Preventing Sepsis in Wales by Achieving High Reliability

Medi | Dydd | September | World
13   | Sepsis| 13        | Sepsis
2012 | Y Byd | 2012      | Day
Andrew’s film
Sepsis kills
but can be cured
if spotted in time

In January 2012 Andrew Roberts nearly died from sepsis; in May he ran a half marathon. If you are aware of sepsis you can prevent it claiming lives.
In the past 10 minutes approximately 150 people have died from sepsis
The Least Known Biggest Killer

- In the developed world, sepsis is increasing annually by 8-13%
- Sepsis is the primary cause of maternal death in the ante and post natal periods

*(CMACE report, 2011)*
A patient with sepsis is 5 times more likely to die than a patient who has suffered a heart attack or stroke.

Sepsis accounts for one third of Critical Care expenditure

Sepsis is responsible for one third of all episodes of in-patient deterioration

In the UK sepsis is estimated to be responsible for the deaths of 37,000 people every year and to cost the NHS £2.5 billion

For Wales this equates to a figure of 1800 deaths and a cost of £125 million

• We Think!
Why Sepsis?

Public Reporting environment:
- Increasing focus on hospital mortality as measure of quality.
- No Incentives. No specific public reporting of sepsis.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Admission Volume</th>
<th>Mortality Volume</th>
<th>Mortality Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMI 2010</td>
<td>5,316</td>
<td>194</td>
<td>3.6%</td>
</tr>
<tr>
<td>Sepsis 2010</td>
<td>13,221</td>
<td>1,668</td>
<td>12.5%</td>
</tr>
</tbody>
</table>

→ 33% of all adult hospital mortalities

>8 X the number of deaths as AMI
Roughly 300/year
BUT
This is only those recorded by an ‘in hours’ outreach service in a small DGH
• Sepsis is a life-threatening condition that arises when the body's response to an infection injures its own tissues and organs.

• Sepsis leads to shock, multiple organ failure and death especially if not recognized early and treated promptly.
What is Sepsis?

Systemic Inflammatory Response due to an infection
What is sepsis?

Infection

- Infection
- Virus
- Fungal
- Parasite

Sepsis

- Sepsis
- Septic Shock
- Severe sepsis

SIRS

- Burns
- Trauma
- Pancreatitis
- Other
<table>
<thead>
<tr>
<th>Number of patients in Wales</th>
<th>HAI type</th>
<th>Number of HAI*</th>
<th>% of HAI</th>
<th>Prevalence (%) of HAI by type</th>
</tr>
</thead>
<tbody>
<tr>
<td>9094</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UTI</td>
<td>80</td>
<td>20.9</td>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td>SSI</td>
<td>75</td>
<td>19.6</td>
<td>0.8</td>
<td></td>
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<tr>
<td>GI infection</td>
<td>44</td>
<td>11.5</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>Pneumonia</td>
<td>42</td>
<td>11.0</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>BSI</td>
<td>34</td>
<td>8.9</td>
<td>0.4</td>
<td></td>
</tr>
<tr>
<td>Skin and soft tissue infection</td>
<td>32</td>
<td>8.4</td>
<td>0.4</td>
<td></td>
</tr>
<tr>
<td>LRT infection</td>
<td>25</td>
<td>6.5</td>
<td>0.3</td>
<td></td>
</tr>
<tr>
<td>Eyes and ENT infection</td>
<td>22</td>
<td>5.8</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>Systemic infection</td>
<td>8</td>
<td>2.1</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td>CRI-CVC</td>
<td>5</td>
<td>1.3</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td>Reproductive tract infection</td>
<td>4</td>
<td>1.0</td>
<td>&lt;0.1</td>
<td></td>
</tr>
<tr>
<td>Neonatal infection</td>
<td>3</td>
<td>0.8</td>
<td>&lt;0.1</td>
<td></td>
</tr>
<tr>
<td>CRI-PVC</td>
<td>3</td>
<td>0.8</td>
<td>&lt;0.1</td>
<td></td>
</tr>
</tbody>
</table>

* Counts the number of HAI (i.e. Patients may have multiple HAI).

Key: UTI – urinary tract infection; SSI – surgical site infection; GI – gastrointestinal; BSI – bloodstream infection; LRT – lower respiratory tract; ENT – ear-nose-throat; CRI-CVC – catheter related infection (central venous catheter); CRI-PVC – catheter related infection (peripheral vascular cannula); CNS – central nervous system; CVS – cardiovascular system.

Acute Sector
- SSI (23.7%)
- UTI (16.7%)
- Pneumonia (12.3%)

Non-Acute
- UTI (36.1%)
- Eyes & ENT (14.5%)
- SST (12.1%)
Sepsis is a life-threatening condition that arises when the body's response to an infection injures its own tissues and organs. Sepsis leads to shock, multiple organ failure, and death especially if not recognized early and treated promptly. Sepsis remains the primary cause of death from infection despite advances in modern medicine, including vaccines, antibiotics, and acute care. Millions of people die of sepsis every year worldwide.

The HAP Roadmap
(focus is aspiration pneumonia)

Hospital-Acquired PN
- 2500 patients/yr
- 24,000 days/yr
- 385 deaths/yr
- #1 cause HA sepsis
- #1 cause preventable stroke mortality

National IP Goals 2011
1. assessment of best practices
2. identification of patients at risk
3. determination of what hospitals already doing relative to prevention
4. determine what other organizations are doing

Adjunctive prevention efforts to include:
- Build screening and doc prompts in electronic medical record
- Develop Implementation Plans, Tools & Measures
- Pilot in NCal (ED, POM, ICU) and knowledge sharing with other regions
- Develop Standardized Processes w/ Stakeholders
- Deconstruct to Segments—Post-op, Med Surg units, SNF, other
- Literature and Best Practice Review
- Develop Expert Teams

2012...
Q4 2011: Inter-Regional Knowledge sharing and planning
NCal HAP Bundle (Pilot)
- Risk Assessment and Resp Care (I/S)
- Oral Care
- Up in bed, with meals, up and walking
- Tube Care (feeding)
- Education

reduce HAP rate 2012 and beyond
If only we had a simple way
to identify sepsis?
Severe Sepsis Screening Tool

Are any 2 of the following SIRS criteria present and new to your patient?

**Obs:**
- Temperature >38.3 or <36 °C
- Respiratory rate >20 min⁻¹
- Heart rate >90 bpm
- Acutely altered mental state

**Bloods:**
- White cells <4x10⁹/l or >12x10⁹/l
- Glucose >7.7mmol/l (if patient is not diabetic)

If yes, patient has SIRS
Is this likely to be due to an infection?

*For example*

- Cough/ sputum/ chest pain
- Dysuria
- Abdo pain/ diarrhoea/ distension
- Headache with neck stiffness
- Line infection
- Cellulitis/wound infection/septic arthritis
- Endocarditis

If yes, patient has SEPSIS

Start SEPSIS SIX
Severe Sepsis: Ensure Outreach and Senior Doctor attend NOW!

**Senior staff: check for SEVERE SEPSIS**

- **BP**
  - Syst < 90 / Mean < 65 mmHg (after initial fluid challenge)

- **Lactate**
  - > 4 mmol/l

- **Urine output**
  - < 0.5 ml/kg/hr for 2 hrs

- **INR**
  - > 1.5

- **aPTT**
  - > 60 s

- **Bilirubin**
  - > 34 μmol/l

- **O₂**
  - Needed to keep SpO₂ > 90%

- **Platelets**
  - < 100 x 10⁹/l

- **Creatinine**
  - > 177 μmol/l or UO < 0.5 ml/kg/hr

Severe Sepsis: Ensure Outreach and Senior Doctor attend NOW!
Heart of England Sepsis Screening Tool (wards) NHS

Apply if MEWS is 4 or more, or if infection suspected

Are any 2 of the following SIRS* criteria present and new to your patient?
- Temperature <35 or >38.3°C
- Respiratory rate >20/min
- Heart Rate >90 bpm
- Acutely altered mental state
- WCC <4 x 10^9/l or >12 x 10^9/l

If patient is neutropenic and any 1 present, follow 'yes' and call Consultant

Follow standard MEWS protocol
Re-apply screening tool if situation changes

Patient has SIRS: Think SEPSIS!!!!

Is this likely to be due to an infection?
- Cough / sputum / chest pain
- New / persistent diarrhoea
- New / persistent abdominal pain / distension
- Headache with neck stiffness
- Line infection
- Wound infection / cellulitis
- Arthritis

For example

If yes, follow 'yes' to Sepsis 6 Stx Pathway

This patient has SEPSIS
Ensure Doctor present within 30 mins
Immediately start Sepsis Stx Pathway (overleaf)

Patient has SIRS
Continue MEWS every 20 mins
Give oxygen to keep SpO2 >92%
Consider fluid challenge
Look for other causes of SIRS
(UA/S/C/CT/RTW, sinuses, trauma, pneumonia, MRSA)
Re-evaluate for sepsis if MEWS increases or condition changes
Discontinue screen

C. Is there any 1 high risk factor?

D. Now complete 3 investigations

1. Give high-flow oxygen

2. Give IV antibiotics

3. Give a fluid challenge

4. Take blood cultures

5. Measure lactate

6. Measure accurate urine output

This is SEVERE SEPSIS

FY or CT Call Registrar of Consultant to attend urgently

Ensure Critical Care Outreach aware of need to attend urgently

* SIRS = Systemic Inflammatory Response Syndrome
What is the Cost?

A typical episode of sepsis costs in excess of £20,000.
What is the Solution?
Surviving Sepsis Campaign: International guidelines for management of severe sepsis and septic shock: 2008*

R. Phillip Dellinger, MD; Mitchell M. Levy, MD; Jean M. Carlet, MD; Julian Bion, MD; Margaret M. Parker, MD; Roman Jaeschke, MD; Konrad Reinhart, MD; Derek C. Angus, MD, MPH; Christian Brun-Buisson, MD; Richard Beale, MD; Thierry Calandra, MD, PhD; Jean-Francois Dhainaut, MD; Herwig Gerlach, MD; Maurene Harvey, RN; John J. Marini, MD; John Marshall, MD; M Ranieri, MD; Graham Ramsay, MD; Jonathan Sevransky, MD; B. Taylor Thompson, MD; Sean Townsend, MD; Jeffrey S. Vender, MD; Janice L. Zimmerman, MD; Jean-Louis Vincent, MD, PhD; for the International Surviving Sepsis Campaign Guidelines Committee

Crit Care Med 2008
Sepsis is NOT the ICU’s problem

• Transfer to ICU is not necessarily a positive outcome
EGDT
Call for specialist support

CVP line
- < 8 mmHg
  - Crystalloid
  - Colloid
- > 8 mmHg
  - MAP
    - < 65 or < 90 mmHg
      - Vasoactive Drugs
    - > 65 & > 90 mmHg
      - ScvO₂
        - < 70%
          - Transfuse red cells until Hb > 10 g/dl
          - YES
            - ScvO₂ > 70%
            - NO
            - Inotropic agents
- > 70%
  - Goals Achieved

Rivers et al 2001, NEJM; 345, 1368-1377
The Importance of Early Goal-Directed Therapy for Sepsis Induced Hypoperfusion


NNT to prevent 1 event (death) = 6-8

ARR 16%
Compliance at Good Hope Hospital (%)

- Sepsis 6
- Resusc
- Both
- Mortality

Graph showing compliance percentages from April 2009 to October 2009.
The Sepsis Six

1. Give high-flow oxygen via non-rebreath bag
2. Take blood cultures and consider source control
3. Give IV antibiotics according to local protocol
4. Start IV fluid resuscitation Hartmann’s or equivalent
5. Check lactate
6. Monitor hourly urine output consider catheterisation

within one hour

..plus Critical Care support to complete EGDT
Running average survival in septic shock based on antibiotic delay (n=2154)

For each hour’s delay in administering antibiotics in septic shock, mortality increases by 7.6%
Running average survival in septic shock based on antibiotic delay (n=4195)

Funk and Kumar
Critical Care Clinics 2012 (in press)
Risk stratification by lactate

Trzeciak, S et al., Acad Emerg Med; 13, 1150-1151. n=1613
Survive Sepsis

Achieving 80% reliability with delivering the Sepsis Six within 1 hour for each year, for every 500 beds in a hospital means...

- 62 lives saved
- 883 fewer bed days
- 520 fewer Critical Care bed days

Why aren’t we achieving reliability?

• 38% of in-hospital cases of cardiac arrests (and subsequent resuscitation attempt) could have been avoided if patient care had been properly managed.

• These cardiac arrests are in the main not due to cardiac problems but are the end point of acute deterioration.
What do you expect?

- Underfunded
- Understaffed
- Undereducated

Was there ever a golden time?
Well ……

- 1987 - Near all arrests in patients known to be unstable
  - Sax FL, Medical patients at high risk for catastrophic deterioration, Critical Care Medicine
- 1990 - 84% of cardiac arrests are proceeded by deterioration of respiratory and mental function
  - Schein RMH, Clinical Antecedents to in-Hospital Cardiopulmonary Arrest, Chest
- 1994 - 66% of cardiac arrests have documented deterioration 6 hours pre-arrest
  - Franklin C, Developing strategies to prevent in-hospital cardiac arrest, Critical Care Medicine
- 1998 - 40% of cardiac arrests or ICU admissions are preceded by abnormal physiological observations
  - McQuillan et al, NCEPOD Report
- 2005 - 20% of ICU admissions are avoidable
  - NCEPOD Report
- 2007 - 11% of hospital deaths are caused by avoidable systemic errors
  - NPSA
This is not a new problem
Nor is it unique to the UK
Education is necessary but not sufficient.
We need to concentrate on changing behaviour.
Fig 9. Percentage of patients with an admission diagnosis of STEMI having primary angioplasty within 90 minutes of arrival in hospital

Fig 18. 30 day mortality, [with 95% confidence limits] for all patients having STEMI.
The data for 2010/11 are provisional and may be revised.
Achieving High Reliability

• What are we trying to achieve – a change in behaviour
• How will we know when we get there – when that behaviour is measured to be reliable
The best available evidence

- NICE Clinical Guideline 50 (Acutely Ill patients in hospital: Recognition of and response to acute illness in adults in hospital) is not applied universally. Each hospital must ensure that they comply with this NICE guidance. (Medical Directors)
RRAILS bundle compliance demonstrates compliance with NICE CG50, Time to Intervene and SSC guidelines.
Admission Bundle –

- Assessment on admission was considered deficient in 47% of the cases under review.

- Observation baseline and plan within 2 hours of admission communicated to the clinical team
  - Full set of observations on admission
  - Clear monitoring plan specifying the physiological observations to be recorded and how often.
  - Communicate this information to the clinical team
Recognition Bundle

- 75% of cases displayed clear warning signs that the patient was deteriorating.
- Of these patients the signs were not recognised in 35%.

- Early identification and risk stratification of the deteriorating patient.
  - Monitor physiological observations at least every 12 hours according to plan
  - Perform Risk Assessment by recording NEWS.
  - Consider severe sepsis if patient is ‘at risk’ (NEWS >2)
  - Communicate this information to the clinical team.
Response Bundle

• 75% of cases displayed clear warning signs that the patient was deteriorating.
• Of these patients the signs were not acted on in 56% and not communicated to senior doctors in 55% of cases.

• Appropriate and timely treatment of acute illness
  • Inform appropriate staff using SBAR tool
  • Change frequency of observations
  • Additional monitoring if appropriate
  • Timely assessment and initiation of response
  • Initiate Sepsis Six bundle if appropriate
Sepsis Six

• Achieving 80% reliability with delivering the Sepsis Six within 1 hour for each year, for every 500 beds in a hospital means 62 lives saved, 883 fewer bed days and 520 fewer Critical Care bed days


• In Wales this could mean 500 fewer deaths and £12m saved per year

  Give high-flow oxygen via non-rebreath bag
  Take blood cultures and consider source control
  Give IV antibiotics according to local protocol
  Start IV fluid resuscitation Hartmann’s or equivalent
  Check lactate
  Monitor hourly urine output consider catheterisation
Admission and Recognition Bundles

• Detail actions that should take place on a regular, routine basis such as:
  – Observations
  – Calculating and recording NEWS score
  – Querying sepsis if the score is high
  – Communicating NEWS and risk to whole team

• The aim is to embed these actions and behaviours into normal everyday practice

• So a high compliance with these bundles is demonstration that practice is based upon the best available evidence
What are we trying to achieve?

• Culture where all clinical team, including medical and AHP staff, is aware of patients who might be at risk of deterioration
  – From the moment that they are admitted
  – At the start of and during each shift
  – At nights and weekends

• Potentially sick patients are
  – Identified early
  – Change in status is communicated to the whole team
  – Frequency and type of observations for those patients to be common knowledge.

• This will make it less likely that observations are missed even if the nurse who has responsibility for that patient is absent from the ward.
Encourage the ethos of group responsibility

% compliance with Obstetric Day Unit Bundle (ODUB) by week
Day Unit YGC

Aide memoir implemented and manual obs

HCSW started to remind the midwives to complete the diary
Establish ‘ward to board’ reporting systems to ensure organisation situational awareness

Measurement for assurance vs measurement for improvement
How will we know when we get there?

- Measure these bundles daily, on all appropriate patients
- Rapid and regular (daily at first) feedback
- Print out run charts and post in visible communal areas
- Achievement of >95% compliance with the bundles, day in, day out (including night shift) demonstrates that the evidence based actions have become embedded in practice.
- Then measure less frequently (weekly or monthly)
- The frequency of measurement should be increased if:
  - There is concern about identification of at risk patients or
  - If there are an increased number of occurrences of sepsis or deterioration
Response and Sepsis Six bundles

• Only take place when specific criteria have been achieved
  – NEWS score reflecting a low, medium or high risk of deterioration
  – Positive sepsis screening.

• This is important outcomes data for the healthcare organisation and needs to be reported on an all incident basis
As this is important information at the organisational level, the organisation must agree and communicate definitions of:

- Trigger
- Escalation process
- Response
Define the trigger – what are you expected to act on?

- What level of risk are we measuring our response at?
  - Low – NEWS 3
  - Medium - NEWS 6
  - High – NEWS 9

- Are we measuring incidences of sepsis, septic shock or severe sepsis
Define the escalation process – who, when and how do we tell?

- Make highly visible – posters, intranet etc.
- Standardise for all disciplines
- Integrate into training
- Replace not add to existing documentation
- Practice using them – simulation etc
Define the response – make expectations explicit?

Does the response bundle = was this done yes/no?

Are all response actions captured upon one document?

When is time zero?
Data collection – making it easier to do the right thing
Where do you put stuff you want everyone to know?

Why do we hide track and trigger scores at the foot of the bed and then audit them infrequently?
Putting Important Information In a Prominent Place

• Communicates to the whole team, all the time
• Quickly exposes where staff have difficulty with performing observations/calculating score
• Promotes education and training for possible eventualities
Establish standardised communication tools (eg. PSAG board, SBAR, safety briefing etc)
Safety Briefings

- Ensure EVERYONE knows important information
- Take a short amount of time to complete
- Can be used to gather data in real time
- No need for duplicate data gathering
<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Admissions Bundle</strong></td>
<td>1. How many admissions have you had in this shift?</td>
<td></td>
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<tr>
<td></td>
<td>2. On the white board, how many admissions have recorded both:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• MEWS Score AND</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Frequency of observations?</td>
<td></td>
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<tr>
<td><strong>Recognition Bundle</strong></td>
<td>3. How many patients are on the unit now?</td>
<td></td>
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<tr>
<td></td>
<td>4. During this shift how many of these patients have recorded</td>
<td></td>
</tr>
<tr>
<td></td>
<td>on the white board both:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• MEWS Score AND</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Frequency of observations?</td>
<td></td>
</tr>
<tr>
<td><strong>Response Bundle</strong></td>
<td>5. How many patients are ‘at risk’ (MEWS score higher than 3)?</td>
<td></td>
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<tr>
<td></td>
<td>6. How many ‘at risk’ patients have had an appropriate first</td>
<td></td>
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<tr>
<td></td>
<td>response (start SBAR form)?</td>
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<tr>
<td></td>
<td>Could they have sepsis?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>If yes please use the sepsis pathway tool.</td>
<td></td>
</tr>
<tr>
<td><strong>Sepsis Six Bundle</strong></td>
<td>7. How many patients have been diagnosed as having sepsis?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8. How many of these have received the ‘sepsis six’ within 1</td>
<td></td>
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<tr>
<td></td>
<td>hour of diagnosis?</td>
<td></td>
</tr>
<tr>
<td><strong>Catheter Stop Order</strong></td>
<td>9. How many patients have a catheter in situ?</td>
<td></td>
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<tr>
<td></td>
<td>10. How many catheters can be removed?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11. How many catheters need to be inserted?</td>
<td></td>
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<tr>
<td></td>
<td>Have you considered all the alternatives?</td>
<td></td>
</tr>
</tbody>
</table>

- Total daily admissions
- Bed occupancy
- Ward acuity
- Sepsis incidence
- Total catheter days
Apply ‘human factors’ techniques to counteract the effect of human error
Rehearse, train and prepare for ‘worst case’ scenarios (eg. Simulation)

- All Wales ILS course
- Train as teams
- Train as close to the work place as possible
Approximately 60% reliability
Data from an in hours Outreach service
During this time sepsis was a major contributor to death in 15% of cases
Achieving reliability in detecting and treating sepsis in Wales could result in 500 fewer deaths and £12m saved per year.
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#1000lives
http://www.1000livesplus.wales.nhs.uk/
#sepsis
sepsisteam@gmail.com
@sepsisuk

www.uksepsis.org
September
World
2012 Day
13 Sepsis

save lives
suspect
sepsis