Epidemiology and Surveillance

Basics of Infection Prevention
2-Day Mini-Course
May 2017
Objectives

• Discuss basic principles of epidemiology and how they apply to surveillance
• Review basic surveillance practices: data collection, recording, analysis, interpretation, and communication of surveillance findings
• Describe surveillance process and outcome measures for infection prevention
Epidemiology

- Study of factors affecting health of populations

Clinical care: focus on the individual
- vs -
Epidemiology: focus on the group

- In healthcare, answers questions such as:
  - What factors contribute to increased HAI rates?
  - What populations are at higher risk for developing HAIs?
    - What percentage of the time?
  - Allows assessment of trends over time
Applying Epidemiology in Healthcare

- Surveillance
- Assessment of intervention, new product
- Outbreak identification
Infection Prevention and Hospital Epidemiology

• Goal is prevention of healthcare-associated infections (HAIs)
• Professional societies include
  • Association for Professionals in Infection Control and Epidemiology (APIC)
  • Society for Healthcare Epidemiology of America (SHEA)
  • Infectious Diseases Society of America (IDSA)
• Epidemiologic research and surveillance underlies HAI prevention
  • Data for action
Surveillance

• The ongoing, **systematic** collection, **recording**, analysis, **interpretation** and **dissemination** of data

• Reflects rate of disease onset and/or current health/disease status of a community or population (e.g. healthcare patients)

• Aims to identify risk factors for disease

• Used for public health **action** to reduce morbidity and mortality, and to improve health.
Terminology
Mean

- Measure of central tendency used to describe a data set
- The average value of a set of numbers
- Most affected by outliers
- To calculate:
  - Add the values in the data set
  - Divide by total number of variables

Calculation

\[
\frac{(0+0+2+0+0+3+7+2+12+0+0+1)}{12} = 2.25
\]

Mean = 2.25
Median

• Another measure of central tendency used to describe a data set
• The midpoint of a distribution of values
• To calculate:
  • Order the values in the data set (low to high, or vice versa)
  • Identify middle value

Calculation

0,0,2,0,0,3,7,2,12,0,0,1
Order: 0,0,0,0,0,0,1,2,2,3,7,12
Median = 0.5
Types of numerical measurements

- Incidence
- Prevalence
- SIR
- Incidence density rate
Prevalence

• Proportion of persons in a population who have a particular disease or attribute at a specified point in time
  • Includes both new and pre-existing cases

  All new and pre-existing cases during a given time period
  Population during the same time period

• Can be point or period

• Healthcare epidemiology example:

  MRSA admission prevalence rate = \frac{2 \text{ patients colonized with MRSA}}{10 \text{ patients admitted on Mar 31, 2012}} = 0.2
Incidence

• Proportion of an initially disease-free population that develops disease during a specified period of time

\[ \text{Colon SSI rate} = \frac{8 \text{ SSI in 2015}}{240 \text{ colon surgeries in 2015}} \times 100 = 3.33 \]

• Also referred to as attack rate or risk

• Healthcare epidemiology example:
Incidence density rate

- Measure of incidence that incorporates time directly into the denominator
  - Central line-days, patient-days, person-time
  - Healthcare epidemiology example:

\[
\text{CLABSI rate} = \frac{5 \text{ CLABSI in 2015}}{11,400 \text{ line-days in 2015}} \times 10,000 = 4.38 \text{ CLABSI per 10,000 central-line days}
\]
Prevalence

- Proportion of persons in a population who have a disease or condition at a given point in time
- Measure of infections that are present

Incidence

- Proportion of persons in a population who develop a disease or condition within a specified period of time
- Measure of new infections

Incidence density rate

- Rate of persons in a population who develop a disease or condition within a specified period of person-time
- Measure of new infections
**Confidence interval, p-value**

- **Confidence interval**: range of values to describe uncertainty around a point estimate
  - Measure of variability in data
- **p-value**: measure of statistical significance which tells us the probability of an event occurring due to chance alone
  - Range: 0-1.0
  - Common cut-offs: 0.05, 0.01
  - E.g. An investigator found that men with hypertension were twice more likely to develop complications due to a smallpox vaccination than those with normal blood pressure (p=0.09). There is a 9% chance of finding such an association due to random error in the sample (chance).
Surveillance

• A surveillance system is an **information** loop or cycle
• Starts and ends with communication and action
Endpoint of HAI Surveillance?

Data that demonstrates progress in HAI prevention!

Number of CLABSI by month, Hospital LAC, 2013-15
Surveillance Terms

• **Case definition (also called surveillance definition)**
  – the clinical and laboratory characteristics that a patient must have to be counted as a case for surveillance purposes: Time, place, & person (e.g., age, sex, other characteristics etc.)

• **Universal case reporting**
  – a surveillance system in which all cases of a disease are supposed to be reported

• **Laboratory-based reporting**
  – a surveillance method in which the reports of cases come from clinical laboratory data (forgoing case review/symptomatology)
Quality HAI Surveillance

Key tenets:

• A written plan should serve as the foundation
  • What HAIs am I tracking? Why?
  • How will data be used?
  • If only to meet mandates, how can data be used?
  • Where are opportunities to prevent HAI in MY facility?

• The intensity of surveillance needs to be maintained over time

• Stay consistent over time; apply same surveillance definitions
Scenario

As a new, yet prepared, infection preventionist, you are conducting your daily rounds. As you stop by the ICU, a nurse approaches you and voices her concern that there has been a noticeable increase in the number of CLABSIs in that unit. You reply that you will look into the issue.

Where do you start?
Recommended practices for surveillance: Association for Professionals in Infection Control and Epidemiology (APIC), Inc.

Terrie B. Lee, RN, MS, MPH, CIC, Ona G. Montgomery, RN, MSHA, CIC, James Marx, RN, MS, CIC, Russell N. Olmsted, MPH, CIC, and William E. Scheckler, MD

Surveillance in public health is defined as “the ongoing, systematic collection, analysis, interpretation, and dissemination of data regarding a health-related event for use in public health action to reduce morbidity and mortality and to improve health.” Infection control professionals apply this definition to both reduce and prevent health care–associated infections (HAIs) and enhance patient safety. Surveillance, as part of infection prevention and control programs in health care facilities, contributes to meeting the national public health objective of reducing the frequency of adverse events such as infection or injury. Although the goal of contemporary infection prevention and control programs is to eliminate HAIs, epidemiologic surveillance is still required for accurate quantification of events and demonstration of performance.

Recommended Practices for Surveillance

I. Assess the population
II. Select the outcome or process for surveillance
III. Use surveillance definitions
IV. Collect surveillance data
V. Calculate and analyze infection rates
VI. Apply risk stratification methodology
VII. Report and use surveillance information

AJIC Am J Infect Control 2007; 35:427-40
Recommended Practices for Surveillance

I. Assess the population
Patient Population at Risk for Infection

Do you know:

• What infections occur most commonly?
• What infections are likely to occur?
• Where are greatest opportunities to prevent infections?
• What are the most frequently performed surgeries or procedures?
• What types of patients increase liability and/or costs for the facility?
Scenario: Assess population

- Who is at risk for CLABSI (type of patients)?
- Where are CLABSI occurring in the facility (units)?
II. Select the outcome or process for surveillance

Recommended Practices for Surveillance
Outcome vs. Process Measures

• Outcome - the result of care or performance
  – Infection
  – Length of stay
  – Patient satisfaction

• Process - series of steps that result in an outcome; adherence to polices and recommended practices
  – Immunization
  – Central line insertion practices
  – Hand hygiene
Outcome Measures

Examples:

• Incidence
  • CAUTI per 1000 urinary catheter days (or patient days-?)
  • CLABSI per 1000 central line days
  • VAP per 1000 ventilator days
  • MRSA and VRE BSI per 10,000 patient days
  • CDI per 10,000 patient days
  • Hospital Onset (HO) CDI per 10,000 patient days

• Prevalence
  • Community Onset (CO) CDI per 10,000 patient days
Process Measures

Examples:

• CLABSI prevention: % adherence to CLIP bundle (all or none)
• CDI prevention: thoroughness of environmental cleaning
• CAUTI prevention: % urinary catheters with appropriate indication
Scenario: select measures

• Outcome
  • Number of CLABSI
  • Incidence density rate of CLABSI by unit
  • Standardized infection ratio by unit, facility-wide

• Process
  • Central line insertion practices (CLIP) adherence
Recommended Practices for Surveillance

III. Use surveillance definitions
Surveillance Definitions

- Always refer to written definitions to ensure accuracy of applying case definitions
  - Use standardized, published, validated definitions where available
  - Where not available, prepare written definitions to ensure intra-facility standardization
- For accurate and valid comparisons, use the same definitions
  - If definitions change, the comparability of rates over time will be compromised
NHSN Infection Surveillance Definitions

CDI - Clostridium difficile Infection

Clostridium difficile infection must meet at least one of the following criteria:

- Red stool specimen (conforms to the shape and consistency of the stool)
- Nasal anatomic (includes endoscopic exams)

CDC/NHSN Surveillance Definitions for Specific Types of Infections

- Report each new GI-CDI according to the Repeat Infection Timeframe (RIT) rule for HAIs (see NHSN HAI definitions in Chapter 2 for further details and guidance).
- CDI laboratory-identified event (LabID Event) categorizations (e.g., recurrent CDI assay, incident CDI assay, healthcare facility-onset, community-onset, community-onset healthcare facility-associated) do not apply to HAIs; including *C. difficile* associated gastrointestinal infections (GI-CDI).
- Cohen SH, Gerding DN, Johnson S, Kelly CP, Loo VG, McDonald LC, et al. Clinical practice guidelines for Clostridium difficile infection in adults: 2010 update by the Society for Healthcare Epidemiology of America (SHEA) and the Infectious Diseases Society of America (IDSA). *Infection Control and Hospital Epidemiology* 2010; 31:431-455

Look for updates to definitions at www.cdc.gov/nhsn
Alternative Surveillance Definitions

Surveillance definitions also exist for settings that may not yet be covered by NHSN definitions:

- Home care
- Clinics
- Dental offices

Can check other sources (e.g. APIC, HICPAC)
Recommended Practices for Surveillance

IV. Collect surveillance data
Collecting Surveillance Data

• Data collectors should include IP staff and others with responsibility or interest
• Limit collection to only what is needed
• Be involved in efforts that advance the electronic health record
Prospective Surveillance

- Initiated when patient is still under the care
- Advantages:
  - ability to capture information in real time
  - can interview caregivers
  - can gather findings not recorded in patient record
  - easier to demonstrate temporality (before & after observations) and therefore make causal inferences
- Disadvantages:
  - can’t see full picture, as patient is not discharged
Retrospective Surveillance

- Closed record review after patient has been discharged
- Advantages:
  - allows for comprehensive review of sequential events
  - efficient
- Disadvantages:
  - does not allow for prompt intervention
  - important/relevant information may be missing
- Avoid sole reliance administrative data, i.e. abstracted billing
  - may be useful for identifying possible HAIs
  - not reliable or valid for HAI surveillance on its own
Numerator Data Collection

• Numerator = the “event” being measured
• Examples:
  – HAIs identified through **active surveillance**: CLABSI, CAUTI, SSI, VAP
  – HAIs identified by **laboratory finding alone**: CDI, MRSA BSI, VRE BSI
  – Care **practices, processes, observations**: CLIP, hand hygiene compliance
Denominator Data

- Denominator = Population at risk, or total of all possible events
  - Procedures, patient encounters, or total inpatient time
**Additional Data**

- Data collection may involve collection of risk factor data necessary for risk adjustment

<table>
<thead>
<tr>
<th>HAI</th>
<th>Factors in Risk Adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDI</td>
<td>Test Type; Community admission prevalence; Facility bed size; Facility major teaching status</td>
</tr>
<tr>
<td>CLABSI</td>
<td>Number of patients with central lines; ICU vs ward</td>
</tr>
<tr>
<td>MRSA BSI</td>
<td>Community admission prevalence; Facility bed size; Facility major teaching status</td>
</tr>
<tr>
<td>SSI</td>
<td>Age, ASA score; Wound classification (contaminated or dirty); Procedure duration; General anesthesia; Emergency procedure; Gender; BMI; Diabetes Trauma association; Endoscope; Type of surgery (primary, revision); Blood loss; Approach; Spine Level; Facility bed size Facility major teaching status</td>
</tr>
</tbody>
</table>
Scenario: data collection

- Numerator:
  - Number of CLABSI events in January 2015
- Denominator:
  - Number of central line-days in January 2015
- Additional data:
  - Location of CLABSI (critical care, NICU, PICU, other?)
V. Calculate and analyze infection rates
VI. Apply risk stratification methodology
Calculate appropriate measures

- Prevalence
- Ratio
- Incidence density rate
- Crude rates
- Adjusted rates
  - Incorporate risk adjustment
Why risk adjust?

- Enables HAI predictors to be taken into account in summary measures
- Helps address concerns related to the complexity of patients receiving care in an institution
- Can adjust for testing type (e.g. CDI)
Procedure-associated Risk

- Infection risk varies by type of procedure

<table>
<thead>
<tr>
<th>Procedure code</th>
<th>Operative procedure description</th>
<th>Duration cut point (min)</th>
<th>Risk index category</th>
<th>No. of procedures</th>
<th>No. of SSI</th>
<th>Pooled mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAA</td>
<td>Abdominal aortic aneurysm repair</td>
<td>225</td>
<td>0,1</td>
<td>881</td>
<td>16</td>
<td>1.82</td>
</tr>
<tr>
<td>AAA</td>
<td>Abdominal aortic aneurysm repair</td>
<td>225</td>
<td>2,3</td>
<td>288</td>
<td>15</td>
<td>5.21</td>
</tr>
<tr>
<td>APPY</td>
<td>Appendix surgery</td>
<td>81</td>
<td>0,1</td>
<td>2691</td>
<td>40</td>
<td>1.49</td>
</tr>
<tr>
<td>APPY</td>
<td>Appendix surgery</td>
<td>81</td>
<td>2,3</td>
<td>372</td>
<td>13</td>
<td>3.49</td>
</tr>
<tr>
<td>AVSD</td>
<td>Arteriovenostomy for renal dialysis</td>
<td>111</td>
<td>0,1,2,3</td>
<td>606</td>
<td>6</td>
<td>0.99</td>
</tr>
<tr>
<td>BILI</td>
<td>Bile duct, liver or pancreatic surgery</td>
<td>330</td>
<td>0,1</td>
<td>422</td>
<td>37</td>
<td>8.77</td>
</tr>
<tr>
<td>BILI</td>
<td>Bile duct, liver or pancreatic surgery</td>
<td>330</td>
<td>2,3</td>
<td>202</td>
<td>33</td>
<td>16.34</td>
</tr>
<tr>
<td>BRST</td>
<td>Breast surgery</td>
<td>202</td>
<td>0</td>
<td>997</td>
<td>8</td>
<td>0.80</td>
</tr>
<tr>
<td>BRST</td>
<td>Breast surgery</td>
<td>202</td>
<td>1</td>
<td>914</td>
<td>25</td>
<td>2.74</td>
</tr>
<tr>
<td>CARD</td>
<td>Cardiac surgery</td>
<td>300</td>
<td>0,1</td>
<td>10,382</td>
<td>121</td>
<td>1.17</td>
</tr>
<tr>
<td>CARD</td>
<td>Cardiac surgery</td>
<td>300</td>
<td>2,3</td>
<td>3396</td>
<td>58</td>
<td>1.71</td>
</tr>
<tr>
<td>CBGB</td>
<td>Coronary bypass w/chest and donor incision</td>
<td>300</td>
<td>0</td>
<td>1003</td>
<td>3</td>
<td>0.30</td>
</tr>
<tr>
<td>CBGB</td>
<td>Coronary bypass w/chest and donor incision</td>
<td>300</td>
<td>1</td>
<td>47,296</td>
<td>1399</td>
<td>2.96</td>
</tr>
<tr>
<td>CBGB</td>
<td>Coronary bypass w/chest and donor incision</td>
<td>300</td>
<td>2,3</td>
<td>15,706</td>
<td>767</td>
<td>4.88</td>
</tr>
<tr>
<td>CBGC</td>
<td>Coronary bypass graft with chest incision</td>
<td>285</td>
<td>0,1</td>
<td>3495</td>
<td>57</td>
<td>1.63</td>
</tr>
<tr>
<td>CBGC</td>
<td>Coronary bypass graft with chest incision</td>
<td>285</td>
<td>2,3</td>
<td>1147</td>
<td>33</td>
<td>2.88</td>
</tr>
<tr>
<td>CEA</td>
<td>Carotid endarterectomy</td>
<td>133</td>
<td>0,1,2,3</td>
<td>2615</td>
<td>11</td>
<td>0.42</td>
</tr>
<tr>
<td>CHOL</td>
<td>Gallbladder surgery</td>
<td>121</td>
<td>0,1,2,3</td>
<td>3337</td>
<td>23</td>
<td>0.69</td>
</tr>
<tr>
<td>COLO</td>
<td>Colon surgery</td>
<td>198</td>
<td>0</td>
<td>9520</td>
<td>390</td>
<td>4.18</td>
</tr>
</tbody>
</table>
Device-associated Risk

- Infection risk increases with use of invasive devices
  - Higher risk with longer duration

More devices ➔ Increased risk ➔ Increased infections
Patient-, unit-, and facility-level risk

- Infection risk varies by patient-specific risk factors (e.g. age, sex, diabetes status)
- Infection rates vary by patient care unit (e.g. bed size, medical school association)
Calculating SIRs

Observed number of HAIs

\[
SIR = \frac{\text{Number of HAIs}}{\text{Predicted number of HAIs}}
\]

Predicted number of HAIs

SIR is a risk-adjusted composite measure

Scenario SIR:
Hospital has 4 CLABSI over the course of 23,500 patient-days, and national data predicted 2.5:

\[
SIR = \frac{4}{2.5} = 1.6
\]
Applying risk adjustment methods

The SIRs for CLABSIs and CAUTIs are adjusted for:

- Type of patient care location, hospital affiliation with a medical school, location bed size

The SIRs for hospital-onset *C. difficile* and MRSA bloodstream infections are adjusted for:

- Facility bed size, hospital affiliation with a medical school, number of community-onset” cases, and CDI test type

The SIRs for SSIs are adjusted for:

- Duration of surgery, surgical wound class, use of endoscopes, re-operation status, patient age, patient assessment at time of anesthesiology
Scenario: risk adjustment

<table>
<thead>
<tr>
<th>Type of acute care hospital location</th>
<th>No. of locations</th>
<th>No. of CLABSIs</th>
<th>Central line days</th>
<th>Pooled mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical care</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Burn</td>
<td>71 (69)</td>
<td>219</td>
<td>74,949</td>
<td>2.9</td>
</tr>
<tr>
<td>Medical: major teaching</td>
<td>251 (250)</td>
<td>812</td>
<td>669,976</td>
<td>1.2</td>
</tr>
<tr>
<td>Medical: all other</td>
<td>452 (432)</td>
<td>660</td>
<td>611,514</td>
<td>1.1</td>
</tr>
<tr>
<td>Medical cardiac</td>
<td>387 (381)</td>
<td>565</td>
<td>557,944</td>
<td>1.0</td>
</tr>
<tr>
<td>Medical/surgical: major teaching</td>
<td>358 (354)</td>
<td>908</td>
<td>800,019</td>
<td>1.1</td>
</tr>
<tr>
<td>Medical/surgical: all other, ≤15 beds</td>
<td>1,647 (1,510)</td>
<td>1,032</td>
<td>1,260,781</td>
<td>0.8</td>
</tr>
<tr>
<td>Medical/surgical: all other, &gt;15 beds</td>
<td>807 (804)</td>
<td>1,752</td>
<td>2,132,226</td>
<td>0.8</td>
</tr>
<tr>
<td>Neurologic</td>
<td>59 (58)</td>
<td>91</td>
<td>80,894</td>
<td>1.1</td>
</tr>
<tr>
<td>Neurosurgical</td>
<td>181 (178)</td>
<td>300</td>
<td>317,745</td>
<td>0.9</td>
</tr>
<tr>
<td>Pediatric cardiothoracic</td>
<td>43</td>
<td>185</td>
<td>146,328</td>
<td>1.3</td>
</tr>
<tr>
<td>Pediatric medical</td>
<td>31 (26)</td>
<td>19</td>
<td>23,719</td>
<td>0.8</td>
</tr>
<tr>
<td>Pediatric medical/surgical</td>
<td>315 (288)</td>
<td>479</td>
<td>389,069</td>
<td>1.2</td>
</tr>
<tr>
<td>Pediatric surgical</td>
<td>6 (5)</td>
<td>1</td>
<td>3,105</td>
<td>0.3</td>
</tr>
<tr>
<td>Prenatal</td>
<td>8 (1)</td>
<td>0</td>
<td>710</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Will adjust for (stratify by) location when reporting rate, calculating SIR
NHSN published data can help you interpret your HAI data

- Annual reports published in American Journal of Infection Control
Recommended Practices for Surveillance

VII. Report and use surveillance information
Reporting and Using Surveillance Data

“The demonstrable power of surveillance is in sharing findings with those who need to know and who can act on the findings to improve patient safety.”

AJIC Am J Infect Control 2007; 35:427-40

• Plan for distribution of findings
• Report to health care providers most able to impact patient care
• Report in a manner to stimulate process improvement
• Use visual displays of data
  • Charts, graphs, tables, or other graphics data
# Tables and Line Lists

National Healthcare Safety Network

Line Listing for All Central Line-Associated BSI Events

As of: November 3, 2009 at 9:04 AM

Date Range: All CLABEVENTS

<table>
<thead>
<tr>
<th>orgID</th>
<th>patID</th>
<th>dob</th>
<th>gender</th>
<th>admitDate</th>
<th>eventID</th>
<th>eventDate</th>
<th>eventType</th>
<th>spcEvent</th>
<th>location</th>
</tr>
</thead>
<tbody>
<tr>
<td>10018</td>
<td>7425</td>
<td>09/22/1961</td>
<td>M</td>
<td>06/06/2005</td>
<td>1676</td>
<td>06/11/2005</td>
<td>BSI</td>
<td>LCBI</td>
<td>BMT</td>
</tr>
<tr>
<td>10018</td>
<td>MD-4937</td>
<td>09/19/1922</td>
<td>F</td>
<td>05/30/2005</td>
<td>1678</td>
<td>06/21/2005</td>
<td>BSI</td>
<td>LCBI</td>
<td>BMT</td>
</tr>
<tr>
<td>10018</td>
<td>85613</td>
<td>04/18/1951</td>
<td>M</td>
<td>07/08/2005</td>
<td>1685</td>
<td>07/13/2005</td>
<td>BSI</td>
<td>LCBI</td>
<td>S-ICU</td>
</tr>
<tr>
<td>10018</td>
<td>10222</td>
<td>01/04/1978</td>
<td>F</td>
<td>08/01/2005</td>
<td>1927</td>
<td>08/08/2005</td>
<td>BSI</td>
<td>LCBI</td>
<td>MICU</td>
</tr>
<tr>
<td>10018</td>
<td>01-88-145</td>
<td>10/07/1939</td>
<td>M</td>
<td>03/17/2006</td>
<td>3321</td>
<td>03/21/2006</td>
<td>BSI</td>
<td>LCBI</td>
<td>S-ICU</td>
</tr>
<tr>
<td>10018</td>
<td>34-22-100</td>
<td>03/22/1940</td>
<td>M</td>
<td>03/12/2006</td>
<td>4789</td>
<td>03/20/2006</td>
<td>BSI</td>
<td>LCBI</td>
<td>MICU</td>
</tr>
<tr>
<td>10018</td>
<td>86-990-01</td>
<td>12/12/1926</td>
<td>M</td>
<td>03/10/2006</td>
<td>4798</td>
<td>03/14/2006</td>
<td>BSI</td>
<td>LCBI</td>
<td>S-ICU</td>
</tr>
<tr>
<td>10018</td>
<td>26-22-678</td>
<td>03/28/2006</td>
<td>M</td>
<td>03/28/2006</td>
<td>4800</td>
<td>03/31/2006</td>
<td>BSI</td>
<td>LCBI</td>
<td>NICU</td>
</tr>
<tr>
<td>10018</td>
<td>32-54-731</td>
<td>02/21/1959</td>
<td>M</td>
<td>03/06/2006</td>
<td>4820</td>
<td>03/09/2006</td>
<td>BSI</td>
<td>LCBI</td>
<td>S-ICU</td>
</tr>
<tr>
<td>10018</td>
<td>13-19</td>
<td>04/18/1934</td>
<td>F</td>
<td>03/07/2006</td>
<td>4821</td>
<td>03/16/2006</td>
<td>BSI</td>
<td>LCBI</td>
<td>MICU</td>
</tr>
<tr>
<td>10018</td>
<td>44-18-004</td>
<td>08/16/1944</td>
<td>F</td>
<td>02/11/2006</td>
<td>4824</td>
<td>02/21/2006</td>
<td>BSI</td>
<td>LCBI</td>
<td>MICU</td>
</tr>
</tbody>
</table>
Bar Charts

Number of CLABSIs by quarter and unit, Hospital LAC, 2015

Quarter 1: ICU 4, NICU 1, CCU 2
Quarter 2: ICU 5, NICU 3, CCU 1
Quarter 3: ICU 2, NICU 1, CCU 2
Quarter 4: ICU 3, NICU 2, CCU 1
Pie Charts

Number of CLABSI by birth-weigh category, Hospital LAC, 2015

- <= 750 grams
- 751-1000 grams
- 1001-1500 grams
- 1501-2500 grams
- >2500 grams
Line Graphs or Histograms

CLIP observations with 100% bundle adherence, by unit, Hospital LAC, 2015

Present data to demonstrate “surveillance for prevention”
Ebbing Lautenbach, Keith F. Woeltje, and Preeti N. Malani., Practical Healthcare Epidemiology, 3rd Edition
Questions?