Sepsis: developing a regional pathway and a standardised language for deterioration
From confusion to consensus:
The Oxford AHSN Sepsis Pathway

Andrew Brent
Sepsis Clinical Lead, Oxford AHSN
& Oxford University Hospitals NHS Foundation Trust
Oxford AHSN Sepsis Group Aims

• Share experience of QI initiatives
• Share resources (e.g. for training)
• Share data (process & outcome; combine to max learning)
• Joint QI projects (± research)
• Collaboratively review & apply guidelines
National Sepsis Stakeholder Audit
Will you be implementing NICE?

Adults

- Yes: 24%
- Partially: 51%
- No: 25%

82 respondents
>50 acute Trusts
Oxford AHSN approach

• Regional approach to implementation

• Integrate into existing pathways
  – Community
  – Acute admissions
  – Deteriorating patients (Track & Trigger / Early Warning Scores)

• Build on progress already made
  – ‘Red Flag’ Sepsis
  – Sepsis Six
  – Neutropaenic Sepsis
Early Warning Scores

Person with possible infection
- Think ‘could this be sepsis?’ if they present with signs or symptoms that indicate infection, even if they do not have a high temperature.
- Be aware that people with sepsis may have non-specific, non-localising presentations (for example, feeling very unwell).
- Pay particular attention to concerns expressed by the person and family/carer.
- Take particular care in the assessment of people who might have sepsis who are unable, or their parent/carer is unable, to give a good history (for example, young children, people with English as a second language, people with communication problems).

ASSESSMENT
Assess people with suspected infection to identify:
- likely source of infection
- risk factors (see righthand box)
- Indicators of clinical of concern such as abnormalities of behaviour, circulation or respiration.

Healthcare professionals performing a remote assessment of a person with suspected infection should seek to identify factors that increase risk of sepsis or indicators of clinical concern.

People more vulnerable to sepsis
- the very young (under 1 year) and older people (over 75 years) or very frail people
- recent trauma or surgery or invasive procedure (within the last 6 weeks)
- Impaired immunity due to illness or drugs (for example, people receiving steroids, chemotherapy or immunosuppressants)
- Indwelling lines / catheters / intravenous drug misusers, any breach of skin integrity (for example, any cuts, burns, blisters or skin infections).

If at risk of neutropenic sepsis - refer to secondary care

Additional risk factors for women who are pregnant or who have been pregnant, given birth, had a termination or miscarriage within the past 6 weeks - gestational diabetes, diabetes or other co-morbidities; needed invasive procedure such as caesarean section, forceps delivery, removal of retained products of conception, prolonged rupture of membranes, close contract with someone with group A streptococcal infection, have continued vaginal bleeding or an offensive vaginal discharge.

Consider RISK FACTORS & Indicators of CLINICAL CONCERN

Structured Assessment:
Observations & Early Warning Scores

SUSPECT SEPSIS
If sepsis is suspected, use a structured set of observations to assess people in a face-to-face setting.
Consider using early warning scores in hospital settings.
Parental or carer concern is important and should be acknowledged.
NICE High Risk ≈ Red Flag Sepsis

Infection plus:

- HR > 130
- SBP < 90 (MAP <65; ↓SBP >40)
- RR > 25
- SaO₂ < 91%
- Lactate > 2
- New altered mental state
- Purpuric rash, mottled/ashen, or cyanosed
- Poor urine output (not passed urine >18h or <0.5ml/kg/hr)

* = Bilirubin > 34 mmol/L, INR > 1.5, Lactate > 2 mmol/l, Platelets <100x10⁹/L, Creatinine >177 mmol/L

New (NICE 2016)
Care Bundle

- **IV Antibiotics**
  - Pre-alert secondary care if high risk / red flag sepsis
  - Mechanism for delivery pre-hospital if >1h transfer
  - BenPen pre-hospital for suspected meningococcal disease

- **IV Fluids** - guided by need / lactate

- **Consider Oxygen** - target SaO₂ 94-98% (88-92% if risk of T2RF)

- Blood cultures

- Lactate

- **Monitoring** *(urine output)*

- **Source Identification & Control**

- **Escalation criteria**
Oxford AHSN Regional pathway
# Sepsis Six Pathway

**To be applied to all adults and young people over 12 years of age with suspected or confirmed Red Flag Sepsis**

### Action (complete ALL within 1 hour)

1. **Oxygen**
   - Aim to keep saturations 94-98%
   - (88-92% if at risk of CO₂ retention e.g. COPD)

2. **Blood (± other) cultures**
   - At least 1x peripheral blood ± line cultures.
   - CXR & urinalysis (± CSF, urine culture, etc)
   - Source control if all surgeon/radiologist?

3. **IV antibiotics**
   - According to Trust protocol
   - Consider allergies prior to administration.

4. **IV fluids**
   - Consider 500ml stat if low BP or lactate ≥ 2mmol/l. Repeat if clinically indicated – max 30ml/kg

5. **Check serial lactates**
   - If lactate > 4mmol/l consider referral to Critical Care and recheck after each ~10ml/kg challenge

6. **Monitor urine output**
   - Consider if urinary catheter required
   - Commence hourly fluid balance chart

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**If after delivering Sepsis Six there is:**
- further clinical deterioration
- persistent systolic BP < 90 mmHg
- lactate not reducing

*or* a patient is critically ill at any time

Discuss with Critical Care / Outreach team

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**Space available for local short antimicrobial guideline/escalation policy**

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**Oxford AHSN Version**

**Minor wording changes**

**Simplified escalation criteria**
Oxford AHSN Version 1

Early Warning Score

Simplified Amber criteria

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**Patient details (affix label):**

**Staff member completing form:**
- Date (dd/mm/yyyy):
- Name (print):
- Designation:
- Signature:

**Important:** Is an end of life pathway in place? Yes ☐ No ☐

Is escalation clinically inappropriate? Yes ☐ No ☐

Initials: __________________ Discontinue pathway

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**1. Does patient look sick?**

☐ Yes ☐ No

**OR** NEWS ≥3 [inpatients ≥5 or single parameter ≥3]

---

**2. Could this be due to an infection?**

☐ Yes, but source unclear at present

Pneumonia

Urinary Tract Infection

Abdominal pain or distension

Cellulitis/ septic arthritis/ infected wound

Device-related infection

Meningitis

Other (specify: _____________________________)

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**3. ANY red flag criteria?**

Objective evidence of new altered mental state

Heart rate > 130 per minute

Systolic B.P ≤ 90 mmHg (or drop >40 from normal)

Respiratory rate ≥ 25 per minute

New O₂ requirement to keep SaO₂ ≥92% (88% in COPD)

Non-blanching rash / mottled / ashen / cyanotic

Not passed urine in last ~18 h (or U.O. <0.5 ml/kg/hr)

Lactate ≥2 mmol/l (if available)

Severe immunosuppression, e.g. suspected neutropenia

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**4. Any amber flags (other sepsis concern)?**

☐ Other risk factor(s) for severe infection¹

Acute deterioration in functional/mental state

Systolic BP 91-100 mmHg or new arrhythmia

Hypothermia

Patient, relative or health professional remains worried

¹ E.g. recent surgery; immunosuppression; oral steroids; rapidly spreading cellulitis or possible necrotizing fasciitis (is pain out of proportion to clinical signs of cellulitis?);

[N.B. severe immunosuppression incl. neutropenia = red flag]

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**Send bloods (including blood cultures, FBC, U&Es, CRP, LFTs, clotting, VBG)**

**Organize early clinical assessment**

USE SBAR! Review results within 1 hour

**Time clinician attended**

---

**AKI or Lactate ≥2?**

☐ YES ☐ NO

☐ (if infection concern persists)

---

**Clinician to make antimicrobial prescribing decision within 3h.**

*Treat all bacterial infections promptly.*

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If senior clinician happy, may discharge with appropriate safety netting [ED/AMU]

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**Treat Urgently for Sepsis NOW** (see overleaf)

This is time critical, immediate action is required.
Generic Sepsis Screening & Action Tool
To be applied to all non-pregnant adults and young people over 16 years with symptoms of infection, or who are clearly unwell with any abnormal observations.

1. Does patient look sick?
   ORRt NEWS ≥3 (Inpatients ≥5 or single parameter ≥3)?

2. Could this be due to an infection?
   Yes, but source unclear at present
   Pneumonia
   Urinary Tract Infection
   Abdominal pain or distension
   Cellulitis/septic arthritis/infected wound
   Device-related infection
   Meningitis
   Other (specify: __________________)

3. ANY red flag criteria?
   Objective evidence of new altered mental state
   Heart rate > 130 per minute
   Systolic B.P. ≤ 90 mmHg (or drop >40 from normal)
   Respiratory rate ≥ 25 per minute
   New O₂ requirement to keep SpO₂ ≥92% (88% in COPD)
   Non-blanching rash / mottled / ashen / cyanotic
   Not passed urine in last ~18 h (or U.O. <0.5 ml/kg/hr)
   Lactate ≥2 mmol/L (if available)
   Severe immunosuppression, e.g. suspected neutropaenia

4. Assess further for possible sepsis
   Organize early clinical assessment
   USE SBAR!
   Send bloods (including blood cultures, FBC, U&E, CRP, LFTs, clotting, VBG)
   Full clinical assessment
   [Record time clinician attended]
   Consider other investigations (e.g. CXR, urinalysis ± MSU, etc)
   Treat obvious bacterial infections promptly

   Monitor observations at least hourly
   Review blood results within 1 hour
   AXI or Lactate ≥2?
   [If infection concern persists] YES ☐ NO ☐
   Clinician to make antimicrobial prescribing decision within 3h.
   Treat all bacterial infections promptly.
   If senior clinician happy, may discharge with appropriate safety netting [ED/AMU]

Treat Urgently for Sepsis NOW (see overleaf)
This is time critical, immediate action is required.

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Paediatric screening tool

- **Regional Collaboration**
  - Paediatric Critical Care Network (PCCN)
  - Children’s Network
  - Oxford & Wessex AHSNs

- **Validated** against NICE guideline
  - Audit of 227 notes (PCCN)
  - Equally sensitive, more specific

- **Adopted by Oxford AHSN Sepsis group**

- **Implemented across Thames Valley**
  - including Oxford, Buckinghamshire, Milton Keynes, Frimley Health [Swindon agreed in principle]
Going forwards?

Churpek et al. AJRCCM 2016
Oxford AHSN approach

- Regional approach to implementation

- Integrate into existing pathways
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- Build on progress already made
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  - Neutropaenic Sepsis
SUSPICION OF SEPSIS (SOS)

Measuring patient outcomes

How do we evaluate the impact of local, regional and national sepsis programmes?

Bethan Page (Oxford AHSN)

In collaboration with Dr Matt Inada-Kim (Wessex AHSN)
Measurement & surveillance

• **Surveillance** needed to monitor sepsis burden and assess impact of interventions

• Ideally need readily available metrics which can be applied and compared nationally

• HES data is most readily available
Limitations of HES sepsis codes

- Sensitivity of HES sepsis codes (A40/A41) is poor
- **Ascertainment bias** as sepsis initiatives (including CQUIN) change coding practice

![A40/A41 Number of admissions](image_url)
Suspicion of sepsis (SOS)

Need an improved **case definition** for surveillance. ‘SOS’ codes include all bacterial infections.

Advantages include:

- More sensitive
- Identifies wider group of patients at whom many of the sepsis interventions are directed
- Should be less susceptible to ascertainment bias (due to changing coding practices)
## SOS outcomes for Oxford AHSN region

<table>
<thead>
<tr>
<th></th>
<th>2012-13</th>
<th>2013-14</th>
<th>2014-15</th>
<th>2015-16</th>
<th>2016-17* (up to sept)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admissions</td>
<td>52357</td>
<td>55077</td>
<td>63008</td>
<td>67817</td>
<td>33990</td>
</tr>
<tr>
<td>Mortality</td>
<td>6.7%</td>
<td>6.3%</td>
<td>6.3%</td>
<td>5.8%</td>
<td>5.2%</td>
</tr>
<tr>
<td>Length of stay</td>
<td>6.3</td>
<td>6.4</td>
<td>6.4</td>
<td>6.3</td>
<td>5.3</td>
</tr>
<tr>
<td>Readmissions</td>
<td>6.0%</td>
<td>6.2%</td>
<td>6.3%</td>
<td>6.6%</td>
<td>6.2%</td>
</tr>
</tbody>
</table>
SOS mortality by Trust (Oxford AHSN region)
Future plans

- 30 day mortality (currently inpatient mortality)
- Incorporate ICU HES data
- Link to blood culture data to validate methodology
- NHS England collaboration to use methodology nationally
- A short guide for identifying SOS patients in your organisations and regions is available to take away today

Paper in press with BMJ Open this month
(Inada-Kim, Page, Maqsood & Vincent, 2017)
Standardising the language of deterioration in healthcare

Dr Matt Inada-Kim and Mr Geoff Cooper

Wessex Patient Safety Collaborative

A Masterclass based on lessons learned from a collaborative pilot to standardise terminology relating to physical deterioration included a large general practice, 3 care homes, the acute hospital and the ambulance service.
Breakthrough Series (BTS)

Pre-Work
Set improvement goals, collect baseline data and prepare for Learning Event 1

Action Phase 1
Adapt and test improvement strategies

Action Phase 2
Further refine improvement strategies, begin spreading successful changes throughout the organisation

Action Phase 3
Adopt successful changes throughout the organisation

Learning Event 4
Document work, report on results and lessons learned

On-going support
Phone conferences, monthly team reports, on-site peer-to-peer visits

Wessex Patient Safety Collaborative
Connecting and sharing across Wessex to improve patient safety
Most Sepsis arises in the Community, but the focus is on hospitals

Hypotheses: A single, standardised language and pathway for sickness will improve outcomes

Why should the calculation of risk only start in the hospital?

Matt Inada-Kim, Acute Physician, Hampshire Hospitals
National Clinical Advisor, Clinical Lead for Physical Deterioration & Sepsis, Wessex PSC
1. We need to focus on the Community

NCEPOD Sepsis cases prehospital Obs

<table>
<thead>
<tr>
<th>Vital signs recorded</th>
<th>GP (n=129)</th>
<th>%</th>
<th>Paramedic (n=163)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>34</td>
<td>26.4</td>
<td>146</td>
<td>89.6</td>
</tr>
<tr>
<td>Blood pressure</td>
<td>32</td>
<td>24.8</td>
<td>157</td>
<td>96.3</td>
</tr>
<tr>
<td>Heart Rate</td>
<td>40</td>
<td>31.0</td>
<td>163</td>
<td>100</td>
</tr>
<tr>
<td>Respiratory Rate</td>
<td>8</td>
<td>6.2</td>
<td>159</td>
<td>97.5</td>
</tr>
<tr>
<td>AVPU</td>
<td>8</td>
<td>6.2</td>
<td>144</td>
<td>88.3</td>
</tr>
</tbody>
</table>

“National Early Warning Score (NEWS) should be used in both primary care and secondary care for patients where sepsis is suspected. This will aid the recognition of the severity of sepsis and can be used to prioritise urgency of care”

NCEPOD 2015
2. Separating Sepsis from Deterioration is harmful

Could this be sepsis in every deterioration?

Sepsis should be managed with the same triggers as for deterioration.

But not all deterioration is Sepsis.
3. We don’t treat **sepsis**, we treat on **suspicion**

Rx Broad spectrum antimicrobials

Start Smart, then focus

Protocolised Diagnosis & Rx

Clinical Judgement

- Harm of Antibiotic treatment
- Antibiotic resistance
- Benefit of Early antibiotics
4. In order to improve, Processes must be hardwired to Outcomes

**PROCESSES**
- Screening
- Administration time
- Antibiotic reviewing

**OUTCOMES**
- Analyse the “Suspicion of sepsis” group
  - Mortality / ICU admissions
  - Length of stay/ comorbidity
- Benchmark data over time and share results
- Evaluate the efficacy of sepsis improvement
4. Patients define their *badness* by where they are managed...

<table>
<thead>
<tr>
<th>Location</th>
<th>Label</th>
<th>“n”/year (estimated)</th>
<th>Mortality (estimated)</th>
<th>NEWS (off baseline)</th>
<th>Antibiotics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community</td>
<td>Stays at home</td>
<td>“Self limiting illness”</td>
<td>12 million</td>
<td>&lt;0.1%</td>
<td>0-1</td>
</tr>
<tr>
<td></td>
<td>Sees GP but not referred</td>
<td>“Infection”</td>
<td>8 million</td>
<td>&lt;1%</td>
<td>0-2</td>
</tr>
<tr>
<td></td>
<td>Referred but not admitted</td>
<td>“Infection”</td>
<td>400,000</td>
<td>2%</td>
<td>0-3</td>
</tr>
<tr>
<td>Hospital</td>
<td>Hospitalized (mild)</td>
<td>Suspicion of Sepsis</td>
<td>1,000,000_(M)</td>
<td>7%</td>
<td>≥3</td>
</tr>
<tr>
<td></td>
<td>Hospitalized (moderate)</td>
<td>Suspected Sepsis</td>
<td>300,000</td>
<td>23%</td>
<td>≥5</td>
</tr>
<tr>
<td></td>
<td>Admitted to ICU</td>
<td>Suspected Sepsis</td>
<td>36,000_(IC)</td>
<td>35%</td>
<td>≥7</td>
</tr>
</tbody>
</table>

**Suspicion of Sepsis (SOS) = All bacterial infection derived codes (ICD 10)**

≈ Sepsis outcomes measurement & Evaluation of sepsis screening/improvement
Wessex PSC Outcomes from an Acute focus on Sepsis

Wessex SOS total discharges

Wessex Region SOS Mortality
“Speaking the same language is a game changer”

Mr AS - sepsis survivor

With thanks WEAHSN

https://vimeo.com/208284106
<table>
<thead>
<tr>
<th>Time point</th>
<th>Mr Sutton</th>
<th>Mrs X</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient becomes unwell</td>
<td>20:00</td>
<td>20:00</td>
</tr>
<tr>
<td>Calls GP reception</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GP Appointment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambulance call</td>
<td>20:08</td>
<td>09:00</td>
</tr>
<tr>
<td>Ambulance dispatch</td>
<td>20:08</td>
<td>10:30</td>
</tr>
<tr>
<td>Ambulance arrival</td>
<td>20:21</td>
<td>10:45</td>
</tr>
<tr>
<td>Ambulance departure</td>
<td>20:49</td>
<td>14:00</td>
</tr>
<tr>
<td>Pre alert</td>
<td>✓</td>
<td>✕</td>
</tr>
<tr>
<td>A&amp;E arrival</td>
<td>21:20</td>
<td>16:00</td>
</tr>
<tr>
<td>Antibiotic prescription</td>
<td>21:35</td>
<td>17:45</td>
</tr>
<tr>
<td>Antibiotic administration</td>
<td>21:45</td>
<td>18:35</td>
</tr>
<tr>
<td>Delay onset to antibiotics</td>
<td>1:45</td>
<td>22:35</td>
</tr>
<tr>
<td>Discharge</td>
<td>3 days</td>
<td>17 days</td>
</tr>
<tr>
<td>Function</td>
<td>Independent</td>
<td>Carer BD</td>
</tr>
</tbody>
</table>

5:30 NEWS
2:35
Dialects & Tribes
A Collaborative improvement strategy

**System**

*The same physiological language*
Integrated pathways co designed
A single tool
Collaborative pan pathway Ownership
Sustained engagement
Seamless transitions of care

**Strategy**

1. Align Hospitals
2. Implement in Ambulances
3. Community pilot
4. Widespread dissemination

Mark Ainsworth-Smith, Michael Lambert, Matthew Richardson
Dear Colleague,

RE: Use of the National Early Warning Score in Primary Care

As GPs we not only want to provide the best care for our patients but also when we are concerned about patients, we need to be able to access the care they require in a timely manner. In addition, when patients’ health deteriorates it is always helpful to have robust evidence to justify how the decision was made regarding the actions taken by individual clinician.

The *National Early Warning Score* is being used routinely in hospitals, by the Ambulance Service and is going to be available for use in Care Home Homes. It is therefore important that not only general practice understands how this is used by the wider NHS but also how it may be a useful tool to be used in general practice. This tool has been tested in Mid Hampshire and has been found to be helpful.

It is estimated that integration of NEWS into the whole care pathway across England could save 6000 lives per year. A NEWS App can be downloaded for Android and Apple devises by searching NEWS and sepsis screen.

**What is NEWS?**

This is a validated scoring system recommended that will help and support clinicians and not replace clinical skills. A score of 0-3 is allocated to seven physiological measurements and these are:

- Respiration Rate
- Oxygen Saturations
- Supplemental Oxygen
- Temperature
- Systolic BP
- Heart Rate
- Level of Consciousness (defined on the AVPU system)

The NEWS scores are directly linked to mortality, the higher the score above what would normally be expected for the patient, the worse the prognosis.

When a single admission NEWS score is taken in patients with symptoms of infection (the commonest reason for admission) the mortality equates to:

<table>
<thead>
<tr>
<th>NEWS Score</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.5%</td>
</tr>
<tr>
<td>&lt;5</td>
<td>5.5%</td>
</tr>
<tr>
<td>≥5</td>
<td>22%</td>
</tr>
<tr>
<td>≥7</td>
<td>27%</td>
</tr>
<tr>
<td>≥9</td>
<td>38%</td>
</tr>
</tbody>
</table>

*Baseline observations*

Patients with chronic hypoxic states (e.g. COPD) are likely to always score for hypoxia even when well; knowing their baseline oxygen level and the presence of a deterioration in this and in their function is the best guide to determine admission.

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**NEWS =**

Great predictor for admission

No additional time for consultation
NEWS in Care Homes

1. Signs of Deterioration/Sepsis
2. Baseline NEWS
3. Obs Chart
4. Escalation directions
5. Communication tool

CCG / AHSN Injected QI capacity
- Baseline 100 patients
- 27 PDSA cycles
- 3 pilot sites
- 4 training sessions
- 5 focus groups
- 5 case studies
- 100% +ve feedback

Now spreading pan Wessex +
Across community care