Quality Assurance in Severe Sepsis: Audit, Feedback, Improve
Dr. Mark Simmonds, Consultant in Critical Care and Acute Medicine,
Sepsis Lead, Nottingham University Hospitals NHS Trust
mark.simmonds@nuh.nhs.uk

Summary

Rapid treatment of Severe Sepsis can save lives but requires a coordinated response. Trust-wide audit at Nottingham University Hospitals* in 2006 and 2009 showed significant care deficiencies when compared with international guidelines. Whilst system improvements were tackled with improved infrastructure, antibiotic logistics, and staff education, sepsis care remained reliant on individual clinician response. To make sepsis ‘personal’ we created a rapid audit-feedback mechanism. Every patient audited generated an email report to the treating clinical team. Our rolling Trust-wide audit programme has now provided individualised feedback on over 400 cases since November 2011. Antibiotic administration in <1 hour has risen from 40% to over 80% and ‘pre-ICU’ bundle compliance has risen from 25% to 70% across the Trust, with evidence of consistent and sustained response. Outcomes have improved, with crude critical-care sepsis mortality falling from 42% to 28% and our septicemia SMR has dropped from 119 to 86 since 2009. By defining clear goals and expectations, our audit concept has changed from statistic gathering to promoting personal accountability. The NUH Sepsis programme has been innovative, data-driven and clinically led. We are keen to share our experience so that others can improve performance in this wide reaching but previously neglected disease process.

*Nottingham University Hospitals NHS Trust is the fifth largest acute teaching hospital in the country covering a population of 1.2 million for secondary care services on two campuses. NUH is also the major trauma centre for the East Midlands and tertiary neuroscience, burns, renal and haematology centre.

Background

Severe sepsis has high mortality and healthcare costs. Development of international ‘Surviving Sepsis’ guidelines in 2005 led to the inauguration of the Sepsis Action Group (SAG) at Nottingham University Hospitals (NUH). SAG consists of multidisciplinary stakeholders including acute and emergency medics, intensivists, microbiologists, pharmacists, nurses and managers.

A cross-trust audit process (based on patients identified from significant positive blood cultures) was devised that not only determined guideline compliance but also ‘time-lined’ our response to severe sepsis (Fig. 1), from which we identified system and process failures. The audit results were disseminated locally and nationally, with a repeat process in 2009/10.

Sepsis Timeline at NUH 2005/06

| Onset of Severe Sepsis | Seen by first doctor | Blood Culture taken | Antibiotics given | Seen by Senior Doctor | Arrive Critical Care
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>12:00</td>
<td>13:00</td>
<td>14:00</td>
<td>15:00</td>
<td>16:00</td>
<td>17:00</td>
</tr>
</tbody>
</table>

Figure 1: Timeline of Care in 2005/06: Median time to interventions based on patient Time Zero of 12:00. Based on n=46.
Despite system improvements in the interim, our guideline compliance remained poor, with 35% of cases receiving antibiotics in <1 hour and only 25% receiving basic interventions (e.g. blood cultures, fluids) in a timely manner. It was clear that whilst system improvements (e.g. providing first-line antibiotics in acute areas) were straight-forward, sepsis care remained reliant on individual clinician response. Equally, whilst dissemination of organisation level data raised the profile of sepsis, it appeared that individual clinicians did not view it as ‘their problem’.

Since 2011 our improvement strategy has focussed on changing clinical behaviour by galvanising the pride and competitive nature of healthcare workers to drive improvement.

**Aims**

This initiative aimed to promote severe sepsis as a medical emergency, to disseminate ‘best practice’ guidance, and improve timely recognition and treatment of severe sepsis at NUH. Specifically, we aimed to adapt our established audit process so that clinicians would receive reports on individual cases which, in itself, would act as an educational tool. As part of a Trust-wide improvement strategy, we aimed to improve compliance with antibiotic administration in <1 hour from 35% to 70% and improve compliance with a ‘pre-ICU’ care bundle (lactate measurement, blood culture acquisition, fluid and antibiotic administration) from 20% to 50% by April 2014.

**Methods**

In 2011, a rolling audit process was introduced with daily identification of patients admitted to a critical care unit (4 units, 61 beds) with the primary diagnosis of infection. This streamlined the audit process, with patient identification, audit and feedback occurring within days of admission. The pre-ICU care of patients who met criteria was against the Surviving Sepsis Guidelines. Time zero is defined as when criteria for severe sepsis were first met. Information on timings of key interventions (such as doctor review and request for critical care escalation) was also gathered. A rapid-response individualised feedback system was devised that reported timings of interventions and incorporated a traffic light indicator based on agreed clinical standards (Figure 2). The clinical team who had looked after the patient prior to critical care was then emailed a report.

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Target Time (hrs)</th>
<th>Achieved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early Warning Score recorded and escalated</td>
<td>-</td>
<td>No CCOT referral</td>
</tr>
<tr>
<td>Doctor review</td>
<td>0.5</td>
<td>1 hr</td>
</tr>
<tr>
<td>Senior clinician review</td>
<td>2</td>
<td>1 hr</td>
</tr>
<tr>
<td>Blood cultures taken</td>
<td>1</td>
<td>1 hr</td>
</tr>
<tr>
<td>Broad spectrum antibiotics</td>
<td>1</td>
<td>3 hrs</td>
</tr>
<tr>
<td>Lactate measured</td>
<td>3</td>
<td>1.5 hrs</td>
</tr>
<tr>
<td>Adequate fluid resuscitation</td>
<td>3</td>
<td>1 hr</td>
</tr>
<tr>
<td>Escalation to critical care if patient fails to improve</td>
<td>6</td>
<td>6.5 hr</td>
</tr>
</tbody>
</table>

Figure 2: Example ‘traffic light’ report with target times and individual case adherence

The audit/feedback system was endorsed by the Trust Quality Committee with ‘time to antibiotics’ and compliance with the pre-ICU care bundle placed on our Quality Dashboard. Monthly analyses of
audit results create a rolling run-chart of organisational performance.

In April 2012, the sepsis team devised and negotiated a 2 year CQUIN target with commissioners. Since November 2012, our audit and education process has been driven by a part-time ‘Sepsis Nurse’ (0.5 whole time equivalent). This ‘high level’ interest within the organisation has led to a Trust-wide campaign to improve sepsis care. Other interventions include ‘sepsis boxes’, sepsis documentation stickers, a sepsis screening tool for observation charts, an intranet website and computer-aided learning packages.

Results

Since November 2011, we have provided feedback on over 400 severe sepsis cases. Since November 2012 all severe sepsis cases admitted to our critical care units have been audited equating to 30-35 cases per month.

Since 2009, antibiotic administration in <1 hour has risen from 40% to 80% (Figure 3), and ’pre-ICU’ bundle compliance has risen from 25% to 70% consistently (Figure 4). Median time to antibiotics has reduced from 2.5 hours to 30 minutes. Median time to senior review has reduced by 1 hour and time to critical care admission has dropped by 2 hours.

Figure 3: Percent of cases receiving antibiotics within 1 hour of Time Zero

Figure 4: Percent of cases receiving all appropriate elements of the Pre-ICU bundle within time limits
By its nature, this initiative focuses on wards where sepsis is prevalent and has encouraged intense improvement efforts in A+E and Acute Medicine. Less acute areas have also engaged as even individual case reports can improve clinician behaviour. Sepsis is now embedded in undergraduate and postgraduate medical and nursing education in Nottingham and features prominently in multidisciplinary teaching in our simulation centre.

Whilst we had set out to improve and measure process, we have also seen improvement in crude outcome measures. Our unadjusted critical care mortality for patients identified with severe sepsis has dropped from 42% to 28% between 2009 and 2013 and our ‘Dr Foster’ standardised mortality ratio has fallen from 119 to 86. We have also seen a reduction in High Level sepsis incidents.

**Discussion**

The audit/feedback system described above, in itself, acted as a powerful and effective communication tool that targeted individuals with our message and expectations. By presenting rapid feedback in a non-judgmental manner we were able to praise good practice as well as highlight potential for improvement. This method also allowed for a conversation between the improvement team and frontline clinicians. This has led on several occasions to targeted system improvement and team training.

By reporting organisation-level data on a monthly basis, we developed a strong commitment from our Trust board to support this programme. This data was emailed in graphical form to all members of the SAG team, key clinical leaders and board members. By putting sepsis into our Quality Account, we have placed our results in the public domain, and more recently have even been publishing results on Twitter.

Regionally, we have negotiated with commissioners and won their support, ultimately leading to a ‘Sharing Best Practice’ document that was circulated throughout local CCGs and acute Trusts. We have shared our methods, proformas and materials with several local Trusts and have submitted our work to Sepsis UK, NHS England, NHS Scotland, NCEPOD and NICE.

The success of the sepsis programme has resulted in a broader ‘Recognise and Rescue’ strategy at NUH. The concept of audit and individualised feedback is being adapted to other time dependent patient pathways including Early Warning Score escalation, emergency theatres and cardiac arrests.

This scheme has changed our audit concept from one of organisational statistic gathering to one that promotes personal accountability. Whilst we expected a mixed response to unsolicited feedback, the reality was actually very positive as it seems to have been accepted as constructive rather than judgemental criticism.

To make clinically relevant change happen, individual clinicians need to be targeted. Clinicians respond to individualised, relevant data which needs to be objective and factual rather than judgmental and opinionated. This system is, however, highly labour intensive with substantial time and effort devoted to identifying, auditing and reporting cases. Any organisation planning a similar approach would need to be aware of this, and ensure that multi-speciality and multi-disciplinary engagement was in place at the outset. We are currently devising an electronic data collection method with automatic report collation which would greatly improve efficiency.