DRAFT

Evaluating Entered NHSN Data

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Acknowledgement

Information in this presentation is from the NHSN training courses

www.cdc.gov/nhsn

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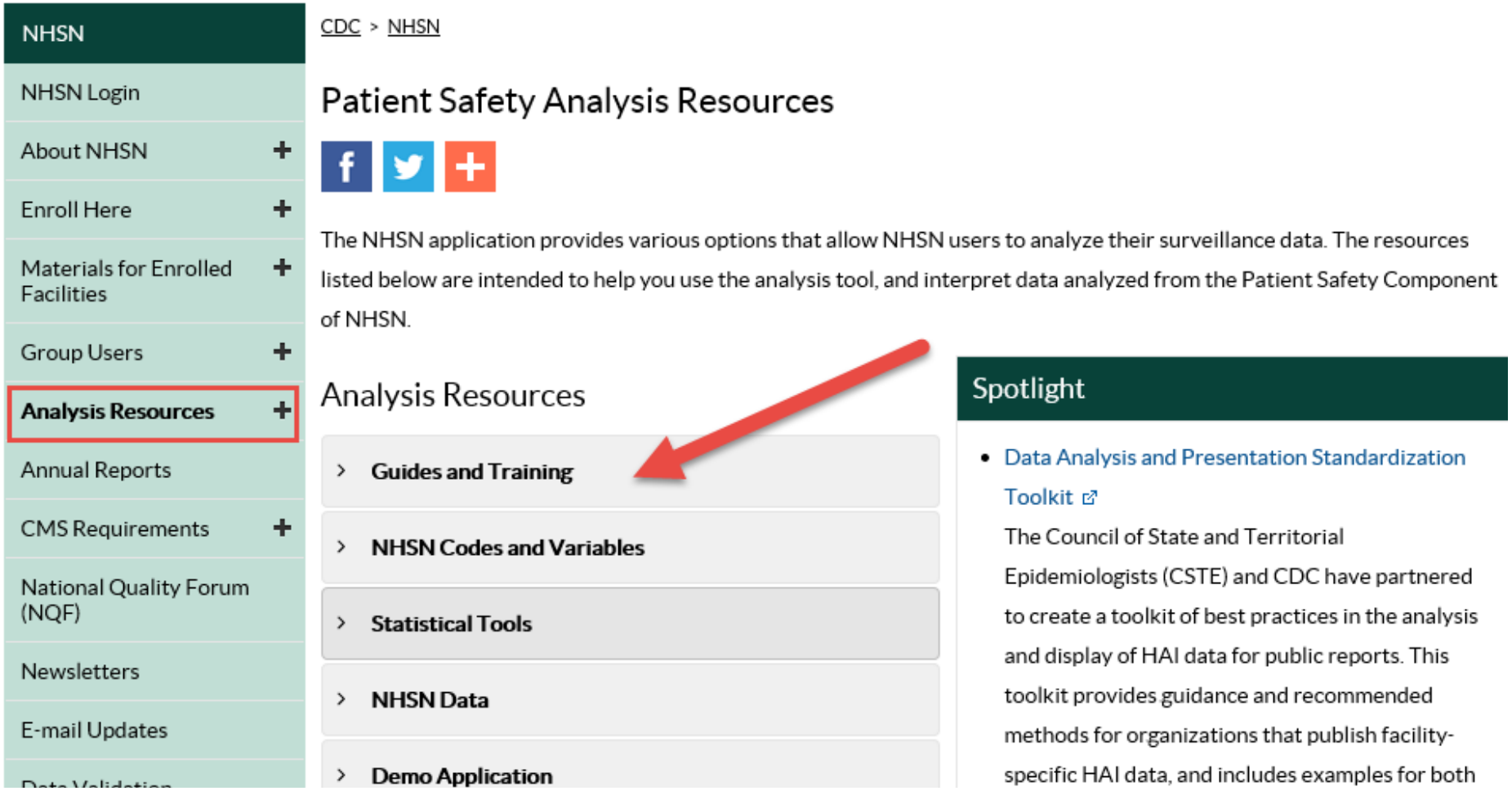
Objectives

- Discuss basic steps for analyzing HAI data in NHSN.
- Identify and interpret various measures used to analyze device-associated HAI data.
- Illustrate how to make internal comparisons of HAI rates over time.

NHSN Analysis Resources



www.cdc.gov/nhsn/PS-Analysis-resources/index.html

NHSN Analysis Resources - continued

- Group Users +
- Analysis Resources –
  - **Analysis Quick Reference Guides**
  - Annual Reports
  - CMS Requirements +
  - National Quality Forum (NQF)
  - Newsletters
  - E-mail Updates
  - Data Validation Guidance
  - HIPAA Privacy Rule +

Analysis Quick Refere

- **General Tips**
- **Troubleshooting Guides**
- **Frequently Requested O**
- **Targeted Assessment Pr**
- **Antimicrobial Use Option Output Types**
- **Output/Report Option Types**
- **Tips for Customizing Your Output/Reports**
- **Detailed Guides for Specific Analysis Options**

Analyzing MBI-LCBI CLABSI Data

Description

Facilities that report CLABSI data may wish to analyze which cases, and how many, were identified as Mu
Injury Laboratory-Confirmed Bloodstream Infections (MBI-LCBI).

CLABSI rate tables and standardized infection ratios (SIRs) generated within NHSN will include all CLABS
of which LCBI definition was met. Facilities can obtain information on which CLABSIs were MBI-LCBI by
variable **mbi_lcbi** in event-level line lists and frequency tables.

Example

You have been following CLABSIs in your hematopoietic stem cell transplant ward (HSCT). Below is a sn
your CLABSI rate table for January 2013:

Org ID=10018 CDC Location=IN:ACUTE:WARD:ONC_HSCT

Location	Summary Year/Month	Perm CLA BSI Count	Perm Central Line Days	Perm CLA BSI Rate	NHSN PCLAB Pooled Mean	Incidence Density p-value #1	Incidence Density Percentile #1
HSCT	2013M01	1	150	6.667	2.4	0.3055	93

Location	Summary Year/Month	Temp CLA BSI Count	Temp Central Line Days	Temp CLA BSI Rate	NHSN TCLAB Pooled Mean	Incidence Density p-value #2	Incidence Density Percentile #2
H							

Why Analyze Data Using NHSN?

- Analysis tools within NHSN help facilitate internal validation activities and help ensure accuracy.
- Reports generated from NHSN can help with prioritizing prevention activities and documenting success of prevention activities.
- Data entered into NHSN will be used by CDC, CMS, and CDPH, and may be used by your corporation* and/or special study groups*.
- It is YOUR data and you should know your data.
  - Take ownership and discover how your data can tell a story about your facility .

*Dependent on membership to NHSN groups and acceptance of conferred rights to share data

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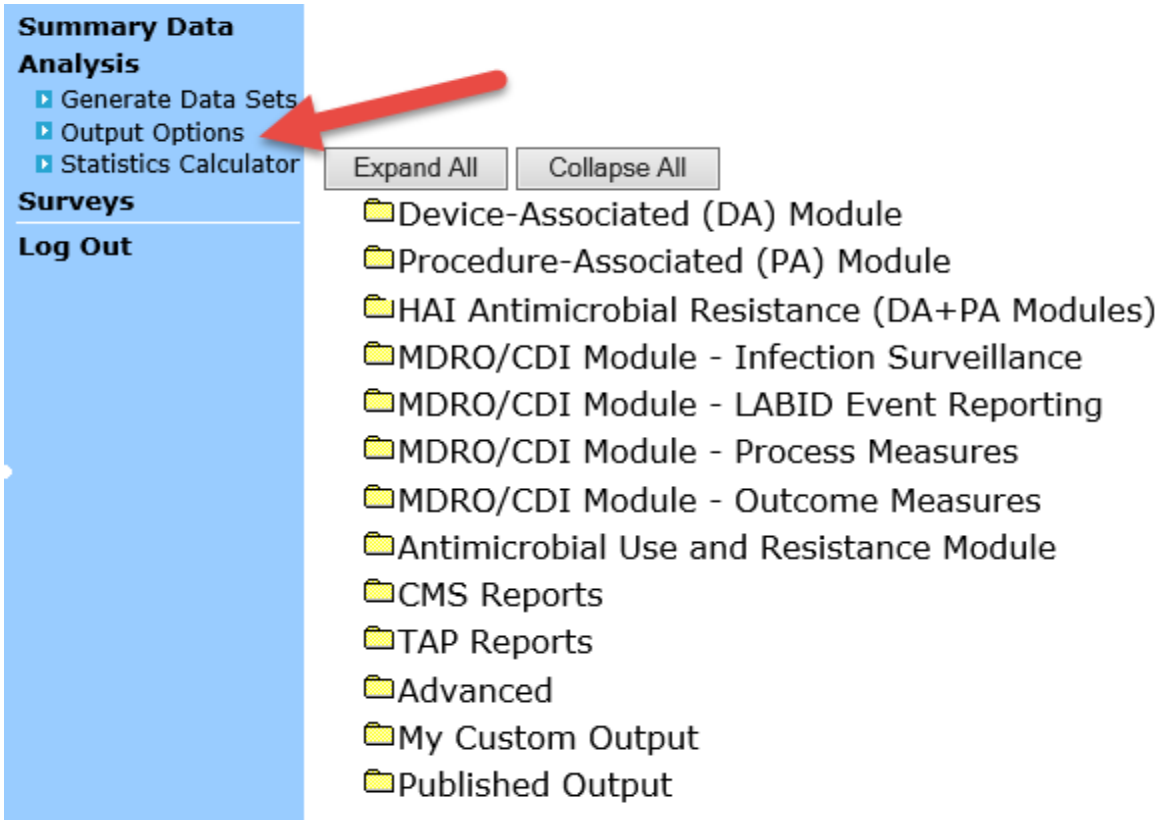
Generating Datasets

- To analyze data in NHSN, you must create a copy of your data; analysis is not performed in the actual live database
- Generating datasets is the first step in performing analysis in NHSN
  - Copies and freezes a copy of your data
  - Organizes data into defined sets for analysis
  - Allows for generation of reports
- Each user has his/her own analysis datasets
  - Based on a user's rights
- May take several minutes to complete this process
- You may navigate or leave NHSN while datasets are generating

Analysis Output Options

- To access the output options tree view, navigate to Analysis ➔ Output Options
- The output options are organized into folders, first by module (e.g., Device-associated Module)



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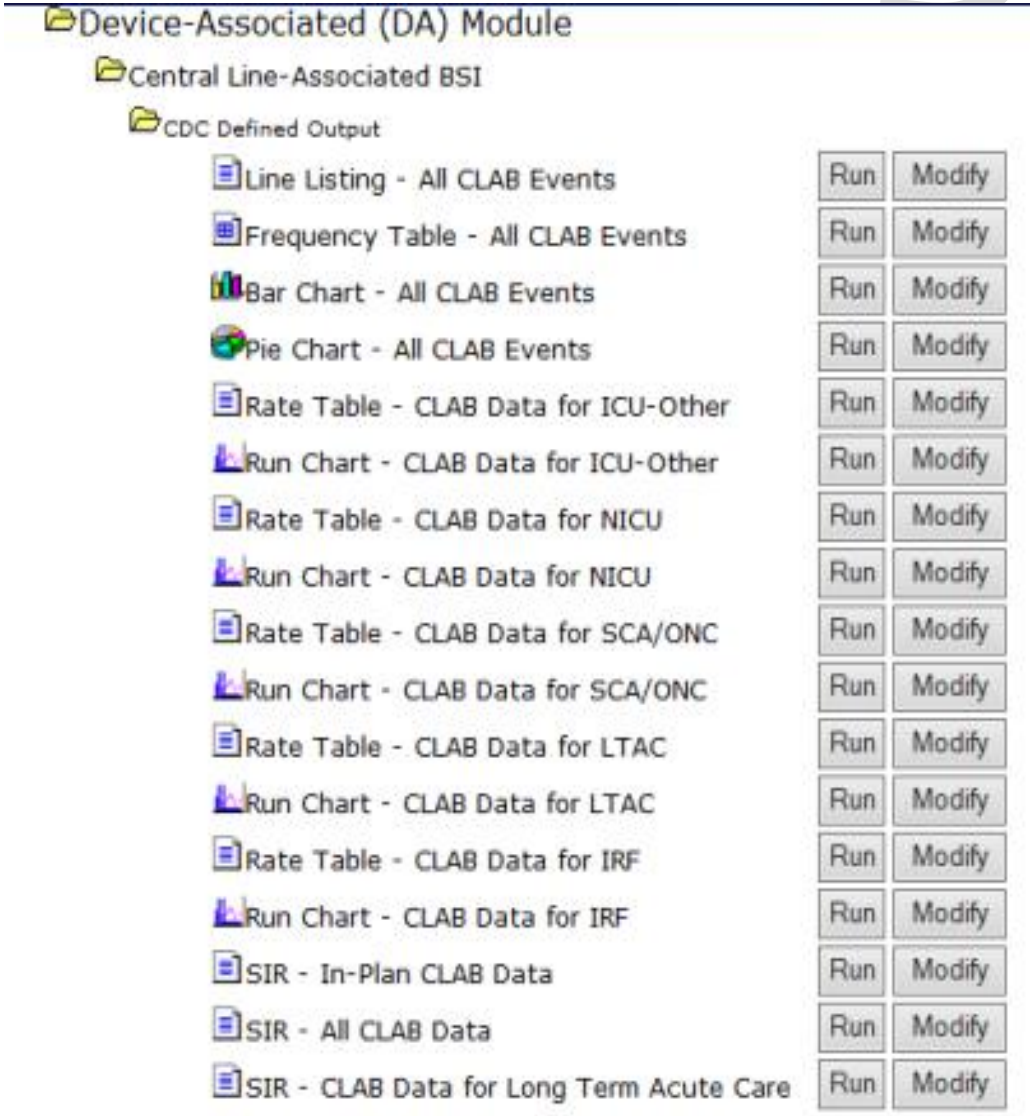
Analysis Output Options - continued



- Each of the infection event level folders can be expanded to show the various output options available
- Click "Run" next to any output option to obtain your data in a "CDC-Defined Output" report

Compatibility Mode

- When I go to the Output Options screen, I can't see all of the folders, or I can only see half of the columns in the Selection Criteria Section
- What happened?

- Your browser is not in "Compatibility Mode" for the NHSN application
- Click on Tools ➔Compatibility View Settings ➔Add cdc.gov ➔or work with your IT department to update your Internet Explorer browser settings

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Metrics and Reports

- Don't limit yourself; experiment with your data. A number of different types of reports are helpful in analyzing your data, including:
  - Line Lists
  - Frequency Tables
  - Charts/graphical reports
  - Rate Tables
  - Standardized Infection Ratios (SIRs)
  - Descriptive statistics (e.g., mean, median, mode, distribution, outliers, etc.)

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Analysis Output Option: Line List

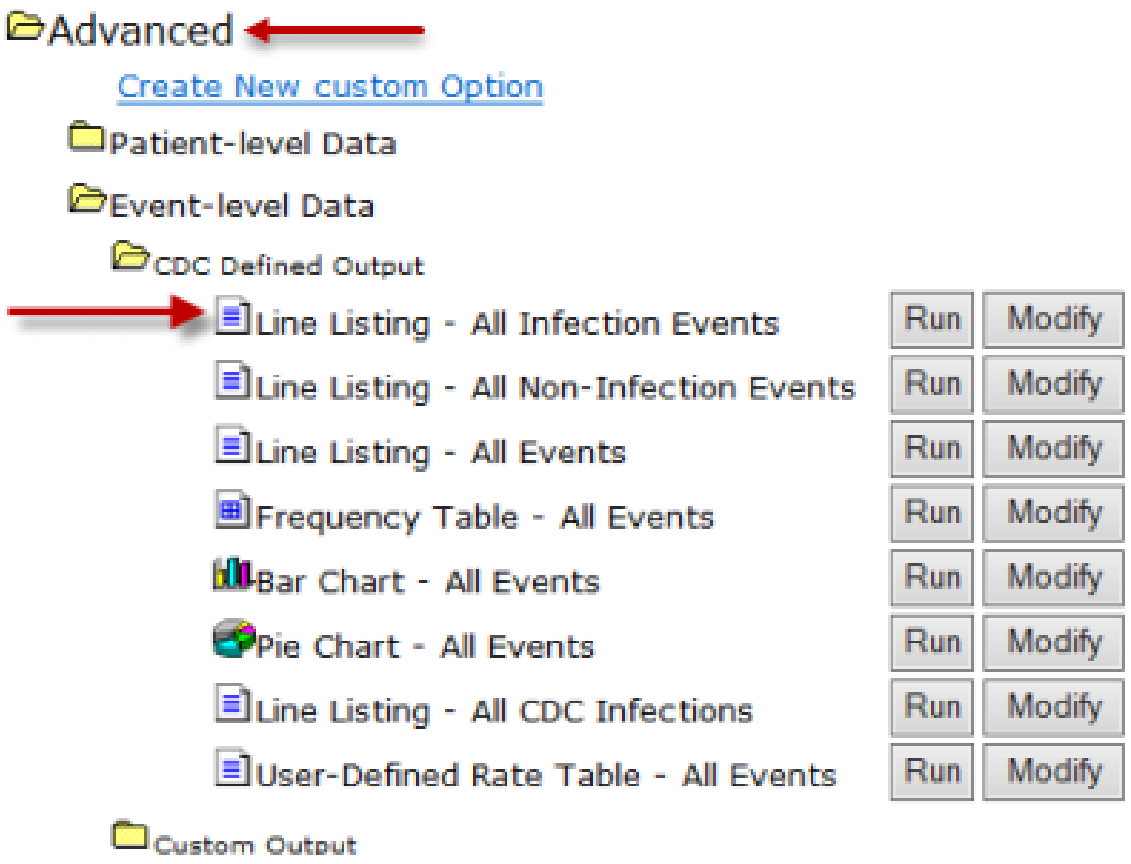
- Line lists allow for record-level review of data
  - Helpful in pinpointing issues in data validity/quality
  - Can help inform rates or identify trends
  - Most customizable type of output from NHSN

National Healthcare Safety Network
CLABSI Events
As of: January 17, 2012 at 11:01 AM
Date Range: CLAB_EVENTS evntDateYr 2011 to 2011

Event ID	Date of Birth	Gender	Fac Admission Date	Event Date	Event Type	Specific Event	Location	Days: Admit to Event	Age on Event Date
234800	09/13/1954	F	02/09/2011	02/11/2011	BSI	LCBI	MICU	3	56
234771	06/15/1956	F	03/20/2011	03/22/2011	BSI	LCBI	71ICU	3	54
234801	07/22/1976	M	02/02/2011	02/05/2011	BSI	LCBI	MICU	4	34
234747	05/13/1953	F	01/31/2011	02/03/2011	BSI	LCBI	71ICU	4	57
234818	09/21/1973	F	01/09/2011	01/12/2011	BSI	LCBI	MICU	4	37
158848	09/13/1942	F	06/10/2011	06/13/2011	BSI	LCBI	MICU	4	68
234802	01/21/2000	F	01/05/2011	01/09/2011	BSI	LCBI	MICU	4	10
234749	09/21/1974	M	03/18/2011	03/21/2011	BSI	LCBI	71ICU	4	36

Analysis Tip for Small Hospitals

- Smaller hospitals may wish to run a single line list inclusive of all HAIs identified.



Analysis Output Option: Frequency Table

- Frequency tables allow you to obtain counts of records meeting certain criteria.

Examples:

- How many CAUTIs were reported as ABUTI
- How many SSIs were reported as PATOs
- How many CDI CO, HO, or CO-HCFA

National Healthcare Safety Network
CAUTI Events
As of: January 17, 2012 at 11:04 AM
Date Range: CAU_EVENTS evntDateYr 2011 to 2011

Frequency
Percent
Row Pct
Col Pct

Table of evntDateYQ by spcEvent			
	spcEvent(Specific Event)		
evntDateYQ(Event-Yr/Qtr)	ABUTI	SUTI	Total
2011Q1	2	3	5
	18.18	27.27	45.45
	40.00	60.00	
	50.00	42.86	
2011Q2	2	4	6
	18.18	36.36	54.55
	33.33	66.67	
	50.00	57.14	
Total	4	7	11
	36.36	63.64	100.00

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Analysis Output Option: Rate Table

- Rate tables display your facility's calculated rates and device-utilization ratios (where appropriate).
- Provide comparisons of your facility's rates and ratios to NHSN pooled means.

National Healthcare Safety Network

Rate Table for Central Line-Associated BSI Data for ICU-Other

As of: January 17, 2012 at 11:18 AM

Date Range: CLAB_RATESICU summaryYr 2011 to 2011

Org ID=10018 CDC Location=IN:ACUTE:CC:CT

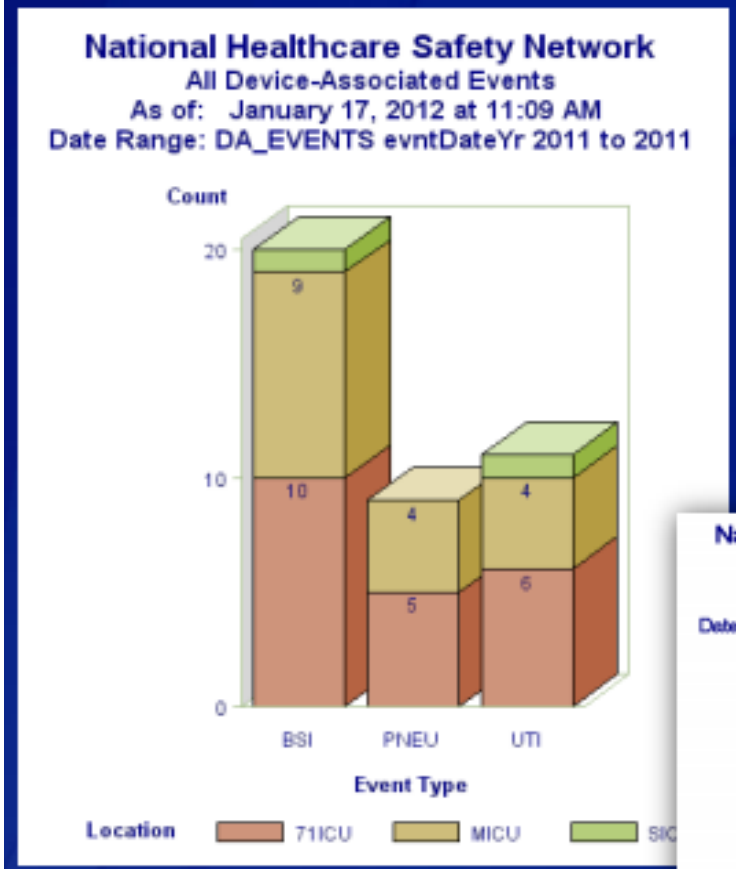
Location	Summary Yr/Qtr	months	CLA BSI Count	Central Line Days	CLA BSIRate	NHSN CLAB Pooled Mean	Incidence Density p-value	Incidence Density Percentile	Patient Days	CL Util Ratio	NHSN Line DU Pooled Mean	Proportion p-value	Proportion Percentile
71ICU	2011Q1	3	6	730	8.219	1.2	0.0003	100	1300	0.562	0.71	0.0000	30
71ICU	2011Q2	2	2	420	4.762	1.2	0.0880	99	1025	0.410	0.71	0.0000	9

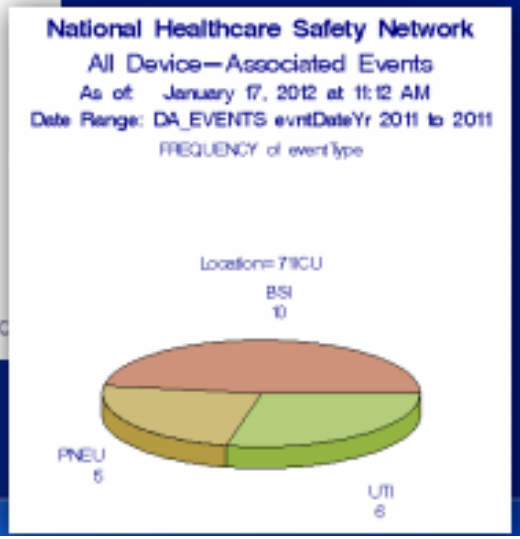
Source of aggregate data: NHSN Report, Am J Infect Control 2011;39:349-367

Data contained in this report were last generated on November 23, 2011 at 10:56 AM.

Analysis Output Options

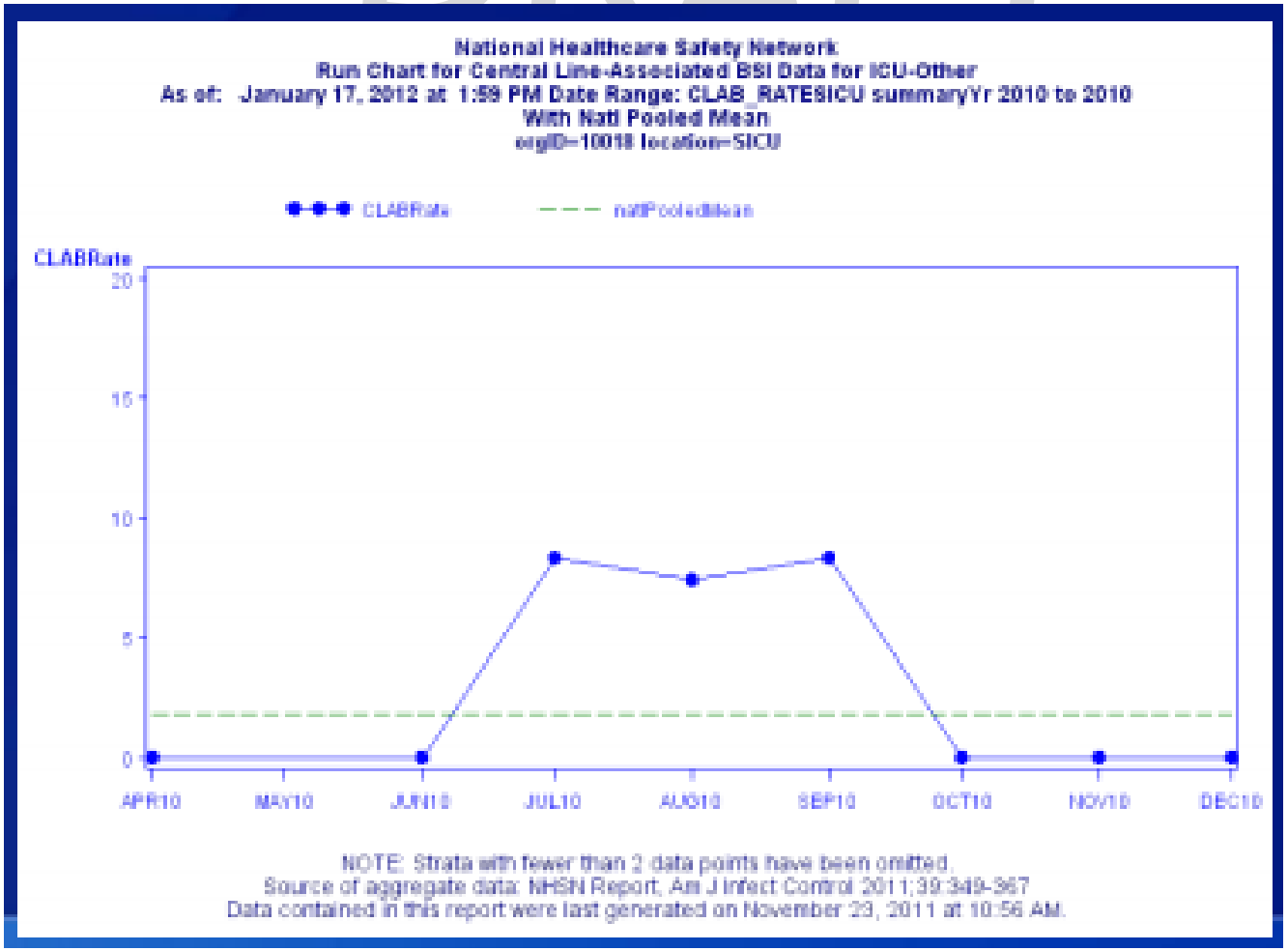
- **Bar Charts & Pie Charts**
  - Graphical report of counts of records meeting certain criteria (think of these as a graphical representation of the frequency table)
  - Example: How many CLABSI events occurred in each ICU?
  - **NOTE: These options do not graphically present rates or standardized infection ratios.**





Analysis Output Option: Run Chart

- Run charts allow you to graph rates and device-utilization ratios over time
- Can include NHSN pooled mean and/ or other defined reference line



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General Tips for Analyzing Data in NHSN

- Develop a timeline to regularly enter, and **analyze**, your hospital's data
  - Consider a timeline that would allow for timely feedback and interventions, if necessary
  - Example: Monthly review of rates and event-level details
- Generate datasets regularly
- Read the footnotes on your reports!
- Review data for accuracy and completeness

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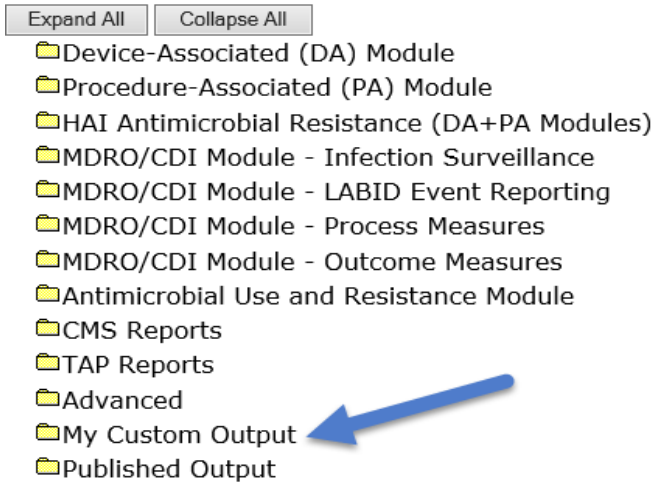
Modify Output (Reports)

- All NHSN output options can be modified or customized to meet your needs
- Modifications can be saved as templates, referred to as "My Custom Output"
  - Custom output options allow you to run the same modifications on updated datasets
- You can modify output options by changing the output format, changing the title, and filtering your data by multiple criteria



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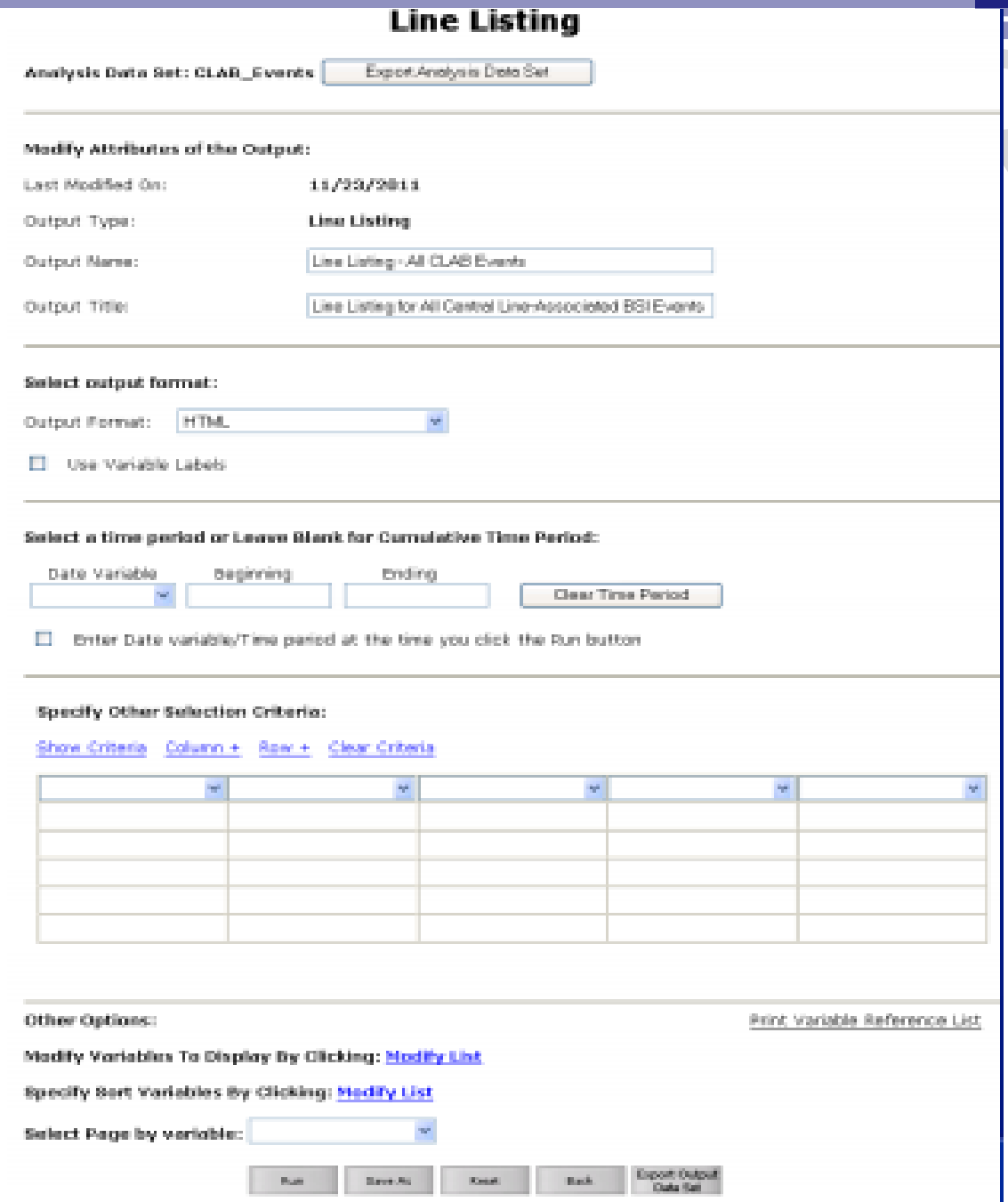
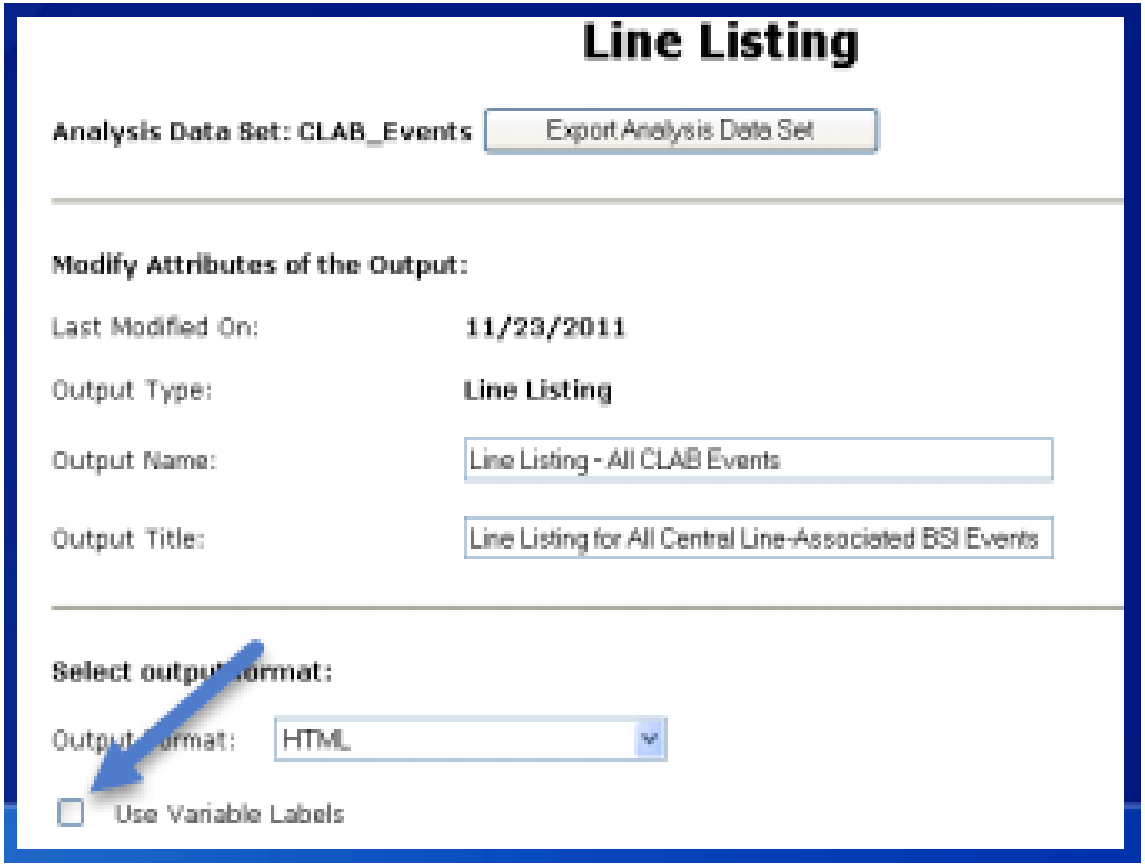


- To modify output or reports in NHSN, use the design modification screen
- To get to the screen, select "Modify" instead of Run from the Output Options page

(Will be described in three main sections on the following slides)

Design Modification Screen – Top Section

- The top section is the same for all output options and allows you to modify output characteristics, such as output name, title, and format

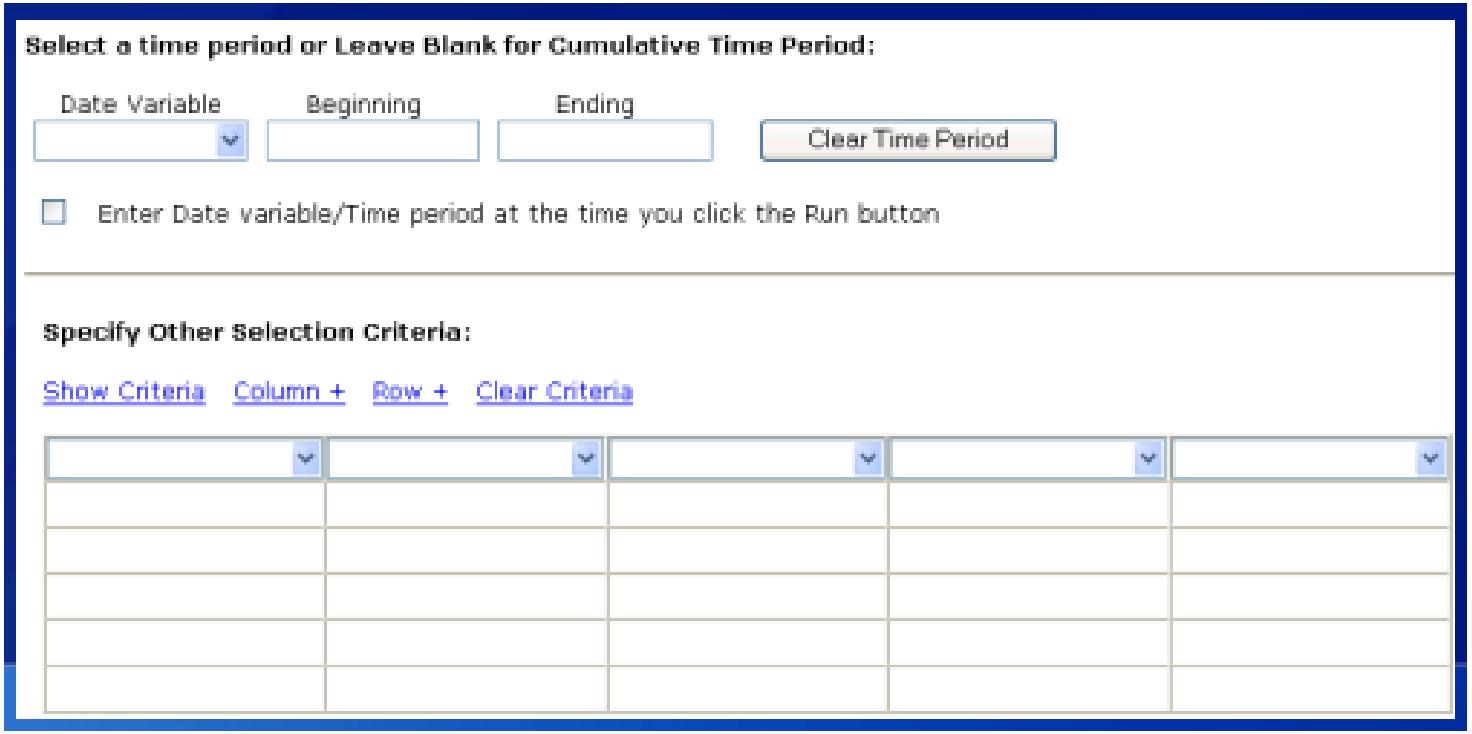


Tips:

- The default output format is HTML, make sure your browser allows pop-ups from cdc.gov
- Using variable labels will provide you with more descriptive column headers in your output

Design Modification Screen: Middle Section

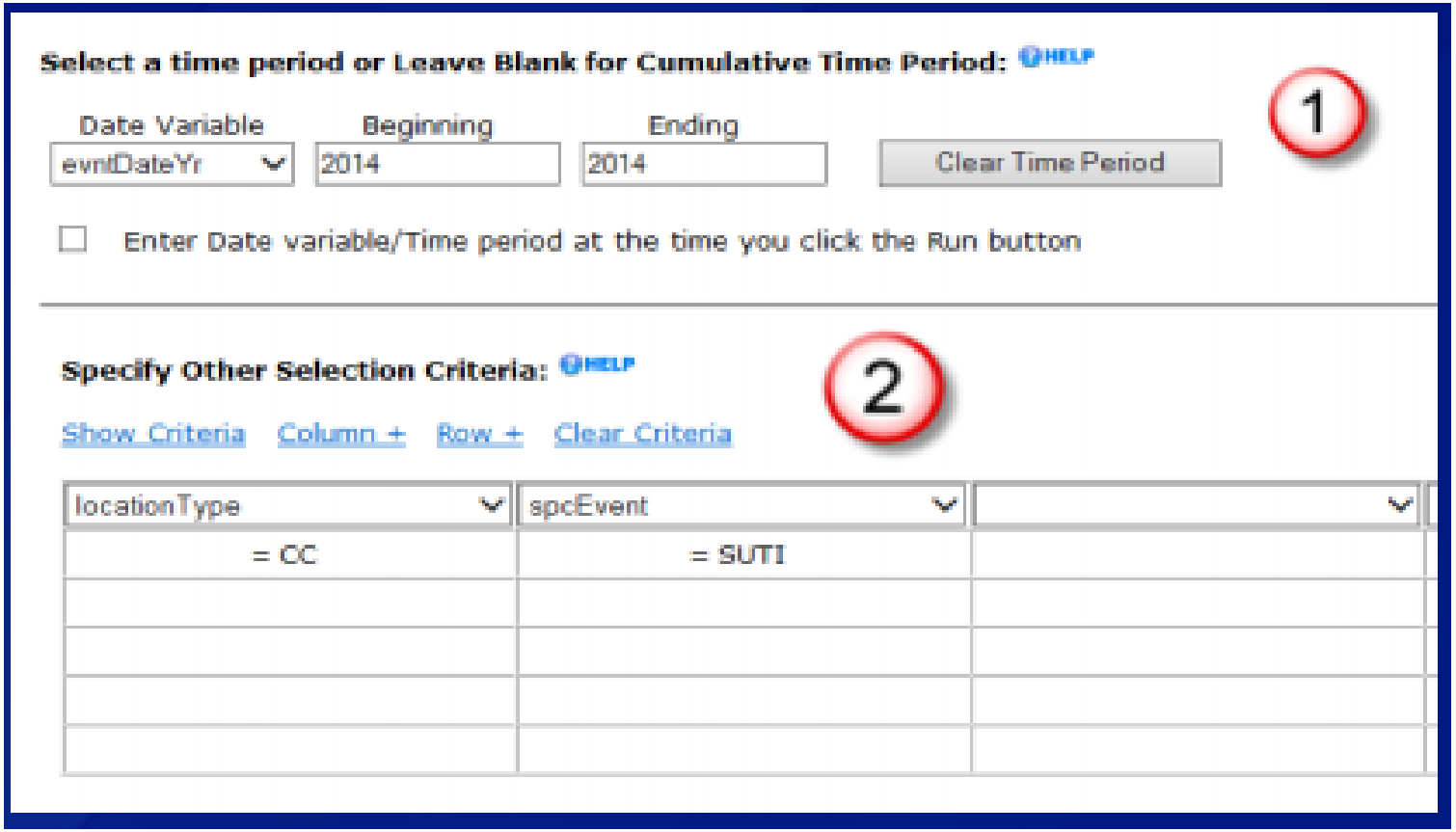
- The middle section is the same for all output options and allows you to specify which data will be considered for the output
- You can filter by time period, as well as location, specific event type, etc.



Example: Modifying Output for a Line List

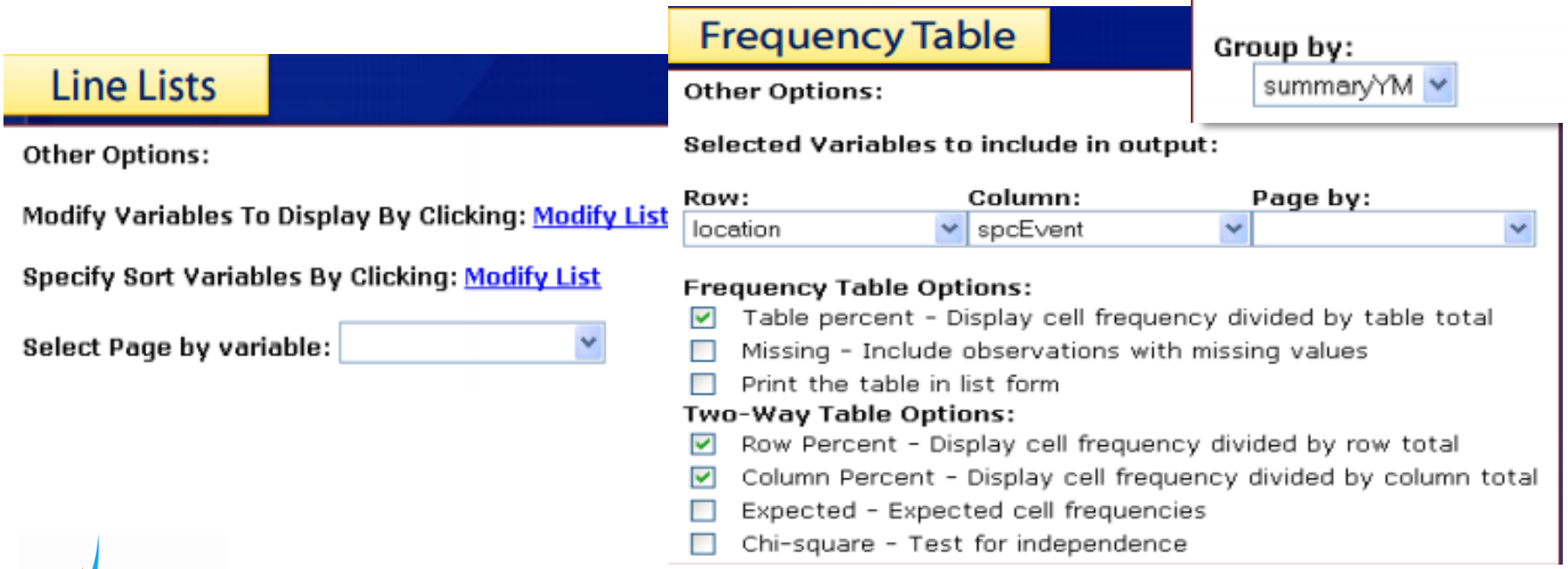
Modifying a CAUTI Line List to include:

1. CAUTI with an event date in 2014 (evntDateYr 2014 to 2014) and
2. Limited to ICUs (locationType = CC) and
3. Limited to specific CAUTI event type "SUTI" (spcEvent = SUTI)



Design Modification Screen: Bottom Section

- The bottom section allows you to specify how the data in the output will be displayed and organized
- These options vary by output type



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Example - Analyzing CAUTI data

- You and your colleagues have completed entering all HAI data into NHSN for the 4th quarter of 2014.
- The task of analyzing HAI surveillance data is distributed among you and your colleagues. You are tasked with analyzing CAUTI data.
- You will be expected to compare each location's rates and device utilization ratios to the national data.
- You will also be expected to provide an overall metric representing your hospital's CAUTI experience (i.e., the SIR).

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CAUTI Device-associated Rates

CAUTI, like other device-associated (DA) rates, are calculated as Incidence Density Rates

- What is an "Incidence Density Rate"?
  - Numerator = # of new cases during a period of time
  - Denominator = person-time during that same period of time (i.e., the population at risk from exposure to the device)
  - Uses a multiplier for interpretation
  - Also referred to as "IDR"

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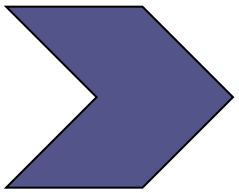
Q1: What measure of person-time is used in the calculation of device-associated rates in NHSN?



A. Patient days

B. Device days

C. Device insertions

D. Patient admissions

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Question 1 Rationale

- Device-associated infection rates are calculated based on person-time for those at risk of infection for that HAI type, as measured by the number of device days

Example:

$$\frac{\text{\# of CAUTIs in MICU for the year}}{\text{\# of urinary catheter days in MICU for the year}} \times 1000$$

Q2: How are DA rates presented by NHSN?

A. Overall, by facility

B. Combined DA rates, by location

C. Overall by location acuity level (e.g., all ICUs combined

D. By individual location for each DA event type

Question 2 Rationale

- Device-associated infection rates are reported to NHSN for each patient care location (unit or ward)
- Location serves as an indicator of "like populations" for the patients receiving care in that location
- Like populations are believed to have similar risks for healthcare-associated infections (HAIs)
  - Similar medical devices
  - Similar invasive procedures
  - Similar host factors affecting susceptibility

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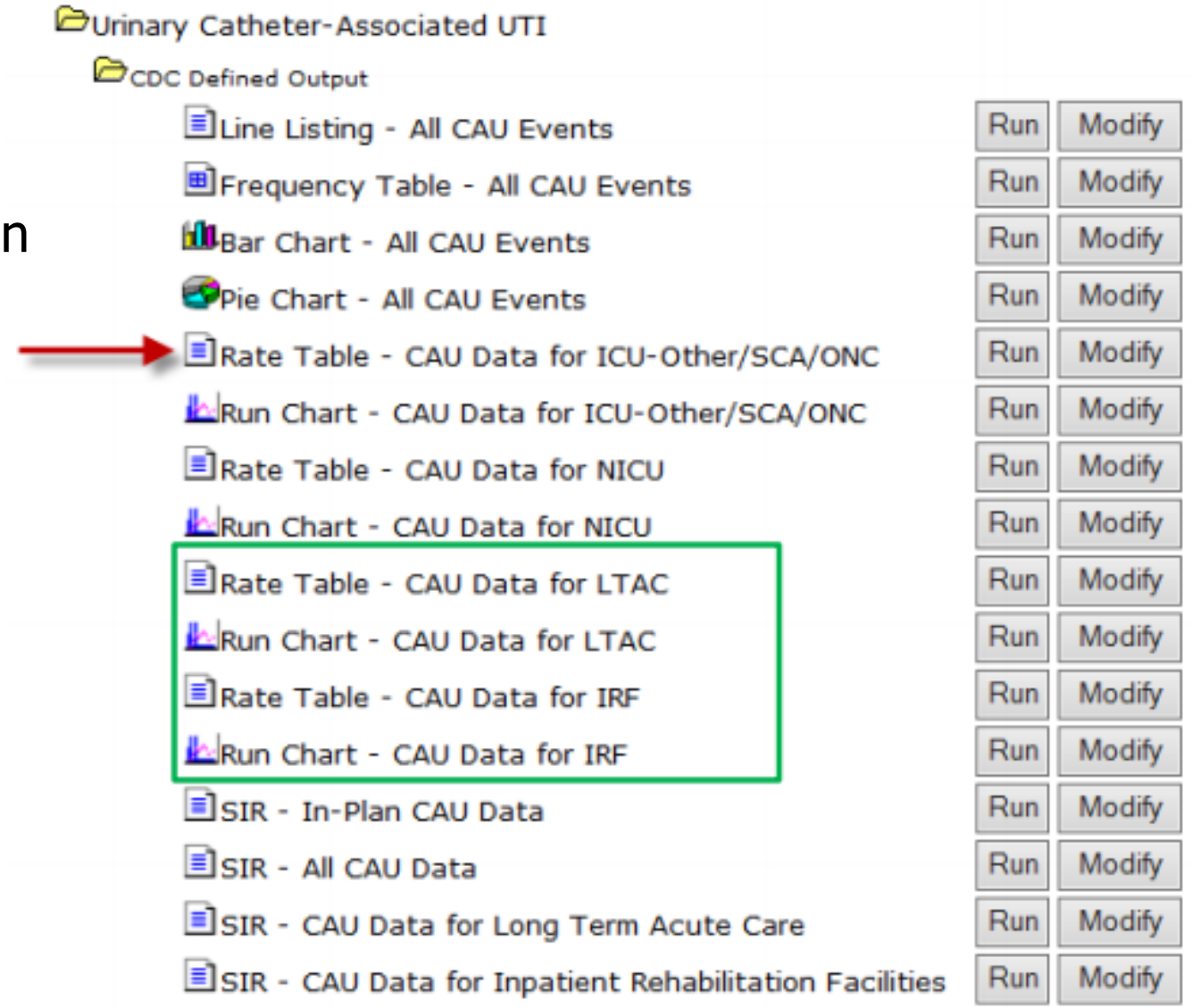
CAUTI Rates from NHSN

- NHSN provides CAUTI rates and device utilization ratios, by location
- Options are available for LTACs and IRFs



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Is it possible to produce rates or an SIR for my hospital's FISCAL year?

YES!

- Rates and SIRs are generated by a default time period, but this can be changed at any time
  - Click "Modify" next to the output option
  - Select your desired time period (e.g., summaryYM 10/2014 – 09/2015)
  - Leave the "Group By" drop-down blank

Quick Reference Guide for producing Fiscal Year/Cumulative Rates and SIRs:

www.cdc.gov/nhsn/PS-Analysis-resources/PDF/FAQ-Fiscal-Year.pdf

Example: CAUTI Rate Table

This table represents partial output from NHSN for 4 ICUs and 3 wards in "our" hospital

Location	CA UTI Count	Urinary Catheter Days	CA UTI Rate	NHSN CAU Pooled Mean	Incidence Density p-value	Incidence Density Percentile
MICU	1	274	3.650	3.5	0.8609	58
SICU	1	592	1.689	3.4	0.5299	27
MSICU	2	683	2.928	2.7	0.8178	61
CT ICU	3	729	4.115	1.8	0.1950	99
Med Ward	0	279	0.000	1.5	0.6521	25
Surg Ward	1	456	2.193	1.3	0.5809	76
Neuro Ward	2	270	7.407	2.2	0.1477	97

CTICU CAUTI Rate Table

Location	CA UTI Count	Urinary Catheter Days	CA UTI Rate	NHSN CAU Pooled Mean	Incidence Density p-value	Incidence Density Percentile
CTICU	3	729	4.115	1.8	0.1950	99

Our hospital's data

NHSN published data and comparisons

Q3: How would you interpret the CTICU's CAUTI rate of 4.115?

Location	CA UTI Count	Urinary Catheter Days	CA UTI Rate	NHSN CAU Pooled Mean	Incidence Density p-value	Incidence Density Percentile
CTICU	3	729	4.115	1.8	0.1950	99

A. 4.1%

B. 4.1 per 1000 patient days

C. 4.1 per 1000 catheter days

D. 4.1 times higher than the national pooled mean

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CTICU CAUTI Rate Table

Location	CA UTI Count	Urinary Catheter Days	CA UTI Rate	NHSN CAU Pooled Mean	Incidence Density p-value	Incidence Density Percentile
CTICU	3	729	4.115	1.8	0.1950	99

Our hospital's data

NHSN published data and comparisons

What are the odds that your finding is a fluke, a coincidence, nothing?

- This probability is called the p-value
  - Helps determine rarity…how rare is this outcome that it could not have happened by chance alone?
- If the calculated p-value is very small (less than 1 in 20 or 5% or 0.05 = $p<0.05$), finding is probably not due to chance alone
  - $p<0.05$ is a convenient cut-point that is widely accepted
- Interpreting the "Incidence Density p-value"
  - $p<0.5$ = our rate is "significantly different" than the NHSN pooled mean
  - $p>0.05$ = our rate is no different than the NHSN pooled mean

Example: NHSN Incidence Density p-value

- The p-value is included in NHSN device-associated incidence rates output
- Comparing your facility's rate, by location, to the NHSN pooled mean for that same location type

Location	CA UTI Count	Urinary Catheter Days	CA UTI Rate	NHSN CAU Pooled Mean	Incidence Density p-value	Incidence Density Percentile
CTICU	3	729	4.115	1.8	0.1950	99

Example: Asking the question "are 3 CAUTI in 729 urinary catheter days at your hospital different than 1,715 UTI in 942,852 catheter days at all NHSN reporting hospitals for that location type?"

Q4: Based on the data in this table, is your CAUTI rate significantly different from the NHSN pooled mean?

Location	CA UTI Count	Urinary Catheter Days	CA UTI Rate	NHSN CAU Pooled Mean	Incidence Density p-value	Incidence Density Percentile
CTICU	3	729	4.115	1.8	0.1950	99

A. No, based on the p-value

B. Yes, based on the p-value

C. Yes, based on practical significance

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Q5: How would you interpret the percentile for the CTICU?

Location	CA UTI Count	Urinary Catheter Days	CA UTI Rate	NHSN CAU Pooled Mean	Incidence Density p-value	Incidence Density Percentile
CTICU	3	729	4.115	1.8	0.1950	99

A. 99% of the cardiothoracic ICUs contributing to the pooled mean had a rate equal to ours.

B. 99% of the cardiothoracic ICUs contributing to the pooled mean had a rate lower than ours.

C. 99% of the cardiothoracic ICUs contributing to the pooled mean had a rate higher than ours.

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Device Utilization Ratios

- Device utilization (DU) ratios help assess the proportion of days in which patients were at risk for the DA infection
- Calculated as:

$$\frac{\#\ of\ device\ days}{\#\ of\ patient\ day}$$

Device Utilization Ratios

- The device utilization ratio is the number of device days compared to (divided by) the number of patient days.
- Similar to device-associated rates, your location's device use is compared to the NHSN pooled mean.

Location	# UC Days	# Pt days	DU Ratio	NHSN Pooled Mean	P-value	Percentile
MICU	274	365	0.75	0.67	0.1336	65
SICU	592	911	0.65	0.72	0.0489	25
MSICU	683	1035	0.66	0.65	0.8133	45
CT ICU	729	959	0.76	0.65	0.0023	60
Med Ward	279	1395	0.20	0.15	<0.0001	80
Surg Ward	456	2533	0.18	0.22	0.0002	32
Neuro Ward	270	1800	0.15	0.17	0.0024	50

Q6: How would you interpret the DU Ratio results for the CTICU?

Location	Urinary Catheter Days	Patient Days	Cath Util Ratio	CathDU_Mean	Proportion p-value	Proportion Percentile
CTICU	729	959	0.76	0.65	0.0023	60

A. The DU ratio in the CTICU is not significantly higher than the NHSN pooled mean.

B. Compared to the NHSN pooled mean, we would not consider the DU ratio in the CTICU "actionable".

C. The DU Ratio in the CTICU is significantly higher than the NHSN pooled mean, based on the p-value.

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Elements of HAI Data Interpretation

- Cover the basics
  - How many HAIs?
  - Rate, DU ratio, SIR
  - Over what period of time?
- Interpret the statistical results
  - P-value
  - Percentile
- Highlight successes or pitfalls
  - Which locations experienced zero HAIs?
  - Examine for trends – have rates gone up, or down, in any location compared to previous time period?
  - If a goal is set that is different from NHSN pooled mean, how is the progress towards that goal?

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Elements of HAI Data Interpretation - continued

- Supplement the data
  - What were the organisms identified? Any trends?
  - What special prevention efforts/education have started during this time period?
  - Have there been any significant changes in staff or type of patients receiving care in the unit?
  - Has surveillance been part of any special initiatives?
  - Have there been any internal, or external validation programs that have taken place during this time period?
  - Have NHSN surveillance definitions changed?
  - Has education about NHSN definitions enhanced surveillance?
- Look ahead
  - What are the plans to lower rates, or maintain low rates?

Standardized Infection Ratio (SIR)

- The SIR is a summary measure
- Used to compare the HAI experience among one or more groups of patients to that of a standard population (e.g. NHSN)
  - Indirect standardization method
  - Accounts for differences in HAI incidence within groups
- Used in public reporting by CDC (at state and national levels), CDPH, and CMS (at facility level on Hospital Compare)
- SIRs are currently available for CLABSI, CAUTI, SSI, MRSA Bacteremia LabId, and CDI LabID

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Standardized Infection Ratio - continued

$$SIR = \frac{\text{Observed \# of HAIs}}{\text{Expected (Predicted) \# of HAIs}}$$

- Observed # of HAIs – the number of infections that occur in your hospital, i.e. events that you enter into NHSN
- Expected or predicted # of HAIs – comes from national baseline data
  - Calculating the # of expected HAIs can differ depending on the measure

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Number of Expected Infections <1

- If the number of expected events is less than 1, the SIR is not calculated
- Why not?
  - To enforce a minimum precision criterion
  - To aid in interpretation of the results

Example: Imagine a facility observed 2 CAUTIs during a time period but NHSN estimates that 0.5 CAUTIs were expected

  - If calculated, the SIR would be 4 – indicating that the facility observed 4 times the number of infections expected. Yet, only 2 were identified
  - The comparison is too imprecise to be considered valid

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95% Confidence Interval

- NHSN produces a p-value and 95% confidence interval with each SIR – both can be used to assess significance of the SIR
- A 95% CI is an interval for which there is a high degree of confidence that it contains the true SIR
  - The upper and lower limits are used to determine the significance and accuracy (or precision) of the SIR
- Allows you to assess variability of an estimated SIR
- If the confidence interval includes the value of 1, then the SIR is not significant

  i.e., if the lower bound is ≤1 and the upper bound is ≥1, then the SIR is not significant

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SIR – Which is reported to whom?

Program	Uses what SIR
Facility corporate and/or special groups (SUSP)	All SSI SIR Model
California Department of Public Health (CDPH)	Complex A/R SSI Model
CMS	Complex 30 day SSI Model

For further information on what SIR Model includes see:
http://www.cdc.gov/nhsn/pdfs/pscmanual/9pscssicurrent.pdf
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Additional Resources

- Analysis Resource page:
  www.cdc.gov/nhsn/PS-Analysis-resources/index.html
- More Analysis training:
  www.cdc.gov/nhsn/Training/analysis/index.html
- NHSN Annual Reports:
  www.cdc.gov/nhsn/dataStat.html

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Summary

- NHSN analysis features allow you to know your data and assists you to share your facility's outcomes with stakeholders.
- For up to date data, the first step is always to generate a dataset.
- There are a number of different types of reports that can be generated; they can be customized and saved.
- Don't be afraid to experiment, you cannot alter your data when using the analysis features.

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Thank you

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