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The Centers for Disease Control and Prevention (CDC)

NHSN e-News

## Your Guide to the Standardized Infection Ratio (SIR)

With the new version of NHSN (version 6.3), new output options are available that will permit the calculation of standardized infection ratios (SIRs) for central line-associated bloodstream infection (CLABSI) and surgical site infection (SSI) data. Each of these measures fall in line with the State-Specific Healthcare-associated Infections Summary Data Report, published by CDC. For SSIs, we will make the transition from SSI rates to the SSI SIR with this new version of the NHSN tool. The SSI SIR is the result of logistic regression modeling that considered all procedure-level data collected by NHSN facilities in order to provide better risk adjustment than afforded by the risk index. In addition, the SSI SIR provided to facilities within NHSN will be more precise and be calculated only if appropriate for comparisons. As we make this transition, we understand that you will have numerous questions, including how to operationalize this new statistic in your facility to drive prevention practices. This guide is intended to answer some of these questions.

### STANDARDIZED INFECTION RATIO (SIR)

#### *What is a standardized infection ratio (SIR)?*

The standardized infection ratio (SIR) is a summary measure used to track HAIs at a national, state, or local level over time. The SIR adjusts for patients of varying risk within each facility. The method of calculating an SIR is similar to the method used to calculate the Standardized Mortality Ratio (SMR), a summary statistic widely used in public health to analyze mortality data. In HAI data analysis, the SIR compares the actual number of HAIs reported with the baseline U.S. experience (i.e., NHSN aggregate data are used as the standard population), adjusting for several risk factors that have been found to be significantly associated with differences in infection incidence. In other words, an SIR greater than 1.0 indicates that more HAIs were observed than predicted, accounting for differences in the types of patients followed; conversely, an SIR less than 1.0 indicates that fewer HAIs were observed than predicted.

#### **\*\*\*\*Important Take Away Points\*\*\*\***

- ✚ The new SSI SIRs provide improved risk adjustment and replace risk-stratified SSI rates.
- ✚ The SIRs use 2006-2008 as the baseline period, and therefore, SIRs are calculated for 2009 and forward.
- ✚ To allow for more precise comparisons, SIRs are calculated only if the number of expected HAIs (numExp) is  $\geq 1$ .

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**CENTRAL LINE-ASSOCIATED BLOODSTREAM INFECTION (CLABSI) SIRs***How is the SIR calculated for CLABSI?*

The SIR is calculated by dividing the number of observed infections by the number of expected infections. The number of expected infections, in the context of statistical prediction, is calculated using CLABSI rates from a standard population during a baseline time period. The baseline period for CLABSI SIR calculations is 2006-2008 NHSN aggregate as reported in the NHSN Report. Therefore SIRs are calculated for CLABSI data in 2009 and forward.

**NOTE: The SIR will be calculated only if the number of expected HAIs (numExp) is  $\geq 1$ .** When the numExp is  $<1$ , this indicates that, based on the NHSN aggregate rates, the central line-day count in your facility or location is too low to calculate a precise SIR and comparative statistics. When this is the case, you may wish to group your SIRs by a longer time period, such as year (summaryYr).

$$\text{SIR} = \frac{\text{Observed (O) HAIs}}{\text{Expected (E) HAIs}}$$

This table provides an example of how a facility's CLABSI data from four different locations can be "rolled up" into a single risk-adjusted summary statistic, i.e., the SIR. The expected number of CLABSI for each location is calculated by multiplying the location's number of central line days by the NHSN rate and dividing by 1,000. Then, the expected number of CLABSI are summed and used as the denominator for the overall SIR across these locations.

Type of ICU Location	# CLABSI	# Central line-days	CLABSI Rate	NHSN Rate	p-value	Expected # of CLABSI
Medical cardiac	2	380	5.26	2.0	0.09	0.76
Medical	1	257	3.89	2.6	0.15	0.67
Med/Surgical	3	627	4.78	1.5	0.11	0.94
Neurosurgical	2	712	2.81	2.5	0.32	1.78
<i>Total</i>	<i>8</i>	<i>1976</i>	<i>4.05</i>	<i>---</i>	<i>---</i>	<i>4.15</i>

$$\text{Overall CLABSI SIR} = \text{Observed/Expected} = 8/4.15 = 1.93$$

*What is the advantage of using CLABSI SIRs instead of CLABSI rates?*

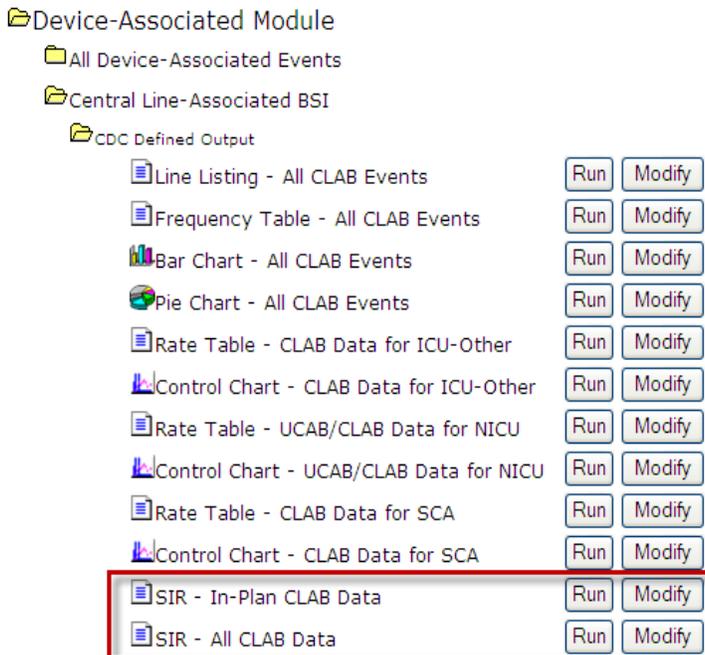
The CLABSI SIR allows you to summarize your data by more than a single location, adjusting for differences in the incidence of infection among the location types. For example, you will be able to obtain one CLABSI SIR adjusting for all locations reported. Similarly, you can obtain one CLABSI SIR for all specialty care areas in your facility.

Additionally, the CLABSI SIR may be an easier measure to discuss among internal and external stakeholders.

Location-specific CLABSI rates will continue to be a useful tool in your prevention efforts. CLABSI rates will provide the information needed to identify granular, temporal changes in CLABSI occurrence and device utilization.

*What CLABSI SIR options are available?*

There are two CLABSI SIR output options available – one for in-plan CLABSI data only and one for all CLABSI data.



Each CLABSI SIR output option will produce SIRs by half-year (summaryYH) for 2009 and forward. The following tables will be included with each output option to allow analyses from a “big picture” overall level to a granular location level:

- Overall SIR
- SIR for each location group (e.g., all ICUs and Wards [non-NICU or SCA] combined)
- SIR for each CDC location type (e.g., all Surgical ICUs combined)
- SIR for each individual location (e.g., 22ICU)

For a detailed explanation of a sample CLABSI SIR output, please see [Appendix A](#).

*How do I interpret the CLABSI SIR?*

Example: Overall CLABSI SIR

The below SIR table is an example of an Overall CLABSI SIR. This facility reported CLABSI data for four locations of different types during 2009. Note that while the infection count and central line days are provided, this information should not be used for comparison of a crude CLABSI rate. Instead, the central line days are provided to inform you of the precision of the SIR.

Org ID	Summary Yr	Infection Count	Number Expected	Central Line Days	SIR	SIR p-value	95% Confidence Interval
10018	2009	9	7.191	3786	1.25	0.2962	0.653, 2.184

- During 2009, there were 9 CLABSIs identified in our facility, and we observed 3786 central line days from the locations from which the CLABSIs were reported.
- Based on the NHSN 2006-2008 baseline data, 7.191 CLABSIs were expected.
- This results in an SIR of 1.25 (9/7.191), signifying that during this time period our facility identified 25% more CLABSIs than expected.
- The p-value and 95% Confidence Interval indicate that the number of observed CLABSIs is not significantly higher than the number of expected CLABSIs.

When the infection count is 0, the lower bound of the 95% Confidence Interval will not be calculated. When analyzing these data as a group user, an additional overall CLABSI SIR will be calculated for all facilities reporting these data to the group.

## SURGICAL SITE INFECTION (SSI) SIRs

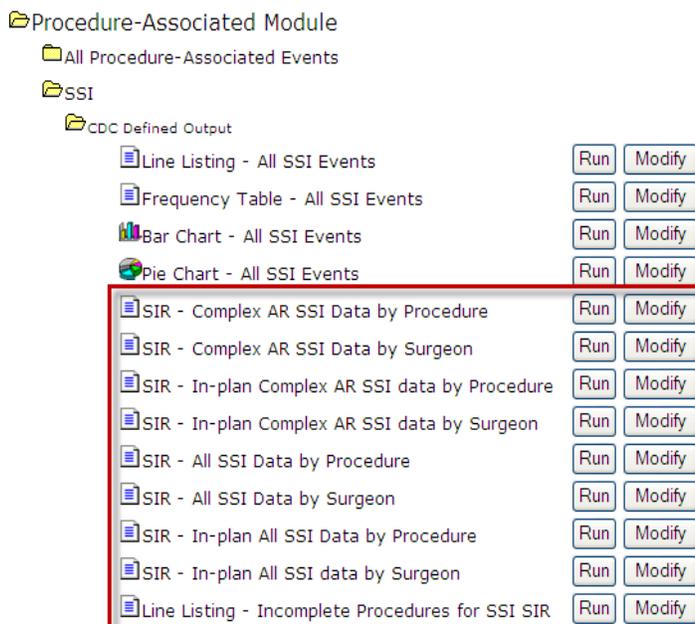
### How is the SIR calculated for SSIs?

The SIR is calculated by dividing the number of observed infections by the number of expected infections. For a given operative procedure category, the number of expected infections, in the context of statistical prediction, is derived from a logistic regression model using a baseline time period. The baseline for the SIR calculations uses 2006-2008 data, and therefore SSI SIRs are calculated for procedure data in 2009 and forward.

**NOTE: The SIR will be calculated only if the number of expected HAIs (numExp) is  $\geq 1$ .** When the numExp is  $<1$ , this indicates that the number of procedures performed is too low to calculate a precise SIR and comparative statistics. When this is the case, you may wish to group your SIRs by a longer time period, such as year (summaryYr).

### What SSI SIR options are available?

There are eight different SSI SIR output options available – four output options by procedure and four output options by surgeon.



For a detailed explanation of sample output, please see [Appendix B](#).

Each SSI SIR output option will produce SIRs by half-year (summaryYH) for 2009 and forward. The following tables will be included with each output option:

- Overall SIR
- SIR for each procedure
- SIR for each procedure, by outpatient (Y or N) (All SSI SIRs only)
- Incomplete and Custom Procedures not Included in SIR

The All SSI SIRs will include all procedures and superficial incisional primary, deep incisional primary, and organ/space SSIs. Secondary SSIs are not included.

The Complex AR SIRs will include only inpatient procedures and Deep Incisional Primary and Organ/Space SSIs that were identified during admission (A) or readmission to your facility (R), as defined in the NHSN Manual.

The In-Plan SIRs will include only those procedures that were included in your monthly reporting plans.

*How do I interpret the SSI SIR?*

## Example #1: Overall SSI SIR

Org ID	Summary Yr	Procedure Count	infCountAll	All SSI Model Number Expected	All SSI Model SIR	All SSI Model SIR p-value	All SSI Model 95% Confidence Interval
10018	2009	524	13	6.687	1.94	0.0196	1.150, 3.091

- During 2009, there were 524 procedures performed and 13 SSIs identified.
- Based on the NHSN 2006-2008 baseline data, 6.687 SSIs were expected.
- This results in an SIR of 1.94 (13/6.687), signifying that during this time period our facility identified 94% more SSIs than expected.
- The p-value and 95% Confidence Interval indicate that the number of observed SSIs is significantly higher than the number of expected SSIs.

## Example #2: SSI SIR by Procedure and Half-Year with Number Expected &lt; 1

Org ID	Procedure Code	Summary Yr/Half	Procedure Count	infCountAll	All SSI Model Number Expected	All SSI Model SIR	All SSI Model SIR p-value	All SSI Model 95% Confidence Interval
10018	HPRO	2009H1	26	1	0.295	.	.	.
10018	HPRO	2009H2	102	0	1.432	0.00	.	.

- During the first half of 2009 (2009H1), there were 26 HPRO procedures performed and 1 SSI identified.
- Based on the NHSN 2006-2008 baseline data, <1 SSI was expected and therefore, a precise SIR could not be calculated.

When the number expected is less than 1, you should check your data for procedures that were excluded from the SIR, as described in [Appendix C](#).

*Will any procedures be excluded from the SIRs?*

Yes. The All SSI SIR will exclude any procedure record that meets the exclusion criteria defined in Appendix C, as well as custom procedures. The Complex A/R SSI SIR will exclude all outpatient procedures in addition to those procedures meeting the exclusion criteria, and custom procedures.

You will be able to obtain a detailed list of all non-Custom excluded procedures that meet the exclusion criteria, by using a new output option: "Line Listing – Incomplete Procedures for SSI SIR." For an explanation of this output option, please see [Appendix C](#).

In addition, SIRs will not be calculated for the current time period. For example, if running the SIRs in November, 2010 by half-years, the 2010H2 data will not be calculated or displayed, as the time period is not yet complete.

### *Will any SSIs be excluded from the SIRs?*

Yes. All superficial incisional secondary (SIS) and deep incisional secondary (DIS) SSIs will be excluded from all SIR calculations. In addition, any SSI will be excluded if its corresponding procedure is excluded from the SIR.

### *How is this different from the current SSI SIRs in NHSN?*

The previous SSI SIRs were based on the basic risk index and published risk-stratified SSI rates. The new SSI SIRs will use improved risk adjustment calculated through logistic regression modeling. Not only does this allow for all available risk factors to be considered, but it also allows for the risk factors to be procedure-specific. Note that each risk factor's contribution will vary according to its significant association with risk. Based on this logistic regression modeling, it was determined that for all NHSN procedures, the models predicted SSI risk better than the basic risk index, and as a result, the basic risk index will no longer be used when analyzing SSI data at a national level.

Please see [Appendix D](#) for a list of predictive risk factors obtained from the logistic regression models for each of the NHSN operative procedures.

#### **Example: Logistic Regression Model**

This table lists the risk factors found to be significant for a particular NHSN operative procedure category. Note that each risk factor's contribution varies, as represented by the parameter estimate for each factor.

Factor	Parameter Estimate	OR	p-value
<i>Intercept</i>	-5.448	-	-
Age (≤44 vs >44)	0.520	1.659	<0.0001
ASA (3/4/5 vs 1/2)	0.425	1.529	0.0415
Duration (>100 vs ≤100)	0.501	1.650	0.0019
Med school affiliation (Y vs N)	1.069	2.912	<0.0001

*The model represented in this table is for teaching purposes only and should not be considered an actual model from which to calculate a patient's risk of SSI.*

The parameter estimates above can be plugged into the following formula:

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

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

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

**Example: Applying the Logistic Regression Model to Determine Each Patient’s Risk**

The probability of SSI is calculated using the logistic regression model above. For example, the probability of SSI for Patient 1 in the table below can be calculated as:

$$\text{logit}(\hat{p}) = -5.448 + 0.520(1) + 0.425(1) + 0.501(1) + 1.069(1) = -2.934$$

$$\text{Solve for } \hat{p} : \hat{p} = e^{\text{logit}(\hat{p})} / (1 + e^{\text{logit}(\hat{p})})$$

$$\hat{p} = e^{-2.934} / (1 + e^{-2.934}) = 0.050 = \text{probability of SSI for Patient 1}$$

Note that this can also be interpreted as a 5.0% risk of infection for Patient 1.

The probability of SSI is calculated for each patient and then summed to give the expected number of SSIs for this population.

This table represents a partial list of 100 hypothetical patients who have undergone this particular procedure, and the risk factors present for each.

Patient	Age	Duration	ASA	Medical School Aff.	SSI	Probability of SSI
1	40	117	4	Y	0	0.050
2	53	95	2	N	0	0.004
3	30	107	2	Y	1	0.033
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
100	37	128	4	Y	1	0.050
TOTAL					Observed (O)	Expected (E)
					3	2.91
SIR= O/E =3/2.91 = 1.03						

## Will I still be able to obtain SSI rates from NHSN?

### Advanced

[Create New custom Option](#)

Patient-level Data

Event-level Data

Procedure-level Data

CDC Defined Output

Line Listing - All Procedures	Run	Modify
Frequency Table - All Procedures	Run	Modify
Bar Chart - All Procedures	Run	Modify
Pie Chart - All Procedures	Run	Modify
Rate Table - SSI Data by Procedure and Risk Index	Run	Modify
Control Chart - SSI Data by Procedure and Risk Index	Run	Modify
Rate Table - Specific Event SSI Rates by Procedure	Run	Modify
Control Chart - Specific Event SSI Data by Procedure	Run	Modify
Rate Table - SSI Data by Surgeon, Procedure, and...more	Run	Modify
Control Chart - SSI Data by Surgeon, Procedure, ...more	Run	Modify

You will still be able to obtain SSI rates, using the legacy basic risk index, within NHSN analysis. These rates have been moved to the “Advanced” section of the output options. Note that while these options are available, you will be able to obtain only your facility’s SSI rates; comparison to the previously-published NHSN SSI pooled means will no longer be available.

### Where can I find more information?

First State-Specific Healthcare-Associated Infections Summary Data Report CDC’s National Healthcare Safety Network (NHSN) January-June, 2009, available at: <http://www.cdc.gov/HAI/statesummary.html>

2009 NHSN Report, available at: <http://www.cdc.gov/nhsn/PDFs/dataStat/2009NHSNReport.PDF>

For in-depth Analysis Training, please visit: <http://www.cdc.gov/nhsn/training.html>

For a Basic Analysis Quick Tips guide, please visit: <http://www.cdc.gov/nhsn/PDFs/AnalysisBasics.pdf>

For questions, please email us at: [nhsn@cdc.gov](mailto:nhsn@cdc.gov)

APPENDICES A-E: SIR OUTPUT AND RISK FACTOR SAMPLES

Appendix A: Sample CLABSI SIR Output

National Healthcare Safety Network

SIR for All Central Line-Associated BSI Data - By OrgID

As of: September 15, 2010 at 12:18 PM

Date Range: CLAB\_RATES(CU summary)Yr 2009 to 2009

Org ID=10018

Org ID	Summary Yr/Half	infCount	Number Expected	Central Line Days	SIR	SIR p-value	95% Confidence Interval
10018	2009H1	9	7.043	3746	1.28	0.2766	0.667, 2.230

If infCount in this table is less than you reported, aggregate data are not available to calculate numExp.  
 Lower bound of 95% Confidence Interval only calculated if infCount > 0. SIR values only calculated if numExp >= 1.  
 Source of aggregate data: NHSN Report, Am J Infect Control 2009;37:783-805  
 Data contained in this report were last generated on September 15, 2010 at 12:03 PM.

The first table represents an overall SIR for those locations for which CLABSIs were monitored in your facility during the specified time period(s). In this example, there is an overall SIR for the first half of 2009 (2009H1).

National Healthcare Safety Network

SIR for All Central Line-Associated BSI Data - By OrgID/Location Type

As of: September 15, 2010 at 12:18 PM

Date Range: CLAB\_RATES(CU summary)Yr 2009 to 2009

Org ID=10018

Org ID	LocationType	Summary Yr/Half	infCount	Number Expected	Central Line Days	SIR	SIR p-value	95% Confidence Interval
10018	ICU-OTHER	2009H1	9	7.043	3746	1.28	0.2766	0.667, 2.230

If infCount in this table is less than you reported, aggregate data are not available to calculate numExp.  
 Lower bound of 95% Confidence Interval only calculated if infCount > 0. SIR values only calculated if numExp >= 1.  
 Source of aggregate data: NHSN Report, Am J Infect Control 2009;37:783-805  
 Data contained in this report were last generated on September 15, 2010 at 12:03 PM.

The second table provides an SIR by location type and the time period(s) specified. The following are location types that may appear in this table: **ICU-OTHER** (all ICUs and Other non-NICU and non-SCA locations), **SCA**, and **NICU**. All locations would be grouped into one of these defined types.

National Healthcare Safety Network

SIR for All Central Line-Associated BSI Data - By OrgID/CDC Location Code

As of: September 15, 2010 at 12:18 PM

Date Range: CLAB\_RATES(CU summary)Yr 2009 to 2009

Org ID=10018

Org ID	CDC Location	Summary Yr/Half	infCount	Number Expected	Central Line Days	SIR	SIR p-value	95% Confidence Interval
10018	IN-ACUTE:CC:CT	2009H1	4	2.205	1575	1.81	0.1816	0.620, 4.151
10018	IN-ACUTE:CC:CT_PED	2009H1	0	1.036	314	0.00	0.1816	
10018	IN-ACUTE:CC:MS	2009H1	2	1.785	850	1.12	0.5327	0.199, 3.527
10018	IN-ACUTE:CC:S	2009H1	3	1.564	680	1.92	0.2074	0.523, 4.958

If infCount in this table is less than you reported, aggregate data are not available to calculate numExp.  
 Lower bound of 95% Confidence Interval only calculated if infCount > 0. SIR values only calculated if numExp >= 1.  
 Source of aggregate data: NHSN Report, Am J Infect Control 2009;37:783-805  
 Data contained in this report were last generated on September 15, 2010 at 12:03 PM.

The third table provides an SIR by CDC Location and time period(s) specified. For example, if your facility reported CLABSIs for two Medical ICUs, this table would show one SIR for the two locations represented by that CDC Location designation (IN:ACUTE:CC:M).

National Healthcare Safety Network

SIR for All Central Line-Associated BSI Data - By OrgID/Location

As of: September 15, 2010 at 12:18 PM

Date Range: CLAB\_RATES(CU summary)Yr 2009 to 2009

Org ID=10018

Org ID	Location	Summary Yr/Half	Months	infcount	Number Expected	Central Line Days	SIR	SIR p-value	95% Confidence Interval
10018	22ICU	2009H1	1	0	1.036	314	0.00		
10018	71ICU	2009H1	3	4	2.205	1575	1.81	0.1816	0.620, 4.151
10018	ICU	2009H1	3	2	1.785	850	1.12	0.5327	0.199, 3.527
10018	S-ICU	2009H1	3	3	1.564	680	1.92	0.2074	0.523, 4.958

If infCount in this table is less than you reported, aggregate data are not available to calculate numExp.  
 Lower bound of 95% Confidence Interval only calculated if infCount > 0. SIR values only calculated if numExp >= 1.  
 Source of aggregate data: NHSN Report, Am J Infect Control 2009;37:783-805  
 Data contained in this report were last generated on September 15, 2010 at 12:03 PM.

The fourth table is the most granular table, as it provides an SIR for each individual location and time period(s) specified. Using the previous example, if your facility reported CLABSIs for two Medical ICUs, each of those locations would have an SIR calculated in this last table.

## Appendix B: Sample SSI SIR Output

National Healthcare Safety Network  
 SIR for All SSI Data by Procedure - By OrgID  
 As of: October 7, 2010 at 7:23 AM  
 Date Range: SIR\_ALLSSIPROC.summaryYr 2009 to 2009  
 if (((procCode IN ("CBGB", "HPRO", "KPRO"))))

Org ID=10018

Org ID	Summary Yr/Half	Procedure Count	All SSI Model Infection Count	All SSI Model Number Expected	All SSI Model SIR	All SSI Model SIR p-value	All SSI Model 95% Confidence Interval
10018	2009H1	77	4	1.217	3.29	0.0352	1.123, 7.524
10018	2009H2	347	2	3.413	0.59	0.3373	0.104, 1.845

If infCount in this table is less than you reported, aggregate data are not available to calculate numExp.  
 Lower bound of 95% Confidence Interval only calculated if infCount > 0. SIR values only calculated if numExp >= 1.  
 Source of aggregate data: 2006-2008 NHSN SSI Data  
 Data contained in this report were last generated on October 7, 2010 at 7:20 AM.

The first table represents an overall SIR for those operative procedures for which SSI were monitored in your facility, during the specified time period(s). In this example, there is an overall SIR for the first and second halves of 2009 (2009H1 and 2009H2).

National Healthcare Safety Network  
 SIR for All SSI Data by Procedure - By OrgID/ProcCode  
 As of: October 7, 2010 at 7:23 AM  
 Date Range: SIR\_ALLSSIPROC.summaryYr 2009 to 2009  
 if (((procCode IN ("CBGB", "HPRO", "KPRO"))))

Org ID=10018

Org ID	Procedure Code	Summary Yr/Half	Procedure Count	All SSI Model Infection Count	All SSI Model Number Expected	All SSI Model SIR	All SSI Model SIR p-value	All SSI Model 95% Confidence Interval
10018	CBGB	2009H1	20	3	0.610	.	.	.
10018	CBGB	2009H2	39	2	0.852	.	.	.
10018	HPRO	2009H1	26	1	0.295	.	.	.
10018	HPRO	2009H2	101	0	0.932	.	.	.
10018	KPRO	2009H1	31	0	0.312	.	.	.
10018	KPRO	2009H2	207	0	1.628	0.00	.	.

If infCount in this table is less than you reported, aggregate data are not available to calculate numExp.  
 Lower bound of 95% Confidence Interval only calculated if infCount > 0. SIR values only calculated if numExp >= 1.  
 Source of aggregate data: 2006-2008 NHSN SSI Data  
 Data contained in this report were last generated on October 7, 2010 at 7:20 AM.

The second table provides an SIR by NHSN operative procedure category and the time period(s) specified. The SIRs that appear in this table will group inpatient and outpatient procedures within each category.

National Healthcare Safety Network  
 SIR for All SSI Data by Procedure - By OrgID/ProcCode/Outpatient  
 As of: October 7, 2010 at 7:23 AM  
 Date Range: SIR\_ALLSSIPROC.summaryYr 2009 to 2009  
 if (((procCode IN ("CBGB", "HPRO", "KPRO"))))

Org ID=10018

Org ID	Procedure Code	Performed in Outpatient Setting?	Summary Yr/Half	Months	Procedure Count	All SSI Model Infection Count	All SSI Model Number Expected	All SSI Model SIR	All SSI Model SIR p-value	All SSI Model 95% Confidence Interval
10018	CBGB	N	2009H1	3	20	3	0.610	.	.	.
10018	CBGB	N	2009H2	4	39	2	0.852	.	.	.
10018	HPRO	N	2009H1	1	26	1	0.295	.	.	.
10018	HPRO	N	2009H2	3	101	0	0.932	.	.	.
10018	KPRO	N	2009H1	1	31	0	0.312	.	.	.
10018	KPRO	N	2009H2	3	207	0	1.628	0.00	.	.

If infCount in this table is less than you reported, aggregate data are not available to calculate numExp.  
 Lower bound of 95% Confidence Interval only calculated if infCount > 0. SIR values only calculated if numExp >= 1.  
 Source of aggregate data: 2006-2008 NHSN SSI Data  
 Data contained in this report were last generated on October 7, 2010 at 7:20 AM.

The third table provides an SIR by NHSN operative procedure category and outpatient status, as well as the time period(s) specified. Note that this table will be available only in the "All SSI SIR" output options.

National Healthcare Safety Network  
 SSI Data Not Included in SIR  
 As of: October 7, 2010 at 7:23 AM  
 Date Range: SIR\_ALLSSIPROC.summaryYr 2009 to 2009  
 if (((procCode IN ("CBGB", "HPRO", "KPRO"))))

Org ID=10018

Summary Yr/Half	Org ID	Procedure Code	Performed in Outpatient Setting?	Procedure Count	All SSI Model Infection Count
2009H2	10018	HPRO	Y	1	0
2009H1	10018	KPRO	Y	2	1

Source of aggregate data: 2006-2008 NHSN SSI Data  
 Data contained in this report were last generated on October 7, 2010 at 7:20 AM.

The fourth table provides a count of the number of procedures and SSIs that were excluded from the SIRs above. Note that this will list only those procedures that were excluded from the SIR due to the exclusion criteria. For detailed information on these excluded procedures, you may review the "Line Listing – Incomplete Procedures for SSI SIR" (see [Appendix C](#)).

### Appendix C: Sample Line List of Procedures Excluded from SIR

Procedures will be excluded from the SIR if they meet any of the following exclusion criteria:

- Missing one or more of the risk factors as defined in [Appendix D](#).
- Procedure duration is <5 minutes or >IQR5, which is defined as five times the interquartile range above the 75<sup>th</sup> percentile. For example, if the interquartile range is 30 minutes (Q3-Q1) and the 75<sup>th</sup> percentile is 100 minutes, the IQR5 would be 100 +(5\*30) = 250 minutes. Please see [Appendix E](#) for a list of IQR5 values for each NHSN Operative Procedure.
- Procedure date is ≤ patient date of birth.
- Patient’s age at procedure is ≥ 109 years.
- Wound Class (swClass) = ‘U’.
- Approach = ‘N’ (for FUSN and RFUSN only.)
- Spinal Level = ‘N’ (for FUSN only.)

**TIP:** When obtaining a line list of procedures excluded from the SIR, it’s best to modify this output option in order to limit to the procedure, time period, and risk factors in question. The example below was limited to CBGB procedures in May, 2010, and includes only those variables of interest to this procedure category.

National Healthcare Safety Network												
Line Listing for Incomplete Procedures for SSI SIR												
As of: September 28, 2010 at 9:10 AM												
Date Range: PROCEDURES procDateYM 2010M05 to 2010M05												
Org ID	Patient ID	Procedure ID	all_incomplete	cmpx_incomplete	Procedure Date	Procedure Code	Date of Birth	Gender	ASA Class	Duration of Procedure - hr	Duration of Procedure - min	Number of Beds
10018	MD-123456	22472	Y	N	05/01/2010	CBGB	09/10/1954	F		3	15	467

After reviewing this line list, the following steps are recommended:

1. Obtain the missing information or correct data. In the example above, the ASA class would need to be obtained.
2. Edit the procedure record in NHSN to include this information. Save the edited record.
3. Re-generate datasets.
4. Run the desired SSI SIR output option.

**Appendix D: Predictive Risk Factors from the All SSI† Logistic Regression Models**

<b>NHSN Operative Procedure<sup>‡</sup></b>	<b>Risk Factor(s) – ALL SSIs</b>
<b>AAA</b>	duration
<b>AMP</b>	duration, hospital bed size*
<b>APPY</b>	emergency, gender, hospital bed size*, wound class
<b>AVSD</b>	age
<b>BILI</b>	asa, duration, hospital bed size*
<b>BRST</b>	asa, duration, hospital bed size*
<b>CBGB/C</b>	age, asa, duration, gender, hospital bed size*
<b>CARD</b>	age, asa, duration
<b>CHOL</b>	age, asa, duration, endoscope, wound class
<b>COLO</b>	age, anesthesia, asa, duration, endoscope, medical school affiliation*, hospital bed size*, wound class
<b>CRAN</b>	age, asa, duration, hospital bed size*, trauma
<b>CSEC</b>	age, anesthesia, asa, BMI, duration, emergency, labor, wound class
<b>FUSN</b>	approach, asa, diabetes, duration, medical school affiliation*, spinal level, trauma, wound class
<b>FX</b>	age, asa, duration, hospital bed size*, outpatient
<b>GAST</b>	asa, duration, emergency
<b>HER</b>	age, asa, duration, gender, outpatient
<b>HPRO</b>	age, anesthesia, asa, duration, total/partial/revision, hospital bed size*, trauma
<b>HYST</b>	age, anesthesia, asa, duration, endoscope, hospital bed size*
<b>KPRO</b>	age, anesthesia, asa, duration, gender, revision, hospital bed size*, trauma
<b>KTP</b>	age, asa, duration, hospital bed size*
<b>LAM</b>	anesthesia, asa, duration, endoscope
<b>LTP</b>	age, duration, emergency
<b>NECK</b>	duration
<b>NEPH</b>	duration
<b>OVRY</b>	asa
<b>PRST</b>	duration
<b>PVBY</b>	age, asa, duration, gender, medical school affiliation*
<b>REC</b>	duration, endoscope, gender, wound class
<b>RFUSN</b>	approach, diabetes, duration
<b>SB</b>	duration, hospital bed size*
<b>THOR</b>	duration, hospital bed size*
<b>THYR</b>	age
<b>VHYS</b>	age, asa, duration, medical school affiliation*
<b>VSHN</b>	age, medical school affiliation*, hospital bed size*, wound class
<b>XLAP</b>	age, duration, hospital bed size*

\*These risk factors originate from the Patient Safety Annual Facility Survey.

† All SSI = superficial incision, deep incisional, and organ/space SSI detected during admission, readmission, or post-discharge

‡ There were insufficient data for the following procedures in order to detect significant differences in risk, thus overall incidence will be used in the SIR calculations: CEA, HTP, PACE, SPLE.

## Appendix D (cont'd.): Predictive Risk Factors from the Complex A/R SSI<sup>^</sup> Logistic Regression Models

NHSN Operative Procedure <sup>‡</sup>	Risk Factor(s) – Complex A/R SSIs <sup>^</sup>
AAA	duration, wound class
APPY	emergency, gender, hospital bed size*, wound class
AVSD	age
BILI	asa, duration, hospital bed size*
BRST	asa, duration, hospital bed size*
CBGB/C	age, asa, duration, gender, medical school affiliation*, age-gender (interaction)
CARD	age, duration, emergency
CHOL	age, asa, duration, hospital bed size*
COLO	age, asa, duration, endoscope, medical school affiliation*, hospital bed size*, wound class
CRAN	age, duration, hospital bed size*
CSEC	age, anesthesia, asa, BMI, duration, labor, hospital bed size*, wound class
FUSN	approach, asa, diabetes, duration, medical school affiliation*, spinal level
FX	age, duration, hospital bed size*
GAST	age, duration
HER	age, asa, duration, gender, hospital bed size*
HPRO	age, anesthesia, asa, duration, total/partial/revision, medical school affiliation*, hospital bed size*, trauma
HYST	age, asa, duration, hospital bed size*
KPRO	age, asa, duration, gender, revision, medical school affiliation*, hospital bed size*, trauma
KTP	asa, duration
LAM	asa, duration, medical school affiliation*, hospital bed size*
LTP	age, duration
NECK	duration
PVBY	age, asa, duration, medical school affiliation*
REC	duration, gender, hospital bed size*
RFUSN	duration
SB	duration, hospital bed size*
THOR	duration
VHYS	age, duration, medical school affiliation*
VSHN	age, medical school affiliation*, hospital bed size*, wound class
XLAP	duration

\*These risk factors originate from the Patient Safety Annual Facility Survey.

<sup>^</sup>Includes only inpatient procedures and deep incisional and organ/space SSIs identified during admission or readmission to the facility, as defined in the NHSN Manual.

<sup>‡</sup> There were insufficient data for the following procedures in order to detect significant differences in risk, thus overall incidence will be used in the SIR calculations: AMP, CEA, HTP, NEPH, OVRY, PACE, PRST, SPLE, THYR.

### Appendix E: IQR5 Values, in minutes, for NHSN Operative Procedures

NHSN Operative Procedure	IQR5*	NHSN Operative Procedure (cont'd.)	IQR5*
AAA	827	HYST	479
AMP	334	KPRO	354
APPY	300	KTP	717
AVSD	422	LAM	615
BILI	1290	LTP	1254
BRST	711	NECK	1578
CARD	941	NEPH	923
CBGB	846	OVRY	722
CBGC	895	PACE	303
CEA	425	PRST	835
CHOL	314	PVBY	786
COLO	668	REC	1189
CRAN	929	RFUSN	1165
CSEC	171	SB	760
FUSN	879	SPLE	920
FX	515	THOR	744
GAST	565	THYR	500
HER	342	VHYS	449
HPRO	380	VSHN	309
HTP	1051.5	XLAP	830

\*The IQR5 is used as an indicator of an extreme outlier for procedure durations when calculating the SSI SIRs. The IQR5 is calculated as five times the interquartile range (Q1-Q3) above the 75<sup>th</sup> percentile. For example, if the interquartile range is 30 minutes, and the 75<sup>th</sup> percentile is 100 minutes, the IQR5 would be calculated as:  $100 + (30 \times 5) = 250$  minutes. Procedures with a duration greater than the IQR5 were excluded from the baseline data and will be excluded from all SSI SIR calculations for your facility.