The NHSN Re-baseline in Depth

Maggie Dudeck, MPH

Lead – NHSN Methods and Analytics Team

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Let’s get all our ducks in a row!

Objectives

- Interpret SIRs for multiple HAIs within a facility
- Understand how to use additional reports in NHSN to complement SIR data
- Demonstrate how to analyze changes in HAI incidence between two time periods

Checking in…How are you feeling about NHSN Analysis so far?

A. GREAT!! I consider myself a “know it all” by now!

B. Pretty good…but I could use more information about the new models.

C. Ummm – ok, I guess?

D. HELP!

What we've learned so far

- History and overarching methods for the new 2015 baseline and risk-adjustment
- Introduction to running our data in NHSN and how to customize some reports
- Interpretation of statistical measures, like p-values and 95% CIs
- How to run and interpret TAP reports
- Highlights of device-associated SIRs and risk-adjustment

What's still to come…

- Highlights of the SSI SIRs, including new methods to check for inclusions and exclusions of SSIs and procedures
- Details of the LabID SIRs and highlights of the new models
- Bringing it all together for your facility, including rates, SIRs, and graphical display of data

Our Hospital for Today

- 400-bed, major teaching acute care hospital
  - 100 ICU beds
  - 300 non-ICU inpatient beds
  - Includes a CMS-certified Inpatient Rehabilitation Facility (IRF) unit
- 1 ED, 1 Observation Unit

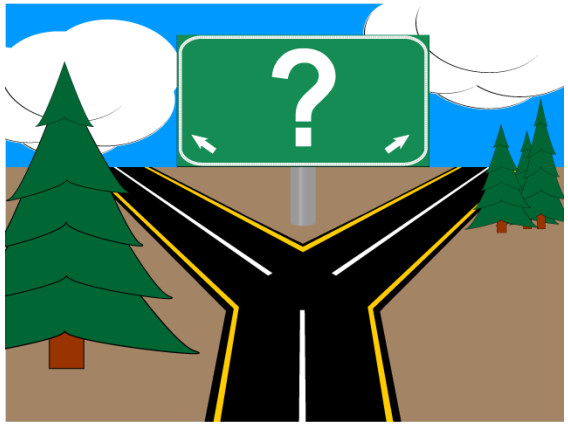
Fictitious data used for illustrative purposes only.

Annual Review

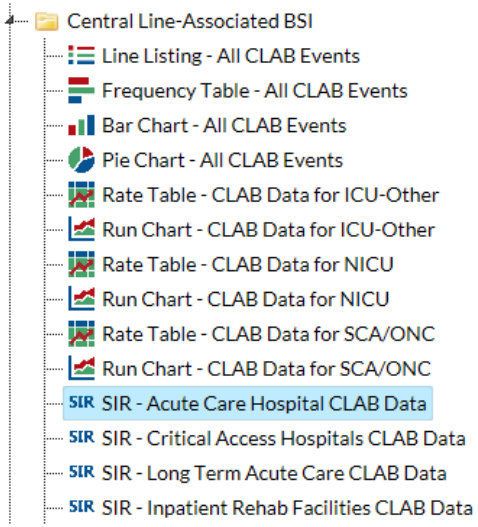
- You and your colleagues have completed HAI data entry for 2016 and you are preparing an annual report for your hospital leadership
- Given that the 2015 baseline provides improved risk-adjustment and a more contemporary comparison, you opt to use the 2015 baseline for your SIR calculations.
- In addition to providing a summary of 2016, you've been asked to summarize the HAI experience for your hospital over the past 3 years (2014-2016).
- You will also be asked to suggest areas of prioritization of additional prevention efforts moving forward.

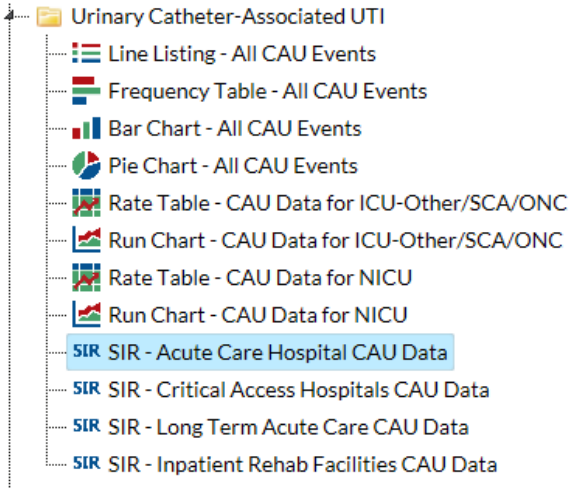
Where to begin?

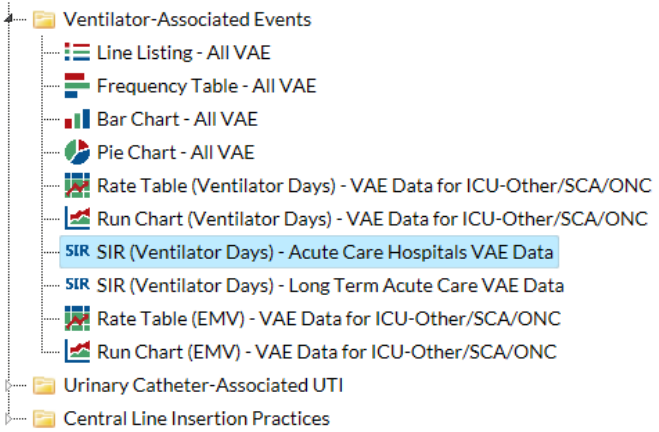
- First, let's make some assumptions about our scenario:
  - Your team regularly analyzes data throughout the year to address issues in a more timely manner (i.e., no surprises!)
  - Your hospital reports the following data into NHSN:
    - CLABSI (medICU, SurgICU, Mixed Acuity)
    - CAUTI (same locs as CLABSI)
    - VAE (beginning July 2016, medICU, SurgICU)
    - MRSA and CDI LabID
    - SSIs for COLO, HYST, KPRO, and HPRO
- Second, let's run the 2016 Annual SIRs for each HAI



Obtaining SIRs from NHSN – Acute Care – Option 1:

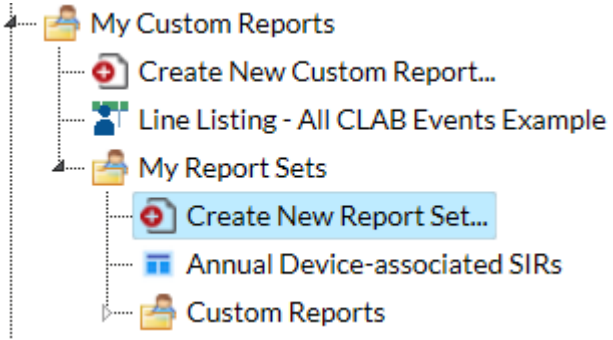


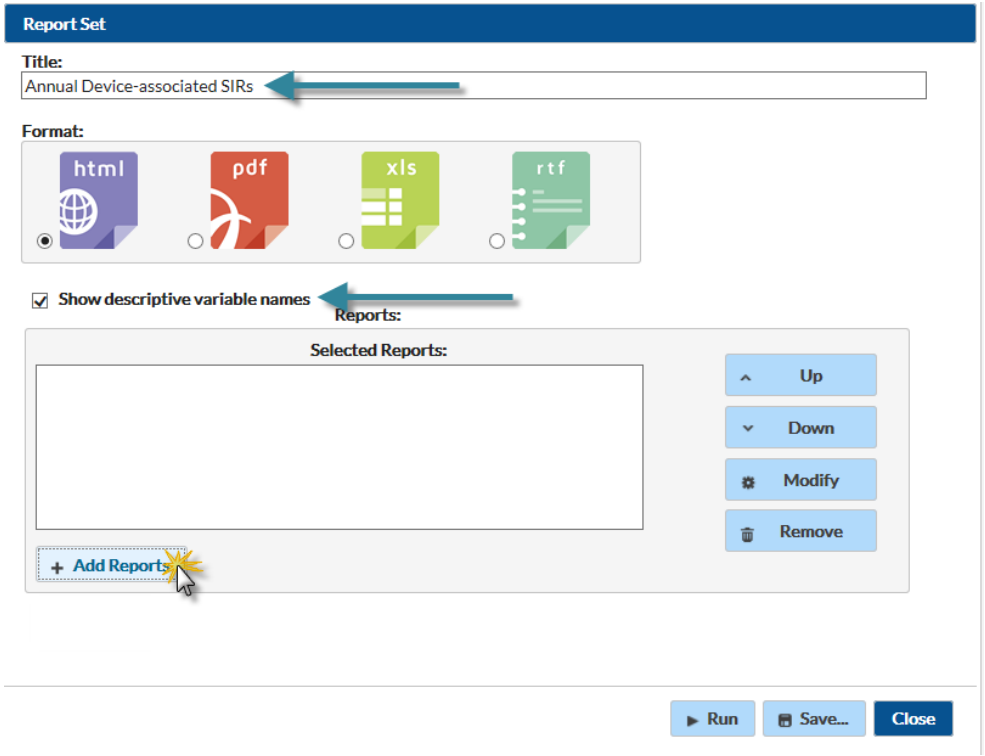




Obtaining SIRs from NHSN – Option 2

- Create a Report Set!
  - Allows you to run multiple reports at one time
- In this example, I used custom reports that I already created.





Create a Report Set

Use the Search features to search by report name or dataset name!

Available Reports

	Report Name	Data Set	Custom	Published	Modi
	SIR x	x			
☑	Annual CAUTI SIR	bs2_CAU_RatesICU_SCA	Y	N	03/10/2017
☑	Annual CLABSI SIR	bs2_CLAB_RatesICU	Y	N	03/10/2017
☑	Annual VAE SIR	bs2_VAE_RatesICU_SCA	Y	N	03/10/2017
☐	CR 536 Verification (CLABSI SIR for IPPS)	bs2_CLAB_RatesICU	Y	Y	10/14/2016
☐	LA Feb 2013SIR - All SSI Data by Procedure	bs1_SIR_AllSSIProc	Y	Y	04/21/2015
☐	Line Listing - Procedures Excluded from SIR	Procedures	N	N	03/06/2017
☐	Line Listing - Procedures Excluded from SSI SIR	Procedures	N	N	03/06/2017
☐	SIR (Ventilator Days) - Acute Care Hospitals VAE Data	bs2_VAE_RatesICU_SCA	N	N	03/06/2017
☐	SIR (Ventilator Days) - Long Term Acute Care VAE Data	bs2_VAE_RatesLTAC	N	N	03/06/2017
☐	SIR - ACH CDI FacwideIN LabID Data	bs2_LABID_RatesCDIF	N	N	03/06/2017
☐	SIR - ACH MRSA Blood FacwideIN LabID Data	bs2_LABID_RatesMRSA	N	N	03/06/2017
☐	SIR - Acute Care Hospital CAU Data	bs2_CAU_RatesICU_SCA	N	N	03/06/2017
☐	SIR - Acute Care Hospital CLAB Data	bs2_CLAB_RatesICU	N	N	03/06/2017
☐	SIR - Adult All SSI Data by Procedure	bs2_SIR_AdultAllSSIProc	N	N	03/06/2017
☐	SIR - Adult All SSI Data by Surgeon	bs2_SIR_AdultAllSSISurg	N	N	03/06/2017
☐	SIR - Adult Complex AR SSI Data by Procedure	bs2_SIR_AdultCmpxSSIPr	N	N	03/06/2017
☐	SIR - Adult Complex AR SSI Data by Surgeon	bs2_SIR_AdultCmpxSSISu	N	N	03/06/2017
☐	SIR - All CAU Data	bs1_CAU_RatesICU_SCA	N	N	03/06/2017
☐	SIR - All CLAB Data	bs1_CLAB_RatesICU	N	N	03/06/2017
☐	SIR - All SSI Data by Procedure	bs1_SIR_AllSSIProc	N	N	03/06/2017

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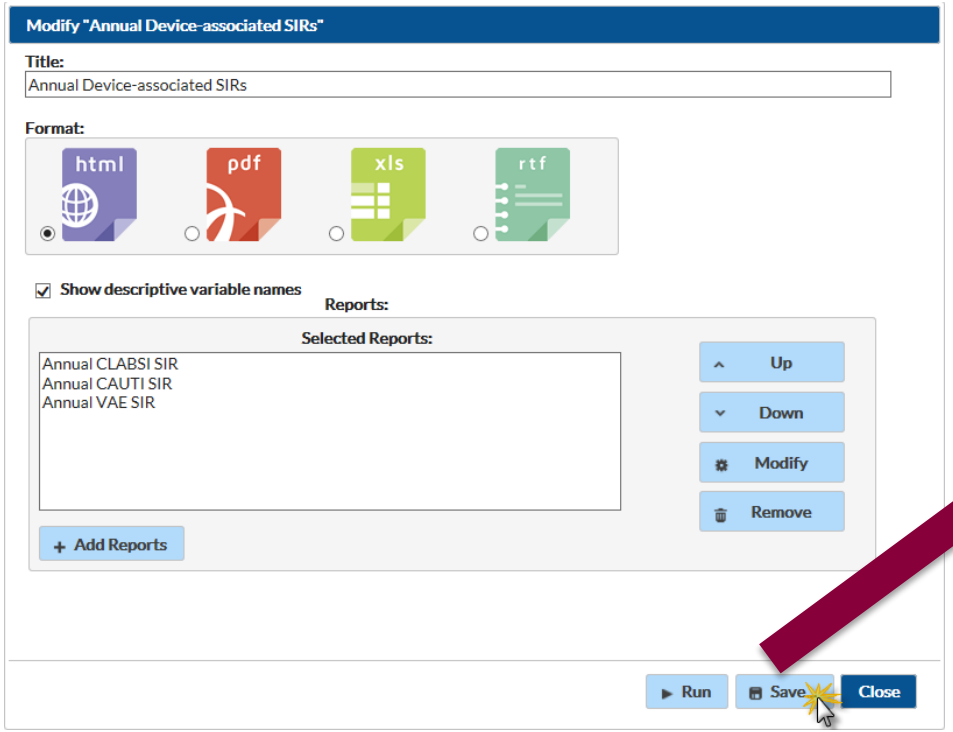
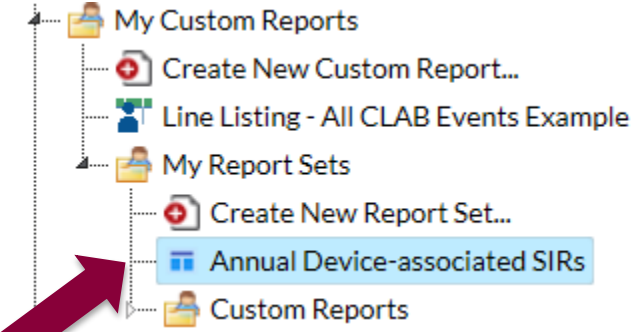
Select Cancel

Create a Report Set (cont'd)





Results – Hospital DA Infections

HAI	# Events	# pt days	# device days	Rate	# pred	SIR	P-value	95% CI
CLABSI	14	47,990	5,630	2.487	6.12	2.288	0.006	(1.302, 3.747)
CAUTI	27	47,990	21,450	1.259	34.158	0.790	0.2161	(0.532, 1.134)
Total VAE	16	17,320	2,230	7.175	15.061	1.062	0.7799	(0.629, 1.688)
IVAC Plus	5	17,320	2,230	2.242	5.60	0.893	0.8540	(0.327, 1.979)

Fictitious data used for illustrative purposes only.

Question 1: A new member of your team prepared the table below for the presentation. Are these data appropriate to share with leadership, as is?

A. Yes, because all relevant information is included.

★ B. No, because the rates are not risk-adjusted.

C. No, because the device utilization ratios are not included.

D. No, because I'm concerned the data may not be accurate.

HAI	# Events	# pt days	# device days	Rate	# pred	SIR	P-value	95% CI
CLABSI	14	47,990	5,630	2.487	6.12	2.288	0.006	(1.302, 3.747)
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Question 1: Rationale

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B. No, because the rates are not risk-adjusted

Crude, unadjusted device-associated rates do not provide an accurate picture of what may be happening in your hospital. Rates can differ depending on patient population and patient care areas.

Fictitious data used for illustrative purposes only.

Interpretation

HAI	# Events	# pt days	# device days	# pred	SIR	P-value	95% CI
CLABSI	14	47,990	5,630	6.12	2.288	0.006	(1.302, 3.747)
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- In 2016, there were 14 CLABSIs and 27 CAUTIs identified in 2 ICUs and the Mixed Acuity unit.
- Based on the 2015 national data, our CLABSI SIR was significantly high at 2.288 indicating there were 128% more infections than what was predicted to occur, given the types of patients and amount of central line days.
- Our CAUTI SIR indicated that we had 21% fewer infections than predicted. While the CAUTI SIR is less than 1, this is not statistically significant.

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Interpretation (cont'd)

HAI	# Events	# pt days	# device days	# pred	SIR	P-value	95% CI
CLABSI	14	47,990	5,630	6.12	2.288	0.006	(1.302, 3.747)
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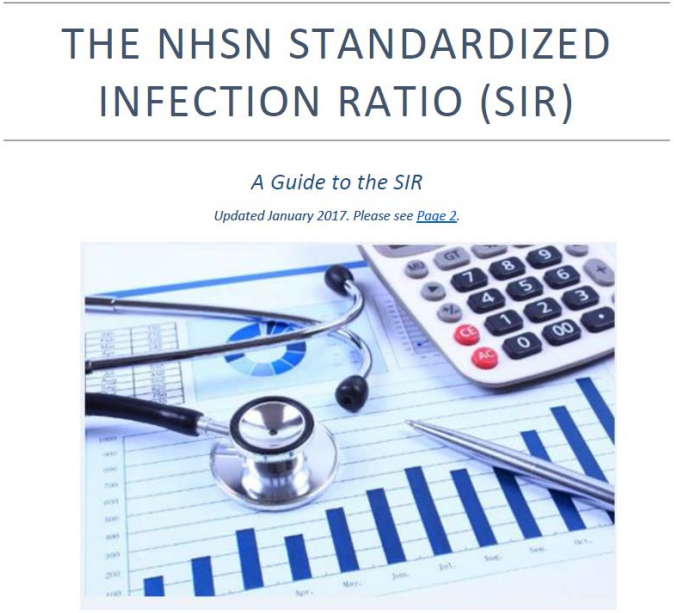
- We began VAE surveillance in our 2 ICUs in July. In 6 months, we identified 16 VAEs, 5 of which were either IVAC or PVAP.
- Neither the Total VAE or IVAC Plus SIRs are statistically significant, meaning these SIRs are no different than 1.
- Given that we have only 6 months of data, more surveillance of this event is needed in our facility and we will closely monitor for prevention opportunities in these ICUs.

Fictitious data used for illustrative purposes only.

WAIT!

- There are a couple of new individuals in your hospital leadership – they are not yet familiar with SIRs and the risk adjustment.
- Remember your audience!
  - Be prepared with high-level information about the SIRs
    - Example: The SIR is a risk-adjusted summary measure that compares our hospital to the 2015 National experience. This measure allows us to measure progress over time.
  - Know how the risk-adjustment applies to your hospital!

Your Hospital and Risk-Adjustment



- Review the SIR Guide!
  - Provides information about the SIR, as well as the various models
- Develop talking points suitable for your hospital and the HAI data you collect and measure
- Perhaps bring a copy with you when interpreting data!

Interpretation – The "Elevator" Version

HAI	# Events	# pt days	# device days	# pred	SIR	P-value	95% CI
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IVAC Plus	5	17,320	2,230	5.60	0.893	0.8540	(0.327, 1.979)

- In 2016, our hospital experienced a significantly high amount of CLABSIs, 128% more than predicted given the 2015 National data.
- We are making progress with CAUTI – 21% less than predicted. Although, this progress is not *statistically* significant and additional prevention efforts are still needed.
- We have 6 months of ventilator-associated event data and will be closely monitoring incidence of these events over the next several months.

Fictitious data used for illustrative purposes only.

Question 2: What can help us better understand our DA infection data?

A. Location-specific SIRs and rates
B. Event-level information
C. Quarterly SIRs
D. Location-specific device-utilization ratios
E. All of the above

Question 2: Rationale

- All of the following options can provide data that will complement the overall SIRs for each of the HAIs we're measuring
  - Location-specific SIRs and rates
  - Event-level information
  - Quarterly SIRs
  - Location-specific device-utilization ratios
  - All of the above

Quarterly CAUTI SIRs

Location	Quarter	Events	UC Days	Pt days	# Pred	SIR	Rate	DUR
Med ICU	1	4	2250	3840	3.002	1.332	1.78	0.59
Med ICU	2	5	2280	4780	3.057	1.635	2.19	0.48
Med ICU	3	2	2560	4500	3.419	0.585	0.78	0.57
Med ICU	4	1	2270	3300	3.029	0.330	0.44	0.69
Surg ICU	1	3	2660	5220	5.058	0.593	1.13	0.51
Surg ICU	2	3	2600	3480	4.893	0.613	1.15	0.75
Surg ICU	3	4	2480	4610	4.874	0.821	1.61	0.54
Surg ICU	4	2	2360	4400	4.315	0.463	0.85	0.54
Mixed Acuity	1	2	550	3750	0.695	--	3.64	0.15
Mixed Acuity	2	0	450	3650	0.548	--	0.00	0.12
Mixed Acuity	3	0	430	3540	0.548	--	0.00	0.12
Mixed Acuity	4	1	560	2920	0.719	--	1.79	0.19

Fictitious data used for illustrative purposes only.

Event-level Data

- Consider a Frequency Table that will display pathogen counts for each HAI type
- This example is a frequency table in it's simplest form, exported as a .xls and modified
- Could run a frequency table of pathogens by location or specified time period (e.g., month, quarter)

Pathogen 1 Description	Frequency	Percent
Acinetobacter baumannii - ACBA	3	11.11%
Acholeplasma laidlawii - ACHOLAID	1	3.70%
Achromobacter - ACHSP	1	3.70%
Anaerobiospirillum succinoproducens - ANSU	1	3.70%
Bacillus patagoniensis - BPATA	1	3.70%
Enterobacter aerogenes - EA	2	7.41%
Enteropathogenic Escherichia coli - ECEP	1	3.70%
Enterococcus faecium - ENTFM	5	18.52%
Enterococcus faecalis - ENTFS	3	11.11%
Gram-negative bacillus - GNR	1	3.70%
Granulicatella adiacens - GRADJ	2	7.41%
Klebsiella pneumoniae - KP	4	14.81%
Raoultella ornithinolytica - RAOORN	1	3.70%
Staphylococcus chromogenes - STACHR	1	3.70%
TOTAL	27	100

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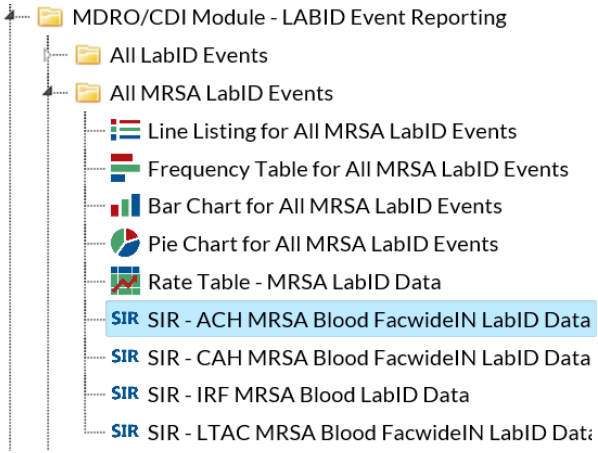
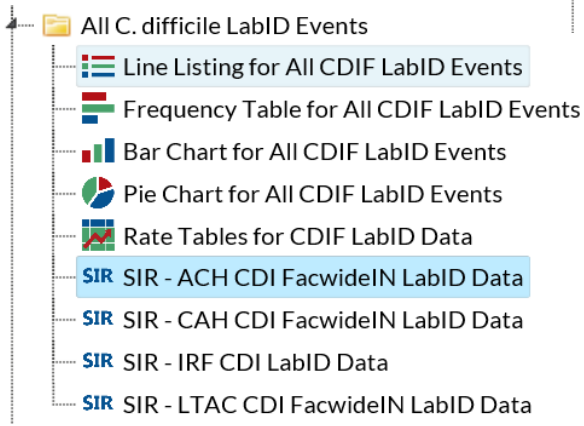
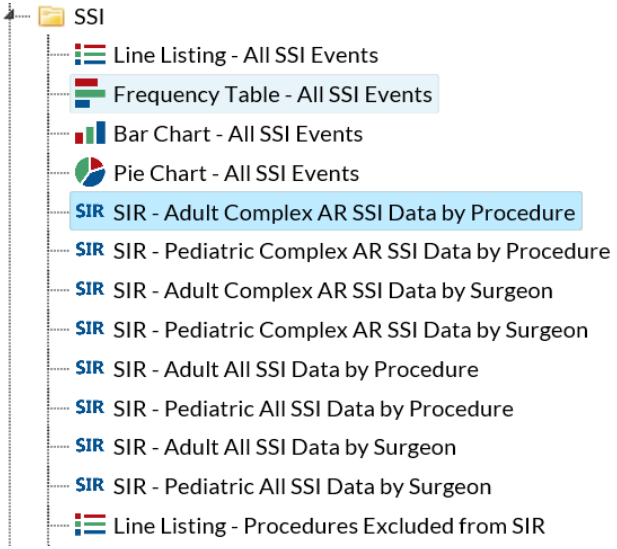
LabID and SSI Reports







LabID and SSI Data

Procedure	# SSIs	# procs	# pred	SIR	P-value	95% CI
Overall - Adult	13	710	7.8182	1.663	0.0845	(0.925, 2.772)
COLO	6	150	3.561	1.685	0.2206	(0.683, 3.504)
HPRO	2	270	2.453	0.815	0.8530	(0.137, 2.694)
HYST	3	70	0.702	--	--	--
KPRO	2	220	1.102	1.815	0.4017	(0.304, 5.996)

HAI	# Events	# pt days	# pred	SIR	P-value	95% CI
CDI	86	118,000	88.930	0.967	0.7686	(0.778, 1.188)
MRSA blood	9	123,000	6.500	1.385	0.3310	(0.675, 2.541)

Fictitious data used for illustrative purposes only.

Question 3: True or False – the overall SSI SIR is an average of the procedure-specific SIRs.

A. True

★ B. False

Procedure	# SSIs	# procs	# pred	SIR	P-value	95% CI
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Question 3: Rationale

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The overall SSI SIR is calculated by dividing the sum of the observed SSIs by the sum of the predicted. This includes those procedures that may have <1 predicted infection.

More details will be discussed tomorrow, during the SSI Analysis presentation!

Fictitious data used for illustrative purposes only.

More on the SSI Data…

Procedure	# SSIs	# procs	# pred	SIR	P-value	95% CI
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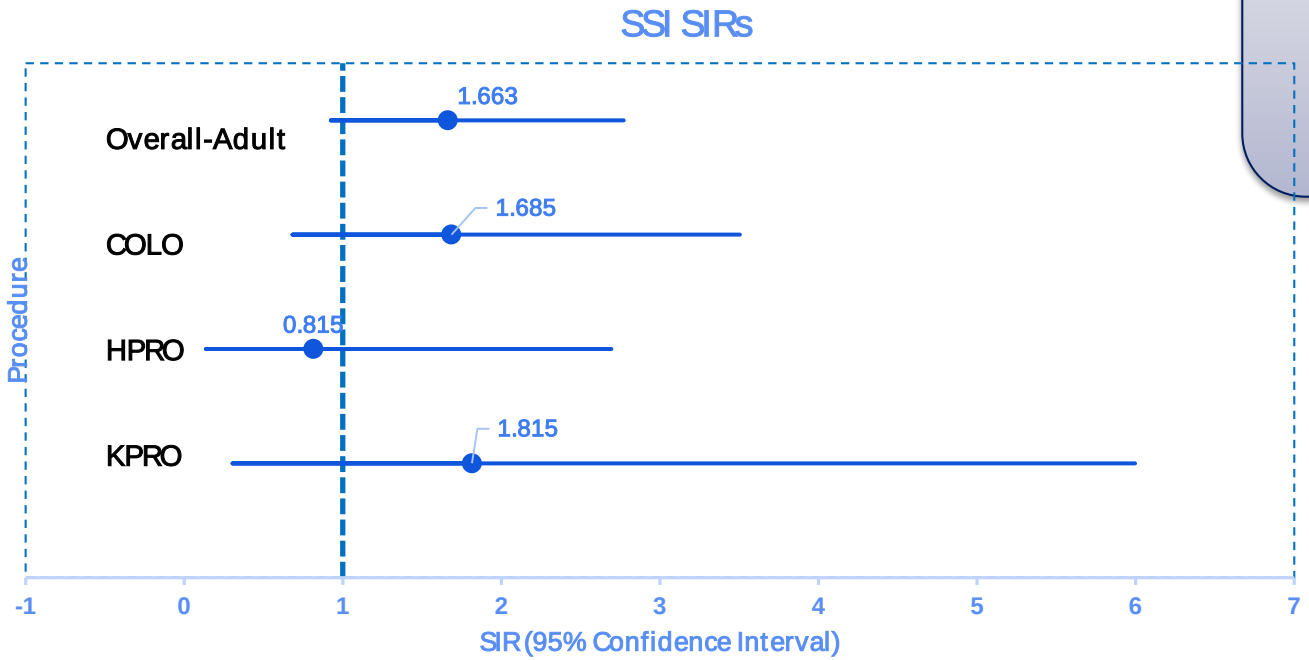
- Carefully review each procedure category
- What do you notice about these data? Are there any areas of concern?
- What do the 95% CIs tell us?
- What additional information could complement this summary table?

Fictitious data used for illustrative purposes only.

95% Confidence Intervals



If the 95% CI includes 1, then the SIR is not significant.

What to do when the # Predicted is <1?

Procedure	# SSIs	# procs	# pred	SIR	P-value	95% CI
HYST	3	70	0.702	--	--	--

- The information is still useful!
  - In this example, 0.7 SSIs predicted, but we observed 3
- For other measures (e.g., CLABSI, CAUTI, etc.) you may want to use rates and perform internal trends
  - Use the “Compare Two Incidence Density Rates” option in the NHSN Statistics Calculator

LabID Data

HAI	# Events	# pt days	# pred	SIR	P-value	95% CI
CDI	86	118,000	88.930	0.967	0.7686	(0.778, 1.188)
MRSA blood	9	123,000	6.500	1.385	0.3310	(0.675, 2.541)

- Although LabID SIRs are available for FacWideIN only, the data are still summarized
  - Events are entered by location of specimen collection
  - Different FacWideIN rates are available (e.g., CO prevalence rates, HO incidence rates, etc.)
  - Possible for temporal changes throughout the year

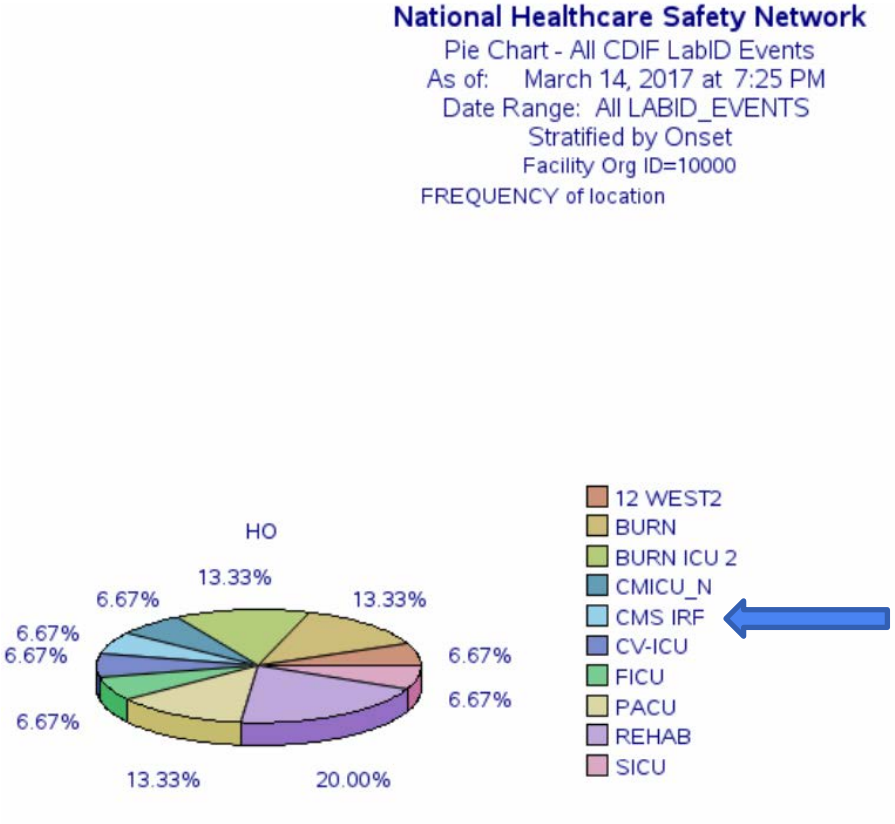
Fictitious data used for illustrative purposes only.

Supplementing with Graphics

- Graphical reports can illustrate specific points regarding your summarized data
- Pie charts and bar charts are useful for event level data (e.g., pathogen distribution, locations of events, specific types of SSIs, etc.)
- Run charts are useful for DURs and rates

Pie Chart Example

- This example shows a distribution of HO incident CDI LabID events by location where the specimen was collected
  - We can see event(s) identified in our IRF unit, which would *not* be included in the FACWIDEIN SIR
  - Remember to review IRF data separately!!



Your Hospital and Risk-Adjustment, Part 2

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- Looking at the MRSA blood LabID SIR:
  - The p-value is >0.05, so we know our SIR is not statistically different from 1
  - BUT – we have about 38% more infections than predicted.
  - What makes up the MRSA blood SIR for our hospital??
- Let's look at the details in the SIR guide…

SIR Guide – MRSA blood LabID (pages 34-35)

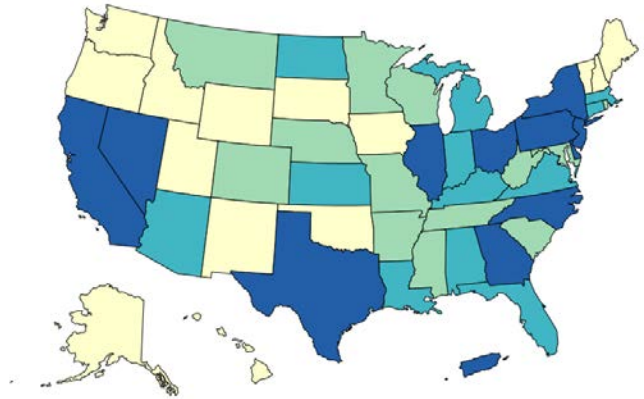
Table 1. Acute Care Hospitals	
Parameter	**Parameter Estimate**
Intercept	*-11.3759*
Inpatient Community-Onset Prevalence Rate*: >0.037 per 100 admissions	0.3650
Inpatient Community Onset Prevalence Rate*: ≤0.037 per 100 admissions	REFERENT
Average Length of Stay**: ≥5.1 days	0.2787
Average Length of Stay**: 4.3-5.0 days	0.0955
Average Length of Stay**: 0-4.2 days	REFERENT
Medical School Affiliation‡: Major teaching status	0.2585
Medical School Affiliation‡: Graduate or undergraduate teaching status	0.1166
Medical School Affiliation‡: none	REFERENT
Facility type: Cancer Hospital *(HOSP-ONC)*	1.1894
Facility type: General Acute Care Hospital *(HOSP-GEN)*	0.4355
Facility type: Other Specialty Hospital	REFERENT
Number of ICU beds‡: ≥45	0.5650
Number of ICU beds‡: 21-44	0.4599
Number of ICU beds‡: 11-20	0.3394
Number of ICU beds‡: 7-10	0.4720
Number of ICU beds‡: 0-6	REFERENT

Table 1, Continued	
Parameter	**Parameter Estimate**
Outpatient Community-Onset Prevalence Rate ED/24-hour Observation Unit^: > 0.032 per 100 encounters	0.3476
Outpatient Community-Onset Prevalence Rate ED/24-hour Observation Unit^: > 0 and ≤ 0.032 per 100 encounters	0.1048
Outpatient Community-Onset Prevalence Rate ED/24-hour Observations^: 0 per 100 encounters, or no applicable locations	REFERENT

- The information in this table tells us what contributes to the **predicted number of infections**
- Review the table and identify the parameters applicable to your hospital

Comparison to National Data

- At times, you may be asked for a comparison of your hospital to the national data
- The SIRs are a comparison to the 2015 National data, and provide a risk-adjusted measure
- The upcoming Predicted Rate calculator will allow you to obtain the national, risk-adjusted 2015 rates using the same risk-adjustment as the SIRs
- The upcoming National and State SIR Report will provide percentile distributions for each HAI



SIRs Over Time

- Now…to analyze our data over time!

> *"…you've been asked to summarize the HAI experience for your hospital over the past 3 years (2014-2016)."*

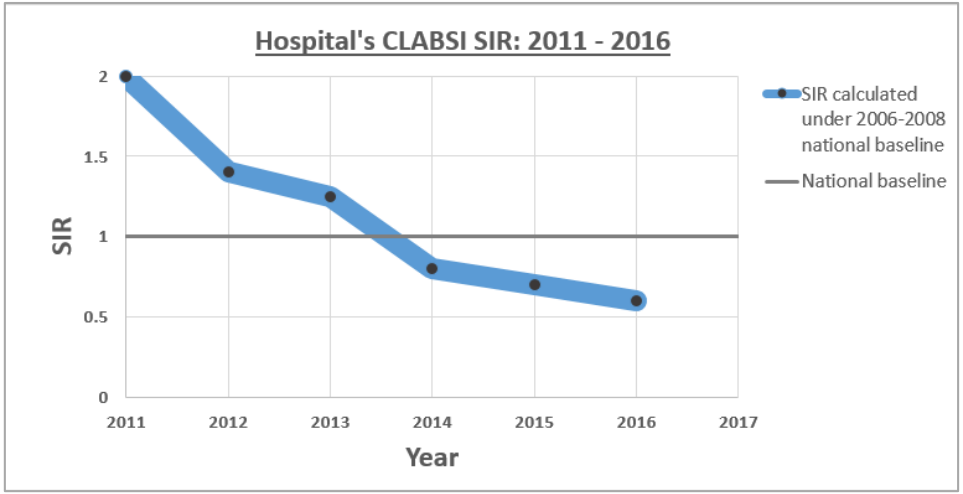
- The following examples will use graphics to illustrate changes over time.

Question 4: If you want to trend SIRs for 2014-2016, which SIR baseline(s) should you use?

A. Only the original baseline for each HAI
B. Only the 2015 baseline for each HAI
C. Original baseline for 2014-15, and 2015 baseline for 2016
D. Both the original and the 2015 baseline for 2015-2016
E. It depends…so none of the above.

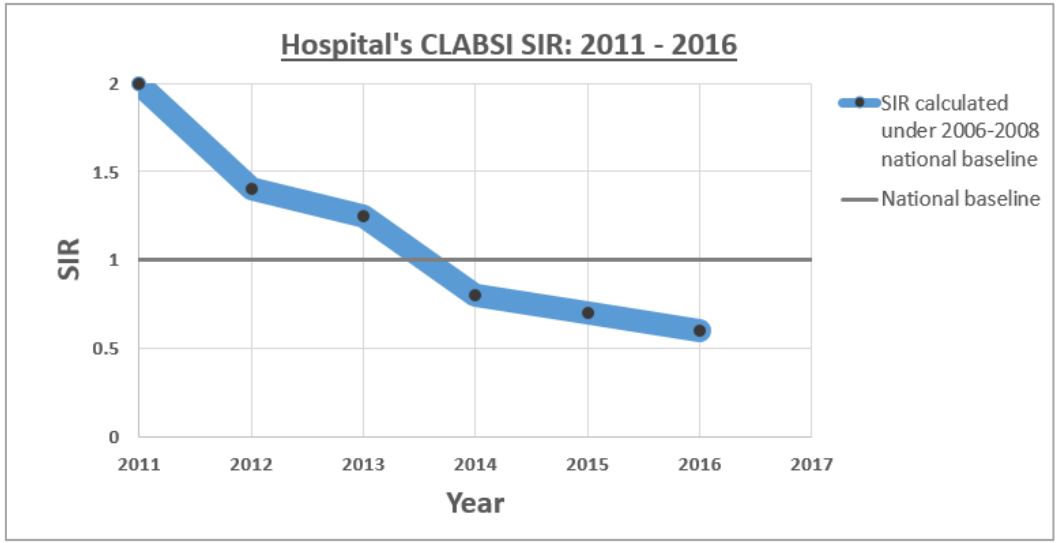
Example: Review SIRs Under Original Baseline Through 2016

- This example hospital has been tracking their CLABSI SIRs since 2011
  - Recently implemented a new CLABSI prevention measure in 2015
  - Any visible changes in the CLABSI SIR between 2015 and 2016?



Best Practices for Graphical Display of SIR

- SIRs have been labeled with the corresponding baseline
- Continuous SIR display stops at 2016; 2017 data must use the new baseline
- For descriptive purposes only
  - No statistical analyses were performed



Transition Period: Which SIRs Do We Use?

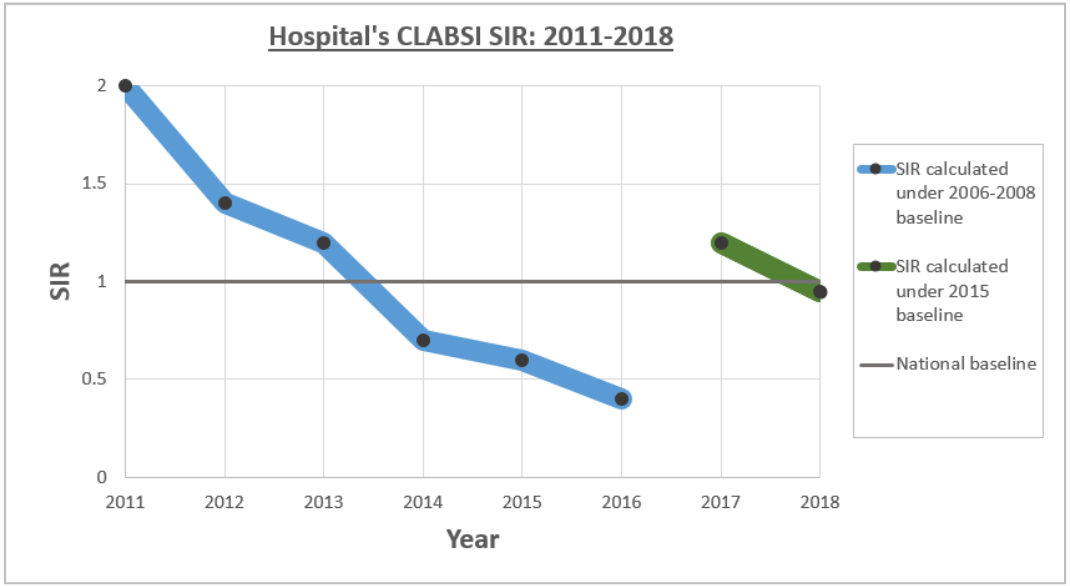
- If needed, continue reviewing SIRs under original baseline through 2016
  - Show effectiveness of prevention activities
  - Progress over time from the original baseline population
  - Review data that will be used in HVBP
- Begin reviewing SIRs under the new baseline from 2015 and forward
  - New starting place for measuring HAIs
- CDC will start using the new baseline with 2015 data
  - HAI Progress Report
  - National and state 2015 SIRs will use the updated risk models

SIR Display

- The following slides will show examples and recommendations for how to display and interpret SIRs during this transition period, calculated under either baseline.
- Basic principles of SIR display during transition:
  - Understand which time periods are available for each baseline
  - If displaying SIRs over time in a continuous line, the SIRs from all time periods must be calculated under the *same* baseline
  - SIRs under the new baseline cannot be directly compared to SIRs from the original baseline
  - When presenting or discussing your hospital's SIRs, be sure to clearly label the baseline time period used
- There are MANY more ways to display SIR data!

Incorporate New Baseline

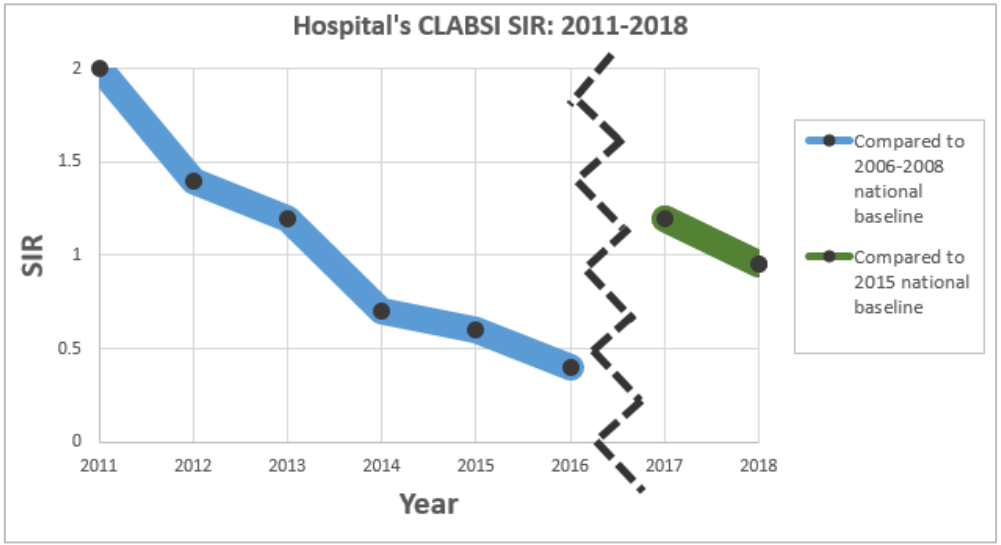
- This example hospital has been tracking their CLABSI SIRs since 2011
- IP would like to continue monitoring SIRs on a single graph beyond 2016
  - Must incorporate new baseline!



Note: SIR = 1 always represents the national baseline

Incorporate New Baseline

- SIRs under new baseline cannot be compared to SIRs from original baseline!
- Acceptable to show SIRs under both baselines in a single figure, given:
  - Line graph is *not* connecting points between different baselines
  - Each baseline is clearly labeled



Alternative Example: Transition at 2015

- When presenting SIRs under new baseline for the first time, consider showing SIRs under the old baseline for context and as an indication of past progress

Talking Points: Discussing SIRs During Transition Period

- 2011 – 2014 SIRs under original baseline
- 2014 SIR = 0.50
- Interpretation: In 2014, our facility saw 50% fewer CLABSIs than predicted, compared to the **2006-2008** national experience

- 2015 SIR under new baseline- transition year
- 2015 SIR = 1.20
- Interpretation: In 2015, this facility saw 20% more CLABSIs than predicted, based on the **2015** national experience

Assessing Changes in HAI Experience Over Time

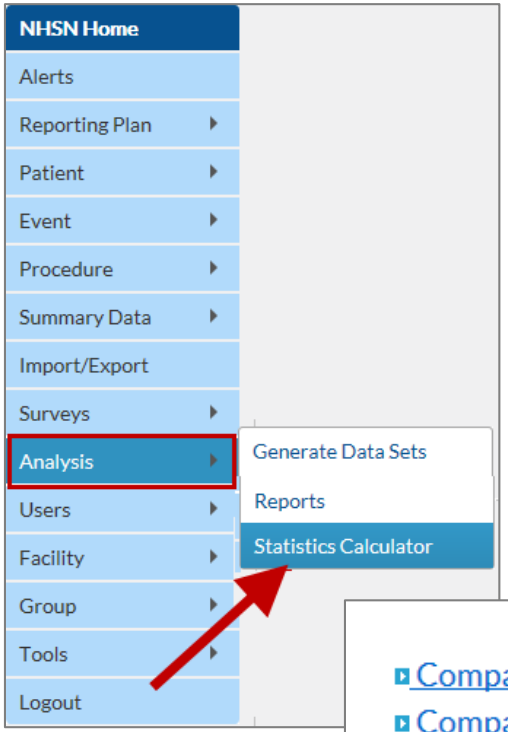
- SIRs under the original baseline **cannot** be directly compared to any SIRs calculated under the new baseline
  - Different risk adjustment, different baseline population
- When comparing SIRs from two time periods, both SIRs must have been calculated under the *same* baseline
  - 2014 vs. 2015 SIRs: original baseline
  - 2015 vs. 2016 SIRs: use *either* the new baseline or original baseline for both SIRs in the comparison
  - 2016 vs. 2017 SIRs: new baseline

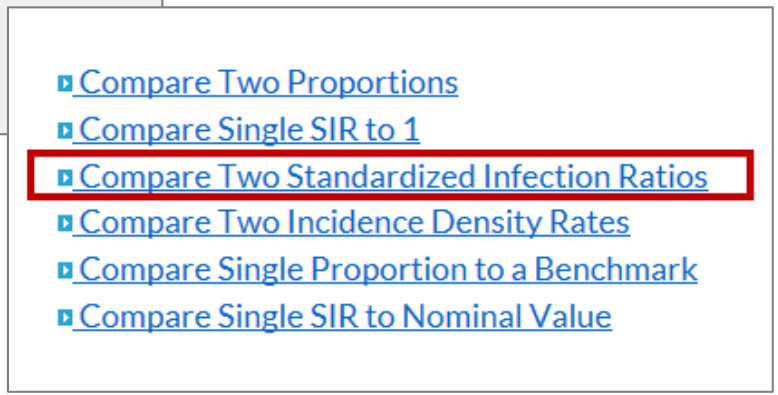
- Perform statistical comparison of 2 SIRs directly in NHSN

Example

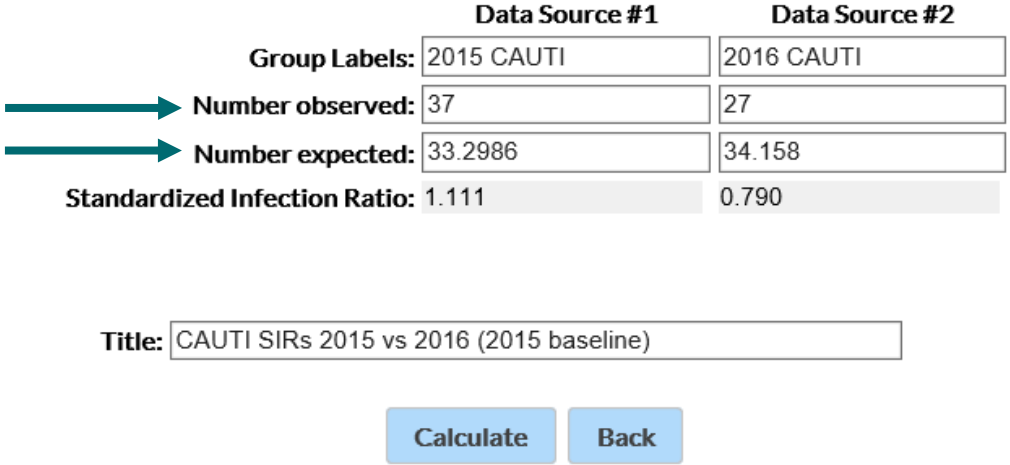
- Our hospital has been participating in a prevention collaborative for CAUTI
- IP would like to determine whether there was a significant change in CAUTI in 2016 compared to 2015
- SIRs calculated under either baseline could be used for this comparison. IP decided to use the 2015 national baseline:
  - 2015 CAUTI SIR = 1.111
  - 2016 CAUTI SIR = 0.790

NHSN Statistics Calculator





NHSN Statistics Calculator



Example- 2015 vs. 2016 SIR

- 2015 SIR: 37 observed / 33.2986 predicted infections = 1.111
- 2016 SIR: 27 observed / 34.158 predicted infections = 0.790
- Optional fields: Group Labels, Title

NHSN Statistics Calculator

National Healthcare Safety Network
CAUTI SIRs 2015 vs 2016 (2015 baseline)
As of: March 15, 2017 at 7:28 AM

	2015 CAUTI	2016 CAUTI
Observed	37	27
Expected	33.2986	34.158
SIR	1.111	0.79

Relative ratio of SIRs (data column 2 / data column 1): 0.79/1.111 = 0.711 (71.1%)
Two-tailed p-value: 0.1794
95% Conf. Interval: 0.429, 1.168

Interpretation: Is the 2016 SIR different from the 2015 SIR?

- P-value = 0.1794
- 95% confidence interval = (0.429, 1.168)

Question 5: What conclusions can we make about the CAUTI experience, based on these results?

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A. Our hospital has not made any progress reducing CAUTIs.
B. Our hospital has made significant progress reducing CAUTIs.
C. Our hospital has made some progress reducing CAUTIs.
D. The results of this comparison are inconclusive.

Question 5: Rationale

C. Our hospital has made some progress reducing CAUTIs.

Why “some progress”?

- We have seen reduction in both the number of CAUTIs, as well as the SIR.
- BUT, this is not a statistically significant reduction.

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Targeting Prevention Efforts

- As part of the annual review, you were also asked to provide feedback on where prevention efforts could be prioritized.
- The TAP strategy can help with this! Remember, TAP reports are available for:
  - CAUTI
  - CLABSI
  - CDI LabID
- Use additional reports in NHSN to learn more about what is contributing to your hospital's HAI experience.

Summary

- Various reports in NHSN allow facilities to complement their summarized SIR measures with additional, more granular information.
- SIRs under two different baselines should not be directly compared to each other, but there are options that allow a facility to consider transitioning to the new baseline when measuring progress over time.
- When interpreting SIRs and other data, remember your audience and understand how the risk-adjustment is applied for your hospital.

Additional Resources

- Rebaseline webpage: https://www.cdc.gov/nhsn/2015rebaseline/index.html
- NHSN SIR Guide: https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf
- Analysis Quick Reference Guides: https://www.cdc.gov/nhsn/ps-analysis-resources/reference-guides.html
- Past NHSN Trainings: https://www.cdc.gov/nhsn/training/

Questions?

nhsn@cdc.gov

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.