

# Antimicrobial Stewardship Strategy:

## Facilitation of appropriate and timely antimicrobial administration in severe sepsis/septic shock

*Interventions to facilitate prompt administration of appropriate antimicrobials and improve outcomes (including mortality) in patients with severe sepsis and septic shock.*



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Priority Level: **A**

Difficulty Level: **2**

### Program Stage:

- Early
- ✓ Intermediate
- Advanced

### Antimicrobial Stewardship Outcomes:

- Clinical outcomes

For more information on these criteria and how they were developed, please see the

[Antimicrobial Stewardship Strategy Criteria Reference Guide](#).

## Description

This is an overview and not intended to be an all-inclusive summary. As a general principle, patients must be monitored by the health care team after changes to therapy resulting from recommendations made by the antimicrobial stewardship team.

### Rationale

Prompt administration of appropriate antimicrobials (within the first hour of recognition of septic shock) improves outcomes (including mortality) in patients with severe sepsis and septic shock.<sup>1,2</sup> Thus, the choice and timely administration of antimicrobials are of utmost importance.

### Implementation

This strategy has two important elements. The first is recommending appropriate empiric therapy to cover the most likely pathogens based on the presumed source of infection. The second is identifying and removing barriers that could interfere with prompt administration.

The choice of antimicrobials should be guided by patient-specific factors, expected pathogens and local susceptibility patterns. Given the narrow margin of error with severe sepsis/septic shock, broad-spectrum regimens to cover all likely pathogens are typically used at first, with re-evaluation and then de-escalation at 48 to 72 hours, if possible. It is also important to ensure the patient receives an adequate initial antimicrobial dose. The initial dose should be at the high end of the dosage range, because patients with severe sepsis/septic shock often have a large volume of distribution.

Subsequent doses or dosing intervals can be altered as required if organ failure exists.

Strategies to facilitate the appropriate and timely antimicrobial administration in severe sepsis/septic shock should be multidisciplinary and could include:

- Development of “sepsis bundles” to rapidly identify and adequately treat patients.
- Development of [clinical guidelines, pathways and/or preprinted order sets](#) for the identification and management of sepsis, including recommendations for the choice of antimicrobial (based on the suspected site of infection) and an initial dose.
  - Order sets and guidelines should specify that antimicrobials must be administered immediately. They should also include orders for cultures prior to antimicrobial administration.
  - Order sets and guidelines should include the dose of antimicrobial to be administered.
  - Some sepsis order sets indicate only the initial antimicrobial dose. Subsequent orders would specify the ongoing regimen.
- Identifying and removing logistical barriers to prompt antimicrobial administration (e.g., stocking of certain antimicrobials in the emergency department, introduction of a “shock box”, policies to indicate that initial antimicrobial orders should be filled and administered immediately).
- Education for nurses on the importance of timing for the first antimicrobial dose and the need for reminders at the point of care (e.g., signage in medication rooms, prompts on automated dispensing units).
- Education for pharmacy technicians on the importance of providing the first dose of antimicrobials in a timely fashion.

## Advantages

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- Prompt administration of appropriate antimicrobials as part of a sepsis bundle (e.g., including early recognition of sepsis, fluid administration, cultures) improves patient outcomes.

## Disadvantages

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- Requires co-ordination with multiple stakeholders to implement the necessary components (e.g., early recognition, fluid resuscitation, appropriate cultures).

## Requirements

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- Multidisciplinary group to champion intervention, and to establish and audit processes.

## Associated Metrics

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- Time from triage to antimicrobial administration for patients with severe sepsis/septic shock.
- Time from order to antimicrobial administration for patients with severe sepsis/septic shock.

## References

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1. Kumar A, Roberts D, Wood KE, Light B, Parrillo JE, Sharma S, et al. Duration of hypotension before initiation of effective antimicrobial therapy is the critical determinant of survival in human septic shock. *Crit Care Med*. 2006;34(6):1589–96.
2. Kumar A, Ellis P, Arabi Y, Roberts D, Light B, et al. Initiation of inappropriate antimicrobial therapy results in a fivefold reduction of survival in human septic shock. *Chest*. 2009;136(5):1237–48.  
Available from: <http://journal.publications.chestnet.org/article.aspx?articleid=1090138>

## Additional Useful References

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**Select articles to provide supplemental information and insight into the strategy described and/or examples of how the strategy was applied; not a comprehensive reference list. URLs are provided when materials are freely available on the Internet.**

- Micek ST, Roubinian N, Heuring T, Bode M, Williams J, Harrison C, et al. Before-after study of a standardized hospital order set for the management of septic shock. *Crit Care Med*. 2006;34(11):2707–13.
- Mok K, Christian MD, Nelson S, Burry L. Time to administration of antibiotics among inpatients with severe sepsis or septic shock. *Can J Hosp Pharm*. 2014; 67(3):213–9. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4071083/>

*Retrospective chart review at a single centre assessed the interval from diagnosis of severe sepsis and septic shock to antibiotic administration. The results prompted changes to expedite antimicrobial delivery.*

## Tools and Resources

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- Society of Critical Care Medicine. Surviving sepsis campaign [Internet]. Illinois: Society of Critical Care Medicine; c2015. [cited 2015 Sep 24]. Available from: <http://www.survivingsepsis.org/Resources/Pages/Protocols-and-Checklists.aspx>  
*Contains examples of other institution's protocols, checklists and policies to improve care in patients with septic shock.*
- Start smart—then focus. Appendix 1. Resource materials: examples of audit tools, review stickers and drug charts [Internet]. London: Public Health England; 2015 [cited 2015 Sep 24]. Available from: [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/417041/Revised\\_S\\_STF\\_Tools\\_Annex\\_FINAL.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/417041/Revised_S_STF_Tools_Annex_FINAL.pdf)  
*Contains sample sepsis audit tool (pp. 27–8).*
- Zvonar R. [The “shock box”: expediting delivery of antibiotics for septic shock](#). Poster presented at: Annual Professional Practice Conference: Canadian Society of Hospital Pharmacists. 2010 Jan 30–Feb 3; Toronto, ON.

## Samples/Examples

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- [Example 1: Markham Stouffville Hospital - Pre-printed Orders Sepsis Management](#)
- [Example 2: Peterborough Regional Health Centre - Emergency Sepsis Order Set](#)
- [Example 3: Markham Stouffville Hospital Corporation - Sepsis Protocol Audit Form](#)

*These documents have been generously shared by various health care institutions to help others develop and build their antimicrobial stewardship programs. We recommend crediting an institution when adopting a specific tool/form/pathway in its original form.*

*Examples that contain clinical or therapeutic recommendations may not necessarily be consistent with published guidelines, or be appropriate or directly applicable to other institutions. All examples should be considered in the context of the institution's population, setting and local antibiogram.*

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## Links with Other Strategies

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- [Disease-specific treatment guidelines, pathways, algorithms and/or associated order forms](#)
- [Empiric antibiotic prescribing guidelines](#)

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## For further information

[Antimicrobial Stewardship Program](#), Infection Prevention and Control, Public Health Ontario.

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## Example 1: Markham Stouffville Hospital Corporation - Pre-printed Orders Sepsis Management

MARKHAM STOUFFVILLE HOSPITAL  
Markham Site Uxbridge Site



### PRE-PRINTED ORDERS SEPSIS MANAGEMENT Page 1 of 2

<b>Date &amp; Time:</b> <b>Allergies:</b> <input type="checkbox"/> NKA	Airborne Precautions: <input type="checkbox"/> Yes <input type="checkbox"/> No Droplet Precautions: <input type="checkbox"/> Yes <input type="checkbox"/> No Contact Precautions: <input type="checkbox"/> Yes <input type="checkbox"/> No
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Action	ADULT SEPSIS ORDERS				
	<p><b>Inclusion Criteria: Age 18 and older, At least two (2) of the following Systemic Inflammatory Response Syndrome (SIRS) criteria + SUSPECTED INFECTION</b></p> <p> <input type="checkbox"/> Heart rate greater than 90 bpm  <input type="checkbox"/> Temperature less than 36 degrees Celsius or greater than 38 degrees Celsius  <input type="checkbox"/> Respiratory rate greater than 20 breaths/minute and/or intubated  <input type="checkbox"/> WBC greater than <math>11 \times 10^9/L</math> or less than <math>4 \times 10^9/L</math> </p>				
	<p><b>General</b></p> <p>Vital Signs with neurovitals q1h</p> <p> <input type="checkbox"/> Oxygen titrate <math>F_i O_2</math> to keep <math>SpO_2</math> <input type="checkbox"/> greater than 94% or <input type="checkbox"/> greater than ____%  <input type="checkbox"/> Naso/Orogastric Tube to straight drainage  <input type="checkbox"/> Foley catheter with Urometer         </p>				
	<table style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> <p><b>Lab Investigation</b></p> <p> <input type="checkbox"/> CBC, Electrolytes, Creatinine, BUN, Glucose  <input type="checkbox"/> Ca, Mg, Phosphate <input type="checkbox"/> Albumin <input type="checkbox"/> Amylase, Lipase  <input type="checkbox"/> AST, ALT, Alk Phos, Bili  <input type="checkbox"/> Lactate <input type="checkbox"/> ABG <input type="checkbox"/> VBG <input type="checkbox"/> PTT, INR <input type="checkbox"/> CK, Troponin  <input type="checkbox"/> Glucometer every 2 hours            Other: _____         </p> </td> <td style="width: 50%; vertical-align: top;"> <p> <input type="checkbox"/> Blood culture *  <input type="checkbox"/> Sputum culture  <input type="checkbox"/> Urine culture <input type="checkbox"/> Urinalysis  <input type="checkbox"/> Stool culture            Other: _____            * Blood culture (two sets, two separate sites, 10 minutes apart)            Time of blood draw: ____/____/____         </p> </td> </tr> </table>	<p><b>Lab Investigation</b></p> <p> <input type="checkbox"/> CBC, Electrolytes, Creatinine, BUN, Glucose  <input type="checkbox"/> Ca, Mg, Phosphate <input type="checkbox"/> Albumin <input type="checkbox"/> Amylase, Lipase  <input type="checkbox"/> AST, ALT, Alk Phos, Bili  <input type="checkbox"/> Lactate <input type="checkbox"/> ABG <input type="checkbox"/> VBG <input type="checkbox"/> PTT, INR <input type="checkbox"/> CK, Troponin  <input type="checkbox"/> Glucometer every 2 hours            Other: _____         </p>	<p> <input type="checkbox"/> Blood culture *  <input type="checkbox"/> Sputum culture  <input type="checkbox"/> Urine culture <input type="checkbox"/> Urinalysis  <input type="checkbox"/> Stool culture            Other: _____            * Blood culture (two sets, two separate sites, 10 minutes apart)            Time of blood draw: ____/____/____         </p>		
<p><b>Lab Investigation</b></p> <p> <input type="checkbox"/> CBC, Electrolytes, Creatinine, BUN, Glucose  <input type="checkbox"/> Ca, Mg, Phosphate <input type="checkbox"/> Albumin <input type="checkbox"/> Amylase, Lipase  <input type="checkbox"/> AST, ALT, Alk Phos, Bili  <input type="checkbox"/> Lactate <input type="checkbox"/> ABG <input type="checkbox"/> VBG <input type="checkbox"/> PTT, INR <input type="checkbox"/> CK, Troponin  <input type="checkbox"/> Glucometer every 2 hours            Other: _____         </p>	<p> <input type="checkbox"/> Blood culture *  <input type="checkbox"/> Sputum culture  <input type="checkbox"/> Urine culture <input type="checkbox"/> Urinalysis  <input type="checkbox"/> Stool culture            Other: _____            * Blood culture (two sets, two separate sites, 10 minutes apart)            Time of blood draw: ____/____/____         </p>				
	<p><b>Diagnostic</b></p> <p> <input type="checkbox"/> CXR <input type="checkbox"/> ECG            Other: _____         </p>				
	<p><b>IV Therapy</b></p> <p> <input type="checkbox"/> <b>Bolus:</b> Give bolus _____ (20 mL/kg) 0.9% Sodium Chloride rapidly.            Draw Lactate 1 hour after bolus  <i>If systolic BP is less than 90 mmHg after initial bolus, repeat bolus</i>  <b>Notify MD if systolic BP remains below 90 mmHg after second bolus</b>  <input type="checkbox"/> IV infusion: 0.9% Sodium Chloride IV at _____ mL/hour  <input type="checkbox"/> with 20 mmol KCl/L <input type="checkbox"/> with 40 mmol KCl/L  <input type="checkbox"/> Other IV Fluids: _____         </p>				
	<p><b>In ED/Critical Care only</b></p> <p>If systolic BP remains less than 90 mmHg after 2nd bolus, ED or ICU RN will initiate the following medications:</p> <p> <input type="checkbox"/> DOPamine <b>5 mcg/kg/min</b> and titrate to a maximum of <b>20 mcg/kg/min</b> to maintain Mean Arterial Pressure (MAP) of 65-90 mmHg  <input type="checkbox"/> Norepinephrine <b>2 mcg/min</b> and titrate to a maximum of <b>20 mcg/min</b> to maintain Mean Arterial Pressure (MAP) of 65-90 mmHg  <input type="checkbox"/> Other: _____         </p>				
	<p><b>Referrals:</b> <input type="checkbox"/> ICU <input type="checkbox"/> Medicine <input type="checkbox"/> Surgery</p>				
MD/RN(EC) Signature	Date & Time	Unit Secretary signature	Date & Time	RN signature	Date & Time

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## Example 1: Markham Stouffville Hospital Corporation - Pre-printed Orders Sepsis Management (continued)

MARKHAM STOUFFVILLE HOSPITAL  
Markham Site Uxbridge Site

### PRE-PRINTED ORDERS SEPSIS MANAGEMENT Page 2 of 2

Date & Time:
Allergies: <input type="checkbox"/> NKA

Action	ADULT SEPSIS ORDERS	
	<b>Emergency Management / Initial Antibiotic Therapy</b> Time first dose of antibiotic given in ED: _____ <b>Antibiotics:</b> _____	
MD/RN(EC) Signature	Date & Time	Unit Secretary signature Date & Time RN signature Date & Time
<b>Action</b>	<b>Ongoing Antibiotic Therapy</b> Time next dose of antibiotic given: _____ <input type="checkbox"/> Continue above antibiotics (ensure frequency specified) OR <input type="checkbox"/> Change as below	
<b>Source of Infection</b>	<b>Antibiotic</b> <input type="checkbox"/> Piperacillin / Tazobactam 4.5 g IV q8h <i>If patient has beta lactam allergy (history of anaphylaxis) give:</i> <input type="checkbox"/> Ciprofloxacin 400 mg IV q8h <b>PLUS</b> Metronidazole 500 mg IV q12h	
Unknown; Intra-Abdominal		
Skin and Soft Tissue	<input type="checkbox"/> Piperacillin / Tazobactam 4.5 g IV q8h <b>PLUS</b> Vancomycin 1 g IV q12h <i>If patient has beta lactam allergy (history of anaphylaxis) give:</i> <input type="checkbox"/> Ciprofloxacin 400 mg IV q12h <b>PLUS</b> Vancomycin 1 g IV q12h <b>PLUS</b> Metronidazole 500 mg IV q12h	
Pulmonary - not at risk for Pseudomonas	<input type="checkbox"/> Ceftriaxone 2 g IV q24h <b>PLUS</b> Azithromycin 500 mg IV q24h <i>If patient has beta lactam allergy (history of anaphylaxis) give:</i> <input type="checkbox"/> Moxifloxacin 400 mg IV q24h	
Pulmonary - at risk for Pseudomonas (previous Pseudomonas infection, health-care associated disease, immunocompromised)	<input type="checkbox"/> Ciprofloxacin 400 mg IV q12h <b>PLUS</b> Piperacillin / Tazobactam 4.5 g IV q8h <i>If suspected atypical pneumonia ADD:</i> <input type="checkbox"/> Azithromycin 500 mg IV q24h <i>If patient has beta lactam allergy (history of anaphylaxis) give:</i> <input type="checkbox"/> Moxifloxacin 400 mg IV q24h <b>PLUS</b> Tobramycin (5 mg/kg) _____ mg IV q24h	
Urologic	<input type="checkbox"/> Ampicillin 1 g IV q6h <b>PLUS</b> Gentamicin (5 mg/kg) _____ mg IV q24h <i>If patient has beta lactam allergy (history of anaphylaxis) give:</i> <input type="checkbox"/> Sulfamethoxazole-trimethoprim (5 mg/kg of trimethoprim component) _____ mg IV q6h <b>PLUS</b> Vancomycin 1 g IV q12h	
IV Catheter	<input type="checkbox"/> Vancomycin 1 g IV q12h <i>If patient is neutropenic ADD</i> <input type="checkbox"/> Ceftazidime 2 g IV q8h	
Suspected Meningitis	<input type="checkbox"/> Ceftriaxone 2 g IV q12h <b>PLUS</b> Vancomycin (15 mg/kg) _____ mg IV q12h <i>If Patient is greater than 50 years old, immunocompromised or pregnant ADD:</i> <input type="checkbox"/> Ampicillin 2 g IV q4h	
Febrile Neutropenia	<input type="checkbox"/> Piperacillin / Tazobactam 4.5 g IV q8h <i>If pneumonia on chest radiograph ADD:</i> <input type="checkbox"/> Vancomycin (15 mg/kg) _____ mg IV q12h <i>If patient has beta lactam allergy (history of anaphylaxis) give:</i> <input type="checkbox"/> Ciprofloxacin 400 mg IV q12h <b>PLUS</b> Vancomycin (15 mg/kg) _____ mg IV q12h	
Gynecology	<input type="checkbox"/> Ceftriaxone 2 g IV q24h <b>PLUS</b> Metronidazole 500 mg IV q12h <i>If patient has beta lactam allergy (history of anaphylaxis) give:</i> <input type="checkbox"/> Gentamicin 5 mg/kg _____ mg IV q24h <b>PLUS</b> Clindamycin 900 mg IV q8h	
<b>*Do not adjust the first dose of antibiotics for renal or hepatic function. The pharmacist will adjust subsequent doses of antibiotics as appropriate.</b>		
MD/RN(EC) Signature	Date & Time	Unit Secretary signature Date & Time RN signature Date & Time

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## Example 2: Peterborough Regional Health Centre - Emergency Sepsis Order Set



**Peterborough Regional Health Centre**  
**Page 1 of 3 Page Order Set**  
**Guidelines on Back**

Emergency Sepsis Order Set		SMO/IE	KARDEX	MAR	Notified	Signature of Nurse Date & Time
<b>Allergies/ARS</b> <input type="checkbox"/> Food <input type="checkbox"/> Latex <input type="checkbox"/> Medications <input type="checkbox"/> No Known Allergies <input type="checkbox"/> Contrast Media <input type="checkbox"/> Environmental <b>Specify Allergies/ARS:</b> _____						
Precautions: <input type="checkbox"/> Contact <input type="checkbox"/> Droplet Contact <input type="checkbox"/> Airborne—Reason: _____ Code Status: <input type="checkbox"/> Full Resuscitation or _____						
<b>Identification of Severe Sepsis/Septic Shock</b> <input type="checkbox"/> Systemic Inflammatory Response Syndrome (SIRS) – 2 of the following: <input type="checkbox"/> Temperature greater than 38°C or less than 36°C <input type="checkbox"/> HR greater than 90 bpm <input type="checkbox"/> RR greater than 20 <input type="checkbox"/> WBC greater than 12 or less than 4 <input type="checkbox"/> Sepsis = SIRS + suspected infection <input type="checkbox"/> Severe Sepsis = Sepsis + evidence of any organ dysfunction (mottled skin, altered LOC, urine output less than 0.5 mL/h) <input type="checkbox"/> Septic Shock = Severe Sepsis PLUS <input type="checkbox"/> Systolic BP less than 90, MAP less than 65 mmHg after 30 mL/kg fluid bolus <input type="checkbox"/> Lactate equal to or greater than 4 mmol/L						
<b>Consults</b> <input type="checkbox"/> Intensivist <input type="checkbox"/> Palliative Service <input type="checkbox"/> Hospitalist    Other: _____						
<b>Vitals/Monitoring</b> <input checked="" type="checkbox"/> BP and HR q 15 minutes while fluid resuscitation in progress <input checked="" type="checkbox"/> Vitals with intake and output q 1 h						
<b>Lines/Tubes</b> <input type="checkbox"/> Insert urinary catheter						
<b>Respiratory</b> <input checked="" type="checkbox"/> O <sub>2</sub> at _____ LPM. Titrate O <sub>2</sub> to achieve target SpO <sub>2</sub> greater than 92%						
<b>Laboratory Investigations</b> <input checked="" type="checkbox"/> CBCD, LUTES, CREA, GLU <input checked="" type="checkbox"/> PT (INR), APTT <input checked="" type="checkbox"/> CK, TROPI <input checked="" type="checkbox"/> ECG <input checked="" type="checkbox"/> Ca, Mg, PHOS <input checked="" type="checkbox"/> VBG <input checked="" type="checkbox"/> ALP, BILI, ALB, AST, LIPASE <input type="checkbox"/> ABG <input checked="" type="checkbox"/> Lactic Acid now and q 2 h x 2 <input type="checkbox"/> Type + Screen <input checked="" type="checkbox"/> Blood C+S x 2 STAT (prior to antibiotics) <input checked="" type="checkbox"/> Blood C+S from each vascular device in place for greater than 48 hours <input checked="" type="checkbox"/> Urine R+M <input checked="" type="checkbox"/> Urine C+S <input checked="" type="checkbox"/> Sputum C+S <input checked="" type="checkbox"/> Wound C+S if wound(s) present <input type="checkbox"/> Beta HCG (serum) for females of childbearing age						
<b>Diagnostic Imaging</b> <input checked="" type="checkbox"/> Chest X-ray <input type="checkbox"/> PA + Lateral <input type="checkbox"/> Portable Reason: Sepsis-rule out pneumonia <input type="checkbox"/> CT _____ Reason: _____ <input type="checkbox"/> Ultrasound _____ Reason: _____ Other: _____						
<b>IV Therapy</b> (See guidelines back of Page 1) <input checked="" type="checkbox"/> IV Fluid Resuscitation STAT <b>Patient Weight</b> _____ kg <input type="checkbox"/> Actual <input type="checkbox"/> Estimated <input type="checkbox"/> Give 0.9% NaCl 1,000 mL rapid IV bolus by pressure bag over 30 minutes <input type="checkbox"/> Repeat bolus of _____ mL until systolic BP greater than 90 mmHg or minimum of 30 mL/kg infused. Do not use IV Pump After initial IV fluid resuscitation: <input type="checkbox"/> 0.9% NaCl at _____ mL/h Other: _____ rate: _____ mL/h <input checked="" type="checkbox"/> Notify physician if resuscitation goals not met after IV bolus** (See back of Page 1)						
<b>Physician/Nurse Practitioner Signature:</b> _____						
<b>Date (d/m/y):</b> _____						
<b>Time:</b> _____						

Emergency Sepsis/MD/06-13/V2

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## Example 2: Peterborough Regional Health Centre - Emergency Sepsis Order Set (continued)

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### **Fluid Resuscitation Goals: All 4 of the following:**

- HR is less than 100 beats per minute
- SBP is greater than 90 mmHg (or MAP is greater than 65 mmHg)
- Urinary output is equal to or greater than 0.5 mL/kg/h
- If central line, CVP target range 8-12 cm H<sub>2</sub>O

### **Risk Factors for Pseudomonas**

HIV

Neutropenia

Solid organ or hematopoietic transplant recipient

Cystic fibrosis

Severe structural lung disease

Frequent administration of antibiotics (4 or more courses over past year)

Repeated exacerbations of COPD requiring antibiotic and/or steroid use

Isolation of pseudomonas during previous hospitalization

### **Criteria for True Penicillin Allergy**

Anaphylaxis

Angioedema

Urticarial Rash (e.g. hives, not maculopapular)

Bronchospasm or wheezing

Hypotension (to drug, not condition being treated)

Laryngeal Edema

Toxic epidermal necrolysis (Steven Johnson Syndrome)

Interstitial Nephritis

Emergency Sepsis/MD/06-13/V2

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## Example 2: Peterborough Regional Health Centre - Emergency Sepsis Order Set (continued)



Peterborough Regional Health Centre  
Page 2 of 3 Page Order Set  
Guidelines on Back

Emergency Sepsis Order Set		SMO/IE	KARDEX	MAR	Notified	Signature of Nurse Date & Time
<b>Allergies/ARS</b> <input type="checkbox"/> Food <input type="checkbox"/> Latex <input type="checkbox"/> Medications <input type="checkbox"/> No Known Allergies <b>Specify Allergies/ARS:</b> _____						
<b>Antibiotic Therapy</b> (*Adjust dose for renal function) <b>PNEUMONIA</b> (community acquired) <b>Option 1</b> - No prior antibiotics or has had fluoroquinolone for any reason in last 3 months <input type="checkbox"/> Ceftriaxone 2 g IV load, then 1 g IV q 24 h <b>PLUS</b> Azithromycin 500 mg IV q 24 h <b>Option 2</b> - Has had any beta-lactam or macrolide in previous 3 months or a true penicillin allergy (anaphylaxis, angioedema, etc.) – See back of Page 1 <input type="checkbox"/> Moxifloxacin 400 mg IV q 24 h <b>*Contraindication:</b> Fluoroquinolones or macrolides in prolonged QT interval or if patient is on any drug known to prolong QT interval, e.g. Amiodarone, Haloperidol, Methadone, Ondansetron, Quinidine, Sotalol, etc. Consult Pharmacy and consider referring to www.torsades.org <b>Option 3</b> - If patient is on a QT-prolonging medication or has prolonged QT interval <input type="checkbox"/> Ceftriaxone 2 g IV load, then 1 g IV q 24 h <b>PLUS</b> Doxycycline 100 mg PO q 12 h <b>Option 4</b> – Reserved for patients with risk factors for pseudomonas aeruginosa (Page 1 back) <b>IF SEVERE BETA-LACTAM ALLERGY:</b> Consider Infectious Disease Consult <input type="checkbox"/> Piperacillin-Tazobactam 4.5 g IV q 6 h* <b>PLUS</b> <input type="checkbox"/> Ciprofloxacin 400 mg IV q 12 h* <b>OR</b> <input type="checkbox"/> aminoglycoside (Gentamycin if no alternative)*						
<b>UROSEPSIS</b> <b>1<sup>st</sup> Line:</b> <input type="checkbox"/> Ceftriaxone 2 g IV load, then 1 g IV q 24 h <b>IF TRUE PENICILLIN ALLERGY:</b> <b>2<sup>nd</sup> Line:</b> <input type="checkbox"/> Ciprofloxacin 400 mg IV q 12 h*						
<b>SEPSIS OF UNKNOWN ORIGIN</b> <b>1<sup>st</sup> Line:</b> <input type="checkbox"/> Ceftriaxone 2 g IV load, then 1 g IV q 24 h <b>OR</b> (if Pseudomonas suspected): <input type="checkbox"/> Piperacillin/Tazobactam 4.5 g IV q 6 h* <b>PLUS</b> (if MRSA suspected): <input type="checkbox"/> Vancomycin 15-20 mg/kg IV _____ mg IV q _____ h (Max 2 g)* (See Vancomycin Order Set) <b>IF TRUE PENICILLIN ALLERGY:</b> <input type="checkbox"/> Ciprofloxacin 400 mg IV q 12 h* <b>OR</b> <input type="checkbox"/> aminoglycoside (Gentamycin if no alternative)* <b>PLUS</b> <input type="checkbox"/> Metronidazole 500 mg IV q 12 h <b>PLUS</b> <input type="checkbox"/> Vancomycin 15-20 mg/kg IV _____ mg q _____ h (Max 2 g)* (See Vancomycin Order Set) <b>For Other Diagnoses:</b> See back of Page 2 for disease specific guidelines See Antimicrobial Stewardship tab on PRHC Intranet Home Page <b>Other Diagnosis:</b> _____ <b>Antibiotic Therapy:</b> _____						
*Adjust dose for renal function						
Physician/Nurse Practitioner Signature: _____		Date (d/m/y): _____		Time: _____		

Emergency Sepsis/MD/06-13/V2

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## Example 2: Peterborough Regional Health Centre - Emergency Sepsis Order Set (continued)

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### Antibiotic Therapy For Sepsis Guidelines

(\*Adjust dose for renal function)

#### Cellulitis

1<sup>st</sup> Line: Cefazolin 2 g IV q 8 h\*

If MRSA risk: Vancomycin 15-20 mg/kg IV (use actual body weight) (Max 2 g)  
(See Vancomycin Order Set)

#### Community Acquired Intra-Abdominal Infection

(Not Spontaneous Bacterial Peritonitis)

1<sup>st</sup> Line: Cefazolin 2 g IV q 8 h\* (mild-mod severity)

OR

Ceftriaxone 2 g IV load, then 1 g IV q 24 h (high severity)  
PLUS Metronidazole 500 mg IV q 12 h

OR If True Penicillin Allergy:

Ciprofloxacin 400 mg IV q 12 h\* PLUS Metronidazole 500 mg IV q 12 h

2<sup>nd</sup> Line: Piperacillin/Tazobactam 4.5 g IV q 8 h\*

Please see Antimicrobial Stewardship tab on PRHC Intranet Home Page under Surgery, BPIGS, IAI guidelines

#### Febrile Neutropenia

1<sup>st</sup> Line: Piperacillin/Tazobactam 4.5 g IV q 8 h\*

Refer to Febrile Neutropenia Guidelines for further information:

[http://www.idsociety.org/uploadedFiles/IDSA/Guidelines-Patient\\_Care/PDF\\_Library/FN.pdf](http://www.idsociety.org/uploadedFiles/IDSA/Guidelines-Patient_Care/PDF_Library/FN.pdf)

#### Meningitis

Ceftriaxone 2 g IV q 12 h

**PLUS** Vancomycin 20 mg/kg IV (use actual body weight) (Maximum 2 g)

(See Vancomycin Order Set)

Then if age greater than 50 years or immunosuppressed: **Add** Ampicillin 2 g IV

If pneumococcus suspected (before or with 1<sup>st</sup> dose of antibiotic):

Give Dexamethasone 10 mg IV

If true allergy to penicillins/cephalosporins, consider call to Infectious Diseases Service at a teaching centre (KGH, Sunnybrook, Mt. Sinai)

#### Spontaneous Bacterial Peritonitis (SBP)

1<sup>st</sup> Line: Ceftriaxone 2 g IV load, then 1 g IV q 24 h

2<sup>nd</sup> Line: Ciprofloxacin 400 mg IV q 12 h\*

\*Adjust dose for renal function

Emergency Sepsis/MD/06-13/V2

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**PRHC**  
Peterborough Regional  
Health Centre

## Emergency Sepsis Order Set

Emergency Sepsis/MD/06-13/V2

## Antimicrobial Stewardship Strategy: Appropriate antimicrobial administration in sepsis Page 12 of 14

## Example 3: Markham Stouffville Hospital Corporation - Sepsis Protocol Audit Form

This form was used at Markham Stouffville Hospital to audit compliance with the protocol for patients admitted with possible sepsis, including use of the sepsis preprinted orders, if antibiotics started and lactate and blood cultures drawn within 6 hours of patient presenting to the Emergency Department.

### Triage Audit for the Identification of Possible Septic Patients

Audit Completed By: \_\_\_\_\_ Date: \_\_\_\_\_

Patient ID Number	Triaged Date & Time	Chief Complaint	CTAS level	SIRS Criteria Met/ID	Sepsis Protocol initiated	ABX Timing <6hrs / Time / Name	Lactate < 6hrs / Time	Blood Culture < 6hrs / Time	Admitting Diagnosis	Comments
				/						
				/						
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Developed by Professional Practice, August 2010



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# Poster: The “Shock Box”: Expediting Delivery of Antibiotics for Septic Shock



## The “Shock Box”: Expediting Delivery of Antibiotics for Septic Shock

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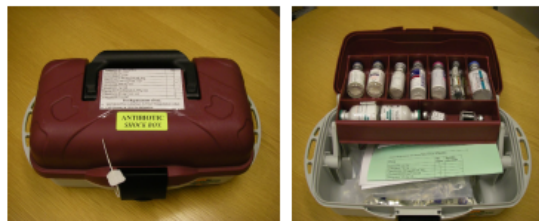
### INTRODUCTION

- Reported mortality rates for patients with severe sepsis and septic shock range from 20-54%.
- Timely administration of antimicrobials is a key factor in improving outcomes in severely ill patients with infection.
- The time to the initial appropriate antibiotic dose had the greatest influence on survival in a landmark study of patients with septic shock.<sup>1</sup> In this study, a 7.6% increase in mortality was observed for each hour of delay in administration of appropriate antibiotic therapy.
- The Surviving Sepsis Campaign recommends antimicrobial administration within 1 hour of recognition of severe sepsis or septic shock.<sup>2</sup>
- Delays in administration of the initial antibiotic dose may occur as a result of delays in order processing and/or delivery.

### OBJECTIVES

- To describe the “Shock Box” introduced at The Ottawa Hospital (TOH) as one initiative to optimize management of patients with severe sepsis and septic shock.
- To determine whether the Shock Box was used appropriately and improved the time to delivery of the first antibiotic dose.

Figure 1: The Shock Box Contents



### METHODS

- The concept of a “Shock Box” was developed at TOH to provide ready access to common antibiotics prescribed for management of sepsis. Representatives from the Pharmacy Department and Divisions of Emergency Medicine, Critical Care, Infectious Diseases, and Internal Medicine met to determine content, logistics and locations of boxes.
- TOH is a 1000 bed tertiary care teaching hospital with inpatient beds across 2 campuses. Services include Medicine, Surgery, Oncology and Critical Care.
- Education was provided in the form of emails to pharmacy, nursing and medical staff. The concept of the Shock Box was also introduced at a Medical Grand Rounds entitled “Code Sepsis”.
- A retrospective audit using a convenience sample of 50 cases was conducted after the boxes were in circulation to determine appropriateness of use and effect on delivery of first antibiotic dose.
- Data collected included patient demographics, service, antibiotic(s) used, indication, signs of severe sepsis/septic shock (e.g., blood pressure, signs of end organ impairment), interval between time order written and drug administered when both times were available, time of day the box was used, and culture results.
- Use of the Shock Box was considered appropriate if the patient had severe sepsis, septic shock or a diagnosis of meningitis.

### RESULTS

#### DESCRIPTION OF THE SHOCK BOX:

- The Shock Box is shown in Figure 1.
- Antibiotics contained in the box are reported in Table 1. In addition, the boxes include a Dilution and Administration Instruction sheet, the TOH Guidelines for Empiric Antibiotic Therapy and a data collection sheet. (Figure 1)
- Boxes were distributed to the Medicine Floors, the Intensive Care Units, Hematology Oncology ward, and were provided to the Rapid Assessment of Critical Events (RACE) team. All antibiotics in the box were made available in the Emergency Department (ED).

#### AUDIT RESULTS:

- The Shock Boxes were used 122 times between November 1, 2008 and August 15, 2009. Of the 122 uses, 18 were not evaluable (lack of patient identification on data collection sheet, illegible, etc).
- Services using the Boxes included: Hematology/Oncology (77%), General Medicine (18%), ICU (3%) and others (2%). One campus accounted for the majority (95%) of use. No data could be collected from the ED.
- Thirty of the 51 charts (59%) reviewed in detail were Hematology patients.
- The Shock Box was used appropriately in 22/51 (43%) cases. Of the Hematology subset, the box was used appropriately in 4/30 (13%) of cases.
- In 41/51 (80%), a single agent was taken from the box; in the remainder 2 drugs were withdrawn, for a total of 61 agents.
- The most commonly used antibiotics were vancomycin (39%) and piperacillin/tazobactam (30%) (Table 2)
- For orders where both the time ordered and time administered were available (n=36), the average time to first dose was 41.4 minutes. (Median: 22 minutes; range: 0-3.75 hours). In a previous review of patients admitted to ICU with septic shock, the average time of antibiotic order to administration was 2.72 hours.
- Of the patients with blood cultures drawn on the day the box was opened (n=41), 9 patients (22%) had a positive blood culture. Ten patients had positive non-blood cultures.

Table 1:  
Shock Box Contents

Drug	Quantity in box	# times used (n=61)
Cefotaxime 2 g vial	1	5
Ceftazidime 2 g vial	1	3
Ciprofloxacin 400 mg/200 mL bag	1	4
Clindamycin 600 mg/4 mL vial	2	1
Meropenem 500 mg vial	1	3
Meropenem 1 g vial	1	2
Piperacillin/Tazobactam 3.375 g vial	2	18
Tobramycin 80 mg/2 mL vial	6	0
Vancomycin 1 g vial	2	24
NS 100 mL	2	0
NS 250 mL	1	1

### CONCLUSION

- The introduction of a “Shock Box” expedited delivery of the initial antibiotic dose in patients with severe sepsis and septic shock compared to a historic control.
- The Box was inappropriately accessed in a significant portion of cases according to initial criteria.
- Education is required to reserve use of the box for its original intent.

### REFERENCES

- Kumar A *et al.* Crit Care Medicine 2006;34:1589-96.
- Dellinger RP *et al.* Crit Care Med 2008;36:296-327.

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