Proposed standard measures for public reporting of California hospital-specific central line associated bloodstream infections (CLABSI) data

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Epidemiology Unit
Agenda

• Background
  – Goals and mandates
  – Key considerations
  – CDC/NHSN risk adjustment
• CDPH Metrics Work Group
• Proposed standard measures for public reporting based on CDPH Metrics Work Group recommendations
• Managing expectations
Goals for public reporting

• Produce data that are valid, fair to hospitals, and useful to consumers
  – Inform the public
  – Improve hospital care
  – Provide incentive for collaboration between hospitals and prevention experts based on benchmarking
California statutory requirements

- Publicly post CLABSI rates, patient days [*sic, should be central line days*] ....acquired at each facility in California
- Follow a ‘risk-adjustment process’ for rates that is
  - consistent with CDC NHSN methods *or*
  - adopt by regulation, a fair and equitable process consistent with the recommendations of HAI Advisory Committee
- CDPH required hospitals report CLABSI using CDC NHSN as of April 1, 2010
Key constraints for the standard measures

• Must include denominator (central line days) and rate
• Must risk adjust - account for different patient care locations when comparing hospitals
  – rates of infection vary by type of patient care location
  – types of patient care locations vary by hospital
  – Using CDC/NHSN methods
• Acceptable to hospitals and public
Additional considerations – rate comparisons

• Rates may vary:
  – Random variation (imprecision)
  – Distortion (systematic errors)
  – Chance
  – Real differences

• Must disclose potential limitations for appropriate interpretation
Competing priorities make choice of a standard measure challenging

- Simplicity vs. validity?
- Complexity vs. ease of use/understandability?
- What are CDC NHSN methodologies, primary and secondary measures?
CDC primary standard measures for national publication – stratified rates

- Published by unit
- Period 2009, published Spring 2011

Table 3. Pooled means and key percentiles of the distribution of laboratory-confirmed central line–associated BSI rates and central line utilization ratios, by type of location, DA module, 2006 through 2008

<table>
<thead>
<tr>
<th>Type of location</th>
<th>No. of locations*</th>
<th>No. of CLABSI</th>
<th>Central line-days</th>
<th>Pooled mean</th>
<th>10%</th>
<th>25%</th>
<th>50% (median)</th>
<th>75%</th>
<th>90%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical care units</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Burn</td>
<td>35</td>
<td>390</td>
<td>70,932</td>
<td>5.5</td>
<td>0.0</td>
<td>1.2</td>
<td>3.1</td>
<td>7.5</td>
<td>11.8</td>
</tr>
<tr>
<td>Medical cardiac</td>
<td>228 (221)</td>
<td>876</td>
<td>436,409</td>
<td>2.0</td>
<td>0.0</td>
<td>0.0</td>
<td>1.3</td>
<td>2.5</td>
<td>4.6</td>
</tr>
<tr>
<td>Medical major teaching</td>
<td>125</td>
<td>1410</td>
<td>549,088</td>
<td>2.6</td>
<td>0.1</td>
<td>1.1</td>
<td>2.3</td>
<td>3.7</td>
<td>5.2</td>
</tr>
<tr>
<td>Medical all others</td>
<td>153 (147)</td>
<td>687</td>
<td>362,288</td>
<td>1.9</td>
<td>0.0</td>
<td>0.0</td>
<td>1.0</td>
<td>2.4</td>
<td>4.3</td>
</tr>
<tr>
<td>Medical/surgical major teaching</td>
<td>182 (181)</td>
<td>1474</td>
<td>699,300</td>
<td>2.1</td>
<td>0.0</td>
<td>0.6</td>
<td>1.7</td>
<td>2.9</td>
<td>4.6</td>
</tr>
<tr>
<td>Medical/surgical all others ≤ 15 beds</td>
<td>718 (650)</td>
<td>1130</td>
<td>755,437</td>
<td>1.5</td>
<td>0.0</td>
<td>0.0</td>
<td>1.8</td>
<td>3.7</td>
<td>4.6</td>
</tr>
<tr>
<td>Medical/surgical all others &gt; 15 beds</td>
<td>280 (277)</td>
<td>1449</td>
<td>986,982</td>
<td>1.5</td>
<td>0.0</td>
<td>0.0</td>
<td>1.1</td>
<td>2.0</td>
<td>3.6</td>
</tr>
<tr>
<td>Neurologic</td>
<td>24 (23)</td>
<td>61</td>
<td>45,153</td>
<td>1.4</td>
<td>0.0</td>
<td>0.0</td>
<td>1.0</td>
<td>1.9</td>
<td>3.2</td>
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<tr>
<td>Neurosurgical</td>
<td>72</td>
<td>396</td>
<td>160,879</td>
<td>2.5</td>
<td>0.0</td>
<td>0.0</td>
<td>1.9</td>
<td>3.2</td>
<td>5.3</td>
</tr>
</tbody>
</table>
CDC secondary measure
Standard infection ratio (SIR)

• SIR = observed/expected
• Used to compare states; adjusted for national data
• Uses NHSN 2006-8 rates as the reference (to calculated expected infections)

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Location Type</td>
<td>#CLABSI</td>
<td>#Central line-days</td>
</tr>
<tr>
<td>Medical ICU</td>
<td>170</td>
<td>100,000</td>
</tr>
<tr>
<td>Surgical WARD</td>
<td>58</td>
<td>58,000</td>
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</tbody>
</table>

\[
SIR = \frac{\text{observed}}{\text{expected}} = \frac{170 + 58}{100000 \times \left(\frac{2}{1000}\right) + 58000 \times \left(\frac{1.5}{1000}\right)} = \frac{228}{200 + 87} = \frac{228}{287} = 0.79 \quad 95\% CI = (0.628, 0.989)
\]

*defined as the number of CLABSI per 1000 central line-days

### Central Line-Associated Bloodstream Infections

<table>
<thead>
<tr>
<th>State</th>
<th>No. of Facilities Reporting</th>
<th>Observed</th>
<th>Predicted</th>
<th>SIR</th>
<th>95% CI for SIR</th>
<th>Lower</th>
<th>Upper</th>
<th>0</th>
<th>1.0</th>
<th>2.0</th>
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<tbody>
<tr>
<td>48</td>
<td>59</td>
<td>118.95</td>
<td>0.50</td>
<td>0.38</td>
<td>0.64</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>37</td>
<td>50</td>
<td>82.21</td>
<td>0.61</td>
<td>0.45</td>
<td>0.80</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>204</td>
<td>818</td>
<td>1176.83</td>
<td>0.70</td>
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<td>0.74</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>63</td>
<td>183</td>
<td>158.11</td>
<td>1.16</td>
<td>1.00</td>
<td>1.34</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>72</td>
<td>282</td>
<td>245.99</td>
<td>1.15</td>
<td>1.02</td>
<td>1.29</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>8</td>
<td>3</td>
<td>10.99</td>
<td>0.27</td>
<td>0.07</td>
<td>0.71</td>
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<tr>
<td>76</td>
<td>161</td>
<td>193.81</td>
<td>0.83</td>
<td>0.71</td>
<td>0.97</td>
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<tr>
<td>62</td>
<td>86</td>
<td>148.07</td>
<td>0.58</td>
<td>0.47</td>
<td>0.72</td>
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<tr>
<td><strong>California</strong></td>
<td>118</td>
<td>432</td>
<td>521.13</td>
<td>0.83</td>
<td>0.75</td>
<td>0.91</td>
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<tr>
<td>50</td>
<td>64</td>
<td>94.25</td>
<td>0.68</td>
<td>0.52</td>
<td>0.87</td>
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<tr>
<td>30</td>
<td>65</td>
<td>69.46</td>
<td>0.94</td>
<td>0.72</td>
<td>1.19</td>
<td></td>
<td></td>
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<tr>
<td>8</td>
<td>20</td>
<td>33.84</td>
<td>0.59</td>
<td>0.36</td>
<td>0.91</td>
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<tr>
<td>140</td>
<td>301</td>
<td>333.46</td>
<td>0.90</td>
<td>0.80</td>
<td>1.01</td>
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<tr>
<td>48</td>
<td>234</td>
<td>179.95</td>
<td>1.30</td>
<td>1.14</td>
<td>1.48</td>
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<td></td>
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<tr>
<td>70</td>
<td>124</td>
<td>211.44</td>
<td>0.59</td>
<td>0.49</td>
<td>0.70</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>13</td>
<td>22.93</td>
<td>0.57</td>
<td>0.34</td>
<td>0.90</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>72</td>
<td>183</td>
<td>222.97</td>
<td>0.82</td>
<td>0.71</td>
<td>0.95</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>182</td>
<td>604</td>
<td>610.22</td>
<td>0.99</td>
<td>0.91</td>
<td>1.07</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>US</strong></td>
<td><strong>1538</strong></td>
<td><strong>4615</strong></td>
<td><strong>5618.75</strong></td>
<td><strong>0.82</strong></td>
<td><strong>0.80</strong></td>
<td><strong>0.85</strong></td>
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</tbody>
</table>
SIR – may be misleading

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Provides a single summary measure</td>
<td>• May not preserve consistency between populations being compared. Will be biased in extreme situations</td>
</tr>
<tr>
<td>• Is more stable than direct method as it minimizes the variance, giving a smaller standard error and narrower confidence intervals. It may be more appropriate when dealing with statistical significance of small populations</td>
<td>• Hospitals may be directly compared to the standard population but not each other (unless they have same distribution of units)</td>
</tr>
<tr>
<td></td>
<td>• Can only compare over time if the reference population is ‘frozen’ at a fixed point in time.</td>
</tr>
</tbody>
</table>
SIR – may be misleading
CDPH Metrics Work Group

• While HAI AC on hiatus, CDPH convened a panel of experienced leaders in hospital epidemiology to make recommendations for public reporting of HAIs including CLABSIs

• Provided detailed recommendations
Metrics Work Group members

**VOTING**
- Susan Huang, MD MPH (Chair)
- David Birnbaum, PhD MPH
- Raymond Chinn, MD*
- Loren Miller, MD MPH
- Frank Myers, MA CIC*
- Andrew Noymer, PhD MSc
- Kathleen Quan, RN, CIC
- Francesca Torriani, MD*

**NON-VOTING CDPH REPS**
- Kate Cummings, MPH
- Kavita Trivedi, MD
- Lynn Janssen, MS, CIC
- Jon Rosenberg, MD

*Member of the CA HAI Advisory Committee
Proposed standard measures based on CDPH Metrics Work Group recommendations
Time window for reporting

• Annual rates as recommended
Primary standard measures

• Unadjusted rates stratified by subgroups of units or ‘strata’ (details on strata to follow)
  – Alphabetically list hospitals, numbers of infections, line days and patient days
    • Hospital strata ≥ 100 central line days: report rate and indicate (by symbol) if statistically lower than, normative to, or higher than the state average
    • Hospital strata < 100 central line days: do not report rate or statistical testing results

• Central line utilization ratio
Proposed reporting strata

- Adult ICU (7 distinct strata)
- Adult non-ICU (5 distinct strata)
- Pediatric ICU (2 distinct strata)
- Pediatric non-ICU (1 strata)
- Adult specialty care (3 distinct strata)
- Pediatric specialty care (3 distinct strata)
- LTACS
Reporting strata — additional details

- **Adult ICU**
  - Medical – Major Teaching
  - Medical – Other
  - Med/Surg – Major Teaching
  - Med/Surg – Other
  - Surgical
  - Burn
  - Trauma

- **Adult non-ICU**
  - Medical
  - Med/Surg
  - Surgical
  - Stepdown
  - Rehabilitation

- **Adult specialty care areas**
  with perm and temporary lines listed separately
  - Oncology
  - Bone marrow transplant
  - Transplant
  - Long term acute care
Reporting strata details - continued

• **Pediatric ICU**
  – Neonatal (NICU)
    • Stratify by birth weight; combine central line and umbilical catheter BSIs and line days
  – General pediatric (PICU)

• **Pediatric non-ICU** (all units combined)

• **Pediatric specialty care areas with permanent and temporary lines reported separately**
  – Oncology
  – Bone marrow transplant
  – Transplant
Example of proposed data flow

Reports: CLABSI reports by locations

**Inpatient critical care units for adults (including mixed adult/pediatric)**
Table 1: Adult ICU: Medical Units, Major Teaching Hospitals
Table 2: Adult ICU: Medical Units, Others Hospitals
Table 3: Adult ICU: Medical/Surgical Units, Major Teaching Hospitals
Table 4: Adult ICU: Medical/Surgical Units, Others Hospitals
Table 5: Adult ICU: Surgical Units
Table 6: Adult ICU: Burn Units
Table 7: Adult ICU: Trauma Units

**Inpatient wards (non critical care) for adults (including mixed adult/pediatric):**
Table 8: Adult Medical Wards
Table 9: Adult Medical/Surgical Wards
Table 10: Adult Surgical Wards
Table 11: Adult Stepdown Wards
Table 12: Adult Rehabilitation Wards
Example of unadjusted rates by strata (in this case, Adult Med ICU)

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Infections</th>
<th>Line days</th>
<th>Patient days</th>
<th>Device Utilization Ratio</th>
<th>Rate per 1000</th>
<th>95% Confidence Interval</th>
<th>Statistical Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital A</td>
<td>2</td>
<td>3483</td>
<td>19463</td>
<td>17.9</td>
<td>0.6</td>
<td>0.1 - 2.1</td>
<td></td>
</tr>
<tr>
<td>Hospital B</td>
<td>10</td>
<td>4489</td>
<td>6930</td>
<td>64.7</td>
<td>2.2</td>
<td>1.1 - 4.1</td>
<td></td>
</tr>
<tr>
<td>Hospital C</td>
<td>3</td>
<td>5467</td>
<td>11654</td>
<td>46.9</td>
<td>0.5</td>
<td>0.1 - 1.6</td>
<td></td>
</tr>
<tr>
<td>Hospital D</td>
<td>2</td>
<td>2284</td>
<td>6420</td>
<td>44.9</td>
<td>0.7</td>
<td>0.1 - 2.5</td>
<td></td>
</tr>
<tr>
<td>Hospital E</td>
<td>35</td>
<td>11685</td>
<td>20052</td>
<td>58.3</td>
<td>3.0</td>
<td>2.1 - 4.2</td>
<td>Statistical Interpretation: hospital rate was higher than the state average</td>
</tr>
<tr>
<td>Hospital F</td>
<td>1</td>
<td>70</td>
<td>3887</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital G</td>
<td>1</td>
<td>1477</td>
<td>3388</td>
<td>43.6</td>
<td>0.7</td>
<td>0.0 - 3.8</td>
<td></td>
</tr>
</tbody>
</table>

Statistical Interpretation:
- ○: Hospital rate was lower than the state average
- ○: Hospital rate was no different than the state average
- ●: Hospital rate was higher than the state average

Blank cells represent hospitals reporting fewer than 100 central line days;
Proposed standard measures, continued

• Secondary measures
  – Recommend against secondary adjusted metrics, including the SIR, pending further evaluation
  – Convene experts to explore value of additional adjusted measures
  – In 2012, CDPH proposes a tabular summary of strata-specific statistical testing results (similar to Consumer Reports Rating Tables)
### Statistical interpretation of CLABSI rates by hospital and patient care location

<table>
<thead>
<tr>
<th>Intensive Care Areas</th>
<th>Wards</th>
<th>Special Care Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital A</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Hospital B</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Hospital C</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Hospital D</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Hospital E</td>
<td>○</td>
<td>○</td>
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<tr>
<td>Hospital F</td>
<td>○</td>
<td>○</td>
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<tr>
<td>Hospital G</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Hospital H</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Hospital I</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

- ○ Statistical interpretation: hospital rate was lower than the state average
- ○ Statistical interpretation: hospital rate was no different than the state average
- ○ Statistical interpretation: hospital rate was higher than the state average

Blank cells indicated that the hospital did not report use of any central lines in this unit type.
Recommendations, continued

• Other recommendations
  – Ensure clear communication about changing surveillance criteria
  – Prior to publication, give each institution an opportunity to review reported data
Managing expectations about the standard measures and the 2012 report

- CDPH and California hospitals have adopted CDC/NHSN surveillance, reporting, and risk-adjustment protocols for CLABSI which will make rate comparisons published in 2012 much more informative to all stakeholders, most especially the public.
- CDPH continues to expect that hospitals are complying with NHSN reporting protocols and continues to assist hospitals in identifying systematic data errors, however, hospitals remain solely responsible for their data.
Managing expectations about the standard measures and the 2012 report

- Protocols cannot completely eliminate distortion from information or confounding errors (validation is yet to come)
- CDPH must continue to provide the appropriate context for interpreting rates
  - A high rate may reflect
    - Weak infection control
    - Strong surveillance methods that favor more complete identification of infections
    - Non standard or inappropriate definitions
    - More medically complex patients
  - A low rate may reflect
    - Strong infection control
    - Weak surveillance methods that favor non-detection of infections (missed cases)
    - Non standard or inappropriate definitions
    - Less medically complex patients
Managing expectations about the metric and the 2012 report

• Therefore, rates published in 2012 are best thought of as a starting point for asking questions about the quality of care in California hospitals
Summary – 2012 report

• Report period – 12 months (annual rates)
• Primary standard measures
  – Unadjusted stratified rates using unit-based strata
  – Central line utilization ratio
• Display hospitals alphabetically by strata
  • Infections, line days, patient days, - ALL
  • Rate, 95% CI, symbol for stat testing based on line days – Strata with at least 100 line days
• Display all hospitals in a table that graphically summarizes strata-specific testing results
Wrap up

• Feedback from HAI AC Committee:
  – Comments on proposed standard measures
  – partnership on expectations