Meaningful Definition of the Standardized Infection Ratio

By Kevin T. Kavanagh, MD, MS, FACS and Daniel M. Saman, DrPH, MPH, CPH

Recommendations:

1. Risk factors used for adjustment should relate to the patient population and not based upon risks associated with facility type or size.
2. The SIR should reflect the "Obtainable" and not the "Expected" rate of infections.
3. The Obtainable SIR should be set at the peak of the distribution curve which is reflective of higher performing facilities.
4. The Obtainable SIR should be calculated every other year using data from the most recent 3 years. This enables the SIR to be reset as control of CLABSI progressively improves. The data used to calculate the SIR needs to reflect the outcomes obtainable from the current standard of care.

To be useful to consumers, data for hospital associated infections (HAI) must be both understandable and meaningful. Currently, the Standardized Infection Ratio (SIR) is used to clarify the data. This is a ratio of the number of "Observed HAI" to the number of "Expected HAI", thus, the expected or predicted SIR for a facility is equal to 1.0.[1]

It is our contention that in risk adjustments, only metrics for patient risks should be factored into the equation. Metrics which primarily reflect facility factors which are associated with a high risk of infection should not be used to adjust the data. One of the purposes of public reporting is to identify differences in facilities not to adjust for those differences. Thus, the use of factors such as bed size of patient care location and medical school affiliation should be questioned.

Surgical Site Infections (SSI):

Risk factors used to adjust Surgical Site Infection (SSI) rates include but are not limited to age, ASA, duration, hospital bed size, BMI, emergency, gender, trauma, and medical school affiliation.[1,2] The risk factors used vary with the type of procedure.[1,2] Overlapping risk factors which can be highly correlated, such as age and ASA, should only be used together with caution. Researchers have recommended incorporating both factors into a combined grading system.[3] A major adjustment factor used in the calculation of SIRs for surgical site infections is affiliation with a medical school. One could interpret this to mean that there is a significant risk of infection if a patient is admitted to a University Hospital.[2] An example of an logistic regression model similar to that used to calculate SIRs for SSIs is shown below:

$$\text{logit}(\hat{p}) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4$$

$$= -5.448 + 0.520\ (\text{Age} \le 44^{*}) + 0.425\ (\text{ASA } 3/4/5^{*}) + 0.501\ (\text{Duration} > 100^{*}) + 1.069\ (\text{Med school affiliation}^{*})$$

**For these risk factors, if present = 1; if not = 0*

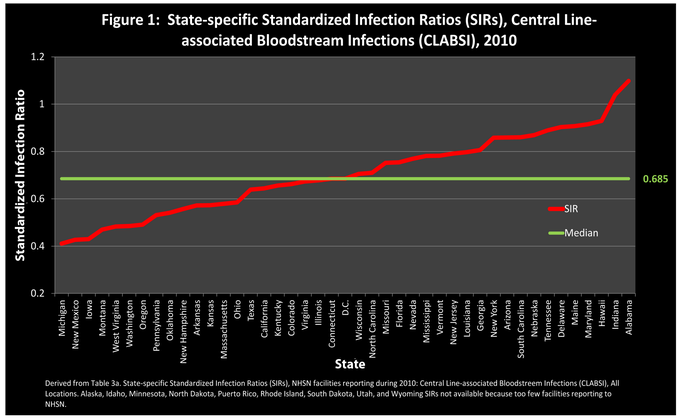
Central Line Associated Blood Stream Infections (CLABSI):

Both affiliation with a medical school and bed size of patient care location are used to adjust the SIRs for CLABSIs.[4,5] The adjustment for affiliation with a medical school is considerable, effectively erasing more than one in five CLABSIs reported in "Medical Major Teaching" facilities as compared to "Medical All Others".[5] The following baseline data is used to adjust facility CLABSI SIRs:[5]

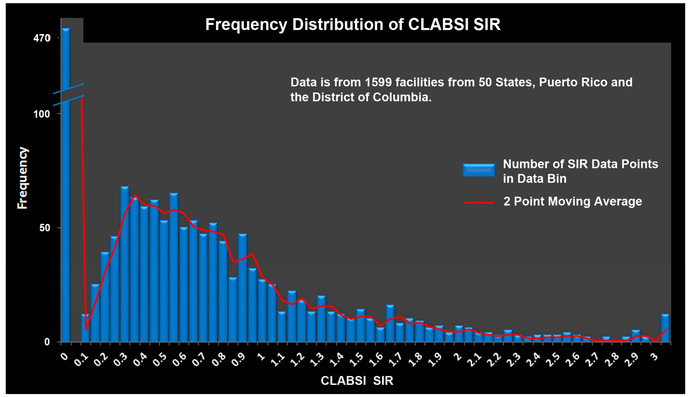
- **Medical, major teaching -- 2.6 CLABSI per 1,000 central line days**
- **Medical, all others -- 1.9 CLABSI per 1,000 central line days**

Data from 2006 through 2008 is currently used to determine the expected rate for CLABSIs in Intensive Care Units. One could argue that this data was collected before the widespread adoption of pubic reporting and protocols used to prevent CLABSI and that these rates are too high to reflect current clinical outcomes.

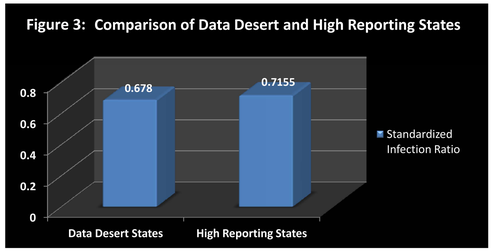
The 2010 CDC risk-adjusted aggregate state data (all bed locations) varied widely with a median of 0.685 and a 2.5 times difference between the best and worst performing state (See Figure 1),[4] but the "Expected SIR" is set such that 95% of the states fall into an as expected category (SIR <= 1).



A clearer and more useful consumer definition is recommended. The SIR should reflect what is "Obtainable" and not "Expected". To estimate an "Obtainable SIR", individual facility "Expected SIRs" from 1599 facilities from 50 States and the District of Columbia with at least 1 predicted CLABSI were analyzed. Facility data was reported to the NHSN in 2011. A skewed distribution was found with the peak approximating an SIR of 0.35. In 473 facilities, the SIR equaled zero and in 49 facilities the SIR was greater than 2 (See Figure 2).



The data in Figure 1 was derived from both states that have a high percentage of reporting facilities and from states that are virtual Data Deserts. An analysis was performed on the 2010 aggregate state CLABSI data reported by the CDC to control for a possible bias that in Data Desert states only high functioning facilities report data. No significant difference was observed between Data Desert states having less than or equal to 20.7% of facilities reporting (N=11), compared to states that had equal to or greater than 64.9% of facilities reporting (N=12). The SIRs were 0.678 and 0.7155, respectively (See Figure 3).



Such an analysis should be used to calculate an "Obtainable SIR" whose value is set to 1.0. The remainder of the facility SIRs can then be adjusted accordingly to facilitate meaningful use of the data.

References:

1) Center for Disease Control and Prevention. NHSN e-News: SIRs Special Edition. Oct. 2010, Updated Dec. 10, 2010.

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3) Van der Walt P and Nizami H. The correlation between the AA Grading system, length of hospital stay and complication rates after total hip and knee arthroplasty. J. Bone Joint Surg Br. 2012 Vol. 94-B Supp XII 6.

4) Center for Disease Control and Prevention. National and State Healthcare-Associated Infections Standardized Infection Ratio Report. January—December 2010. Apr.19, 2012.

5) Edwards JR, Peterson KD, Mu Y, et al. National Healthcare Safety Network (NHSN) report: Data summary for 2006 through 2008, issued December 2009. Am J Infect Control. 2009 37:783-805.

Author Affiliations: Health Watch USA
www.healthwatchusa.org

Health Watch USA