antibiotics were administered in the ED, showing overall median with 95% confidence interval



There was an improvement across all quartiles of performance for the administration of antibiotics within 1 hour of arrival and prior to leaving the ED.

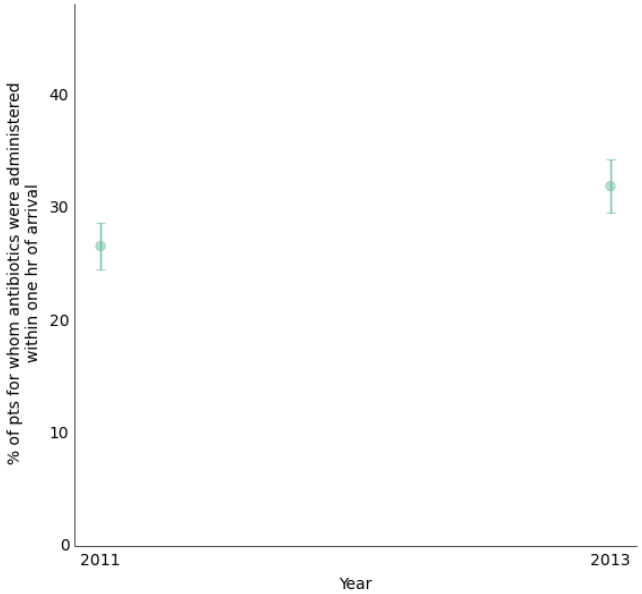
Chart 25: Histogram of patients for whom antibiotics were administered **within one hour of arrival** for all EDs, showing quartiles



The CEM standard is that in 50% of cases antibiotics should be administered within one hour of arrival in the ED.

Overall, the median for antibiotic administration was 94%. Twenty-six EDs met the standard of giving antibiotics before leaving the ED in all cases.

Chart 26: Historical trend of patients for whom antibiotics were administered in the ED **within one hour of arrival**, showing overall median with 95% confidence interval



There has been an improvement across all quartiles of performance.

Antibiotics – commentary and recommendations

The treatment of severe sepsis and septic shock in the ED with antibiotics shows a favourable upward trend across the board. Antibiotics given in the ED is at a median of 94% and within the first hour of attendance has increased from 27% to 32%.

Each hour's delay in giving antibiotics in septic shock increases mortality by 7.6%

Every ED should make the giving of antibiotics to patients with sepsis as easy as possible. Consideration should be given to:

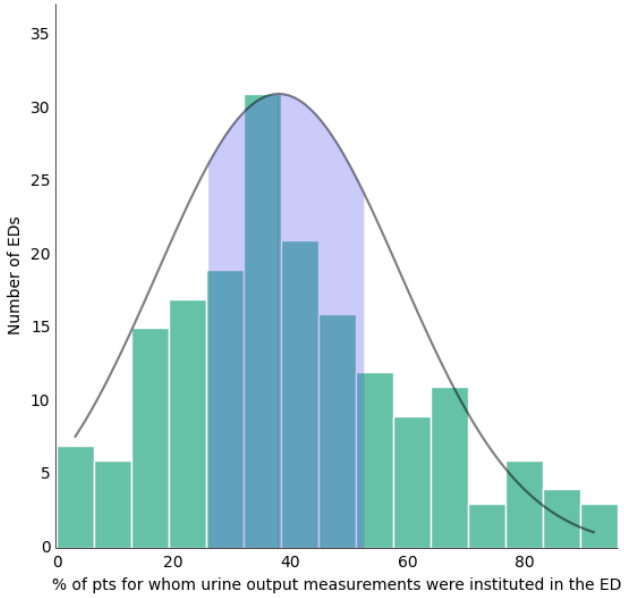
- Stock – are all antibiotics that could potentially be given stocked in the ED, negating the need to request them from other wards or Pharmacy?
- Location – are the antibiotics kept in a central location that is co-located with the equipment for mixing, drawing them up and giving, such as a 'Sepsis Trolley' or specific cupboard?
- Choice – are the Trust's antibiotic guidelines readily available to the staff in the ED, such as handbooks or online or clearly displayed in areas where patients with sepsis are treated?
- Prescribing – can prescribing rights for antibiotics be extended in certain circumstances?
- Advice – is expert advice readily available in complicated cases or allergies?

This standard has improved and one third of patients receive antibiotics within an hour, up from a quarter in the 2011 audit. Half of all patients with severe sepsis and septic shock should receive antibiotics in an hour and all before leaving the ED. This standard may be reviewed before the next audit as sepsis management improves globally and new evidence emerges.

SECTION 5: Urine measurements

Q10. Were urine output measurements instituted in the ED?

Chart 27: Histogram of patients for whom urine output measurements were instituted in the ED for all EDs, showing quartiles

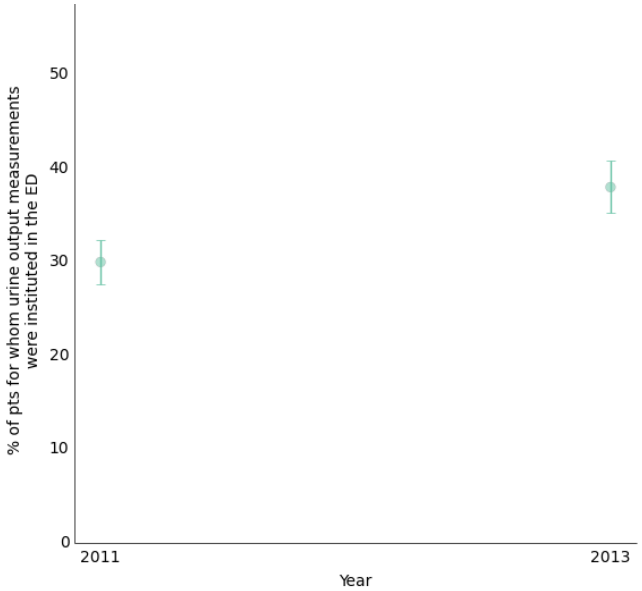


The histogram shows the variation in performance between EDs.

No ED instituted urine output measurements for every patient. One ED achieved this for 96% of patients.

Four EDs did not institute urine output measurements for any patients.

Chart 28: Historical trend of patients for whom urine output measurements were instituted in the ED, showing overall median with 95% confidence interval



There has been improvement across all quartiles since the 2011 audit.

Urine measurements – commentary and recommendations

Blood pressure vs. blood flow

Tissue perfusion is dependent upon the blood pressure and the blood flow. Blood flow is determined by the cardiac output. Whilst blood pressure is routinely measured and monitored, it is harder to determine the cardiac output and therefore blood flow. In sepsis, tissue perfusion is of utmost importance and we must monitor the blood flow as best we can.

Urine output can help us to gauge a patient's blood flow. The kidney can autoregulate for changes in blood pressure and urine output is therefore generally independent of blood pressure, but it cannot autoregulate for a decrease in blood flow. A patient with decreased tissue perfusion may have a normal blood pressure and, without the use of invasive techniques, it is only by monitoring the urine output that abnormal blood flow will be detected.

This audit shows that monitoring urine output is not done well in the ED and the results show a disappointing median of only 38% although this has shown a significant improvement from 30% in 2011. All patients having their blood pressure monitored should also have their urine output measured. It is very simple to do and should be part of the culture of care for sick patients in the ED.

CEM Standards for Severe Sepsis and Septic Shock

1. Temperature, pulse rate, respiratory rate, blood pressure, oxygen saturation, mental status (AVPU or GCS) and capillary blood glucose within 15 minutes of arrival
2. Senior EM assessment of patient within 60mins of arrival
3. High flow O_2 via non-re-breathe mask was initiated (unless there is a documented reason to the contrary) before leaving the ED
4. Serum lactate measured before leaving the ED
5. Blood cultures obtained before leaving the ED
6. Fluids - first intravenous crystalloid fluid bolus (up to 20mls/kg) given:
    - 75% within 1 hour of arrival
    - 100% before leaving the ED
7. Antibiotics administered
    - 50% within 1 hour of arrival
    - 100% before leaving the ED
8. Urine output measurements instituted before leaving the ED

Sepsis Six **(source: http://sepsistrust.org)**

1. Administer high-flow oxygen
2. Take blood cultures and consider infective source
3. Administer intravenous antibiotics
4. Give intravenous fluid resuscitation
5. Check haemoglobin and serial lactates
6. Commence hourly urine output measurement

Thank You

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

However, should you have any queries about the report please e-mail audit@collemergencymed.ac.uk or phone 020 7400 6108

Details of the CEM Clinical Audit Programme can be found at:

http://www.collemergencymed.ac.uk/Shop-Floor/Clinical Audit/Current Audits

This report is endorsed by

THE UK SEPSIS TRUST

Acknowledgements

The commentary and recommendations in this report draws on content from the Survive Sepsis manual produced by the UK Sepsis Trust, available at: http://survivesepsis.org/

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