Aligning NSW Sepsis Pathways with antimicrobial stewardship principles to improve patient care

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Clinical Excellence Commission
Learning objectives

• Describe the actions taken in NSW to reduce preventable harm from sepsis

• Identify the key components of the SEPSIS KILLS toolkit relevant to AMS teams

• Outline key changes made to the NSW Adult Sepsis Pathway to better incorporate AMS principles
Reducing harm from sepsis in NSW
Why is sepsis a problem?

• Systemic response to infection leading to organ damage, shock and death
• High mortality/morbidity - increases with delayed Rx
  – 20-25% adults (ARISE, 2007), 10 % children (Han et al., 2003)
  – Increases 7.6% per hour with delays to treatment (Kumar et al., 2006)
• Major cause of avoidable death in hospital
• Approximately 30% RR calls are sepsis related
Why is sepsis a problem?

• Difficult diagnosis:
  – Signs and symptoms can be subtle especially in elderly/children
  – Temperature is NOT a reliable indicator (Gray et al., 2012)

• Increasing incidence:
  – 18 million cases worldwide annually (Adhikari et al., 2010)
  – Aus/NZ ICUs 17,000 + severe sepsis/septic shock (Finfer et al., 2004)
  – Increased incidence in the elderly and chronically ill

• Resource intensive
NSW 2008/09 Clinical Focus Report

• Lack of skills and knowledge
• Failure to recognise and respond
• Failure to manage ongoing care appropriately
• Failure to manage sepsis as a medical emergency

The SEPSIS KILLS Program

- **2011**: Adult Emergency Departments
- **2013**: Paediatric Emergency Departments
- **2014**: Adult and Paediatric inpatient wards
- **2015**: Maternal and Newborn pathways
- **2016**: Adult and Paediatric pathways revised
SEPSIS KILLS: 3 key messages

• **RECOGNISE** the risk factors, signs and symptoms of sepsis

• **RESUSCITATE** with rapid administration of intravenous antibiotics and fluids

• **REFER** to appropriate senior clinicians and teams with retrieval if appropriate
Elements of the SEPSIS KILLS Program

- Governance
- CERS
- Sepsis Tools
- Education
- Evaluation
SEPSIS KILLS: early intervention saves lives

The increasing incidence of sepsis is well recognised, and is generally attributed to the growing prevalence of chronic conditions in ageing populations. In New South Wales, the number of patients with a diagnosis of sepsis in the Admitted Patient Data Collection (APDC) has increased steadily.

Abstract

Objective: To implement a statewide program for the early recognition and treatment of sepsis in New South Wales, Australia.

Setting: Ninety-seven emergency departments in NSW hospitals.

Intervention: A quality improvement program (SEPSIS KILLS) that promoted intervention within 60 minutes of recognition, including taking of blood cultures, measuring serum lactate levels, administration of intravenous antibiotics, and fluid resuscitation.

- Mortality (overall) decreased from 19.3% to 14.1% (p < 0.0001)
- Mean ICU hrs ↓ 32.7 hrs to 25.8 hrs (p < 0.0001)
- Mean LOS ↓ 13.5 days to 11.5 days (p < 0.0001)

Outcome measures

In-hospital mortality - Adults

Process measures

**Time to 1st antibiotics (mins)**
Adult and paediatric patients

- **Mean**
- **Median**

Source: CEC Sepsis database (n= 28,412)

SEPSIS KILLS tools and relevance to AMS programs
# SEPSIS KILLS Tools and Resources

<table>
<thead>
<tr>
<th>Tools</th>
<th>Education</th>
<th>Evaluation</th>
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</table>
| • Implementation Guide  
  • Pathways  
  • Antibiotic Guidelines  
  • Blood Culture Guidelines | • E-learning package  
  • Videos  
  • Lactate information sheet  
  • Information for patients and families | • Sepsis database  
  • Data collection form  
  • Guide to using sepsis data |

Sepsis Pathways

Pathways guide clinicians to THINK about sepsis NOT prescriptive ......clinical judgement is KEY
When to use sepsis pathways

• Consider sepsis any time your patient deteriorates
  – AND/OR have signs and symptoms of infection
  – PLUS Red or Yellow Zone observations
  – OR a clinician is concerned/suspects sepsis
Reliability: bundle six actions

- Give oxygen
- Take a lactate
- Take blood cultures
- Give empirical IV antibiotics
- Administer IV fluids
- Monitor and reassess
Antibiotics for severe sepsis

• Adult patient, no focus/unknown source:
  – No penicillin allergy:
    • gentamicin IV + flucloxacillin IV +/- vancomycin IV
  – Non-immediate penicillin hypersensitivity:
    • gentamicin IV + cefazolin IV +/- vancomycin IV
  – Immediate penicillin hypersensitivity:
    • gentamicin IV + vancomycin IV

• Paediatric patient, no focus/unknown source:
  – No penicillin allergy:
    • cefotaxime IV + gentamicin IV + vancomycin IV
  – Non-immediate penicillin hypersensitivity:
    • cefotaxime IV + gentamicin IV + vancomycin IV
  – Immediate penicillin hypersensitivity:
    • ciprofloxacin IV + vancomycin IV

Antibiotics for severe sepsis

• Adult patient, secondary to CAP:
  – No penicillin allergy:
    • ceftriaxone IV + azithromycin IV
    • benzylpenicillin IV + gentamicin IV + azithromycin IV
  – Non-immediate penicillin hypersensitivity:
    • ceftriaxone IV + azithromycin IV
  – Immediate penicillin hypersensitivity:
    • moxifloxacin IV

• Paediatric patient, secondary to CAP:
  – No penicillin allergy:
    • ceftriaxone IV + vancomycin IV
    • cefotaxime IV + vancomycin IV
  – Non-immediate penicillin hypersensitivity:
    • ceftriaxone IV + vancomycin IV
    • cefotaxime IV + vancomycin IV
  – Immediate penicillin hypersensitivity:
    • ciprofloxacin IV + vancomycin IV
    • moxifloxacin IV

Options for intraosseous and IMI administration in guideline

Antibiotics for severe sepsis

- Adult patient, secondary to urinary tract source:
  - No penicillin allergy:
    - gentamicin IV + amoxy/ampicillin IV +/- ESBL cover (mero or amik)
  - Non-immediate penicillin hypersensitivity:
    - gentamicin IV +/- ESBL cover (mero or amik)
  - Immediate penicillin hypersensitivity:
    - gentamicin IV +/- ESBL cover (with amik)

- Paediatric patient, secondary to urinary tract source:
  - No penicillin allergy:
    - gentamicin IV + amoxy/ampicillin IV +/- ESBL cover (mero or amik)
  - Non-immediate penicillin hypersensitivity:
    - gentamicin IV + vancomycin IV +/- ESBL cover (mero or amik)
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Sepsis kit contents

- Sepsis pathway
- Antibiotic guideline
- Data collection form
- Personal protective equipment
- Venepuncture / cannulation equipment
- Antibiotic vials as per local guidelines
- IV resuscitation fluid
- Giving sets (including blood pump set)
- Blood culture bottles
- Pathology tubes
- Pathology forms
- Syringes
The NSW Adult Sepsis Pathway – alignment with AMS principles
I must treat all patients that may have sepsis with antibiotics promptly.

I don’t want to MISS sepsis. The patient may die and I might be blamed.

Antibiotic resistance is a global threat to public health and we all must use less antibiotics.

I don’t want to prescribe antibiotics unnecessarily. They might cause side effects and the AMS team might yell at me.

Horowitz HW. 2013, NEJM. Fever of unknown origins or fever of too many origins?
Method

• The CEC AMS Expert Advisory Committee were asked to review the state-wide adult sepsis pathway and identify areas for improvement.

• Based on local experience of managing patients with suspected sepsis and concerns regarding unintended consequences of the pathway.

• Changes were reviewed by the Deteriorating Patient Program Steering Committee.

• A final set of changes were accepted and adopted into the NSW adult sepsis pathway.
Results

• The AMS Expert Advisory Committee identified four key areas for improvement:
  – Distinguishing patients with severe sepsis or septic shock from those with sepsis or infection
  – Timely collection of specimens for culture other than blood cultures
  – Time frames for administering antibiotics
  – Review of pathology results and antibiotics at 24 and 48 hours

• To address these issues, changes were proposed, based on recommendations from international sepsis guidelines and the AMS Clinical Care Standard
When to use & exclusions

Risk factors, signs & symptoms of infection

Between the Flags criteria
Lactate: how sick is your patient?

Mortality based on lactate level

- < 2.5: 5%
- 2.5-4: 7%
- > 4: 27%

Lactate: how sick is your patient?

Mortality based on SBP and lactate level

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<th>SBP and/or Serum lactate level</th>
<th>Mortality</th>
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<tr>
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<tr>
<td>SBP &lt;90 Lactate &lt;2</td>
<td>9%</td>
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<tr>
<td>SBP &lt;90 Lactate &gt;2</td>
<td>26%</td>
</tr>
<tr>
<td>Lactate &gt;4</td>
<td>27%</td>
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NSW sepsis mortality – lactate, CEC/HIE linked data n=3851 (2012)
Clinician, patient and family communication

Escalation of care including SENIOR CLINICIAN review

Clinician, patient and family communication
Sepsis: life-threatening organ dysfunction due to a dysregulated host response to infection

Septic shock: needing vasopressors for a MAP $\geq 65$mmHg AND lactate $>2$mmol/L despite adequate fluid resuscitation

Quick SOFA score – Sepsis –related Organ Failure Assessment
Score $\geq 2$ = increased mortality
Sepsis is a medical emergency

- **SYSTEMATIC ASSESSMENT** using the A-G approach
- **VASCULAR ACCESS** intravenous or intraosseous
- **CULTURES** blood and other specimens
- **LACTATE** ≥2mmol/L post adequate fluid resuscitation is significant
- **FLUID BOLUS** crystalloid
  - 20mL/kg (emergency)
  - 250-500mL (ward)
- **CONSIDER** vasopressors if no improvement after second bolus and transfer to a higher level of care
Antibiotics  First/new antibiotic administered  Date: ___/___/____  Time: ____ : ____

Blood cultures (at least two sets) and other relevant cultures should be collected PRIOR to antibiotic administration. However in patients with severe sepsis or septic shock, if difficult to obtain cultures do not delay administration of antibiotic(s). Refer to local Antimicrobial Stewardship policies/procedures regarding antibiotic instructions. 
Consult Infectious Diseases Physician or Clinical Microbiologist if required.

Severe sepsis or septic shock

Use CEC Adult Antibiotic Guideline for Severe Sepsis & Septic Shock or locally endorsed antibiotic prescribing guideline

Prescribe and administer antibiotics within 60 MINUTES of sepsis recognition

Sepsis

Use locally endorsed antibiotic prescribing guideline

Prescribe and administer antibiotics promptly in a timeframe directed by senior clinician (must be within 2 hours)
Alignment with AMS Program goals:

- **Pathway:** Patients that are suspected to be septic receive empiric antibiotic therapy promptly
- **Guideline:** Patients that are septic receive appropriate antibiotic therapy according to the suspected source of sepsis
- **Sepsis kit:** Antibiotics are readily available to treat patients with suspected sepsis without delay
Alignment with AMS Program goals:

- Antibiotic therapy is reviewed once microbiology results and other investigations are available
- Review may include stopping, changing or maintaining antibiotic therapy
- Reminder to seek advice from ID/Microbiology
- Reminder to obtain AMS team approval for restricted antibiotics
Summary of key changes proposed by AMS EAC

• Patients with concerning vital signs, but not requiring a formal Rapid Response, have a senior clinician review to determine time-frame for investigations and whether sepsis treatment should begin

• Antibiotics to be given within 60 min for patients with severe sepsis or septic shock and within 2 h for patients with sepsis

• Additional prompts for collection of urine, CSF and other specimens for culture before giving antibiotics

• Additional prompts for review of pathology results and antibiotics at 24-48 hours, including obtaining AMS team approval for restricted antibiotics and seeking advice from ID/microbiology physician if required
What we have learned

• Early identification and treatment crucial
• Early senior medical review of patients prevents poor outcomes
• Inpatient setting needs more focus including integration with AMS
  – Pathway
  – Antibiotic guideline
  – Access to antibiotics
  – Referral to AMS/ID/Micro team
• Importance of addressing diagnostic error
Success factors

• Use of local patient stories and data
• Executive and senior clinician leadership
• Planned implementation
• Easily accessible resources e.g. sepsis trolley, lactate testing
• Junior staff supported to speak up and escalate care
• Rapid Response team as sepsis champions
Opportunities for improvement

• Medical engagement and leadership
• Inpatient program uptake – spread and sustain
• Monitoring and feedback processes using data
• Moving beyond time to antibiotics to bundle of care reliability
• Dealing with unintended consequences
  – Ensuring Inpatient and ID physicians are at the table
  – Missed cultures and antibiotic review when results available
  – AMS – appropriate antibiotics, friends not foes!
Questions?

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References and further reading


Jones, D. The Epidemiology of adult Rapid Response Team patients in Australia. Anaesthesia and Intensive Care 2014; 42 (2).
