

Introduction to the NHSN Re-baseline

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Objectives

- Describe the history and current status of the rebaseline
- Understand the high-level aspects of the new risk-adjustment methods and models

A “Warm Up”

- Consider the next 30 minutes a “warm-up” for the analysis presentations you’ll hear this week
 - Overarching analysis and implementation methods for the 2015 SIR baseline
 - Reasoning behind some changes

The Rebaseline: A brief history

- Rebaseline: CDC's term for the process of determining a new baseline year, as well as the assessment and employment of new risk models, for the calculation of SIRs.
- Planning began in 2014, when 2015 was determined to be the new baseline year for SIRs.
 - 2015: Preparations began – education, communications, implementation process, data quality work, etc.
 - 2016: Analysis year – included preliminary and final risk modeling, validation, implementation of models
 - 2017: Ongoing education, production of manuscripts, etc.

“The Rebaseline 200”: New Models Developed at CDC

HAI	ACHs	CAHs	LTACHs	IRFs
CLABSI (non-MBI)	✓	✓	✓	✓
Central Line SUR	✓	✓	✓	✓
MBI	✓			
CAUTI	✓	✓	✓	✓
Urinary Catheter SUR	✓	✓	✓	✓
VAE	✓	✓	✓	
Ventilator SUR	✓	✓	✓	✓
“All SSI” Models – Adults	✓			
“All SSI” Models – Peds	✓			
“Complex A/R” Models – Adults	✓			
“Complex A/R” Models – Peds	✓			
“Complex 30-day” Models – Adults (COLO and HYST)	✓			
MRSA Bacteremia LabID	✓	✓	✓	✓
CDI LabID	✓	✓	✓	✓

Each procedure category assessed separately, inpatient only

Basis for Using SIRs

$$\text{SIR} = \frac{\# \text{ observed HAIs}}{\# \text{ predicted HAIs}}$$

- The SIR is a risk-adjusted composite measure that allows for scalability
 - For Example: An overall CLABSI SIR can be provided for a hospital with multiple ICUs. Without the SIR, CLABSI data would have to be provided in the form of location-specific rates.
- Use of the SIR requires a baseline, from which progress can be measured
 - The baseline remains static for a number of years
- At some point, the baseline must be updated
 - No set standard on *when* to update a baseline
 - Decision on the timing of updating a baseline may be driven by policy, HAI surveillance definitions, etc.

The Baseline

- **Data reported to NHSN for CY2015 is the new baseline for SIRs**
 - CY2015 data were used to develop new risk models
- Will the baseline be updated every year?
 - CDC does not have plans to update the baseline every year
 - Contributing facilities and HAI surveillance definitions and protocols are expected to remain stable for a number of years
 - Frequently updating the baseline would hinder the ability to measure progress and assess trends at the local, state, and national level

New Risk-adjustment

- “Do the new models take into account...”
 - We can assess what we collect, at the level it’s collected
 - NHSN provides and maintains standard surveillance protocols used to report data to NHSN
- Risk-adjustment is performed at the national level (i.e., using data from all facilities reporting to NHSN throughout the U.S.)
- Not all collected factors were found to be statistically significant, therefore, not all potential factors were kept in the final models
- Significant factors differ depending on the HAI and/or setting

The Rebaseline: Modeling Approach

- Used in-plan data reported to NHSN for January –December 2015 (reported by May 16, 2016)
 - *Why May 16th ?* 2015Q4 Deadline for CMS QRPs, representing most complete data available
- Included facilities from all states, territories, and DoD installations
- Decisions made a priori regarding which factors should or should not be considered potential risk factors in the model
- Data cleaning and outlier detection was performed prior to modeling work
- Lead analysts applied consistent overarching methods and analytic approach

Consistency Explained: Methods vs. Models

- Consistency was applied in the methods used to develop models
 - Includes consistency in which variables were *not* considered due to a priori decisions
- During modeling, each HAI and setting was considered independently from the rest
 - Significant risk factors, and the manner in which they are used, differ across the models

The Rebaseline: Modeling Approach

- Modeling approach consisted of three phases:
 - Phase 1: Forward Stagewise Selection
 - Phase 2: Backward Elimination Validation
 - Phase 3: Bootstrap Validation
- Two types of models used:
 - **Negative binomial regression**: CLABSI, MBI, CAUTI, VAE, MRSA LabID, CDI LabID
 - **Logistic regression**: SSI, SURs

Intercept-only Models

- A few models developed with the 2015 baseline are intercept-only
- “Fancy” term for a model with no statistically significant risk factors (i.e., a regression model without predictors)
 - Think of this like a crude, unadjusted rate
- SIRs are still calculated when an intercept-only model is available

The Case of “No Model” ...

- No outcome = no model
- Some cases where there were no in-plan HAIs reported, therefore no risk models were produced:
 - VAE (incl. Total VAE and IVAC Plus): IRF
 - IVAC Plus: CAH
 - MBI: IRF, LTACH, CAH
 - Up to 18 procedure categories with no Pediatric SSI model
- In these scenarios, no SIRs are available/produced.

Beyond Pooled Mean Rates and DURs

- For some events, NHSN has relied on SIRs for national comparison:
 - SSIs: SIRs in use since 2010
 - MRSA bacteremia and CDI LabID: SIRs in use since 2012
- With implementation of 2015 baseline, DA data are produced in the same way
 - Risk models for DA events provide improved risk-adjustment over the risk-stratified pooled mean rates
 - National pooled mean rates and DURs will not be produced annually
 - Hospitals can continue to obtain their own location stratified rates and DURs

How have SIRs changed?

- SIRs available for more HAI settings than previously
- Improved risk adjustment over previous models and methods
- More current baseline year = more current definitions + more timely national HAI incidence
- Change varies depending on HAI, setting, and your hospital's experience
- 2015 baselined SIRs should be measured independent from the previous SIRs

What has remained the same?

- SIR is only calculated when the predicted # of infections is greater than or equal to 1
- SIR remains a valuable, risk-adjusted, scalable measure
- Same types of statistics provided in SIR reports as was provided previously
- Progress can be measured from the baseline time period

$$\text{SIR} = \frac{\# \text{ observed HAIs}}{\# \text{ predicted HAIs}}$$

Old Baseline = Old Rules!

- Original baselines are referred to as “Baseline Set 1”
 - Output options in NHSN will be moved to a “Baseline Set 1” folder
 - All Baseline Set 1 SIRs will be calculated *through* 2016 data
 - All analysis datasets used to calculate the baseline set 1 SIRs will be renamed and prefaced with “bs1_”
- All Baseline Set 1 reports will use old rules
 - Example: MBIs are included in BS1 output
 - Example: PATOS = Y SSIs are included in BS1 output

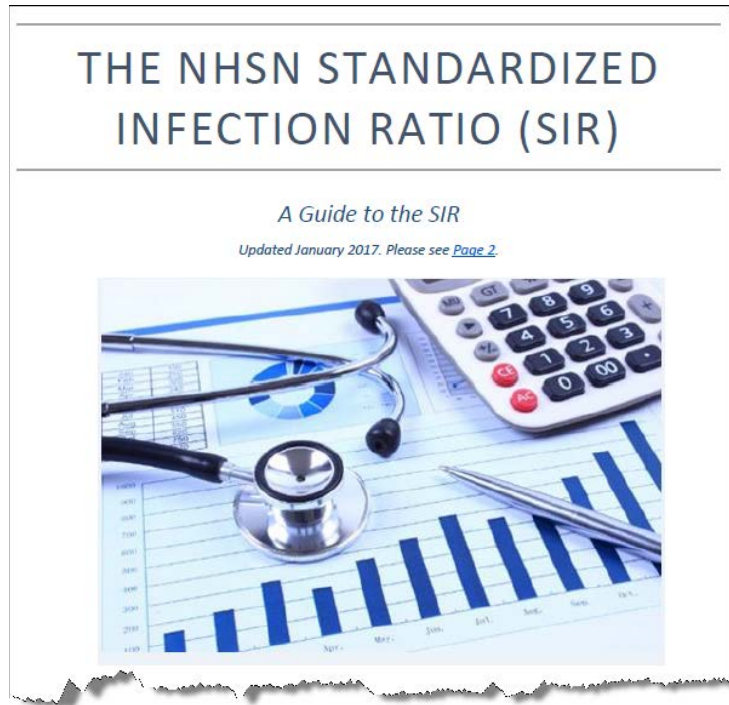
NHSN v8.6: Postponed Rebaseline Reports

- Due to the extensive nature of implementing the new baseline, some reports had to be postponed for a couple of months.
 - The following appear on the list of Reports, but are not yet available and will not produce any results at this time:
 - Bar Chart - All MBI CLABSI Events
 - Pie Chart - All MBI CLABSI Events
 - Run Chart - MBI-CLABSI Data (ICU/Other)
 - Run Chart - MBI-CLABSI (SCA/ONC)
 - Rate Table - MBI-CLABSI Data (NICU)
 - Run Chart - MBI-CLABSI Data (NICU)
 - TAP Report - IRF CDI LabID Data
 - TAP Report - LTAC FACWIDEIN CDI LabID data

NHSN v8.6: Postponed Rebaseline Reports

- Due to the extensive nature of implementing the new baseline, some reports had to be postponed for a couple of months.
 - The following will be added in the **Summer, 2017**:
 - Device-associated Standardized Utilization Ratios (SURs), all device types and settings
 - Mucosal Barrier Injury (MBI) SIRs

NHSN SIR Guide <https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf>



- Posted in December, 2016 – updated in January 2017
- Describes the SIR and related statistical measures
 - Model types
 - P-values
 - 95% Confidence Intervals
 - Example interpretations

NHSN SIR Guide <https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf>

- Includes a detailed Supplement (beginning on page 15)
 - Model details for each HAI
 - Organized by HAI, then setting (e.g., ACHs, IRFs, etc.)
 - Does not include details on the “All SSI” or “Complex A/R SSI” Models
- Methods and complete results will be published this year

Risk Adjustment Factors Included in the SIR Calculation: 2015 Baseline

CLABSI – Central line-associated Bloodstream Infection

The number of predicted CLABSIs is calculated using a negative binomial regression model (see [page 8](#) above for more information). Previously excluded inpatient locations from the original baseline are included in the SIR under the 2015 baseline (e.g., Telemetry Ward, Mixed Acuity Ward). In cases when the number of predicted events is less than 1.0, the SIR will not be calculated in NHSN. CLABSI events reported to NHSN as mucosal barrier injury (MBI-LCBI) are excluded from the numerator of the CLABSI SIR.

The number of predicted CLABSIs calculated under the 2015 baseline is risk adjusted based on the following variables found to be statistically significant predictors:

Table 1. Acute Care Hospitals (non-NICU locations)

Parameter	Parameter Estimate	Standard Error	P-value
Intercept	-7.3390	0.0190	<0.0001
CDC Location Code: Burn Critical Care	1.2874	0.1119	<0.0001
CDC Location Code: Medical Critical Care	0.2539	0.0405	<0.0001
CDC Location Code: Other Adult ICUs and Mixed Acuity Medical Cardiac Critical Care Surgical Cardiothoracic Critical Care Medical/Surgical Critical Care Neurologic Critical Care Neurosurgical Critical Care Respiratory Critical Care Surgical Critical Care Mixed Age Mixed Acuity Unit Adult Step Down Unit (e.g., post-critical care)	0.1164	0.0197	<0.0001
CDC Location Code: Pediatric Cardiothoracic Critical Care Pediatric Burn Critical Care Pediatric Cardiothoracic Critical Care	0.4130	0.0595	<0.0001

More to Come this Week...

- Learn how to use, modify and interpret various reports in NHSN
- Learn more about the risk adjustment methods and models for different HAIs
- Learn about special inclusions/exclusions in the SIRs

Questions?

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For more information, contact CDC
1-800-CDC-INFO (232-4636)
TTY: 1-888-232-6348 www.cdc.gov

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

