Emergency Department
Epidemiology & Management Of
Sepsis
Abel Wakai
Department of Emergency Medicine
Beaumont Hospital
Dublin

Sepsis Management Conference
Wednesday 18th November 2015
79% of patients with sepsis in Canadian hospitals are admitted through Emergency Departments.

38% of patients who develop severe sepsis will die.

Let’s change that.

We can decrease mortality and morbidity from sepsis by using simple, effective, and timely therapies in our Emergency Departments.

Join the BC Sepsis Network today.
www.BCSepsis.ca
Outline

• Role Of The Emergency Department (ED) In The Management Of Sepsis
• Epidemiology Of ED Sepsis
• ED Diagnosis Of Sepsis
• ED Management Of Sepsis
• Management Of Sepsis As An ED Key Performance Indicator
The Role of the ED

- Identifying patients with sepsis
- Risk stratification for severe sepsis & septic shock
- Initiating resuscitation & treatment
- Ensuring the correct onward management of patients identified with sepsis
- Vital to success of collaborative care pathways for seamless management of patients with sepsis
What Is The Burden Of Sepsis In The ED Setting?
Epidemiology of ED Sepsis

Niccolo Machiavelli

as the physicians say it happens in hectic fever, that in the beginning of the malady it is easy to cure but difficult to detect, but in the course of time, not having been either detected or treated in the beginning, it becomes easy to detect but difficult to cure
Epidemiology of ED Sepsis
Epidemiology of ED Sepsis
Epidemiology of ED Sepsis

SIRS → Sepsis → Severe Sepsis → Septic Shock → Multiorgan Dysfunction Syndrome → Death

Increasing Mortality
Disease Progression in Hemodynamically Stable Patients Presenting to the Emergency Department With Sepsis

Seth W. Glickman, MD, Charles B. Cairns, MD, Ronny M. Otero, MD, Christopher W. Woods, MD, MPH, Ephraim L. Tsalik, MD, PhD, Raymond J. Langley, PhD, Jennifer C. van Velkinburgh, PhD, Lawrence P. Park, PhD, Lawrence T. Glickman, VMD, DrPH, Vance G. Fowler Jr, MD, MHS, Stephen F. Kingsmore, MMB, ChB, BAO, and Emanuel P. Rivers, MD, MPH
Determination of the size of the different sepsis categories presenting to a UK teaching hospital emergency department

M Majuran, M Clancy

Table 2  Characteristics of the audit population (n = 310)

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>SIRS without infection</th>
<th>&quot;Uncomplicated&quot; sepsis</th>
<th>Severe sepsis or septic shock</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>N (%)</td>
<td>310 (100)</td>
<td>137 (44.2)</td>
<td>123 (39.7)</td>
<td>50 (16.1)</td>
<td>NS</td>
</tr>
<tr>
<td>Male, n (%)</td>
<td>152 (49.0)</td>
<td>65 (47.4)</td>
<td>65 (52.8)</td>
<td>22 (44.0)</td>
<td>NS</td>
</tr>
<tr>
<td>Female, n (%)</td>
<td>158 (51.0)</td>
<td>72 (52.6)</td>
<td>58 (47.2)</td>
<td>28 (56.0)</td>
<td>NS</td>
</tr>
<tr>
<td>Age (years)*</td>
<td>68 (45–83)</td>
<td>64 (46–81.5)</td>
<td>65 (38–80)</td>
<td>78 (60.75–87.25)</td>
<td>0.002</td>
</tr>
<tr>
<td>Treated in ICU, n (%)</td>
<td>9 (2.9)</td>
<td>5 (3.6)</td>
<td>1 (0.8)</td>
<td>3 (6.0)</td>
<td>NS</td>
</tr>
<tr>
<td>Worst SIRS score during stay*</td>
<td>2 (2–3)</td>
<td>2 (2–2)</td>
<td>2 (2–3)</td>
<td>2.5 (2–3)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

*Data presented as median (IQR).
SIRS, systemic inflammatory response syndrome; ICU, intensive care unit; NS, not significant.
The burden of sepsis in the Emergency Department: an observational snapshot
Sarah L. Cowan\textsuperscript{a}, Jonathon A.A. Holland\textsuperscript{a}, Andrew D. Kane\textsuperscript{a}, Ian Frost\textsuperscript{a} and Adrian A. Boyle\textsuperscript{b}

The primary aim of our study was to establish what proportion of patients in the Emergency Department (ED) fulfill the criteria for sepsis. All adult patients presenting to ED in two 1-week periods, 6 months apart, were included. Notes were reviewed retrospectively to identify which patients fulfilled the criteria for sepsis and severe sepsis. The proportion of patients with sepsis was 4.3\% (95\% confidence interval 3.3\%–5.2\%) and the proportion with severe sepsis was 2.2\% (95\% confidence interval 1.5\%–2.8\%). In conclusion our results suggest that sepsis is more common than previously reported and this represents a significant burden on ED. European Journal of Emergency Medicine 2015, 22:363–365 Copyright © 2015 Wolters Kluwer Health, Inc. All rights reserved.

Keywords: Emergency Department, epidemiology, incidence, sepsis, severe sepsis

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Tel: +44 1223 245151; fax: +44 1223 586968; e-mail: sarah.cowan@nhs.net

Received 11 September 2014 Accepted 6 November 2014
The epidemiology of adults with severe sepsis and septic shock in Scottish emergency departments

Alasdair Gray, Kirsty Ward, Fiona Lees, Colin Dewar, Sarah Dickie, Crawford McGuffie, On behalf of the STAG steering committee

RESULTS
During the study period, there were 308,910 attendances at the 20 participating hospitals. A total of 5,285 (1.7%) of these patients developed criteria for diagnosis of sepsis within 2 days of presentation. The prevalence rate between hospitals ranged from **0.7% to 3.1% of attendances**. Data were available for
Epidemiology of ED Sepsis
Epidemiology of ED Sepsis

Evidence free zone

CAUTION

You are about to enter the ‘Evidence-free’ zone
Epidemiology of ED Sepsis

Sepsis Management
National Clinical Guideline No. 6

Summary

November 2014
The Prevalence of Emergency Department “Uncomplicated” Sepsis in Beaumont Hospital

Ciara McNevin, Ronald McDowell, Peadar Gilligan, Fidelma Fitzpatrick, Abel Wakai
Methods

- Cross-sectional study performed in the ED of Beaumont Hospital
- Annual ED census approximately 50,000 new patient attendances
- Beaumont Hospital Ethics (Medical Research) Committee approved study
Methods

• ED clinical records of all patients presenting to the ED over a one-month period (July to August 2015) screened using Health Service Executive (HSE) Sepsis Screening Form (HSE, 2013) for adult patients to determine whether they fulfilled the criteria for “uncomplicated” sepsis

• Clinical records retrospectively screened within 24 hours of patients’ ED arrival
• Overall, 3467 patients attended the ED during the one-month study period, with 135 patients fulfilling the criteria for sepsis.

• Proportion of patients who fulfilled the criteria for sepsis was **4.41%** (95% CI, 3.7-5.1%, margin of error 0.7%)
Results

• ED prevalence of sepsis was **44.1 cases per 1,000 ED attendances** (95% CI, 37.1 to 51.1 per 1000 ED attendances)
• Median age was 65 years (IQR = 49-79 years; range 16-99 years)
• There were 94 females (61%) and 59 males (39%)
Results

- Proportion of females who fulfilled criteria for sepsis significantly higher than proportion of males (P=0.003; one-sided binomial test)
Results

• No difference in the underlying age distributions of the male and female patients who fulfilled the criteria for sepsis (p=0.12, Mann-Whitney U test)
## Results

### SIRS criteria in patients who fulfilled the criteria for sepsis

<table>
<thead>
<tr>
<th></th>
<th>Heart rate (bpm)</th>
<th>Respiratory rate (bpm)</th>
<th>Temperature (°Celsius)</th>
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<tr>
<td><strong>Median</strong></td>
<td>104</td>
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</tr>
<tr>
<td><strong>IQR</strong></td>
<td>90-113</td>
<td>16-20</td>
<td>36-38</td>
<td>12-18</td>
<td>6-9</td>
</tr>
</tbody>
</table>
• SIRS criteria in patients who fulfilled the criteria for sepsis:
  – 18 patients (12%) of patients who fulfilled the criteria for sepsis had an altered mental status
<table>
<thead>
<tr>
<th>Suspected source of sepsis</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory</td>
<td>56 (36.6%)</td>
</tr>
<tr>
<td>Intra-abdominal</td>
<td>35 (22.9%)</td>
</tr>
<tr>
<td>Urinary</td>
<td>16 (10.5%)</td>
</tr>
<tr>
<td>Central nervous system</td>
<td>6 (3.9%)</td>
</tr>
<tr>
<td>Skin and skin structures</td>
<td>5 (3.3%)</td>
</tr>
<tr>
<td>Device-related</td>
<td>1 (0.7%)</td>
</tr>
<tr>
<td>Unknown</td>
<td>32 (20.9%)</td>
</tr>
</tbody>
</table>
Summary

- Proportion of ED patients who fulfil the criteria for sepsis Beaumont Hospital is 4.41% (95% CI, 3.7-5.1%, margin of error 0.7%)
- ED prevalence of sepsis in Beaumont Hospital is 44.1 cases per 1,000 ED attendances (95% CI, 37.1 to 51.1 per 1000 ED attendances)
- Significantly more females than males
- The most common suspected source of sepsis is respiratory
Limitations

• Limitations of SIRS-criteria rule
• Some SIRS-negative patients at ED presentation may have become SIRS-positive during their ED stay
• Possible seasonal variation
• Accuracy of diagnostic information in clinical records
• Retrospective study design
## Epidemiology of ED Sepsis

<table>
<thead>
<tr>
<th>Study</th>
<th>ED Patients with “Uncomplicated” Sepsis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Majuran &amp; Clancy (2008)</td>
<td>2.1%</td>
</tr>
<tr>
<td>Cowan et al. (2015)</td>
<td>4.3% (95% CI 3.3-5.2%)</td>
</tr>
<tr>
<td>McNevin et al. (2015)</td>
<td>4.4% (95% CI 3.7-5.1%)</td>
</tr>
</tbody>
</table>

Approximately 24,000-53,000 ED “Uncomplicated” Sepsis Patients/Year
ED Diagnosis Of Sepsis

Two or more of the following:

- Temperature >38°C or <36°C
- Heart rate >90 beats/min
- Respiratory rate >20 breaths/min or PaCO₂ <32 torr
- WBC >12,000 cell/mm³, <4,000 cells/mm³, or >10% immature (band) forms


Medscape
Sepsis Screening Form

For Adult Patients

Complete this form and apply if the National Early Warning Score (NEWS) is ≥4 (5 on supplementary O₂), or if infection is suspected.

Clinician to Complete This Section

- Name of Doctor contacted:
- Clinicians Name:
- Clinicians Signature:
- MCRN/WB FN:

Doctor must review within 30 mins (use ISBAR). DOCTOR TO COMPLETE REMAINDER OF THIS DOCUMENT AS APPROPRIATE.

Are any 2 or more modified Systemic Inflammatory Response Syndrome (SIRS) criteria present?

- Respiratory rate > 20 breaths/min
- Heart rate > 90 breaths/min
- WCC < 4 x 10³/L
- Temperature > 38.3°C
- Acutely altered mental status
- Bedside glucose > 7.7 mmol/L (in the absence of diabetes mellitus)

Infection Suspected

Notes: Some groups of patients, such as older people, may not meet the modified SIRS criteria, even though infection is suspected. Where this occurs check for signs of organ dysfunction and raised biomarkers such as C-reactive protein (CRP).

Yes, this is Sepsis

Sepsis Six Regimen must be completed within 1 hour

Has a decision been made NOT to escalate care (excluding further treatment)?

- No proceed
- Yes do not proceed

Take 3

- Blood cultures before giving antibiotics
- Do not delay antibiotic administration > 1 hour if blood cultures are difficult to obtain. Send samples from potentially infected sites eg. sputum, urine, wounds, PIC/CVC. Consider source control.
- Lactate and FBC
- Urine output measurement

Sepsis Six – aim to complete within 1 hour

- O₂ (94-98% SpO₂, or 88-92% in COPD patients)
- IV fluid resuscitation (500ml bolus - give up to 3l/h if resees) Target systolic BP = 90-110mmHg Monitor response to IV fluids and thorax to effect
- Antibiotics according to local guidelines

Laboratory tests must be requested as EMERGENCY and aim to have results available and acted on within the hour

Look for signs of organ dysfunction:

- Systolic BP < 90 or Mean Arterial Pressure < 65 or Systolic BP more than 40 below patient’s normal
- New need for oxygen to achieve saturation > 90%
- Lactate > 2 mmol/L (following administration of fluid bolus)
- Urine output < 0.5ml/kg for 2 hours - despite adequate fluid resuscitation
- Acutely altered mental status
- Glucose > 7.7 mmol/L (in the absence of diabetes)
- Creatinine > 177 micromol/L
- Bilirubin > 34 micromol/L
- Platelets < 100 x 10⁹/L

Any organ dysfunction: This is severe sepsis

Registrar or Consultant to review immediately. Reassess frequently in 1st hour. Consider other investigations and management.

If either present: This is septic shock

Critical care consult required

- Consultant referral
- Consider transfer to a higher level of care

A critical care review may be requested at any point during this assessment. For patients with septic shock, in a hospital with no critical care unit, a critical care consult must be made and transfer to a higher level of care considered, if appropriate, following the consult.

Doctor’s Name:
- MCRN:
- Signature:
- Date:
- Time:

File this document in patient notes: Document management plan.
Epidemiology of the Systemic Inflammatory Response Syndrome (SIRS) in the Emergency Department

Timothy Horeczko, MD, MSCR*  
Jeffrey P. Green, MD†  
Edward A. Panacek, MD, MPH‡  
*University of California Los Angeles, Department of Emergency Medicine, Torrance, California  
†University of California Davis, Department of Emergency Medicine, Sacramento, California

Supervising Section Editor: Christopher Kahn, MD, MPH  
Submitted: April 26, 2013 Revisions: July 24, 2013; Accepted September 30, 2013  
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Full text available through open access at http://escholarship.org/uc/uciem_westjem  
DOI: 10.5811/westjem.2013.9.18064

**Introduction:** Consensus guidelines recommend sepsis screening for adults with systemic inflammatory response syndrome (SIRS), but the epidemiology of SIRS among adult emergency department (ED) patients is poorly understood. Recent emphasis on cost-effective, outcomes-based healthcare prompts the evaluation of the performance of large-scale efforts such as sepsis screening. We studied a nationally representative sample to clarify the epidemiology of SIRS in the ED and subsequent category of illness.

**Methods:** This was a retrospective analysis of ED visits by adults from 2007 to 2010 in the National Hospital Ambulatory Medical Care Survey (NHAMCS). We estimated the incidence of SIRS using initial ED vital signs and a Bayesian construct to estimate white blood cell count based on test ordering. We report estimates with Bayesian modified credible intervals (mCIs).

**Results:** We used 103,701 raw patient encounters in NHAMCS to estimate 372,844,465 ED visits over the 4-year period. The moderate estimate of SIRS in the ED was 17.8% (95% mCI: 9.7 to 26%). This yields a national moderate estimate of approximately 16.6 million adult ED visits with SIRS per year. Adults with and without SIRS had similar demographic characteristics, but those with SIRS were more likely to be categorized as emergent in triage (17.7% versus 9.9%, p<0.001), stay longer in the ED (210 minutes versus 153 minutes, p<0.0001), and were more likely to be admitted (31.5% versus 12.5%, p<0.0001). Infection accounted for only 26% of SIRS patients. Traumatic causes of SIRS comprised 10% of presentations; other traditional categories of SIRS were rare.

**Conclusion:** SIRS is very common in the ED. Infectious etiologies make up only a quarter of adult SIRS cases. SIRS may be more useful if modified by clinician judgment when used as a screening test in the rapid identification and assessment of patients with the potential for sepsis. [West J Emerg Med. 2014;15(3):329–336.]
Figure. Adults with SIRS and subsequent category of illness based on moderate estimate presenting to United States emergency departments, 2007-2010; N=66,388,686 visits.
Time to initial antibiotic administration, and short-term mortality among patients admitted with community-acquired severe infections with and without the presence of systemic inflammatory response syndrome: a follow-up study

Daniel Pilsgaard Henriksen,¹,² Christian B Laursen,³ Jesper Hallas,²,⁴ Court Pedersen,⁵ Annmarie Touborg Lassen¹

Conclusions  SIRS was absent in one-quarter of patients admitted with severe infection. The ‘door-to-antibiotics’ time was significantly shorter for patients with SIRS compared with patients without SIRS, but no difference was found in 30-day mortality.
## ED Diagnosis of Sepsis

**SIRS criteria in patients who fulfilled the criteria for sepsis**

<table>
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Trial of Early, Goal-Directed Resuscitation for Septic Shock

Paul R. Mouncey, M.Sc., Tiffany M. Osborn, M.D., G. Sarah Power, M.Sc., David A. Harrison, Ph.D., M. Zia Sadique, Ph.D., Richard D. Grieve, Ph.D., Rahi Jahan, B.A., Sheila E. Harvey, Ph.D., Derek Bell, M.D., Julian F. Bion, M.D., Timothy J. Coats, M.D., Mervyn Singer, M.D., J. Duncan Young, D.M., and Kathryn M. Rowan, Ph.D., for the ProMISE Trial Investigators*

Goal-Directed Resuscitation for Patients with Early Septic Shock

The ARISE Investigators and the ANZICS Clinical Trials Group*
Severe Sepsis and Septic Shock in Adults

Definitions

- Severe sepsis = The presence of one or more organ system dysfunctions in the context of sepsis defines severe sepsis
- Septic Shock = Patients who have evidence of hypoperfusion (high lactate) or a persistently low blood pressure after initial fluid resuscitation have septic shock
- Senior doctor = ST4 (or equivalent) and above

Standards

1. Temperature, pulse rate, respiratory rate, blood pressure, mental status (AVPU or GCS) and capillary blood glucose on arrival
2. Senior EM assessment of patient within 60mins of arrival
3. High flow O₂ 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.

References

1. Sepsis Six Survive Sepsis, 2009
RCEM Sepsis Standards

- Measured on ED arrival:
  - temperature
  - pulse rate
  - respiratory rate
  - blood pressure
  - mental status (AVPU or GCS)
  - capillary blood glucose
• Senior EM doctor assessment within 60 minutes of ED arrival
• High flow $O_2$ via non-rebreather mask initiated (unless there is a documented reason to the contrary) before leaving ED
• Serum lactate measured before leaving ED
• Blood cultures obtained before leaving ED
• First intravenous crystalloid fluid bolus (up to 20mls/kg) given:
  – 75% within 1 hour of ED arrival
  – 100% before leaving ED
RCEM Sepsis Standards

• Antibiotics administered:
  – 50% within 1 hour of ED arrival
  – 100% before leaving ED
• Urine output measurement instituted before leaving the ED
Sepsis Management As An ED KPI

If you can’t **MEASURE** it
you can’t **MANAGE** it.

Measure Your Way to Success
By Using KPIs
12.4.3 Quality of Care

“A number of condition-specific pathways of care have been developed that involve CC, EM and AM specialists, most notably those governing the management of sepsis”
Development of key performance indicators for emergency departments in Ireland using an electronic modified-Delphi consensus approach

Abel Wakai\textsuperscript{a}, Ronan O'Sullivan\textsuperscript{b,c}, Paul Staunton\textsuperscript{d}, Cathal Walsh\textsuperscript{e}, Fergal Hickey\textsuperscript{f} and Patrick K. Plunkett\textsuperscript{g}

Objective The objective of this study was to develop a consensus among emergency medicine (EM) specialists working in Ireland for emergency department (ED) key performance indicators (KPIs).

Methods The method employed was a three-round electronic modified-Delphi process. An online questionnaire with 54 potential KPIs was set up for round 1 of the Delphi process. The Delphi panel consisted of all registered EM specialists in Ireland. Each indicator on the questionnaire was rated using a five-point Likert-type rating scale. Agreement was defined as at least 70% of the responders rating an indicator as ‘agree’ or ‘strongly agree’ on the rating scale. Data were analysed using standard descriptive statistics. Data were also analysed as the mean of the Likert rating with 95% confidence intervals (95% CIs). Sensitivity of the ratings was examined for robustness by bootstrapping the original sample. Statistical analyses were carried out using SPSS version 16.0.

Results The response rates in rounds 1, 2 and 3 were 86, 88 and 88%, respectively. Ninety-seven potential indicators reached agreement after the three rounds. In the context of the Donabedian structure–process–outcome framework of performance indicators, 41 (42%) of the agreed indicators were structure indicators, 52 (54%) were process indicators and four (4%) were outcome indicators. Overall, the top-three highest rated indicators were: presence of a dedicated ED clinical information system (4.7; 95% CI 4.6–4.9), ED compliance with minimum design standards (4.7; 95% CI 4.5–4.8) and time from ED arrival to first ECG in suspected cardiac chest pain (4.7; 95% CI 4.5–4.9). The top-three highest rated indicators specific to clinical care of children in EDs were: time to administration of antibiotics in children with suspected bacterial meningitis (4.6; 95% CI 4.5–4.8), separate area available within EDs (seeing both adults and children) to assess children (4.4; 95% CI 4.2–4.6) and time to administration of analgesia in children with forearm fractures (4.4; 95% CI 4.2–4.7).

Conclusion Employing a Delphi consensus process, it was possible to reach a consensus among EM specialists in Ireland on a suite of 97 KPIs for EDs. European Journal of Emergency Medicine 2010–114 © 2013 Wolters Kluwer Health | Lippincott Williams & Wilkins.

Keywords: Delphi technique, emergency departments, emergency medicine, key performance indicators, performance indicators

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Received 6 September 2011 Accepted 27 January 2012
Sepsis Management As An ED KPI

Development of key performance indicators for emergency departments in Ireland using an electronic modified-Delphi consensus approach
Abel Wakai\textsuperscript{a}, Ronan O’Sullivan\textsuperscript{b,c}, Paul Staunton\textsuperscript{d}, Cathal Walsh\textsuperscript{e}, Fergal Hickey\textsuperscript{f} and Patrick K. Plunkett\textsuperscript{g}

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Undecided</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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<table>
<thead>
<tr>
<th>Table 2. Process indicators that reached agreement.</th>
<th>Mean Likert scale rating (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time from ED arrival to first ECG in patients with suspected cardiac chest pain</td>
<td>4.7 (4.5-4.9)</td>
</tr>
<tr>
<td>Time to antibiotics in children with suspected bacterial meningitis</td>
<td>4.6 (4.5-4.8)</td>
</tr>
<tr>
<td><strong>Time to antibiotics in sepsis of any cause (e.g. due to bacterial pneumonia, urosepsis, bacterial meningitis)</strong></td>
<td>4.6 (4.4-4.7)</td>
</tr>
<tr>
<td>Time to CT for patients presenting within 4.5 hours of symptoms consistent with a stroke</td>
<td>4.6 (4.4-4.8)</td>
</tr>
<tr>
<td>Door-to-needle (DTN) time for thrombolysis in patients with ST-elevation myocardial infarction (STEMI)</td>
<td>4.6 (4.4-4.9)</td>
</tr>
<tr>
<td>Proportion of patients with pain where pain is assessed at triage</td>
<td>4.6 (4.4-4.9)</td>
</tr>
<tr>
<td>Proportion of children hospitalised for general anaesthesia for minor procedures where ED-based procedural sedation would prevent admission</td>
<td>4.6 (4.4-4.9)</td>
</tr>
<tr>
<td>Proportion of admitted patients transferred to an inpatient ward within 6 hours of ED arrival</td>
<td>4.5 (4.2-4.7)</td>
</tr>
<tr>
<td>Time to analgesia in patients with fractured neck of femur</td>
<td>4.5 (4.3-4.8)</td>
</tr>
<tr>
<td>Time to first clinical assessment by EM Doctor or ED Advanced Nurse Practitioner</td>
<td>4.5 (4.2-4.7)</td>
</tr>
</tbody>
</table>
• **Challenges:**
  – ED Overcrowding
  – Definition of the time stamps
  – Feasibility of collecting relevant minimum data set elements
  – Evidence base
Sepsis Management As An ED KPI
Sepsis Management As An ED KPI
The Effect of Emergency Department Crowding and Time of Day Upon the Adherence to Early Goal-Directed Therapy

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Conclusions: The administration of critical interventions (IVF ≤1 hour and antibiotics ≤1 or ≤3 hours) was delayed during daytime and evening hours when adjusting for patient level factors. ED crowding, (occupancy rate, patient hours, and inpatient boarding) negatively impacts the delivery of time-sensitive interventions. Boarding admitted inpatients in the ED decreases the initiation rate of EGDT for patients meeting criteria. EDs must be mindful of crowding measures as they attempt to optimize delivery of time-sensitive therapies to critically ill patients.
Time to antibiotics for septic shock: evaluating a proposed performance measure

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Principal conclusions: Nearly 1 of 5 patients cannot be captured for performance measurement within 3 hours of ED arrival due to the variable progression of septic shock. Use of this measure would misclassify performance in 23% of patients. Measuring antibiotic administration based on the clinical course of septic shock rather than from ED arrival would be more appropriate.
Feasibility Analysis of ED KPIs

- 12 participant EDs nationally
- 100 randomly selected ED patient records/ED/KPI
- Availability of MDS elements for each KPI
- 9,298 patient records in the 12 EDs
- 105,982 MDS elements relevant to 10 ED KPIs

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### Minimum Data Set (MDS)

<table>
<thead>
<tr>
<th>KPI</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>KPI4</strong></td>
<td>Time to receive first antibiotic in adult ED patients with sepsis</td>
</tr>
</tbody>
</table>
| **ED Arrival** | Hospital record number (medical record number)  
ED episode number  
Date Patient presents  
Time Patient presents |
| **ED Stay** | Date seen by HCP able to initiate treatment (ED Doctor, ANP, Nurse Prescriber)  
Time seen by HCP able to initiate treatment (ED doctor, ANP, Nurse Prescriber)  
Manchester Triage Category of 1 (Red/Immediate) or 2 (Orange/Very Urgent) attributed to patient  
Date patient first receives dose of antibiotic in ED  
Time patient first receives dose of antibiotic in ED  
Antibiotic administered  
ED Diagnosis |
| **ED Departure** | ED Departure date  
ED departure time |
MDS Availability

Percentage of patient records with all MDS elements present

Key Performance Indicator (KPI)

- KPI 8 - 29.9%
- KPI 10 - 24.6%
- KPI 6 - 15.6%
- KPI 7 - 13.4%
- KPI 4 - 9.6%
- KPI 2 - 5.6%
- KPI 1 - 5.5%
- KPI 3 - 1.4%
- KPI 11 - 1.2%
- KPI 5 - 0%

(Overall = 12.5%)
MDS Availability

Percentage of relevant MDS elements available for each KPI across all EDs

(All records)

Key Performance Indicator (KPI)

KPI 10
KPI 6
KPI 8

KPI 4
KPI 7
KPI 1
KPI 2
KPI 3
KPI 11

Percent availability (%)
Time to Antibiotics in Sepsis: A Metric Not Supported by Evidence

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Duration of hypotension before initiation of effective antimicrobial therapy is the critical determinant of survival in human septic shock*

Anand Kumar, MD; Daniel Roberts, MD; Kenneth E. Wood, DO; Bruce Light, MD; Joseph E. Parrillo, MD; Satendra Sharma, MD; Robert Suppes, BSc; Daniel Feinstein, MD; Sergio Zanotti, MD; Leo Taiberg, MD; David Gurka, MD; Aseem Kumar, PhD; Mary Cheang, MSc

Figure 2. Mortality risk (expressed as adjusted odds ratio of death) with increasing delays in initiation of effective antimicrobial therapy. Bars represent 95% confidence interval. An increased risk of death is already present by the second hour after hypotension onset (compared with the first hour after hypotension). The risk of death continues to climb, though, to >36 hrs after hypotension onset.
The Impact of Timing of Antibiotics on Outcomes in Severe Sepsis and Septic Shock: A Systematic Review and Meta-Analysis*

Sarah A. Sterling, MD; W. Ryan Miller, MD; Jason Pryor, MD; Michael A. Puskarich, MD; Alan E. Jones, MD

**Objectives:** We sought to systematically review and meta-analyze the available data on the association between timing of antibiotic administration and mortality in severe sepsis and septic shock.

**Data Sources:** A comprehensive search criteria was performed using a predefined protocol.

**Study Selection:** Inclusion criteria: adult patients with severe sepsis or septic shock, reported time to antibiotic administration in relation to emergency department triage and/or shock recognition, and mortality. Exclusion criteria: immunosuppressed populations, review article, editorial, or nonhuman studies.

**Data Extraction:** Two reviewers screened abstracts with a third reviewer arbitrating. The effect of time to antibiotic administration on mortality was based on current guideline recommendations: 1) administration within 3 hours of emergency department triage and 2) administration within 1 hour of severe sepsis/septic shock recognition. Odds ratios were calculated using a random effect model. The primary outcome was mortality.

**Data Synthesis:** A total of 1,123 publications were identified and 11 were included in the analysis. Among the 11 included studies, 16,178 patients were evaluable for antibiotic administration from emergency department triage. Patients who received antibiotics more than 3 hours after emergency department triage (<3 hr reference) had a pooled odds ratio for mortality of 1.16 (0.92–1.46; p = 0.21). A total of 11,017 patients were evaluable for antibiotic administration from severe sepsis/septic shock recognition. Patients who received antibiotics more than 1 hour after severe sepsis/shock recognition (<1 hr reference) had a pooled odds ratio for mortality of 1.48 (0.69–2.40; p = 0.13). There was no increased mortality in the pooled odds ratios for each hourly delay from less than 1 to more than 5 hours in antibiotic administration from severe sepsis/shock recognition.

**Conclusion:** Using the available pooled data, we found no significant mortality benefit of administering antibiotics within 3 hours of emergency department triage or within 1 hour of shock recognition in severe sepsis and septic shock. These results suggest that currently recommended timing metrics as measures of quality of care are not supported by the available evidence. (Crit Care Med 2015; 43:1907–1915)

**Key Words:** antibacterial agents; antibiotics; septic shock; severe sepsis; shock recognition; timing of antibiotics

Severe sepsis and septic shock remain a major cause of emergency department (ED) visits and ICU admissions and are associated with significant morbidity, mortality, and healthcare costs (1, 2). Previous studies have suggested improved outcomes with the implementation of a structured resuscitation, focusing largely on IV fluid resuscitation, timely broad-spectrum antibiotics, and vasopressor therapy (3–7). Although some authors have suggested the primacy of timely antibiotics administration for improved mortality in severe sepsis and septic shock (8, 9), previously published research evaluating the association of the time to antibiotic administration on outcomes has produced disparate results.

In 2006, Kumar et al (10) reported a 7.6% increase in mortality in patients with sepsis for each hourly delay after the onset of shock. Although subsequent studies have failed to demonstrate such substantial results, several studies have reported increased mortality associated with delays in antibiotic administration either from shock recognition or time from ED triage (8–10). Other studies have not demonstrated any increase in mortality with delay of antibiotic administration based on triage time (11, 12).

The most recent Surviving Sepsis Campaign (SSC) guidelines include specific recommendations regarding the timing...
Conclusion: Using the available pooled data, we found no significant mortality benefit of administering antibiotics within 3 hours of emergency department triage or within 1 hour of shock recognition in severe sepsis and septic shock. These results suggest that currently recommended timing metrics as measures of quality of care are not supported by the available evidence. (Crit Care Med 2015; 43:1907–1915)
Summary

• ED plays a central role in the hospital management of sepsis
• Understanding the epidemiology of sepsis in the Irish ED setting is only beginning
• Understand limitations of current SIRS criteria for diagnosis of sepsis in the ED setting
• RCEM sepsis standards available for ED audits
• Time to antibiotic as a valid & reliable quality-of-care metric may not be data driven
Thank you for listening…
Any Questions?