Epidemiology in the ICU

*Critical Facts for Critical Care*

Patricia L. Cummings, PhD, MPH
Clinical Epidemiologist

June 3, 2017
Critical Care Conference
I have no disclosures.
Overview

• Epidemiology of critical care
• Antimicrobial issues
  – Resistance
  – New TJC Medication Management Standard

THINGS GOT REALLY INTERESTING WHEN THE STATISTICIAN STARTED DOING WARD ROUNDS.
Epidemiology of Critical Care
ICU Descriptive Statistics

Patient factors

• Age
• Admitting diagnosis
• Comorbidities
• Cause of death
• Length of stay

Harnessing Big Data for Better Results

In a typical ICU, a dozen different streams of data light up the monitors at a patient’s bedside, including heart physiology, respiration, brain waves, and blood pressure. Currently it’s up to doctors and nurses to rapidly process and analyze this constant feed of vital signs to make important medical decisions. Emory University Hospital is using software from IBM and Excel-Medical Electronics (EME) for a pioneering collaboration to create advanced, predictive medical care for critically ill patients through real-time streaming analytics. Emory is testing a system that can identify patterns in physiological data and instantly alert clinicians to dangerous signs in patients.
# Changes in Hospital Mortality for U.S. ICU Admissions

<table>
<thead>
<tr>
<th></th>
<th>Cohort</th>
<th>1988-89</th>
<th>2007-09</th>
<th>2010-12</th>
</tr>
</thead>
<tbody>
<tr>
<td># Admissions</td>
<td></td>
<td>17,440</td>
<td>113,743</td>
<td>102,225</td>
</tr>
<tr>
<td>Average age</td>
<td></td>
<td>59.3</td>
<td>61.3</td>
<td>61.4</td>
</tr>
<tr>
<td>Hospital mortality %</td>
<td></td>
<td>17%</td>
<td>12%</td>
<td>11%</td>
</tr>
</tbody>
</table>

EMC data 2012-2016
Avg. age admitted to ICU = 69.0 years

Hospital mortality, age, acute physiology score for 482,601 ICU admissions
ICU Mortality: Diagnostic groups with a >60% reduction in mortality from 1988-89 to 2010-12
ICU Mortality: Diagnostic groups with a 51-59% reduction in mortality from 1988-89 to 2010-12

Figure 3 Diagnostic groups with a 51% to 59% reduction in mortality from 1988-1989 to 2010-2012. Definition of abbreviations: AMI, acute myocardial infarction; CHF, congestive heart failure; SEPSIS, sepsis, non-urinary tract; SGICA, surgery for gastrointestinal malignancy; SICH, surgery for intracerebral hemorrhage; uriSEPSIS, sepsis, urinary tract.
### Changes in Hospital Mortality for U.S. ICU Admissions, 1988 to 2012

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td># Admissions</td>
<td>17,440</td>
<td>113,743</td>
<td>102,225</td>
</tr>
<tr>
<td>≥ 1 chronic health conditions</td>
<td>12%</td>
<td>15%</td>
<td>14%</td>
</tr>
<tr>
<td>% on ventilator, day 1</td>
<td>34%</td>
<td>40%</td>
<td>36%</td>
</tr>
<tr>
<td>ICU LOS (mean days)</td>
<td>4.6</td>
<td>4.0</td>
<td>3.6</td>
</tr>
<tr>
<td>Hospital LOS (mean days)</td>
<td>15.6</td>
<td>10.8</td>
<td>9.7</td>
</tr>
</tbody>
</table>

Critical Care Utilization

- Conditions/Procedures with the highest rate of ICU use in the U.S.
  - Respiratory disease with ventilator support
  - Cardiac-related
    - Acute MI with major complications or comorbidities
    - Chest pain

1 Barrett ML et al., AHRQ-Healthcare Cost and Utilization Project, State Inpatient Databases, Statistical Brief #185, 2014.
• Severe Sepsis (in non-coronary ICU)
• Mortality
  – Sepsis: 30-50%
  – Septic shock: 50-60%
Epidemiology of Sepsis

• Incidence of sepsis in U.S. ICUs
  – Varied estimates due to different case definitions
  – Range from 300 to 1,000 cases per 100,000 persons
  – Increasing incidence with decreasing case fatality rate

Figure 1. Population-Adjusted Incidence of Sepsis, According to Sex, 1979–2000. Points represent the annual incidence rate, and I bars the standard error.
Figure 2. Population-Adjusted Incidence of Sepsis, According to Race, 1979–2000. Points represent the annual incidence rate, and I bars the standard error.
Figure 3. Numbers of Cases of Sepsis in the United States, According to the Causative Organism, 1979–2000.
Points represent the number of cases for the given year, and I bars the standard error.
Projected Incidence of Severe Sepsis in the US: 2001 - 2050

Sepsis

- Increased awareness and tracking
- Aging population
- Immunosuppressed populations
- Spread of antibiotic resistant pathogens
- Broader use of intensive procedures and immunosuppressive agents
# International Study of the Prevalence and Outcomes of Infection in Intensive Care Units

<table>
<thead>
<tr>
<th><strong>Objective</strong></th>
<th>International study in ICUs (EPIC II Study)</th>
</tr>
</thead>
</table>
| **Methods**   | - 1-day prevalence study conducted on May 8, 2007  
|               | - n=13,796 adult (>18 yrs) patients from 1,265 ICUs from 75 countries |
# Reason for ICU Admission

<table>
<thead>
<tr>
<th>Reason</th>
<th>All Patients (n=13,796)</th>
<th>Not Infected (n=6,709)</th>
<th>Infected (n=7,087)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Respiratory</strong></td>
<td>3091 (22.4)</td>
<td>845 (12.6)</td>
<td>2246 (31.7)</td>
</tr>
<tr>
<td><strong>Cardiovascular</strong></td>
<td>3041 (22.0)</td>
<td>1541 (23.0)</td>
<td>1500 (21.2)</td>
</tr>
<tr>
<td><strong>Surveillance/monitoring</strong></td>
<td>2592 (18.8)</td>
<td>1968 (29.3)</td>
<td>624 (8.8)</td>
</tr>
<tr>
<td><strong>Neurologic</strong></td>
<td>2010 (14.6)</td>
<td>994 (14.8)</td>
<td>1016 (14.3)</td>
</tr>
<tr>
<td><strong>Digestive/liver</strong></td>
<td>1306 (9.5)</td>
<td>478 (7.1)</td>
<td>828 (11.7)</td>
</tr>
<tr>
<td><strong>Trauma</strong></td>
<td>1119 (8.1)</td>
<td>593 (8.8)</td>
<td>526 (7.4)</td>
</tr>
<tr>
<td><strong>Renal</strong></td>
<td>324 (2.3)</td>
<td>119 (1.8)</td>
<td>205 (2.9)</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>313 (2.3)</td>
<td>171 (2.5)</td>
<td>142 (2.0)</td>
</tr>
</tbody>
</table>

*Note: The table includes reasons for ICU admission among 13,796 patients. The numbers in parentheses represent the percentage of patients admitted for each reason.*
## Source of Admission

<table>
<thead>
<tr>
<th>Source of Admission</th>
<th>All Patients (n=13,796)</th>
<th>Not Infected (n=6,709)</th>
<th>Infected (n=7,087)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating room/recovery</td>
<td>3510 (25.7)</td>
<td>2178 (32.9)</td>
<td>1332 (18.9)</td>
</tr>
<tr>
<td>ED/ambulance</td>
<td>4010 (29.3)</td>
<td>1980 (29.9)</td>
<td>2030 (28.8)</td>
</tr>
<tr>
<td>Hospital floor</td>
<td>3789 (27.7)</td>
<td>1503 (22.7)</td>
<td>2286 (32.5)</td>
</tr>
<tr>
<td>Other hospital</td>
<td>1921 (14.1)</td>
<td>751 (11.3)</td>
<td>1170 (16.6)</td>
</tr>
<tr>
<td>Other</td>
<td>435 (3.2)</td>
<td>212 (3.2)</td>
<td>223 (3.2)</td>
</tr>
<tr>
<td>Results</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 51% had infection, of those:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 62% gram-negative; 47% gram-positive; 19% fungi</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- <strong>N. America</strong>: highest gram-positive isolates (\textit{S. aureus}/MRSA)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- <strong>Asia</strong>: highest gram-negative isolates (\textit{Pseudomonas} sp.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- <strong>Western/Eastern Europe</strong>: highest fungi rate (\textit{Candida})</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Most common site of infection:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Lung, abdomen, bloodstream</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Results</th>
<th>Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>- 71% patients were receiving antibiotics</td>
<td>- Infection independently associated with increased risk of hospital death</td>
</tr>
<tr>
<td>- Infections, sepsis leading causes of death; accounted for 40% of all</td>
<td>- Risk of infection increased with ICU LOS</td>
</tr>
<tr>
<td>ICU expenditures</td>
<td></td>
</tr>
</tbody>
</table>

Percent distribution of the 10 leading causes of death, by age group: U.S., 2014

Ages 25–44:
- Unintentional injuries: 28.3%
- Heart disease: 11.6%
- Cancer: 12.6%
- Suicide: 11.2%
- Chronic liver disease and cirrhosis: 5.7%
- Homicide: 2.8%
- Stroke: 2.3%
- Diabetes: 2.0%
- HIV disease: 1.5%
- Influenza and pneumonia: 1.4%

Ages 45–64:
- Heart disease: 20.8%
- Cancer: 30.5%
- Chronic liver disease and cirrhosis: 7.4%
- Unintentional injuries: 4.1%
- CLRD: 4.0%
- Diabetes: 3.7%
- Stroke: 3.3%
- Suicide: 3.1%
- Septicemia: 1.6%
- Influenza and pneumonia: 1.5%

Other: 20.6% (Ages 25–44) and 20.1% (Ages 45–64)
Percent distribution of the 10 leading causes of death, by age group: U.S., 2014

**Ages 65 and over**
- Heart disease: 25.5%
- Cancer: 21.5%
- Other: 24.5%
- Septicemia: 1.5%
- Kidney disease: 2.3%
- Influenza and pneumonia: 2.8%
- Unintentional injuries: 2.1%
- Diabetes: 4.8%
- Stroke: 5.9%
- CLRD: 6.5%

**Ages 85 and over**
- Heart disease: 29.2%
- Cancer: 12.2%
- Other: 27.9%
- Hypertension: 1.6%
- Diabetes: 2.6%
- Kidney disease: 2.9%
- Unintentional injuries: 2.1%
- Influenza and pneumonia: 2.0%
- CLRD: 5.0%
- Stroke: 6.9%
- Alzheimer’s disease: 7.5%

**NOTES:** CLRD is Chronic lower respiratory diseases; HIV is Human immunodeficiency virus. Values show percentage of total deaths.

**SOURCE:** NCHS, National Vital Statistics System, Mortality.
Common Sites of Infection in ICU Patients

“"I use so much alcohol-based hand sanitizer, my hands had to join a 12-step program!""
<table>
<thead>
<tr>
<th>Infection Site</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Lungs (pneumonia)</td>
<td>46.9</td>
</tr>
<tr>
<td>2. Other respiratory tract</td>
<td>17.8</td>
</tr>
<tr>
<td>3. Urinary tract</td>
<td>17.6</td>
</tr>
<tr>
<td>4. Bloodstream</td>
<td>12.0</td>
</tr>
<tr>
<td>5. Wound</td>
<td>6.9</td>
</tr>
<tr>
<td>6. Ear, nose, and throat</td>
<td>5.1</td>
</tr>
<tr>
<td>7. Skin and soft tissue</td>
<td>4.8</td>
</tr>
<tr>
<td>8. Gastrointestinal tract</td>
<td>4.5</td>
</tr>
<tr>
<td>9. Cardiovascular system, incl. phlebitis</td>
<td>2.9</td>
</tr>
<tr>
<td>10. Sepsis</td>
<td>2.0</td>
</tr>
</tbody>
</table>
Major Sites of Infection

Medical ICU Patients

- EENT, 3%
- CVS, 5%
- GI, 5%
- LRI, 6%
- BSI, 16%
- SST, 3%
- PNE, 30%
- UTI, 30%

Surgical ICU Patients

- EENT, 3%
- CVS, 4%
- GI, 4%
- LRI, 6%
- BSI, 13%
- SST, 3%
- SSI, 15%
- UTI, 18%
- PNE, 33%

## Device Associated Infections Reported to NHSN, by Critical Care Unit Type, 2011-14

<table>
<thead>
<tr>
<th>Acute Care Hospitals Critical Care Units</th>
<th># of units reporting (n = 17,600)</th>
<th>CLABSI (n=96,532)</th>
<th>CAUTI (n=153,805)</th>
<th>VAP&lt;sup&gt;a&lt;/sup&gt; (n=8,805)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult Medical</td>
<td>748</td>
<td>6,333 (6.6)</td>
<td>14,659 (9.5)</td>
<td>766 (8.7)</td>
</tr>
<tr>
<td>Adult Medical/Surgical</td>
<td>2,807</td>
<td>16,943 (17.6)</td>
<td>34,773 (22.6)</td>
<td>2,737 (31.1)</td>
</tr>
<tr>
<td>All Other Adult Critical Care</td>
<td>1,871</td>
<td>15,046 (3.7)</td>
<td>40,909 (26.6)</td>
<td>3,896 (44.2)</td>
</tr>
<tr>
<td>Pediatric Critical Care</td>
<td>376</td>
<td>3,544 (3.7)</td>
<td>1,960 (1.3)</td>
<td>308 (3.5)</td>
</tr>
<tr>
<td>Neonatal Intensive Care (NICU)</td>
<td>791</td>
<td>7,844 (8.1)</td>
<td>--</td>
<td>639 (7.3)</td>
</tr>
<tr>
<td>Oncology (incl. critical care, ward, and step-down)</td>
<td>616</td>
<td>11,399 (11.8)</td>
<td>2,222 (1.4)</td>
<td>7 (0.1)</td>
</tr>
</tbody>
</table>
Distribution of Pathogens Associated with SSIs Reported to NHSN, 2011-14

CoNS: Coagulase-negative staphylococci
### Distribution of Pathogens Associated with SSIs Reported to NHSN and Type of Surgery, 2011-14

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Abdominal</th>
<th>Cardiac</th>
<th>Vascular</th>
<th>Orthopedic</th>
<th>Neck*</th>
<th>Neuro</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S. aureus</strong></td>
<td>6,922 (9.1%)</td>
<td>3,430 (30.4%)</td>
<td>502 (26.9%)</td>
<td>15,163 (44.2%)</td>
<td>36 (17.0%)</td>
<td>676 (31.2%)</td>
</tr>
<tr>
<td><strong>E.coli</strong></td>
<td>14,955 (19.6%)</td>
<td>647 (5.7%)</td>
<td>165 (8.8%)</td>
<td>1,625 (4.7%)</td>
<td>12 (5.7%)</td>
<td>72 (3.3%)</td>
</tr>
<tr>
<td>Coagulase-Neg. Staph</td>
<td>3,273 (4.3%)</td>
<td>1,641 (14.5%)</td>
<td>114 (6.1%)</td>
<td>4,461 (13.0%)</td>
<td>23 (10.8%)</td>
<td>522 (24.1%)</td>
</tr>
<tr>
<td>E.faecalis</td>
<td>7,197 (9.4%)</td>
<td>325 (2.9%)</td>
<td>135 (7.2%)</td>
<td>1,620 (4.7%)</td>
<td>7 (3.3%)</td>
<td>40 (1.8%)</td>
</tr>
</tbody>
</table>

*Neck surgery and thyroid and/or parathyroid surgery, the top pathogen category was ‘Other Pathogen’ (n=60; 28.3), with S.aureus second highest (n=36; 17.0).
The Antimicrobial Threat

“But Timmy, you have to eat your antibiotics, or you’ll never become a big and strong bacteria.”
Antimicrobial Resistance

• Patients in ICUs are subjected to increased selective pressure and increased colonization pressure

• Importance of antimicrobial stewardship in critical care
  – New TJC Medication Management Standard MM.09.01.01

Antimicrobial Resistance

• In the U.S., antibiotic-resistant (AR) pathogens cause:
  – 2 Million illnesses per year
  – 23,000 deaths per year

• CDC: AR is one of the Top 5 Health Threats in U.S., 2016

Multidrug-Resistant Pathogens

• Isolated in ICUs with increasing frequency:
  – MRSA
  – VRE
  – *Acinetobacter baumannii*
  – Enterobacteriaceae → ESBLs and CREs
  – Carbapenem-resistant *Pseudomonas aeruginosa*


CDC’s Top Drug-Resistant Threats to the U.S.

1. **HAZARD LEVEL URGENT**
   - C. Difficile
   - Carbapenem-R Enterobacteriaceae (CRE)
   - Cephalosporin-R Neisseria gonorrhoeae

2. **HAZARD LEVEL SERIOUS**
   - MDR Acinetobacter, DR Campylobacter, Fluconazole-R Candida, ESBLs, VRE, MDR Pseudomonas aeruginosa, DR Non-typhoidal Salmonella, DR Salmonella Typhi, DR Shigella, MRSA, DR Streptococcus pneumonia, DR tuberculosis

3. **HAZARD LEVEL CONCERNING**
   - Vancomycin-R Staphylococcus aureus
   - Macrolide-R group A streptococci
   - Clindamycin-R group B streptococci

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Methicillin-Resistant *Staphylococcus aureus* | CLABSI, CAUTI, SSI | Combined Years (2011-2014)

Note: HAIs include CAUTI, CLABSI, AND SSI; these account for about 25% of HAIs in acute care hospitals; values excludes some facility types (nursing homes)  All data current as of 12/16/2015

**Footnotes**

**Insufficient Data** - Between 1 and 19 isolates were tested for susceptibility. The percent resistance and accompanying data points cannot be calculated when the number of tested isolates is less than 20

**Not Defined** - Zero isolates were tested. The percent resistance and accompanying data points cannot be calculated when the number of observations in the denominator is zero
Peripheral modifications of $[^{\Psi}][\text{CH}_2\text{NH}]Tpg^4$vancomycin with added synergistic mechanisms of action provide durable and potent antibiotics

Akinori Okano$^{ab}$, Nicholas A. Isley$^{ab}$, and Dale L. Boger$^{ab,1}$

$^a$Department of Chemistry, The Scripps Research Institute, La Jolla, CA 92037; and $^b$The Skaggs Institute for Chemical Biology, The Scripps Research Institute, La Jolla, CA 92037

Contributed by Dale L. Boger, April 25, 2017 (sent for review March 13, 2017; reviewed by Steven L. Castle and Jeffrey N. Johnson)

Subsequent to binding pocket modifications designed to provide dual $\text{d-Ala-d-Ala-d-Lac}$ binding that directly overcome the molecular basis of vancomycin resistance, peripheral structural changes have been explored to improve antimicrobial potency and provide additional synergistic mechanisms of action. A C-terminal peripheral modification, introducing a quaternary ammonium salt, is reported and was found to provide a binding pocket-modified vancomycin analog with a second mechanism of action that is independent of $\text{d-Ala-d-Ala-d-Lac}$ binding. This modification, which induces cell wall permeability and is complementary to the glycopeptide inhibition of cell wall synthesis, was found to provide improvements in antimicrobial potency (200-fold) against vancomycin-resistant Enterococci (VRE). Furthermore, it is shown that this type of C-terminal modification may be combined with a second peripheral (4-chlorobenzyl)carboxylic (CBP) addition to the vancomycin disaccharide to provide even more potent antimicrobial agents (VRE minimum question to ask is if new antibiotics can now be designed that overcome the forces of evolution and selection responsible for bacterial resistance, that are less prone or even immune to resistance development, that avoid many of the common mechanisms of resistance, and that are more durable than ever before. As an alternative to championing the restricted use of antibiotics or conceding that bacteria will always outsmart us, can durable antibiotics be developed that are capable of continued or even more widespread use? Herein, we describe one such effort to create durable antibiotics by deliberate design that may directly counter such evolutionary forces. We identified the glycopeptide antibiotics as an antibiotic class already endowed with features that avoid many mechanisms of resistance. After introduction of designed structural changes that directly overcome the molecular basis of their only prevalent mechanism of resistance, we have explored the mechanism of inhibition of peripheral modifications in the mode.
The Current Landscape

• National requirements for antibiotic stewardship emerging in all healthcare settings
• 48% of hospitals have robust antibiotic stewardship programs, as defined by CDC
• National surveillance system for inpatient antibiotic use in place, but has had slow uptake

Executive Order -- Combating Antibiotic-Resistant Bacteria

EXECUTIVE ORDER

-------

COMBATING ANTIBIOTIC-RESISTANT BACTERIA

By the authority vested in me as President by the Constitution and the laws of the United States of America, I hereby order as follows:

Sec. 5. Improved Antibiotic Stewardship. (a) By the end of calendar year 2016, HHS shall review existing regulations and propose new regulations or other actions, as appropriate, that require hospitals and other inpatient healthcare delivery facilities to implement robust antibiotic stewardship programs that adhere to best practices, such as those identified by the CDC. HHS shall also take steps to encourage other healthcare facilities, such as ambulatory surgery centers and dialysis facilities, to adopt antibiotic stewardship programs.

BARACK OBAMA

THE WHITE HOUSE,
September 18, 2014.
National Action Plan

• Main themes:
  – Slow emergence / prevent spread
  – Strengthen “One Health” surveillance
  – Develop rapid diagnostics
  – Accelerate basic and applied R&D
    • New antibiotics, other therapeutics, vaccines
  – Improve international collaboration
Requirements for Hospitals

Official Publication of Joint Commission Requirements

New Antimicrobial Stewardship Standard

Applicable to Hospitals and Critical Access Hospitals

Effective January 1, 2017

Medication Management (MM)

Standard MM.09.01.01
The [critical access] hospital has an antimicrobial stewardship program based on current scientific literature.

Elements of Performance for MM.09.01.01

1. Leaders establish antimicrobial stewardship as an organizational priority. (See also LD.01.03.01, EP 5)

   Note: Examples of leadership commitment to an antimicrobial stewardship program are as follows:
   ● Accountability documents
   ● Budget plans

2. The [critical access] hospital educates staff and licensed independent practitioners involved in antimicrobial ordering, dispensing, administration, and monitoring about antimicrobial resistance and antimicrobial stewardship practices. Education occurs upon hire or granting of initial privileges and periodically thereafter, based on organizational need.

3. The [critical access] hospital educates patients, and their families as needed, regarding the appropriate use of antimicrobial medications, including antibiotics. (For more information on patient education, refer to Stan-

Continued on page 4
TJC Eight Elements of Performance

1. AS is an organizational priority
2. Educate staff about AR and AS
3. Educate patients/families about appropriate antibiotic use
4. AS multidisciplinary team (ID physician, pharmacist, epidemiologist, IP, IS)
5. ASP includes the CDC Core Elements
6. Organization-approved multidisciplinary protocols
7. Collect, analyze, and report data on ASP
8. Take action on improvement opportunities identified

*Source: www.cdc.gov/getsmart/healthcare/pdfs/core-elements.pdf
What has been done well with TJC requirements?

- Synergy and alignment with CDC, societies (e.g., SHEA and IDSA) and groups writing and enforcing the requirements (TJC and CMS)
- Many components of requirements are reasonable and actionable
  - Require leadership support, incl. financial support
  - Under Medication Management
  - Emphasis on interventions

Potential Limitations

- Significant uncertainty regarding how TJC will assess ASPs during survey
- Seem to focus on patients being discharged on antibiotics, which is not the primary focus of an inpatient ASP
  - “There are specific populations that surveyors will focus on during the accreditation survey as follows:
    - ED patients who are prescribed antimicrobials
    - Ambulatory and clinic patients surveyed under the hospital program who are prescribed antimicrobials
    - Hospitalized patients who will be discharged on antimicrobials”

www.jointcommission.org/standards_information/jcfaq.aspx?ProgramId=5&ChapterId=76&IsFeatured=False&IsNew=False&Keyword
Potential Limitations

• Emphasis on education of HCWs and patients is of uncertain value
  – TJC says providing written material, such as the antibiogram, will meet the educational requirement
  – “Surveyors will not interview patients or family members regarding education provided on the appropriate use of prescribed antimicrobials.”
What Do You Need to Know?

A surveyor may ask you:

• What is this patient here for?
• Why are they on this antibiotic?
• Tell me about the patient’s antibiotic therapy
  • Know indication, dosage, and duration
Summary

• Epidemiology of Critical Care is evolving
  – Aging population, multiple comorbid chronic conditions, drug resistance, improved care
  – EHR > Big Data > Machine Learning

• Antimicrobial resistance is a national security issue and **stewardship is a top priority**
  – Expand evidence base for optimal antibiotic use
  – Improve measurement of overall and appropriate antibiotic use
  – Understand best practice in stewardship interventions in different settings, incl. integration across facilities

*Let’s Make Antibiotics Great Again*
Thank you!