How to Optimize Antimicrobial Stewardship in ICUs

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Conflicts of Interest

- I am the Director of the Mount Sinai Hospital-University Health Network Antimicrobial Stewardship Program
  - I get paid to optimize the use of antimicrobials
- I am the recipient of a sizable grant from the Council of Academic Hospitals of Ontario (supported by the Ontario Ministry of Health and Long-Term Care) to help academic hospitals introduce antimicrobial stewardship programs in the ICU
- I am frequently enlisted (and paid) as an expert witness regarding appropriateness of antimicrobial therapy in medicolegal cases
this whole talk is primarily based on experience rather than published data

I remain as/more skeptical of the work I do compared to the work you do

I am not an intensivist, have not intubated in several years, and have not had to prescribe inotropes for at least 10 years

I don’t have a costume ready for tonight
Summary

- admit that there is a problem
- lead (or find a leader)
- amass the troops
- decide what will make a real difference
- gather data
- do something
- review what you’ve done
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WHAT SEEMS TO BE THE PROBLEM

OFFICER?
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Admit There is a Problem

- on any day, ~70% of your MSICU patients are probably on an antimicrobial
- a very small minority of ICU patients can be admitted, intubated for >72h, and be discharged without being given antimicrobials. Do almost every patient in the ICU get infected?
- look at your antimicrobial resistance and C. difficile rates
- how many of your patients are receiving antimicrobials where you have a sterile site sample guiding therapy?
Control of Infection Due to Klebsiella Aerogenes in a Neurosurgical Unit by Withdrawal of All Antibiotics

D. J. E. Price  J. D. Sleigh*
Division of Neurosurgery, Institute of Neurological Sciences, and Department of Bacteriology, Killearn Hospital, Glasgow

Summary Klebsiella aerogenes infection became epidemic in a neurosurgical intensive-care ward. 1 patient in 4 had chest infections, 1 in 8 had urinary infections, and 8 patients died with klebsiella meningitis. Even isolation of infected cases and treatment with massive doses of colistin failed to control the outbreak. Once antibiotics, both prophylactic and therapeutic, were discontinued in the unit, the incidence of klebsiella infection fell dramatically with no obvious ill-effects on the outcome of infections due to this or other organism. In fact, the infection-rate from all organisms was considerably reduced.
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Admit There is a Problem

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Admit There is a Problem

ICU 1

ICU 2

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Admit There is a Problem

“Our patients are different.”

“Show me the hard data that we are doing it wrong.”

“The only reason centres like [institution you particularly loathe] have been able to show an improvement is because their antimicrobial prescribing was so bad to start.”
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Lead or Find a Leader
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Amass the Troops

- infectious diseases physician and/or microbiologist
- pharmacist external to the ICU
- IT person
- data (health records) person
- hospital executive champion
- project manager
- hospital quality and/or safety officer
- pharmacy director

- nursing unit administrator
- ICU pharmacist
- respiratory therapist
- Infection Control (director or delegate)
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Decide What Will Make a Real Difference

- Mortality is a real difference, but there is no good evidence that ASPs (or any approach to antimicrobial therapy) improve mortality.
- Ventilation days and LOS are real differences, but there is no good evidence that ASPs improve these either.
- I think cost is a difference, and there is good evidence that ASPs can reduce pharmacy costs substantially (although little evidence demonstrating whether ASPs are cost-effective).
- I think drug-resistance is a real difference … although there are no RCTs that show that ASPs reduce AROs.
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Decide What Will Make a Real Difference

- Substituting one antimicrobial (say a broad-spectrum one) for another (narrow-spectrum) antimicrobial might be a difference—but we don’t know.

- Switching from iv to po in an ICU is not necessarily much of a difference.

- Optimizing dosing and frequency might be a difference—but, again, we don’t know.

- Reducing colonization or improving “eradication” are not real differences.
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Decide What Will Make a Real Difference

I think we can accept that unnecessary antimicrobials are harmful (C. difficile, antimicrobial resistance, invasive fungal infections, side effects, etc.)

• so reducing days of antimicrobial therapy is a real difference

• reducing amount (grams, doses, etc.) is probably a real difference

• ensuring patients get an antimicrobial that treats their infection is a real difference
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Decide What Will Make a Real Difference

- doing things consistently (following guidelines and algorithms) IS a real difference ... even if you don’t like/agree with the algorithm

“...better to do it the same every time than to do it right some of the time.”
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Decide What Will Make a Real Difference

A Controlled Trial of a Critical Pathway for Treatment of Community-Acquired Pneumonia

Thomas J. Marrie, MD
Catherine Y. Lau, PhD
Susan L. Wheeler, RN
Cindy J. Wong, MSc
Margaret K. Vandervoort, MSc
Brian G. Feagan, MD
for the CAPITAL Study Investigators

COMMUNITY-ACQUIRED PNEUMONIA (CAP) is a common and serious illness. Each year in the United States, approximately 15% of the 600,000 affected people who are admitted to the hospital die of the disease. Analyses of administrative data show that large variations exist in admission rates, length of hospital stay, and use of institutional resources. Lack of a common approach to the diagnosis and treatment of CAP is often cited as an explanation for these variations. Since the cost to society for the treatment of CAP is high, interventions that increase the efficiency of care are desirable.

Critical pathways are management strategies that define the essential steps of complex processes. These schemata may improve the quality and/or reduce the cost of a product or service by articulating and standardizing how care is provided.

Context Large variations exist among hospitals in the use of treatment resources for community-acquired pneumonia (CAP). Lack of a common approach to the diagnosis and treatment of CAP has been cited as an explanation for these variations.

Objective To determine if use of a critical pathway improves the efficiency of treatment for CAP without compromising the well-being of patients.

Design Multicenter controlled clinical trial with cluster randomization and up to 6 weeks of follow-up.

Setting Nineteen teaching and community hospitals in Canada.

Patients A total of 1,743 patients with CAP presenting to the emergency department at 1 of the participating institutions between January 1 and July 31, 1998.

Intervention Hospitals were assigned to continue conventional management (n = 10) or implement the critical pathway (n = 9), which consisted of a clinical prediction rule to guide the admission decision, levofloxacin therapy, and practice guidelines.

Main Outcome Measures Effectiveness of the critical pathway, as measured by health-related quality of life on the Short-Form 36 Physical Component Summary (SF-36 PCS) scale at 6 weeks; and resource utilization, as measured by the number of bed days per patient managed (BDPM).

Results Quality of life and the occurrence of complications, readmission, and mortality were not different for the 2 strategies. The 1-sided 95% confidence limit of the between-group difference in the SF-36 PCS change score was 2.4 points, which was within a predefined 3-point boundary for equivalence. Pathway use was associated with a 1.7-day reduction in BDPM (4.4 vs 6.1 days; P = .04) and an 18% decrease in the admission of low-risk patients (21% vs 49%; P = .01). Although inpatients at critical pathway hospitals had more severe disease, they required 1.7 fewer days of intravenous therapy (4.6 vs 6.3 days; P = .01) and were more likely to receive treatment with a single class of antibiotic (64% vs 27%; P < .001).

Conclusion In this study, implementation of a critical pathway reduced the use of institutional resources without causing adverse effects on the well-being of patients.


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Decide What Will Make a Real Difference

Antimicrobial Rx was more frequently tailored on basis of quantitative culture results

- Increase in appropriate definitive therapy
- Decrease in mean duration of Rx
# How to Optimize Antimicrobial Stewardship in the ICUs

## Gather Data

<table>
<thead>
<tr>
<th>Indicators</th>
<th>FY 08/09 (Pre-ASP)</th>
<th>FY 09/10</th>
<th>FY 10/11</th>
<th>FY 11/12</th>
<th>FY12/13 Performance</th>
<th>YTD of Previous Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antimicrobial Usage &amp; Costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Antimicrobial DDDs/100 Patient Days</td>
<td>177</td>
<td>171</td>
<td>144</td>
<td>162</td>
<td>155</td>
<td>164</td>
</tr>
<tr>
<td>Systemic Antibacterial DDDs/100 Patient Days</td>
<td>142</td>
<td>128</td>
<td>111</td>
<td>128</td>
<td>122</td>
<td>123</td>
</tr>
<tr>
<td>Systemic Antifungal DDDs/100 Patient Days</td>
<td>31</td>
<td>24</td>
<td>20</td>
<td>27</td>
<td>24</td>
<td>34</td>
</tr>
<tr>
<td>Total Antimicrobial Costs</td>
<td>$332,724</td>
<td>$285,975</td>
<td>$193,129</td>
<td>$279,847</td>
<td>$66,483</td>
<td>$156,129</td>
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<tr>
<td>Total Antimicrobial Costs/Patient Day</td>
<td>$69.01</td>
<td>$59.23</td>
<td>$40.95</td>
<td>$60.24</td>
<td>$52.35</td>
<td>$65.22</td>
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<tr>
<td>Systemic Antibacterial Costs</td>
<td>$174,339</td>
<td>$142,134</td>
<td>$95,773</td>
<td>$125,376</td>
<td>$31,853</td>
<td>$73,225</td>
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<td>Systemic Antibacterial Costs/Patient Day</td>
<td>$29.44</td>
<td>$20.31</td>
<td>$26.98</td>
<td>$25.08</td>
<td>$36.81</td>
<td>$27.09</td>
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<tr>
<td>Systemic Antifungal Costs</td>
<td>$143,100</td>
<td>$132,519</td>
<td>$88,998</td>
<td>$141,865</td>
<td>$30,446</td>
<td>$75,152</td>
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<td>Systemic Antifungal Costs/Patient Day</td>
<td>$29.68</td>
<td>$27.45</td>
<td>$18.87</td>
<td>$30.54</td>
<td>$23.97</td>
<td>$31.39</td>
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</table>

<table>
<thead>
<tr>
<th>Patient Care Outcomes</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital acquired C. difficile cases (rate per 1,000 pt days)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>5 (1.08)</td>
<td>3 (2.36)</td>
<td>tbd</td>
</tr>
<tr>
<td>ICU Average Length of Stay (days)</td>
<td>5.84</td>
<td>5.57</td>
<td>5.67</td>
<td>5.51</td>
<td>5.79</td>
<td>5.08</td>
</tr>
<tr>
<td>ICU Mortality Rate (as a %)</td>
<td>20.1</td>
<td>17.6</td>
<td>16.3</td>
<td>16.5</td>
<td>16.5</td>
<td>16.7</td>
</tr>
<tr>
<td>ICU Readmission Rate within 48 hrs (as a %)</td>
<td>3.7</td>
<td>2.9</td>
<td>2.7</td>
<td>2.7</td>
<td>0.8</td>
<td>2.4</td>
</tr>
<tr>
<td>ICU Ventilator Days</td>
<td>NA</td>
<td>3286</td>
<td>2934</td>
<td>2677</td>
<td>757</td>
<td>609</td>
</tr>
<tr>
<td>ICU Multiple Organ Dysfunction Score (MODS)</td>
<td>4</td>
<td>4.04</td>
<td>4.12</td>
<td>4.25</td>
<td>4.49</td>
<td>4.67</td>
</tr>
</tbody>
</table>

Notes: Defined Daily Dose (DDD) is an internationally accepted method to measure and compare antimicrobial usage (World Health Organization, [http://www.who.int/medicines/medicines/ddd](http://www.who.int/medicines/medicines/ddd)).

Total Antimicrobial DDDs is the sum of systemic antibacterial DDDs + systemic antifungal DDDs + systemic antivirals; non-systemic antimicrobials are excluded.

Data Sources: Antimicrobial DDD and Costs (Pharmnet), C difficile (Infection Control Dashboards), Other ICU Patient Care Indicators (Critical Care Information System)
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Gather Data

Ciprofloxacin

Pre-ASP Median: 57%
Post-ASP Median: 67%

Tobramycin

Pre-ASP Median: 89%
Post-ASP Median: 91%

Ceftazidime

Pre-ASP Median: 63%
Post-ASP Median: 86%

Pip-Tazo

Pre-ASP Median: 73%
Post-ASP Median: 91%

Meropenem

Pre-ASP Median: 55%
Post-ASP Median: 80%
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Gather Data

In Ontario, next month, 3 new indicators will be added to the Critical Care Information System:

- days of antibacterial therapy
- days of antifungal therapy
- ICU-onset C. difficile
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Do Something

✦ anything!

✦ consider:
  - tightly regulated algorithms & protocols
  - prospective audit and feedback
  - (I’m not a fan of restricted drugs, pre-authorization, etc.)
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Review What You’ve Done

- see if you have made a real difference
- be honest with what you see:
  - the limitations of seemingly too-good-to-be-true results
  - the reality of what may be unquestionably underwhelming results