Advanced Analysis in National Healthcare Safety Network (NHSN) Surgical Site Infection (SSI)

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Objectives

- Describe risk adjustment used in the surgical site infections (SSI) standardized infection ratio (SIR) calculations
- Explain how to interpret and use SIRs under the current 2015 risk-adjustment
- Discuss techniques for ensuring SIR data quality and troubleshooting analysis reports

Describe risk adjustment used in the SSI SIR calculations

Background

- The SIR is a risk-adjusted summary measure
- Compares **observed** number of infections to **predicted** number of infections

$$SIR = \frac{Observed\ (O)\ HAIs}{Predicted\ (P)\ HAIs}$$

- Predicted number of infections is
  - Calculated by summing the procedure risk for all procedures included in the summarized calculation
  - The procedure risk is calculated from improved risk models*
- Based on NHSN aggregate data (2006-2008 and 2015)
  - This presentation will focus on the 2015 data

*2006-2008 baseline: Mu Y et al. Infect Control Hosp Epidemiol 2011;32(10):970-986

*2015 Baseline: SIR Guide: https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf

2015 Baseline and Risk-Adjustment: Surgical Site Infections (SSI)

- New 2015 risk-adjusted models for procedures/SSI
  - Separated by patient population: adult and pediatric models
- Number of predicted infections, numPred, (denominator of SIR) calculated using Logistic Regression Models
  - Risk adjusted with patient level data as well as facility level data
- Several factors were reviewed and analyzed to determine significance to the relationship between the exposure (surgery) and the outcome (infection)

2015 Baseline: SIR Guide: https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf

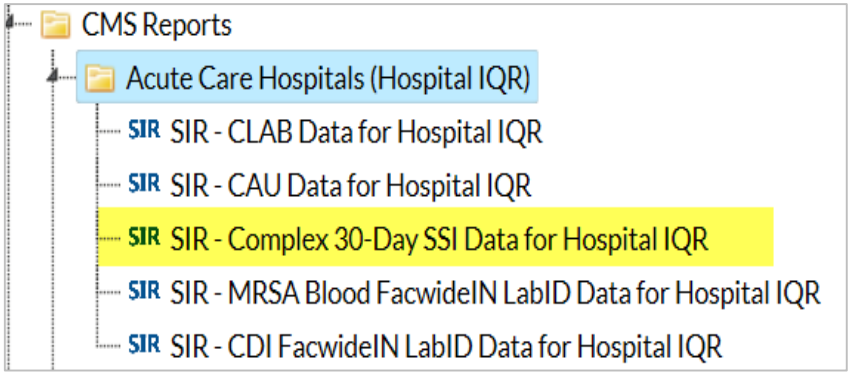
2015 Baseline and Risk-Adjustment: Surgical Site Infections (SSI)

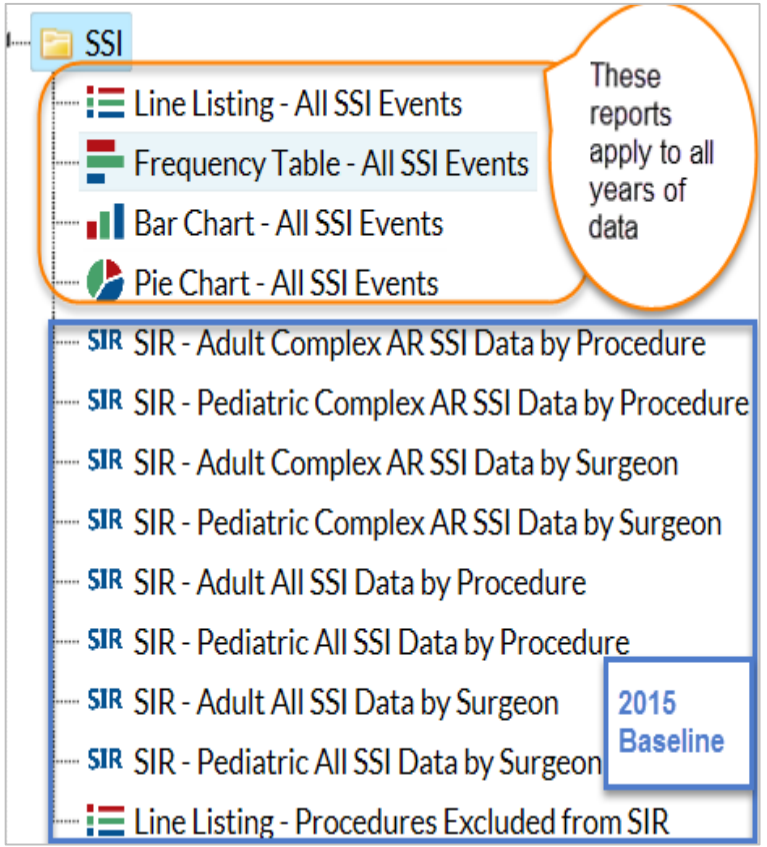
- Factors that were found to be statistically significant to this relationship were included in the final validated model
  - Statistically significant measure by a p-value of 0.05 and lower
- In a later slide, we will briefly review how to manually calculate the risk-adjusted number of predicted infection (denominator of SIR)

2015 Baseline: SIR Guide: https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf

Surgical Site Infection (SSI) Models and Reports

- There are different SSI Models, each has 2 separate reports, by procedure and by surgeon
- **Under the 2015 baseline (BS2)**
  - All SSI Adult Data SIR
  - All SSI Pediatric Data SIR
  - Complex admission/readmission (A/R) Adult SSI SIR
  - Complex A/R Pediatric SSI SIR
  - Complex 30day SSI SIR

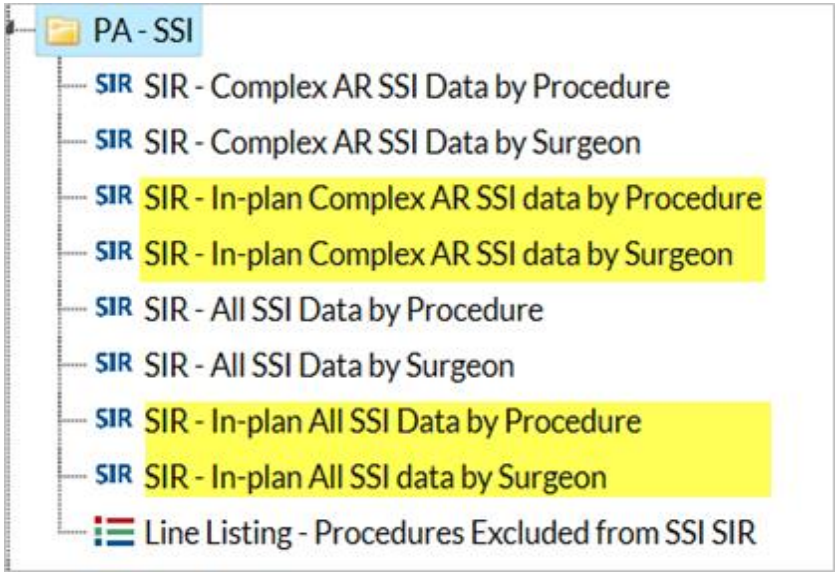


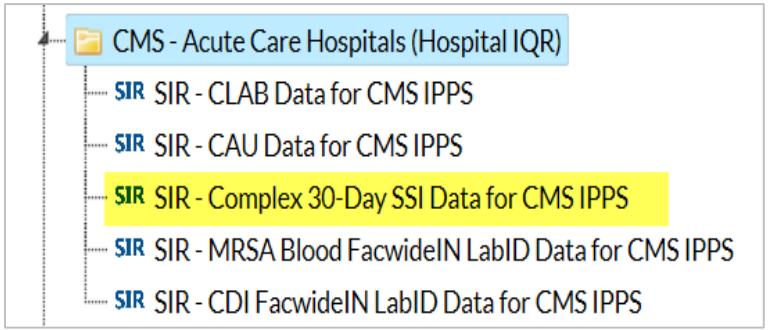


Surgical Site Infection (SSI) Models and Reports

- **Under the 2006-2008 baseline**
  - All SSI Data SIR
  - Complex A/R SSI SIR
  - Complex 30day SSI SIR
- Located in **Baseline Set 1 (BS1)** folder
- Reports are separated also by plan status (in-plan vs. all data)
- Reports can be generated for data up to 2016

Under 2006-2008 Baseline





Surgical Site Infection (SSI) Models-Inclusion Criteria

Included in model: Under 2015 Baseline	All SSI Model-Adult	Complex AR SSI Model-Adult	All SSI Model-Pediatric	Complex AR SSI Model- Pediatric	Complex 30-Day
All NHSN procedure categories	✓	✓	✓	✓	COLO HYST
Procedures in patients <18 years			✓	✓	
Procedures in patients >=18 years	✓	✓			✓
Inpatient procedures	✓	✓	✓	✓	
Outpatient procedures	EXCLUDED FROM ALL PATIENT SAFETY SSI SIR MODELS				
Superficial incisional primary (SIP) SSIs	✓		✓		
Deep incisional primary (DIP) SSIs	✓	✓	✓	✓	✓
Organ/space (O/S) SSIs	✓	✓	✓	✓	✓
DIP and O/S SSIs identified > 30 days after procedure (per protocol)	✓	✓	✓	✓	
SSIs detected on current admission (A)	✓	✓	✓	✓	✓
SSIs detected on follow-up admission to the same facility (RF)	✓	✓	✓	✓	✓
SSI detected on follow-up admission to different facility (RO)	✓		✓		✓
SSIs detected through post-discharge surveillance	✓		✓		✓

Surgical Site Infection (SSI) Models-Inclusion Criteria

- Procedures with either primary closure technique and other than primary closure techniques are included in the SIR under the 2015 baseline

2015 Baseline: SIR Guide: https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf

Question 1: I would like to run an SIR report that summarizes complex COLO and HYST events (deep incisional primary and organ space events), regardless of when detected, in patients older than 18 years at time of surgery. Which model do I use?

A. Complex A/R Adult Model

B. Complex A/R Pediatric Model

C. Complex 30-day Model (CMS)

D. All SSI Adult Model

E. None of the above

Procedure Exclusion Criteria: 2015 Baseline

- Three levels of data exclusions
  - General exclusion criteria:
    - Applicable to procedures (and related SSI events)
  - Exclusion due to potential data quality issues or outliers
    - Hence the need for checking data frequently
  - Facility-level Exclusions
    - Applicable data found on annual survey

2015 Baseline: SIR Guide: https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf

Procedure Exclusion Criteria: 2015 Baseline

General Exclusion Criteria: Applicable to Procedures (and related SSI Event)
Gender= 'Other' ★
Outpatient procedures and resulting SSIs ★
Present at time of surgery (PATOS) is 'Yes' ★
SSIs that are reported as superficial incisional secondary (SIS) or deep incisional secondary (DIS)
Exclusions often due to potential data quality issues or outliers
Age at the time of procedure is greater than 109 years
Closure technique is missing
ASA score is missing
Gender is missing
Adult patients ≥ 18 years: if BMI is less than 12 or greater than 60* ★
Pediatric patients < 18 years: if BMI less than 10.49 or greater than 65.79** ★
Procedure duration less than 5 minutes
If procedure duration is greater than IQR5 (please see Table 4 in the SSI Section of the new SIR Guide for more information)

*This BMI exclusion applies to all procedures on adult patients in all 3 SSI models (All SSI, Complex A/R, Complex 30-Day).

**This BMI exclusion applies to all procedures on pediatric patients, in both applicable SSI models (All SSI and Complex A/R). CDC Growth Charts are used to assess BMI in pediatric patients, calculated using height, weight, age, and gender. More information is here: https://www.cdc.gov/nccdphp/dnpao/growthcharts/resources/sas.htm. New Exclusion ★

Procedure Exclusion Criteria: 2015 Baseline

- The IQR5 is calculated as five times the interquartile range (Q1-Q3) above the 75th percentile, using the national aggregate data.
- For example, if the interquartile range is 30 minutes, and the 75th percentile is 100 minutes, the IQR5 would be calculated as:
  - 100 + (30*5) = 250 minutes

2015 Baseline: SIR Guide: https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf

Exclusion Criteria: 2015 Baseline

Facility-level Exclusions
Data from ambulatory surgery centers (ASCs) and long-term acute care hospitals (LTACHs)
Medical affiliation is missing or medical affiliation is 'Y' and medical type is missing (from Annual Facility Survey)
Number of beds is missing (from Annual Facility Survey)

NOTE: It is often rare that a facility data will be missing the above listed information, but it is important that you are aware of the status of this information.

2015 Baseline: SIR Guide: https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf

2015 Baseline Risk Models: COLO Complex 30-day SSI SIR

Risk Factor		Parameter Estimate
Intercept		*-3.66601*
Risk Factor	Status	
Diabetes	**Yes**	**0.0821**
Diabetes	No	Referent Population
ASA Score: 1, 2, 3/4/5	**Ordinal**	**0.3028**
Gender	**Male**	**0.1036**
Gender	Female	Referent Population
Age (Patient's age/10)	**Continuous**	**-0.1396**
BMI	**≥30**	**0.1259**
BMI	<30	Referent Population
Closure technique	**Other than Primary**	**0.2383**
Closure technique	Primary	Referent Population
Oncology Hospital	**Yes**	**0.5437**
Oncology Hospital	No	Referent Population

2015 Baseline: SIR Guide: https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf

2015 Baseline Risk Models: HYST Complex 30-day SSI SIR

Risk Factor		Parameter Estimate
Intercept		*-5.1801*
Risk Factor	Status	
Diabetes	**Yes**	**0.3247**
Diabetes	No	Referent Population
ASA Score: 1, 2, 3, 4/5	**Ordinal**	**0.4414**
Age (Patient's age/10)	**Continuous**	**-0.1501**
BMI	**≥30**	**0.1106**
BMI	<30	Referent Population
Oncology Hospital	**Yes**	**0.5474**
Oncology Hospital	No	Referent Population

2015 Baseline: SIR Guide: https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf

Question 2: For both COLO and HYST, age shows a protective effect on the relationship between exposure (surgery) and outcome (infection). Meaning as age increases, the risk of infection decreases

Risk Factor		Parameter Estimate
Intercept		*-5.1801*
Risk Factor	Status	
Diabetes	**Yes**	**0.3247**
Diabetes	No	Referent Population
ASA Score: 1, 2, 3, 4/5	**Ordinal**	**0.4414**
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BMI	**≥30**	**0.1106**
BMI	<30	Referent Population
Oncology Hospital	**Yes**	**0.5474**
Oncology Hospital	No	Referent Population

✓ A. True

B. False

Question 2: For both COLO and HYST, age shows a protective effect on the relationship between exposure (surgery) and outcome (infection). Meaning as age increases, the risk of infection decreases

Risk Factor		Parameter Estimate
Intercept		*-5.1801*
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ASA Score: 1, 2, 3, 4/5	**Ordinal**	**0.4414**
Age (Patient's age/10)	**Continuous**	**-0.1501**
BMI	**≥30**	**0.1106**
BMI	<30	Referent Population
Oncology Hospital	**Yes**	**0.5474**
Oncology Hospital	No	Referent Population

Answer is A. Rational: The Parameter estimate shows a negative value, which indicates that as age increases, the risk of infection decrease

A. True

B. False

2015 Baseline Risk Factors: All SSI Model for COLO and HYST

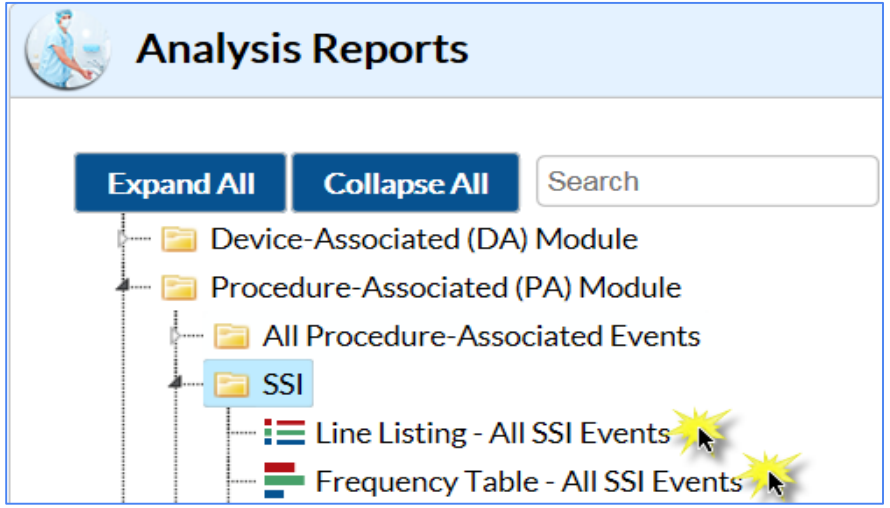
All SSI Adult Model	
COLO	**HYST**
Diabetes	Diabetes
Trauma	ASA
Anesthesia	Medical school affiliation/medical school type
ASA	Bed size
Wound class	Scope
Medical school affiliation/medical school type	Age (at various intervals)
Bed size	Procedure duration
Scope	BMI
Closure	Oncology hospital
Age (at 10 year interval)	
Procedure duration	
BMI	

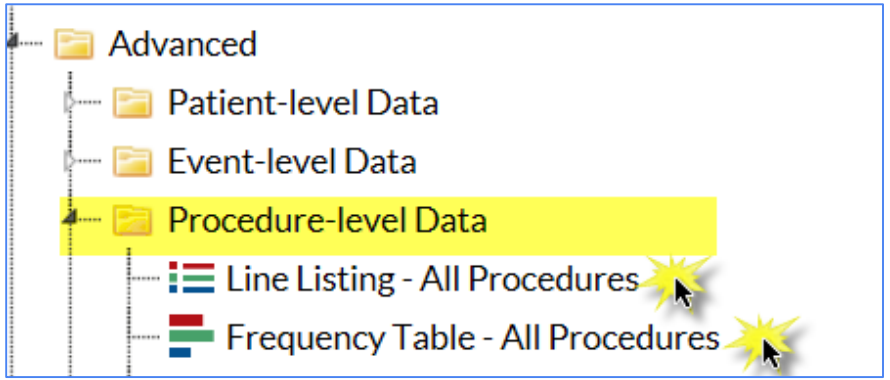
2015 Baseline Risk Factors: Complex A/R SSI Model for COLO and HYST

Complex Admission/Readmission SSI Adult Model	
COLO	***HYST***
Gender	Diabetes
Diabetes	ASA
Trauma	Bed size
Anesthesia	Scope
ASA	Age at various categories
Wound Class	Procedure duration
Bedsize	BMI
Scope	
Closure	
Age at 10 year interval	
Procedure duration	
BMI	

Checking Risk Factors in NHSN- Procedure-level Data

- Checking SSI Data included in SIR
  - For numerator data, run the SSI event line list
    - Analysis→Reports→Procedure-associated (PA) Module→ SSI→ Line Listing - All SSI Events
  - For denominator data, run the All Procedure line list
    - Analysis→Reports→Advanced→ Procedure-level Data→Line Listing - All Procedures





National Healthcare Safety Network
Line Listing for All Surgical Site Infection Events

As of: February 27, 2017 at 1:02 PM
Date Range: SSI_EVENTS procDateYM 2016M03 to 2016M03

orgID	patID	eventType	spcEvent	procDate	procCode	dob	ageAtProc	gender	procDurationHr	procDurationMin	outpatient	closure	whenDetected
10018	123	SSI	DIP	03/16/2016	COLO	01/01/1980	36	F	5	5	N	PRI	RO

bs2_allAdultExcl	bs2_allPedExcl	bs2_cmpxAdultExcl	bs2_cmpxPedExcl	bs2_cmpx30dExcl	bs2_SSIAll	bs2_SSIpedAll	bs2_SSIComplex	bs2_SSIPedComplex	bs2_SSIComplex30d
0	1	0	1	1	1	0	0	0	0

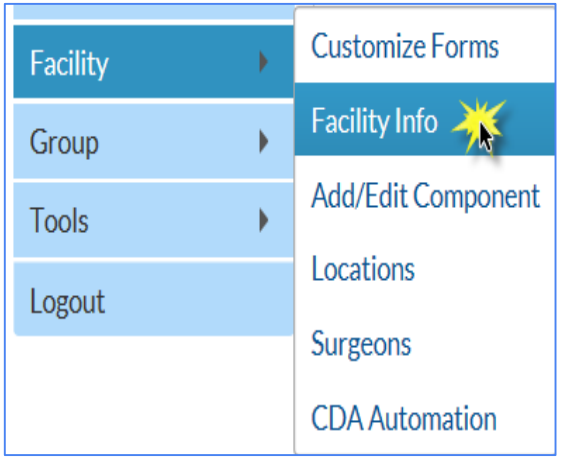
National Healthcare Safety Network
Line Listing for All Procedures

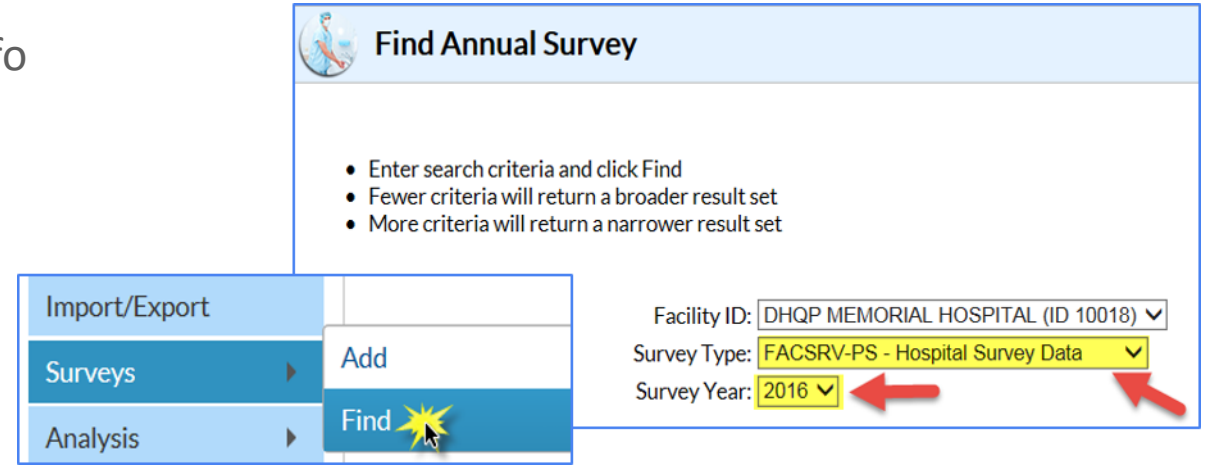
As of: February 27, 2017 at 1:16 PM
Date Range: PROCEDURES procDateYM 2016M03 to 2016M03

orgID	patID	dob	gender	procID	procDate	procCode	BMI_val	asa	ageAtProc	closure	diabetes	procDurationHr	procDurationMin
10018	DHQP100239	01/12/1967	M	58810	03/09/2016	COLO	41.210285	3	49	PRI	N	7	6
10018	DHQP100240	01/18/1951	F	58811	03/26/2016	COLO	44.410305	4	65	PRI	N	5	11

Checking Risk Factors in NHSN- Facility-level Data

- Checking SSI Data included in SIR
  - For facility level data found on annual survey
    - Survey→Find→
  - For facility level data found on facility enrollment page
    - Facility→Facility info





View Annual Survey

Mandatory fields marked with *

Facility ID: * DHQP MEMORIAL HOSPITAL (ID 10018)
Survey Type: * FACSRV-PS - Hospital Survey Data
Survey Year: * 2016

Facility Characteristics (completed by Infection Preventionist):
Facility ownership: * P - For Profit

Hospital Facility:
Number of Patient Days: * 15000
Number of Admissions: * 1000

Is your hospital a teaching hospital for physicians and/or physicians-in-training? * Y - Yes

If Yes, what type: * (•) MAJOR ( ) GRADUATE ( ) UNDERGRADUATE

Number of beds set up and staffed in the following location types (as defined by NHSN):

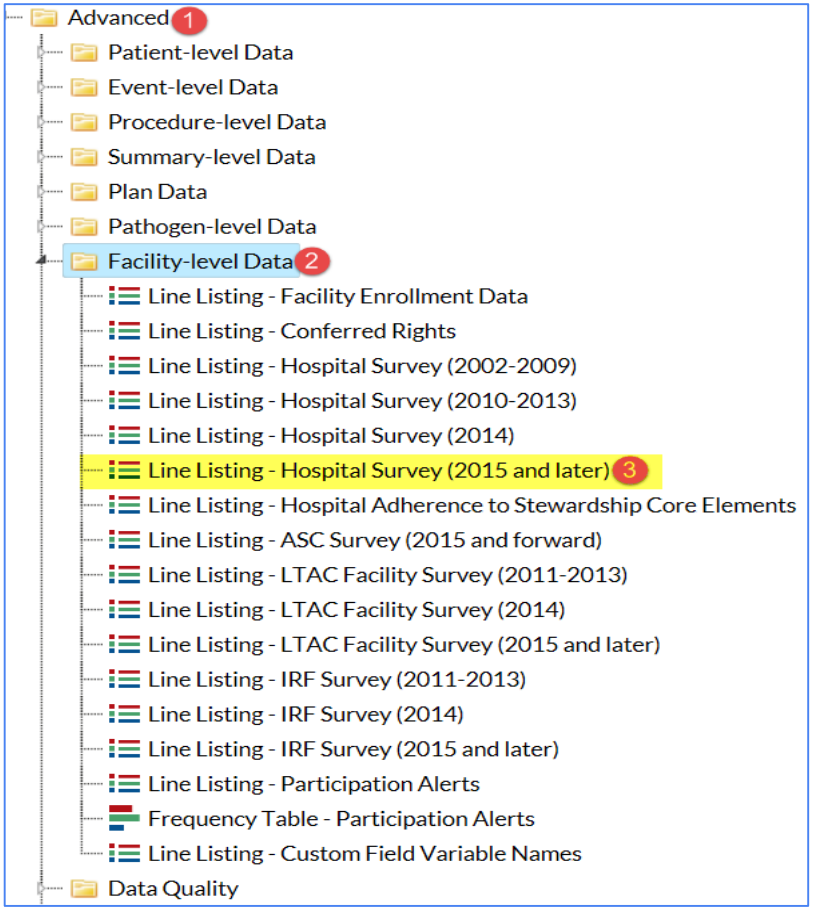
a. ICU beds (including adult, pediatric, and neonatal levels II/III and III): * 100

b. All other inpatient locations: * 300

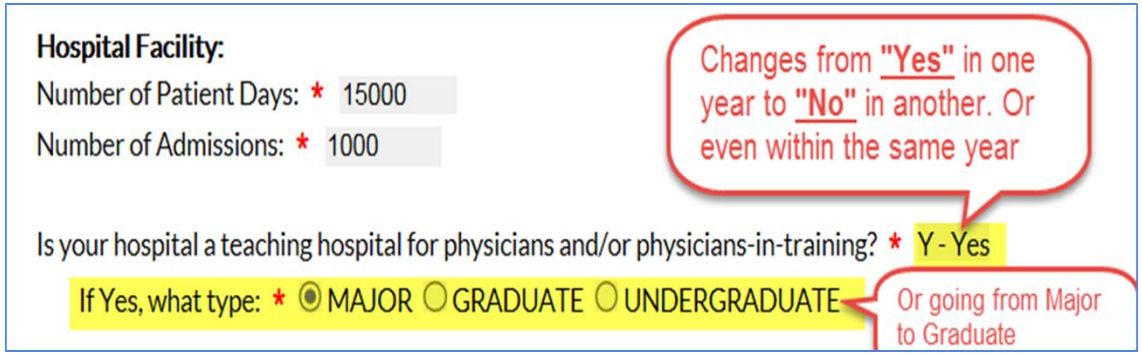
Total Number of Beds Set Up and Staffed: 400

Checking Risk Factors in NHSN- Facility Level Data

- Checking for facility level data including the number of beds, of medical school affiliation or enrollment information
- Analysis→Advanced→Facility-level Data→ Line Listing –Hospital Survey (2015 and later)
- Analysis→Advanced→Facility-level Data→ Line Listing –Facility Enrollment Data



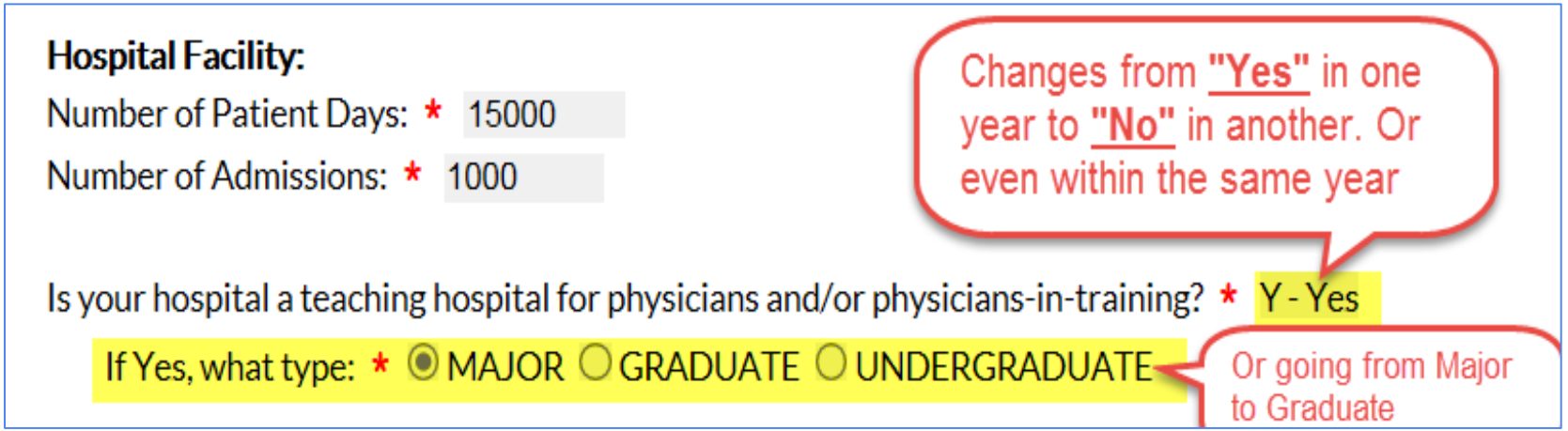
Question 3: My SIR will NOT change if I change from being a teaching hospital to a non teaching hospital.



A. True

✓B. False

Question 3: My SIR will NOT change if I change from being a teaching hospital to a non teaching hospital.



Answer is B. Rationale: Your SIR will be impacted if the model you are running uses the teaching hospital factor in the risk-adjustment and you make changes to that factor from one time period to the other

A. True

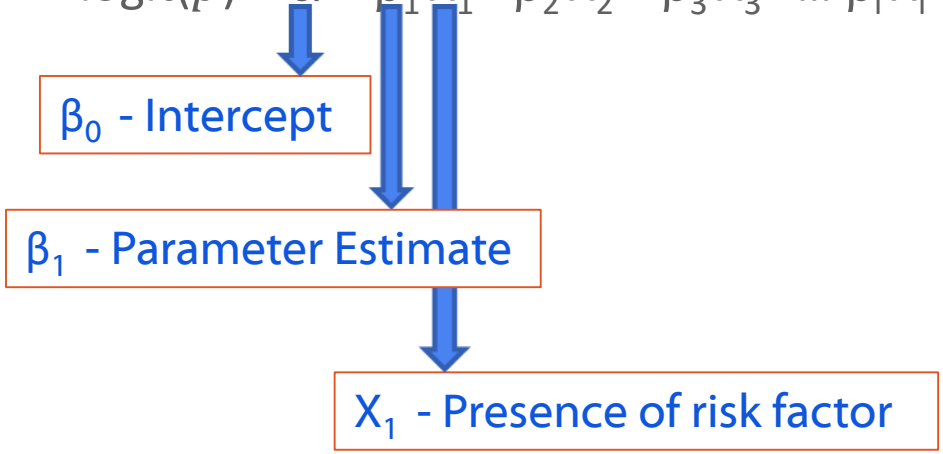
B. False

Now that we are familiar with the risk-adjusted models

How to Calculate the Procedure Risk: Number of Predicted Infections

Calculating the Procedure Risk: Number of Predicted Infections

- Calculated using Logistic Regression model*
- $\text{logit}(\hat{p}) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots \beta_i X_i$



Where α = intercept
β_i = parameter estimate
X_i = presence of risk factor
(For these risk factors, if present = 1; if not = 0)

- Let's review an example of how this is calculated…

*2015 Baseline: SIR Guide: https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf

Calculating the Procedure Risk: Number of Predicted Infections

- $\text{Logit}(\widehat{P}) = -5.1801 + -0.84056(1) + 0.3247(1) + 1.3242(1) + 0.1106(1) + 0.5474(0) = -4.26$

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

  $\hat{p} = e^{-4.26} / (1 + e^{-4.26}) =$ **0.014**

- **Conclusion:** Procedure risk for this patient is 0.014 or 1.4% risk for a deep incisional or organ/space infection following HYST surgery

HYST Surgery: Complex 30-day Risk Model to Predict SSI*		
Risk Factor	Parameter Estimate	Patient 1
Intercept	**-5.1801**	
Age10	-0.1501	56
Diabetes (Y)	0.3247	Y
ASA (1,2,3, 4/5)	0.4414	3
BMI ≥ 30	0.1106	31
Oncology Hospital	0.5474	N

*2015 Baseline: SIR Guide: https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf

Calculating the Procedure Risk: Number of Predicted Infections

- The NHSN SSI events are included in the numerator based on the date of procedure and not the date of event because the **procedure carries the risk for infection** and since the event is linked to the procedure, we are able to determine the relationship between surgery (exposure) and infection (outcome) that way.

*2015 Baseline: SIR Guide: https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf

Calculating the Procedure Risk: Number of Predicted Infections

- When you calculate the procedure risk for each patient within your summary time period and sum them, you get your number of predicted infections for that period

Patient	Age	Diabetes	ASA	BMI	Oncology Hospital	SSI	Probability of SSI ($\hat{p}$)
1	56	Y	3	31	N	0	0.014
2	45	N	2	28	N	0	0.007
.							
.							
200	52	N	2	32	N	1	0.006
Total						**Observed = 1**	**Number Predicted = 3.144**
SIR = Number of observed infections/Number of Predicted infections = 1/3.144 =0.31							

*2015 Baseline: SIR Guide: https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf

Question 4: How would you calculate the overall SIR from the procedure-specific SIRs

National Healthcare Safety Network
SIR for Adult All SSI Data by Procedure (2015 Baseline) - By OrgID/ProcCode
As of: February 14, 2017 at 2:26 PM
Date Range: BS2 SIR ADULTALLSSIPROC summaryYr 2015 to 2016

orgid=10018 CCN=12345 medType=M

orgid	proccode	months	procCount	infCountAdultAll	numPredAdultAll	SIRAll	SIRAll_pval	SIRAll95CI
10018	AAA	8	33	1	1.046	0.956	1.0000	0.048, 4.714
10018	AMP	8	9	0	0.472	.	.	
10018	APPY	5	7	0	0.137	.	.	
10018	AVSD	1	1	0	0.042	.	.	
10018	BILI	4	6	1	1.607	0.622	0.7233	0.031, 3.069
10018	BRST	4	5	0	0.158	.	.	
10018	CARD	10	17	2	0.304	.	.	
10018	CEA	4	4	0	0.039	.	.	
10018	CHOL	3	4	0	0.042	.	.	
10018	COLO	9	37	1	2.645	0.378	0.3297	0.019, 1.864

A. By taking a sum of all the procedure-specific SIRs

✓ B. By dividing the sum of the procedure-specific observed infections by the sum of the procedure-specific expected infections

C. By taking an average of the procedure-specific SIRs

D. None of the above

Question 4: How would you calculate the overall SIR from the procedure-specific SIRs

National Healthcare Safety Network
SIR for Adult All SSI Data by Procedure (2015 Baseline) - By OrgID/ProcCode
As of: February 14, 2017 at 2:26 PM
Date Range: BS2 SIR ADULTALLSSIPROC summaryYr 2015 to 2016

orgid=10018 CCN=12345 medType=M

orgid	proccode	months	procCount	infCountAdultAll	numPredAdultAll	SIRAll	SIRAll_pval	SIRAll95CI
10018	AAA	8	33	1	1.046	0.956	1.0000	0.048, 4.714
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Answer is B.

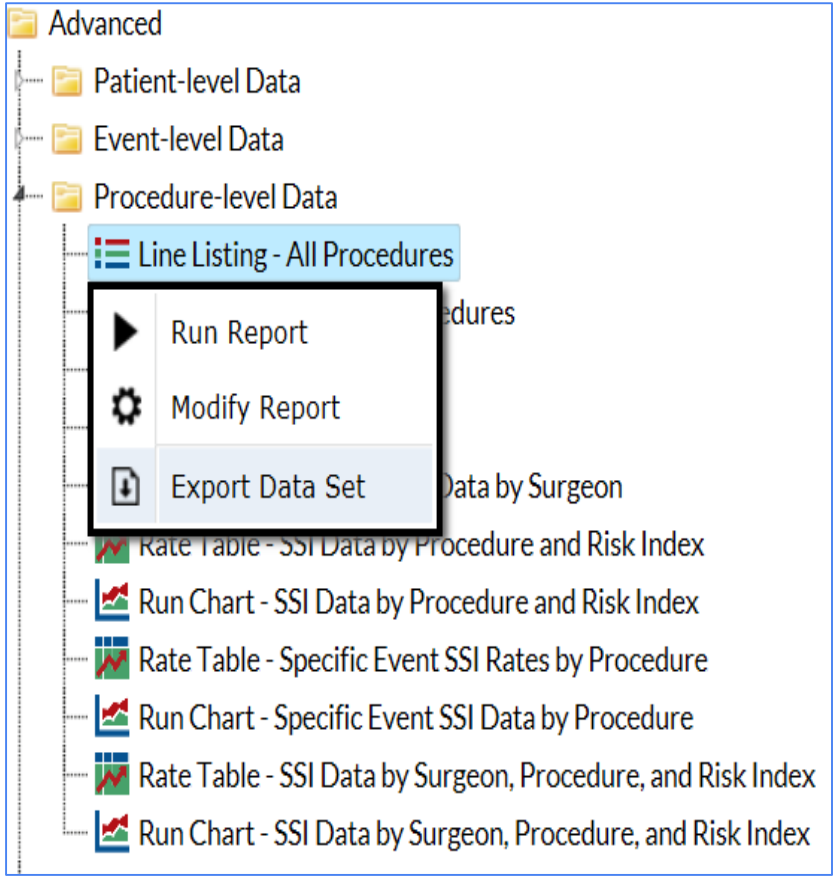
A. By taking a sum of all the procedure-specific SIRs

B. By dividing the sum of the procedure-specific observed infections by the sum of the procedure-specific expected infections

C. By taking an average of the procedure-specific SIRs

D. None of the above

Calculating the Procedure Risk in NHSN



The procedure risk calculated for each patient for the Complex -30-day (CMS) model

The procedure risk calculated for each patient for the All SSI Adult model

The procedure risk calculated for each patient for the Complex AR Adult model

bs2_modelRiskComplex30d	bs2_modelRiskAdultAll	bs2_modelRiskAdultCmpx
0.015	0.0285	0.017
0.0241	0.0385	0.0252
0.007	0.0031	0.0027
0.089	0.0075	0.0016
0.0241	0.0385	0.0134
0.0241	0.0385	0.115

Explain how to interpret and use SIRs under the current risk adjustment

Lets Use an Example

- Your facility wants to examine how your 2016Q1 SIRs have changed (under the “New” baseline)
- You are primarily interested in COLO and HYST
- So you decide to use the CMS report
- What do you do? Where do you start
  - Begin by generating the SIR reports under each baseline
  - Then identify and explain the differences between the SIR data elements
- How can NHSN support your process?

Generating SIRs in NHSN: SSI SIRs under BS1 and BS2

National Healthcare Safety Network
SIR for Complex 30-Day SSI Data for CMS IPPS by Procedure (2006-2008 Baseline) - By OrgID/ProcCode
As of: March 10, 2017 at 11:29 AM
Date Range: BS1_SIR_COMPLEX30DSSIPROC summaryYQ 2016Q1 to 2016Q1

orgid=10018 CCN=12345

orgid	procCount	summaryYQ	infCountComplex30d	numExpComplex30d	SIRComplex30d	30d_pval	SIRComplex30d95CI
10018	461	2016Q1	1	14.448	0.069	0.000	0.003, 0.341
10018	2	2016Q1	0	0.021	.	.	

Includes in-plan, inpatient COLO and HYST procedures in patients >=18 years of age.
Includes SSIs with an event date within 30 days of the procedure date.
Excludes all Superficial Incisional SSIs and Deep Incisional Secondary (DIS
Includes only procedures and associated SSIs that are reported with primar
Lower bound of 95% Confidence Interval only calculated if infCount > 0. SIR
Source of aggregate data: 2006-2008 NHSN SSI Data
Data contained in thisreport were last generated on March 10, 2017 at 11:00 AM.

National Healthcare Safety Network
SIR for Complex 30-Day SSI Data for Hospital IQR by Procedure (2015 Baseline) - By OrgID/ProcCode
As of: March 10, 2017 at 11:43 AM
Date Range: BS2_SIR_CMPX30DSSIPROC summaryYQ 2016Q1 to 2016Q1

orgid=10018 CCN=12345 medType=M

orgid	pr	procCount	summaryYQ	infCountComplex30d	numPredComplex30d	SIRComplex30d	plex30d_pval	SIRComplex30d95CI
10018	C	463	2016Q1	1	11.216	0.089	0.000	0.004, 0.440
10018	H	3	2016Q1	0	0.033	.	.	

1. Includes in-plan, inpatient COLO and HYST procedures in patients >=18 years of age.
2. The SIR is only calculated if numPred is >= 1. Lower bound of 95% Confidence Interval only calculated if infCount > 0.
3. The number of predicted events is calculated based on 2015 national aggregate data. COLOs are risk adjusted for gender, age, ASA, BMI, diabetes, closure, and HOSP-ONC. HYSTs are risk adjusted for age, ASA, BMI and HOSP-ONC.
4. Includes SSIs with an event date within 30 days of the procedure date.
5. Excludes all Superficial Incisional SSIs and Deep Incisional Secondary (DIS) SSIs.
6. Excludes SSIs reported as "present at time of surgery" (PATOS).
7. Includes procedures and associated SSIs that are reported with either primary or other than primary closure techniques.

Source of aggregate data: 2015 NHSN SSI Data
Data contained in thisreport were last generated on March 10, 2017 at 11:00 AM.

Identify and Explain Differences in SIR Data Elements

- The difference in the aggregate data will impact the SIRs from one baseline to the other
- The difference incidence of infection (events) between the 2 baseline years also impact the SIR
- For SSIs, the differences in factors included in the predictive models for the two risk-adjusted baselines can account for the differences in SIRs
  - **2006-2008: Age and ASA for COLO and HYST**
  - **2015: Age, ASA score, gender, BMI, closure technique, cancer hospital, diabetes**
- Differences in inclusion and exclusion criteria could also impact the difference in the data in the SIR tables

2006-2008 baseline: Mu Y et al. Infect Control Hosp Epidemiol 2011;32(10):970-986

2015 Baseline: SIR Guide: https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf

Differences in SIR Report/Output Features

- Report modification page is different: Modifications (including optional steps) are organized by tabs: https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/howtomodifyreport.pdf

- Report titles are different by baseline
  - The baseline year is included in the title

- New Footnotes (changes in content and format)
  - The new baseline footnotes are ordered chronologically, numbered and colored. The footnotes mimic a pattern, across HAIs

Another Example of New SIR: Complex 30-Day SSI SIR

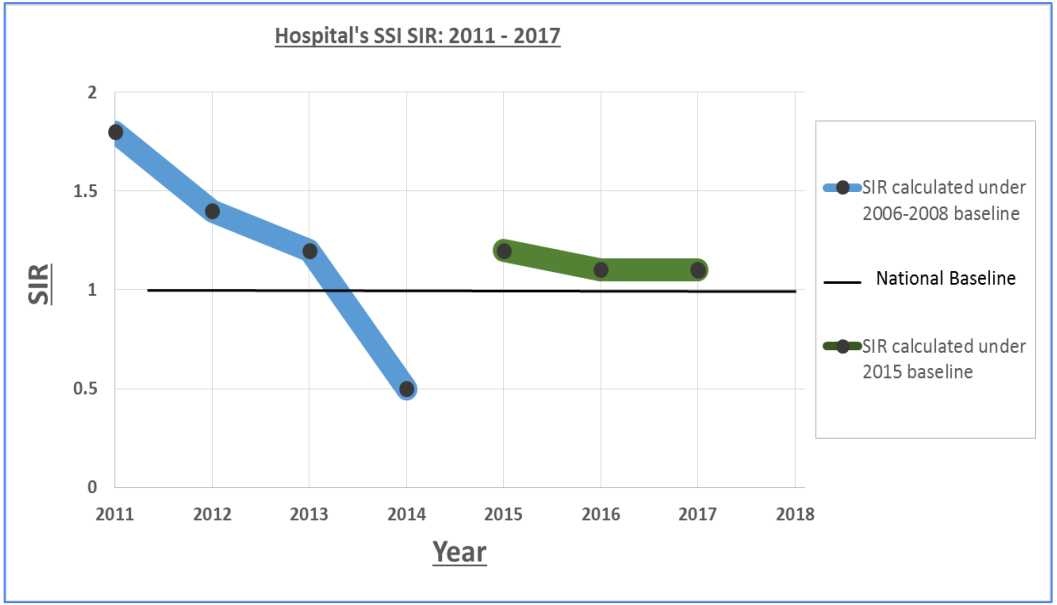
orgid	proccode	procCount	infCountComplex30d	numPredComplex30d	SIRComplex30d	SIRComplex30d_pval	SIRComplex30d95CI
10018	COLO	928	4	22.386	0.179	0.000	0.057, 0.431
10018	HYST	17	4	0.161	.	.	

- 928 of COLO procedures performed in 2015 are included in the SIR, with 4 SSI events. For the time period, and the procedures specified, we predicted that this facility will have over 22 infections
  - Predictive model based on facility level data and patient level data
- 17 of HYST procedures performed in 2015 are included in the SIR, with 4 SSI events. For the time period, and the procedures specified, we predicted that this facility will have less than 1 infection
- Based on statistical evidence, we can conclude that our COLO SIR of 0.179 (with a p-value of 0.000) is different from 1.
- An SIR is not calculated for HYST because the minimum precision criterion (MPC) is not met (i.e., the predicted number of infections is <1)

How do I Present and Interpret my SIR?

- Data can be presented graphically
  - Bar charts
  - *Run charts
  - *When you present multiple time periods of SIR data in a continuous line graph, please make sure you are using the same baseline for each time period. Otherwise, please separate the data points on the graph by baseline year*

Example of displaying SIRs using 2 different baselines on the same graph



*Charts are not available in NHSN. Data should be exported and graphical output created in excel

How do I Present and Interpret my SIR?

- When you interpret the SIR
  - How many SSIs?
  - Over what period of time?
  - SIRs
- Interpret the statistical results
  - What is the p-value and what does it mean?
  - What is the 95% CI and how is it applied?

*Charts are not available in NHSN. Data should be exported and graphical output created in excel

Question 5: In this output, we can ignore the HYST data because there is no SIR.

National Healthcare Safety Network

SIR for Complex 30-Day SSI Data for Hospital IQR by Procedure (2015 Baseline) - By OrgID/ProcCode

As of: February 14, 2017 at 1:52 PM

Date Range: BS2_SIR_CMPX30DSSIPROC summaryYr 2016 to 2016

orgid=10018 CCN=12345 medType=' '

orgid	proccode	procCount	summaryYr	infCountComplex30d	numPredComplex30d	SIRComplex30d	SIRComplex30d_pval	SIRComplex30d95CI
10018	COLO	464	2016	2	11.263	0.178	0.001	0.030, 0.587
10018	HYST	8	2016	2	0.077	.	.	

A. True

✓ B. False

Question 5: In this output, we can ignore the HYST data because there is no SIR.

National Healthcare Safety Network
SIR for Complex 30-Day SSI Data for Hospital IQR by Procedure (2015 Baseline) - By OrgID/ProcCode
As of: February 14, 2017 at 1:52 PM
Date Range: BS2_SIR_CMPX30DSSIPROC summaryYr 2016 to 2016

orgid=10018 CCN=12345 medType=' '

orgid	proccode	procCount	summaryYr	infCountComplex30d	numPredComplex30d	SIRComplex30d	SIRComplex30d_pval	SIRComplex30d95CI
10018	COLO	464	2016	2	11.263	0.178	0.001	0.030, 0.587
10018	HYST	8	2016	2	0.077	.	.	

Rationale: Even though an SIR is not calculated due to the MPC, it is still important to note that as long as exposure is present, the risk of infection is present. According to this output, there are 2 observed infections even though there are no predicted infections. This means that, we have to be vigilant about the steps to take to prevent any potential infections. Moreover, there are data in this table that could be used to review data entered for the summarized time period.

A. True
B. False

Question 6: What does the procedure count field represent? This is the column called procCount located in SIR tables

National Healthcare Safety Network
SIR for Complex 30-Day SSI Data for Hospital IQR by Procedure (2015 Baseline) - By OrgID/ProcCode
As of: March 15, 2017 at 7:42 PM
Date Range: BS2_SIR_CMPX30DSSIPROC summaryYr 2016 to 2016

orgid=10018 CCN=12345 medType=M

orgid	proccode	procCount	fCountComplex30d	numPredComplex30d	SIRComplex30d	SIRComplex30d_pval	SIRComplex30d95CI
10018	COLO	470	3	11.424	0.263	0.004	0.067, 0.715
10018	HYST	17	3	0.135	.	.	

A. The total number of procedures performed within the time period

B. The number of procedures contributing to the calculation of the number of predicted infections

C. The number of in-plan, inpatient procedures in adults 18 years and older

Question 6: What is included in the procedure count? This is the column called procCount located in SIR tables.

National Healthcare Safety Network
SIR for Complex 30-Day SSI Data for Hospital IQR by Procedure (2015 Baseline) - By OrgID/ProcCode
As of: March 15, 2017 at 7:42 PM
Date Range: BS2_SIR_CMPX30DSSIPROC summaryYr 2016 to 2016

orgid=10018 CCN=12345 medType=M

orgid	proccode	procCount	fCountComplex30d	numPredComplex30d	SIRComplex30d	SIRComplex30d_pval	SIRComplex30d95CI
10018	COLO	470	3	11.424	0.263	0.004	0.067, 0.715
10018	HYST	17	3	0.135	.	.	

Answer is B. Rationale: The procedure count field is a subset of all procedures reported by the facility.

This is the number of procedures that contribute to the number of predicted infections.

This number could be different for each model due model-specific inclusion criteria

A. The total number of procedures performed within the time period

B. The number of procedures contributing to the calculation of the number of predicted infections

C. The number of in-plan, inpatient procedures in adults 18 years and older

Discuss techniques for ensuring SIR data quality and troubleshooting analysis reports

Ensuring SSI SIR Data Quality

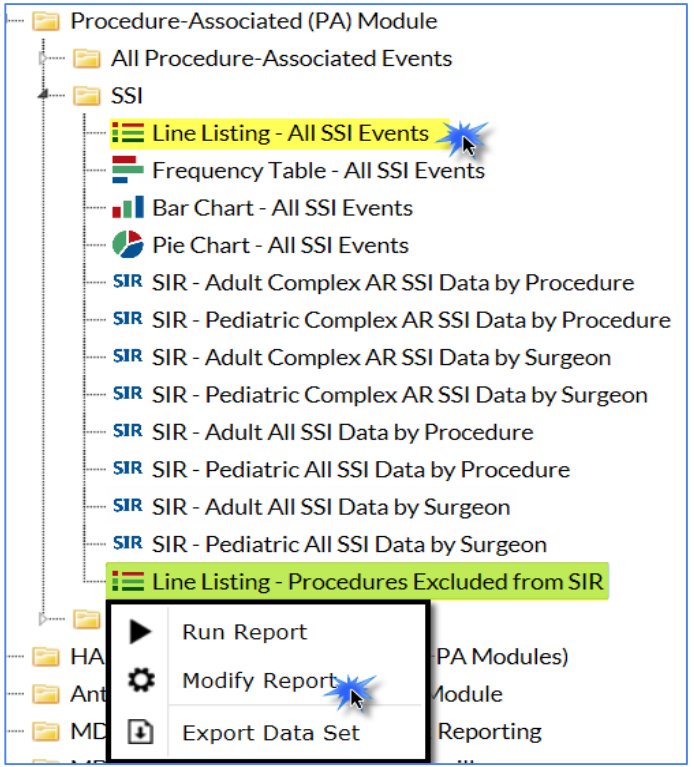
- Follow NHSN protocol closely for SSIs
- Check your annual surveys.
  - Be aware of changes you have reported from year to year
- Check your Monthly reporting plans
  - Make sure procedure categories are included
  - “Off Plan” data have fewer requirements for completion – could lead to missing data fields/variables
- Enter and check denominator and numerator data
- Resolve alerts
- Generate datasets
- Running analysis reports to check data
  - Line list and frequency reports

How Data Quality Impacts SSI SIR

- Your SSI SIR is impacted if data is collected and entered incorrectly
  - Facility-level data (e.g., facility bed size, medical school affiliation, facility type)
  - Patient-level data (e.g., procedure duration, patient height, weight, setting in which procedure is performed)
- Because these data are used in the predictive model, any inaccuracy could be reflected in the predictive model
- The inaccuracy may be subtle
- Others may be more pronounced
  - Adding/editing/deleting events
  - Addressing alerts or failing to do so
  - Monthly reporting plan or the lack there of

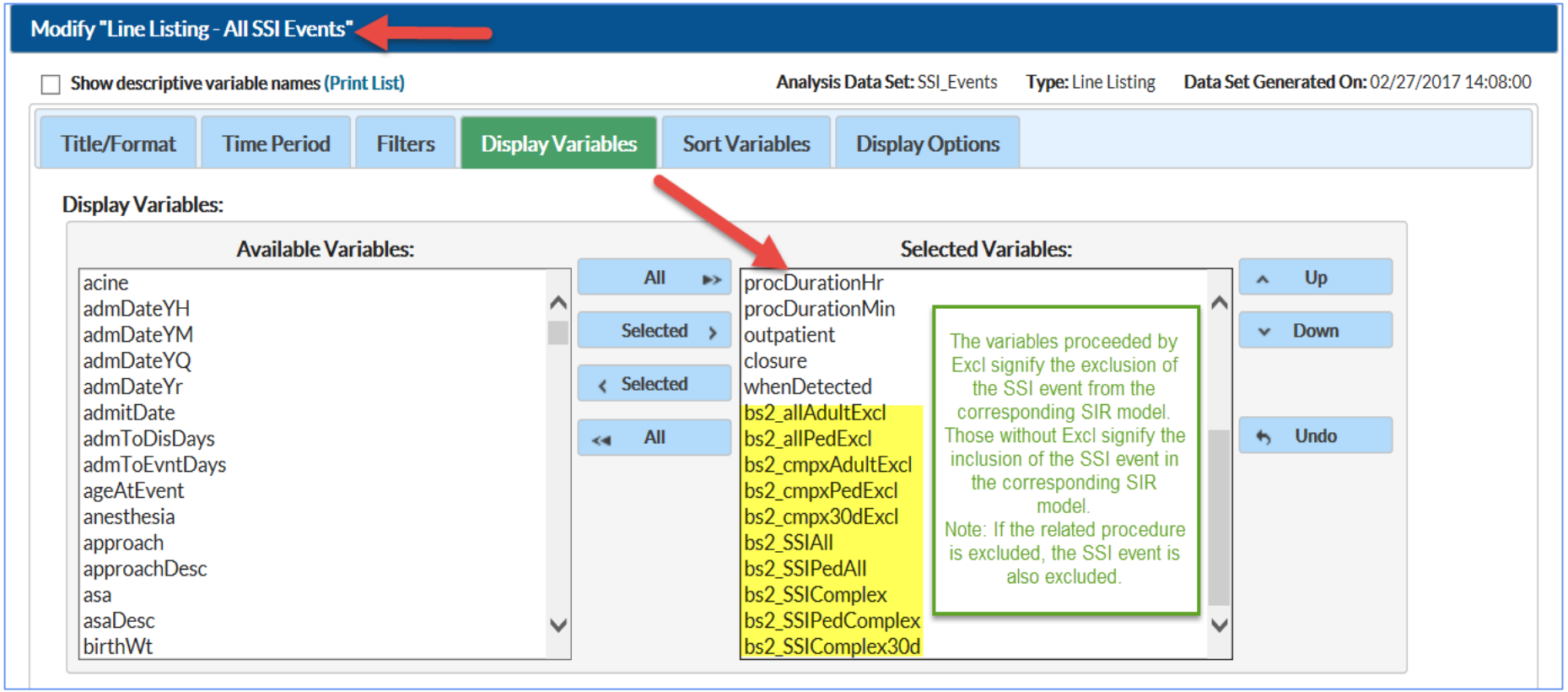
Running Analysis Reports in NHSN

- The process followed to troubleshoot your SSI SIR remains the same
- Existing reports improved to facilitate the troubleshooting process
  - Line Listing- Procedures Excluded from SIR
  - Line Listing- All SSI Events
  - Line Listing- All Procedures
- New variables
  - Indicator variables for SSI events
  - Exclusion variables for procedures
- New naming convention for analysis datasets
  - Datasets are prefixed with “bs1” or “bs2”
    - BS1: original baseline
    - BS2: new baseline



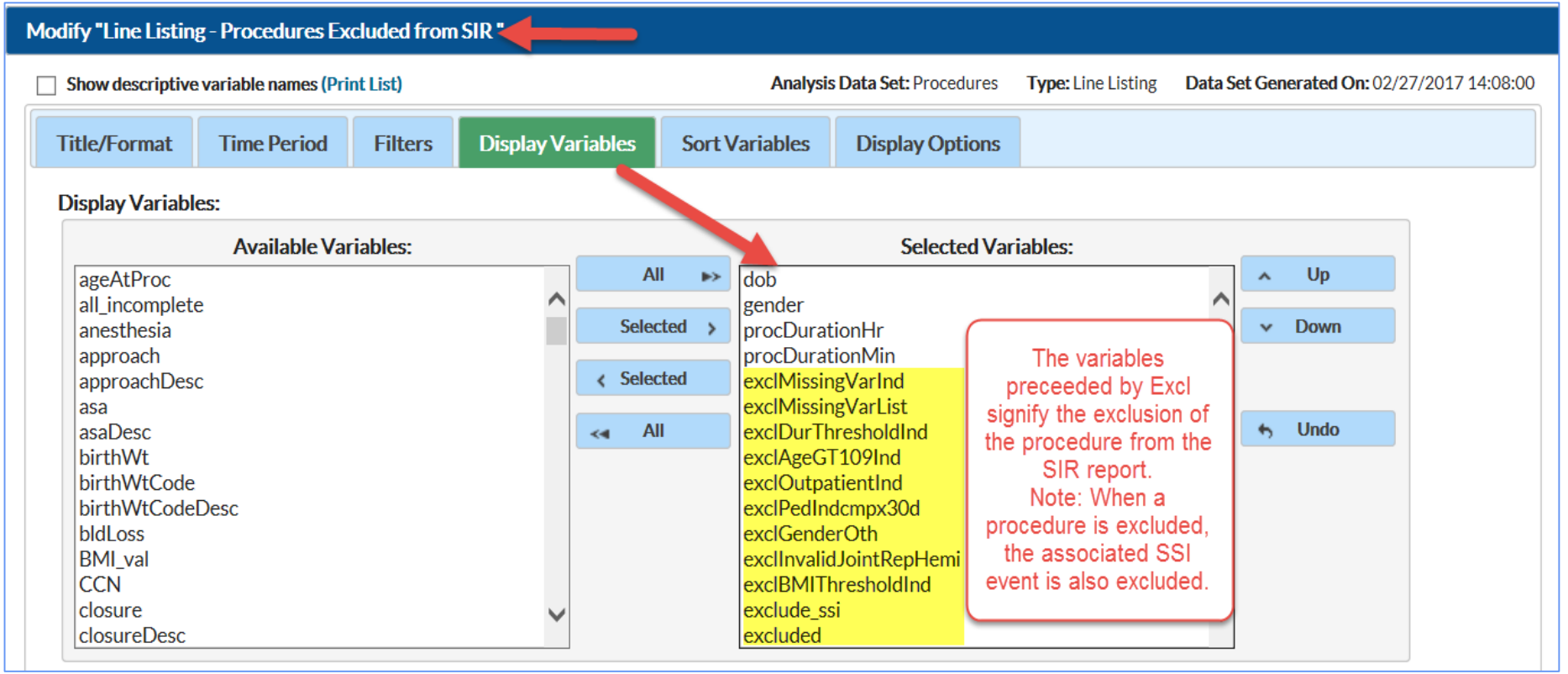
https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/line-list-procedures-excluded-sir.pdf

SSI Event Line Listing (BS2 Baseline)



https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/ssi-events-line-list-qrg.pdf

Line Listing for Procedures Excluded from SSI SIR (BS2 Baseline)



https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/line-list-procedures-excluded-sir.pdf

Line Listing for Procedures Excluded from SSI SIR (BS2 Baseline)

National Healthcare Safety Network

Line Listing for Procedures Excluded from SSI SIR (2015 Baseline)

As of: March 10, 2017 at 12:02 PM

Date Range: PROCEDURES procDateYQ 2016Q1 to 2016Q1

orgID	procCode	procDate	procDurationHr	procDurationMin	exclMissingVarInd	exclMissir	exclDurThresholdInd	exclAgeGT109Ind	exclOutpatientInd	exclPedIndcmpx30d	exclGenderOth	dJointRepHemi	exclBMIThresholdInd
10018	HYST	02/17/2016	0	11	N		N	N	Y	N	N		N
10018	CSEC	03/15/2016	6	15	N		Y	N	N	N	N		N
10018	HPRO	02/06/2016	4	6	N		N	N	Y	N	N		N
10018	COLO	02/10/2016	12	15	N		Y	N	Y	N	N		N
10018	AMP	02/15/2016	6	20	N		..	..	..	..	..		N
10018	AMP	03/30/2016	4	53	N		N	N	N	Y	N	N	N
10018	AMP	01/08/2016	2	56	N		N	N	N	Y	N	N	N
10018	APPY	01/17/2016	1	37	N		N	N	N	Y	N	N	Y
10018	COLO	01/16/2016	3	16	N		N	N	Y	N	N	N	Y
10018	COLO	03/09/2016	7	6	N		N	N	Y	N	N	N	N
10018	CSEC	03/06/2016	2	41	Y	labor	N	N	N	N	N	N	N

https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/line-list-procedures-excluded-sir.pdf

Line Listing for Procedures Excluded from SSI SIR (BS2 Baseline)

National Healthcare Safety Network
Line Listing for Procedures Excluded from SSI SIR (2015 Baseline)
As of: February 27, 2017 at 8:33 PM
Date Range: PROCEDURES procDateYQ 2016Q1 to 2016Q1

orgID	procID	procCode	procDate	exclude_ssi	excluded	bs2_allAdultExcl	bs2_allPedExcl	bs2_cmpx30dExcl	bs2_cmpxAdultExcl	bs2_cmpxPedExcl
10018	57151	HYST	02/17/2016	N	Y	1	1	1	1	1
10018	57568	CSEC	03/15/2016	Y	Y	1	1	1	1	1
10018	57580	HPRO	02/06/2016	N	Y	1	1	1	1	1
10018	58216	COLO	02/10/2016	Y	Y	1	1	1	1	1
10018	58556	AMP	02/15/2016	Y	Y	1	1	1	1	1
10018	58645	AMP	03/30/2016	N	Y	1	1	1	1	1
10018	58646	AMP	01/08/2016	N	Y	1	1	1	1	1
10018	58669	APPY	01/17/2016	N	Y	1	1	1	1	1
10018	58806	COLO	01/16/2016	N	Y	1	1	1	1	1
10018	58810	COLO	03/09/2016	N	Y	1	1	1	1	1

Defining Procedure Exclusion Variables

Variable Names	Definition **Procedure is excluded because one or more of the following is true: =Y (for Yes)**
exclMissingVarInd	Missing a variable required for the risk adjustment of the SIR
exclMissingVarList	If missing variables
exclDurThresholdInd	The procedure duration is greater than the duration cut off point
exclAgeGT109Ind	The patient was older than 109 years old at the time of surgery
exclOutpatientInd	The procedure is an outpatient procedure
exclPedIndcmpx30d	Procedure is a pediatric procedure and excluded from the CMS model
exclGenderOth	The patient's gender was reported as “Other”
exclInvalidJointRepHemi	The value set for 2015 data entered for KPRO and HPRO as JointRepHemi is invalid
exclBMIThresholdInd	The patient's BMI is less than 12 or greater than 60

Defining Procedure Exclusion Variables-Per SSI Models

Variable Name	Definition Procedure is excluded from the specified model (if value is set to 1)
bs2_allAdultExcl	Procedure is excluded from the All Adult SSI SIR model
bs2_allPedsExcl	Procedure is excluded from the All Pediatric SSI SIR model
bs2_cmpxAdultExcl	Procedure is excluded from the Complex AR Adult SSI SIR model
bs2_cmpxPedExcl	Procedure is excluded from the Complex AR Pediatric SSI SIR model
bs2_cmpx30dExcl	Procedure is excluded from the Complex 30-daySSI SIR model

Line Listing for SSI Events Indicator (BS2 Baseline)

National Healthcare Safety Network
Line Listing for All Surgical Site Infection Events
As of: February 28, 2017 at 12:50 PM
Date Range: SSI_EVENTS procDateYQ 2016Q1 to 2016Q1

orgID	patID	eventType	spcEvent	procDate	procCode	ageAtProc	outpatient	closure	bs2_SSIAll	bs2_SSIpedAll	bs2_SSIComplex	bs2_SSIPedComplex	bs2_SSIComplex30d
10018	SLJ4311	SSI	CARD	01/10/2016	CBGC	.	N		0	0	0	0	0
10018	1234	SSI	CARD	01/12/2016	CARD	.	N		0	0	0	0	0
10018	3737	SSI	BRST	01/12/2016	BRST	.	N		0	0	0	0	0
10018	00-00-000	SSI	DIP	01/06/2016	COLO	44	N	PRI	1	0	0	0	1
10018	12345	SSI	IC	02/09/2016	PAOTH	.	N	PRI	0	0	0	0	0
10018	PRO123	SSI	OREP	02/17/2016	HYST	36	Y	PRI	0	0	0	0	0
10018	123	SSI	DIP	03/16/2016	KPRO	36	N	PRI	1	0	0	0	0
10018	SLJ4311	SSI	CARD	01/10/2016	CBGC	43	N	PRI	0	0	0	0	0

1. Please review the Quick Reference Guide related to the new SSI Indicator Variables (URL) for more information on determining which SSIs are included in the SIRs.

Data contained in thisreport were last generated on February 27, 2017 at 2:08 PM.

https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/ssi-events-line-list-qrg.pdf

Defining SSI Event Indicator Variables

Variable Name	Definition Procedure is included in the specified model (if value is set to 1)
bs2_AllSSI	Included in All Adult SSI SIR model
bs2_SSIPedAll	Included in All Pediatric SSI SIR model
bs2_SSIComplex	Included in Complex AR Adult SSI SIR model
bs2_SSIPedComplex	Included in Complex AR Pediatric SSI SIR model
bs2_SSIComplex30d	Included in Complex 30-daySSI SIR model

In Summary…

- The SIR is a summary measure of the SSI events resulting from inpatient surgeries performed in a facility
- While the factors included in the risk-adjusted models have been updated, the predictive model still uses logistic regression to calculate the number of predicted infections.
- The factors included in the calculation have been updated
- The inclusion and exclusion criteria for the SSI SIR numerator and denominator have also been updated
  - Review the document on how to run and interpret the Line listing-Procedures Excluded from SIR
  - Review the document on SSI event indicator variables
- Become familiar with how 2015 baseline changes have impacted your SSI SIR by running the reports and utilizing the resources available on our website

Resources

- **SIR Guide**
  - https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf
- **NHSN Rebaseline Website**
  - Updated information about what to expect with the upcoming rebaseline (FAQ documents, training videos, timelines, and definitions)
  - http://www.cdc.gov/nhsn/2015rebaseline/index.html
- **NHSN Rebaseline Webinar, Part 1**
  - http://streaming.cdc.gov/vod.php?id=6c0af6b3c0105fd24878aafe5065005920161101143220038
- **NHSN Rebaseline Webinar, Part 2**
  - http://streaming.cdc.gov/vod.php?id=d70a9530465cff71217a074bee5f015f20161212144652863
- **Analysis Resource Documents and Guidelines:** Being updated at present and are either available now or will be by the time of release

Resources

- How to modify report
  - https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/howtomodifyreport.pdf
- Troubleshooting Guides
  - **https://www.cdc.gov/nhsn/PS-Analysis-resources/reference-guides.html**
- Detailed Guides for Specific Analysis Options
  - **https://www.cdc.gov/nhsn/PS-Analysis-resources/reference-guides.html**
  - **https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/line-list-procedures-excluded-sir.pdf**
  - **https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/ssi-events-line-list-qrg.pdf**

Thank You!

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