SSI Workshop PART 4: NHSN Basic Analysis and the Standardized Infection Ratio (SIR)

March 2011

HAI Liaison Program
Healthcare-Associated Infections Program
Center for Health Care Quality
California Department of Public Health

Today's Objectives

- Review NHSN Analysis ("the Basics")
- Learn to check your NHSN data for completeness of reporting
- Understand the Standardized Infection Ratio
- Interpret SIR for CLABSI and SSI

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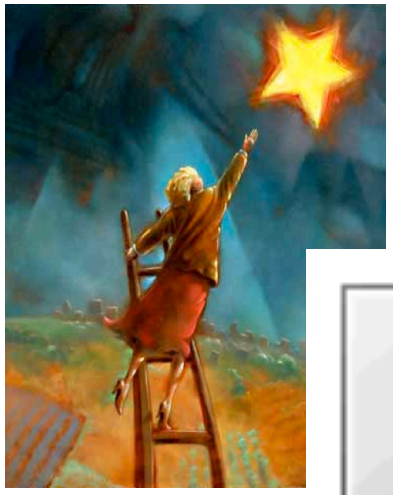
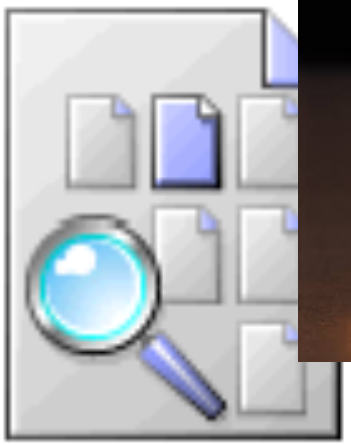
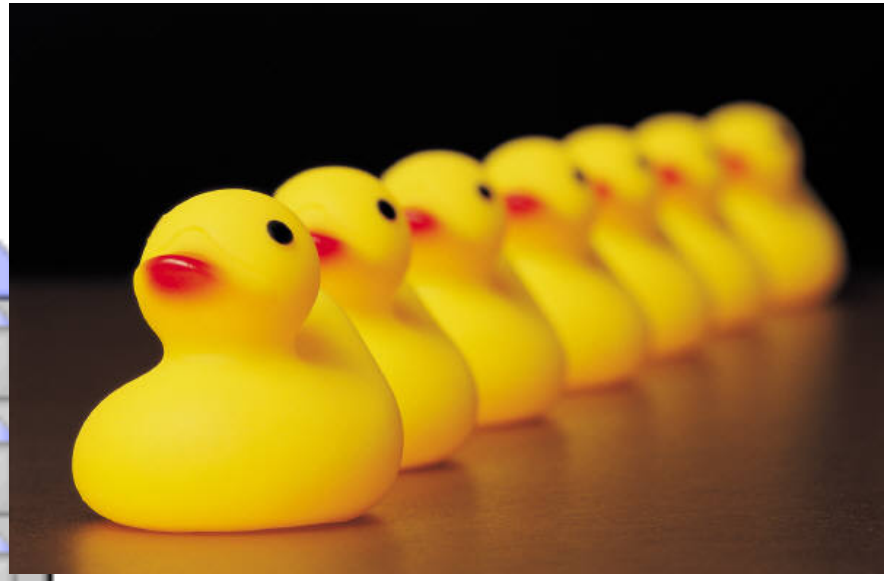
Healthcare-associated Infections HAI Elimination

Just collecting HAI data has many challenges!







Assuming you do surveillance per NHSN protocol, identify all infections, gather accurate denominator data, and enter it all into NHSN, then what?!?

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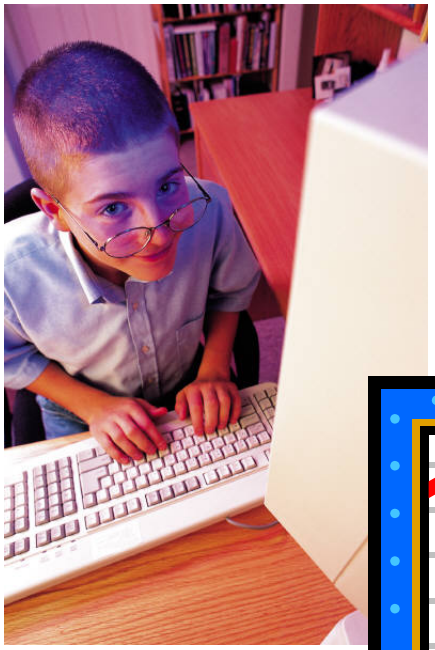
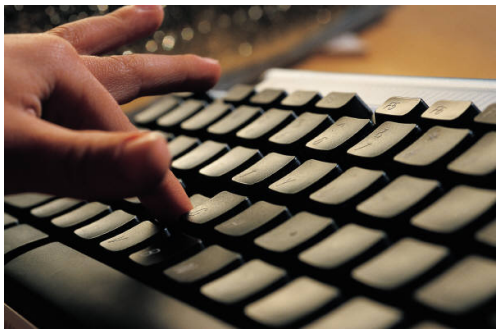
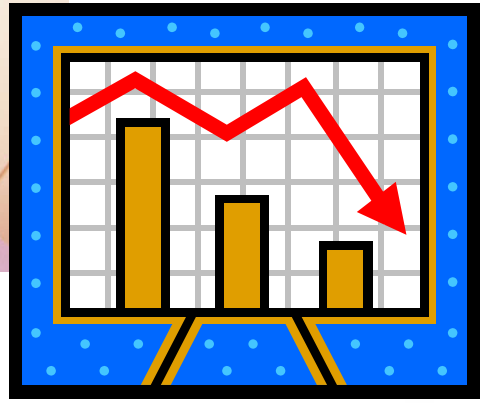
NHSN Analysis Features

A user can generate various types of output including:

- line listings
- frequency tables
- pie charts
- bar charts
- rate tables
- line plots
- control charts
- SIR (for CLABSI & SSI)







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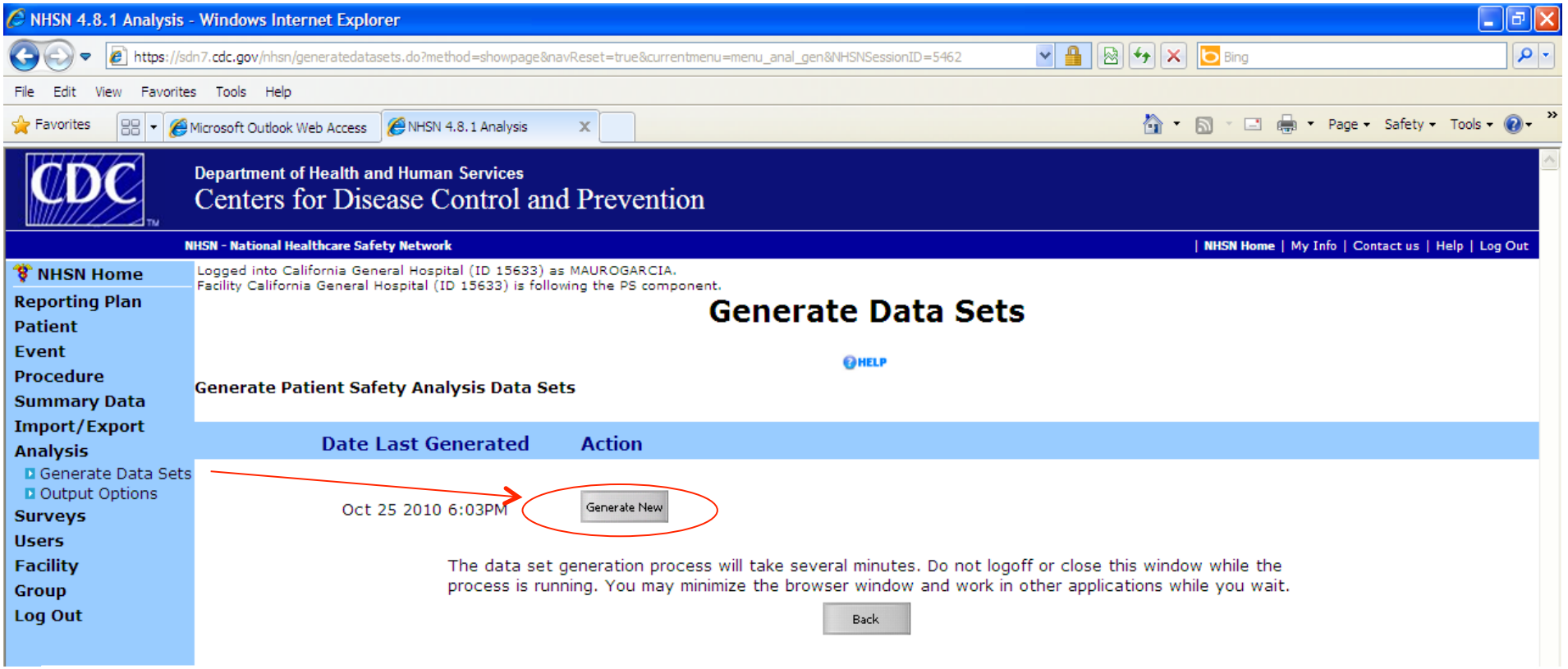
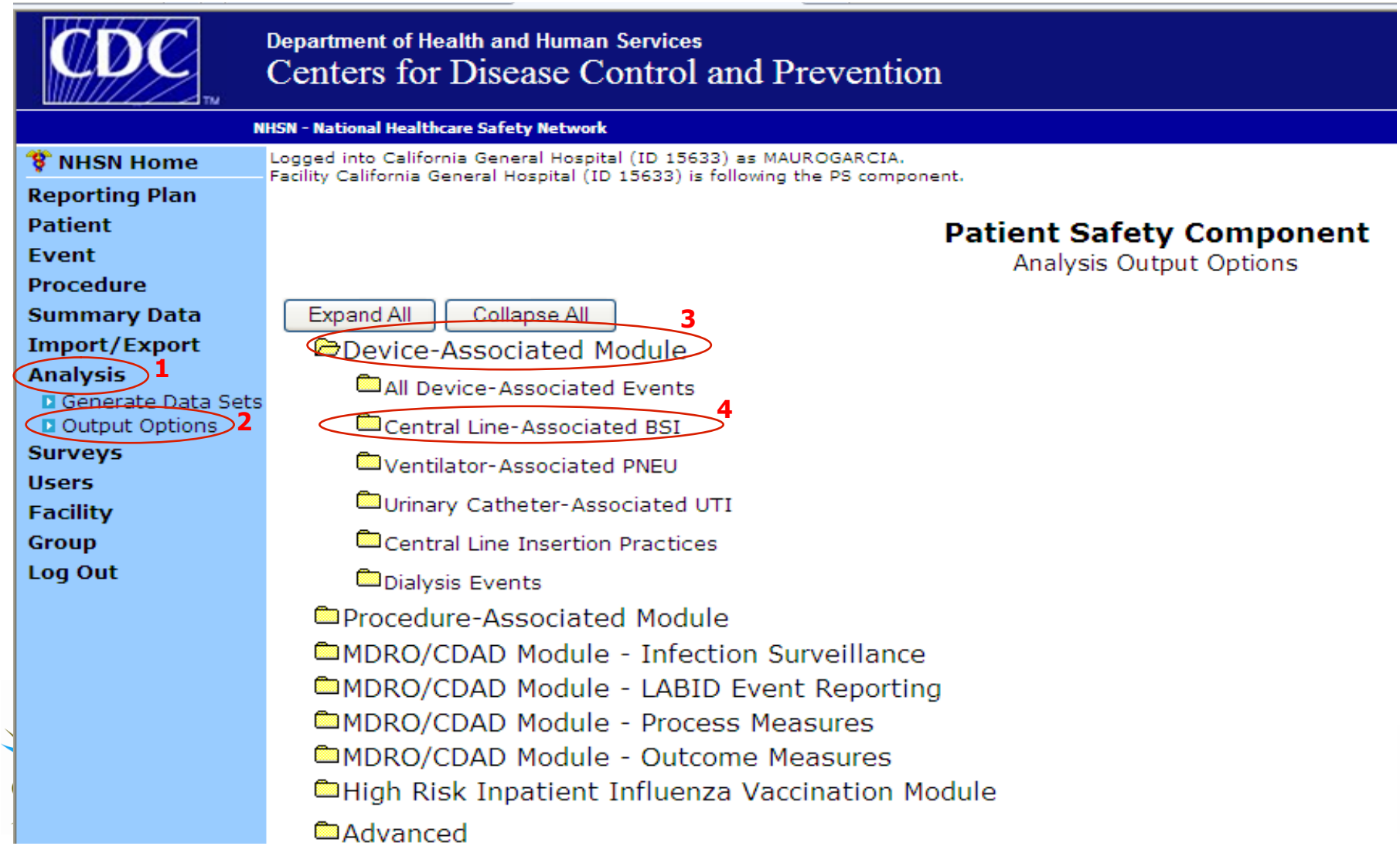
Generate a Data Set

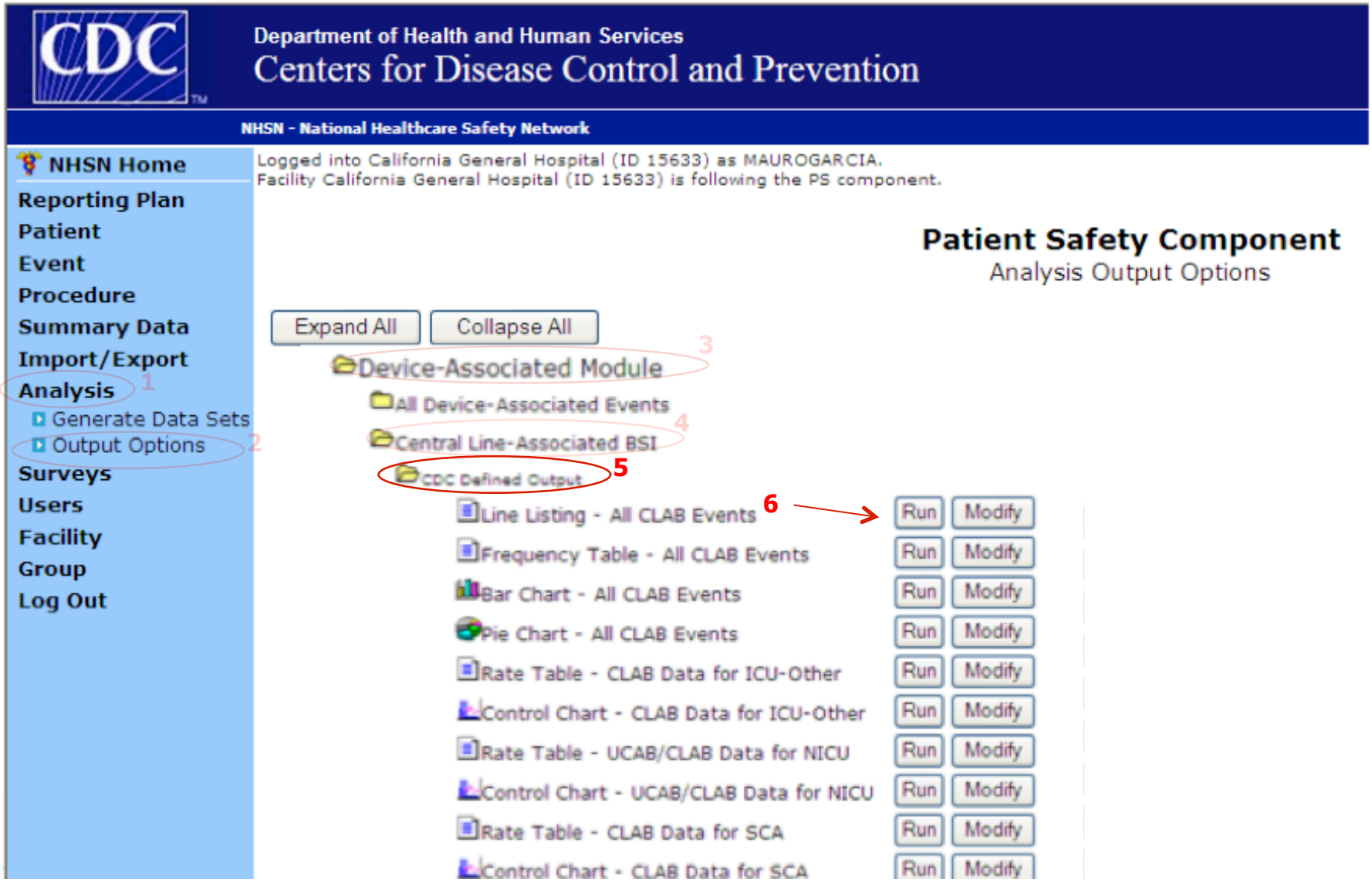
Before any analysis, you must generate a data set to extract your hospital data from the NHSN servers



Choose Analysis Type



Select Output Type – Line List



Run Line List

Line listing output looks like this

National Healthcare Safety Network

Line Listing for All Central Line-Associated BSI Events

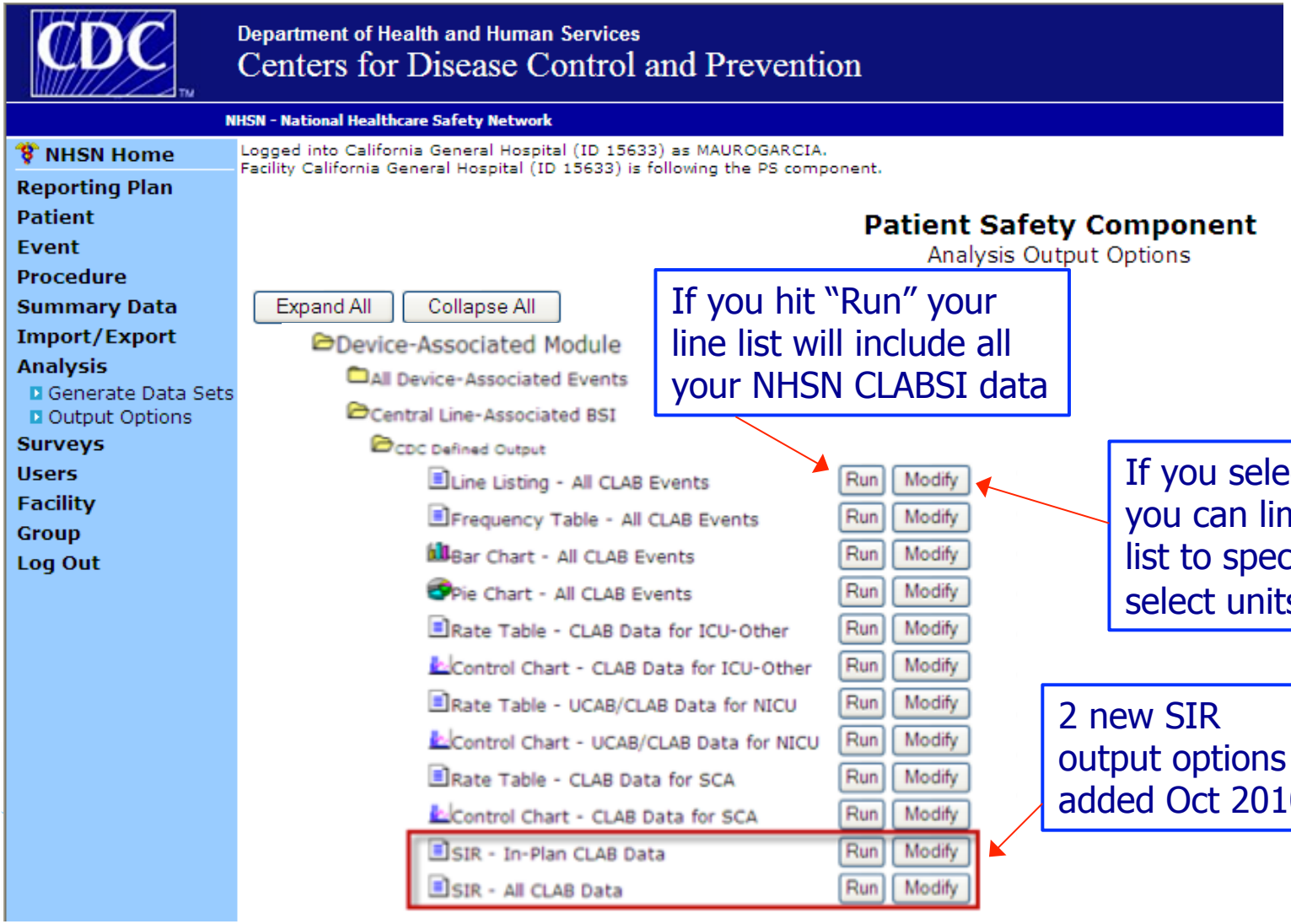
As of: October 27, 2010 at 4:59 PM

Date Range: All CLAB_EVENTS

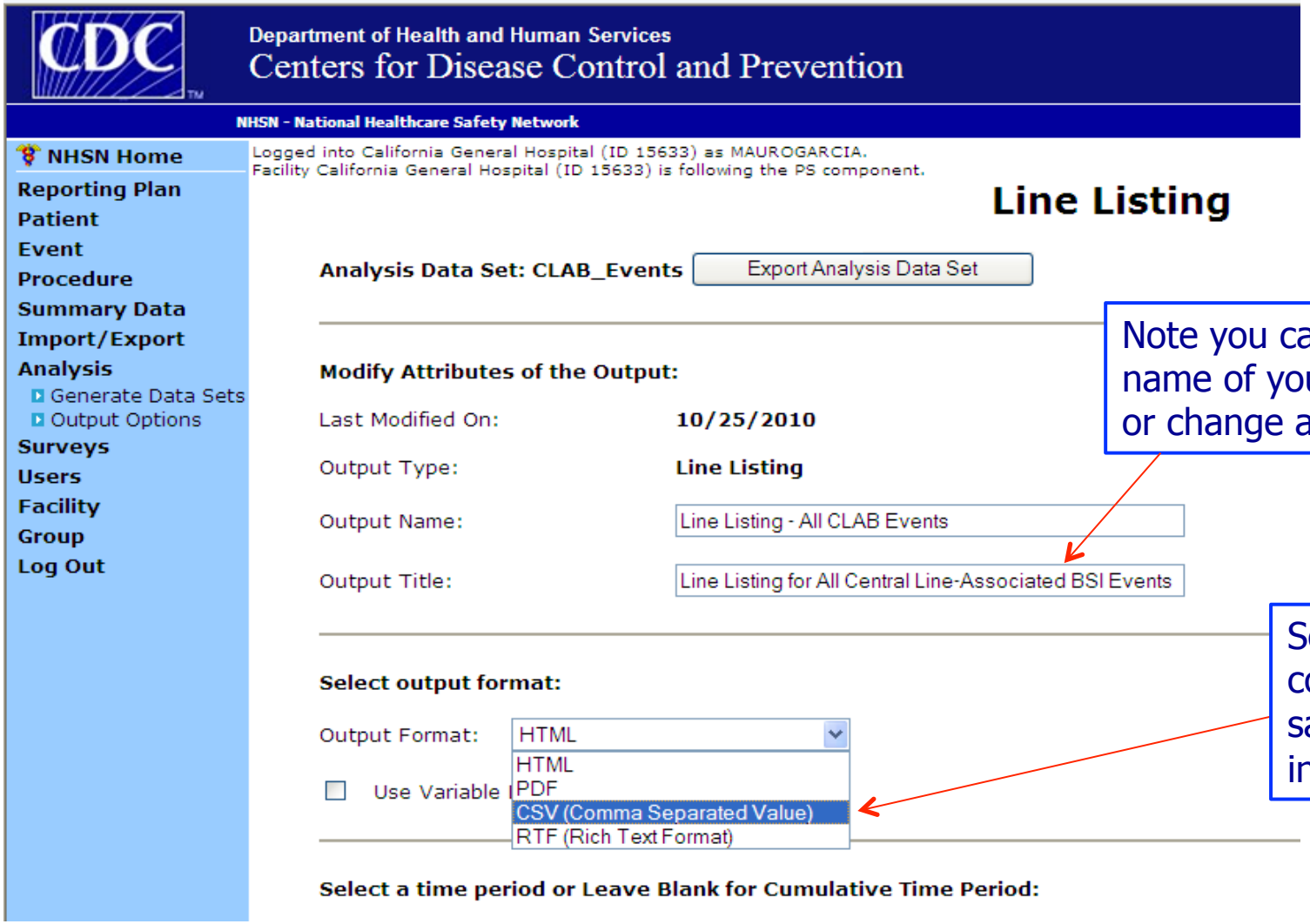
orgID	patID	dob	gender	admitDate	eventID	eventDate	eventType	spcEvent	location
15633	Z-TEST001	01/01/1980	M	08/02/2010	3739668	08/13/2010	BSI	LCBI	Z-ICU
15633	Z-TEST002	01/01/1980	F	10/08/2010	3734183	10/13/2010	BSI	LCBI	Z-ICU
15633	Z-TEST003	01/01/1980	F	09/17/2010	3752048	09/20/2010	BSI	LCBI	Z-ICU
15633	Z-TEST004	01/01/1980	F	10/01/2010	3739433	10/12/2010	BSI	LCBI	Z-MED/SURG
15633	Z-TEST008	01/01/1980	F	08/05/2010	3739724	08/18/2010	BSI	LCBI	Z-OB
15633	Z-TEST009	01/01/1980	F	08/04/2010	3739732	08/18/2010	BSI	LCBI	Z-ICU
15633	Z-TEST012	01/01/1980	M	08/01/2010	3739747	08/02/2010	BSI	LCBI	Z-ICU
15633	Z-TEST015	01/01/1980	F	08/02/2010	3739760	08/24/2010	BSI	LCBI	Z-ICU

Data contained in this report were last generated on October 25, 2010 at 6:03 PM.

"Modify" Options for CLABSI



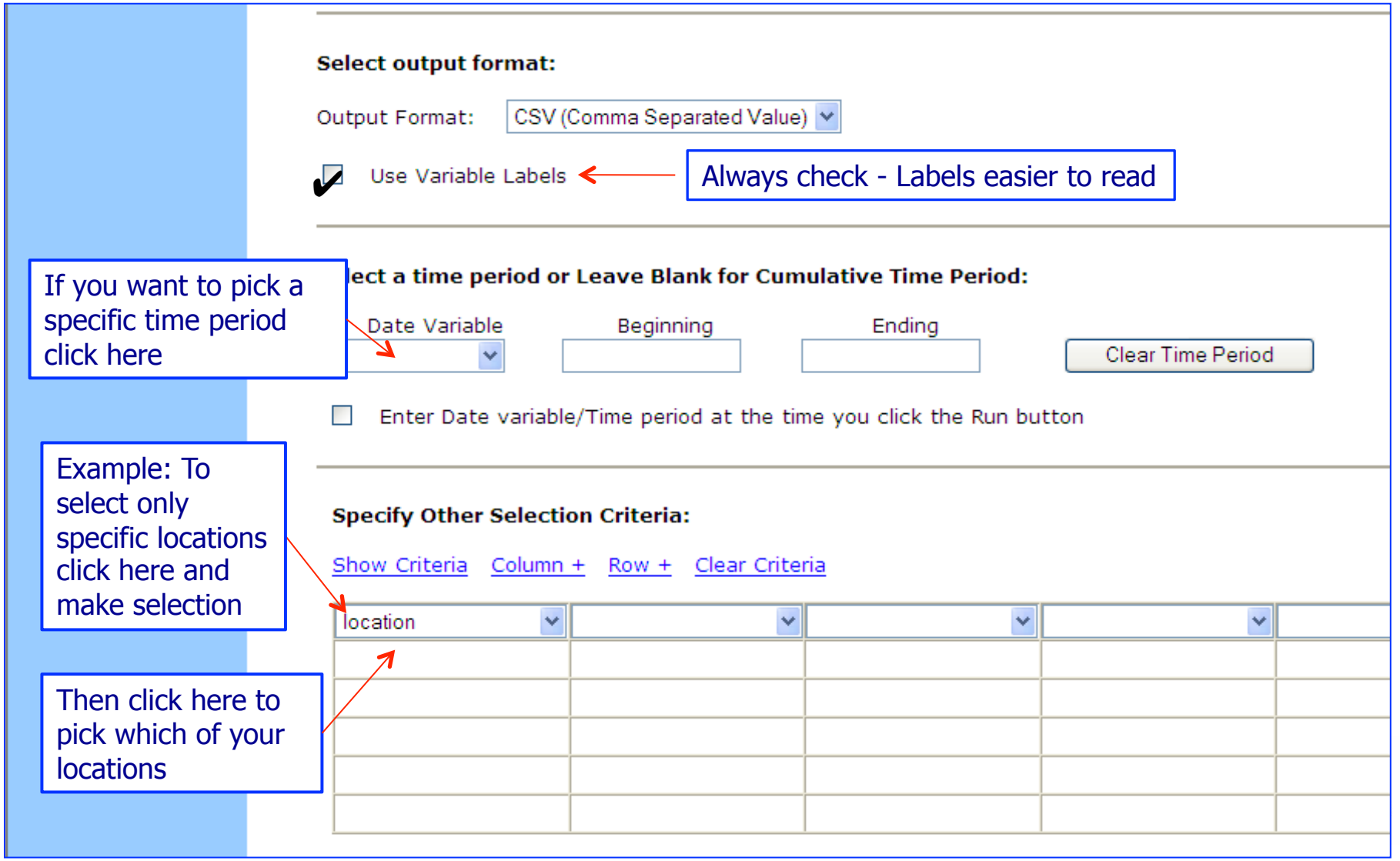
Select Output Format for line listing



Note you can change the name of your report here or change after it's in Excel

Select CSV to convert to save and use in Excel

Modify Variables

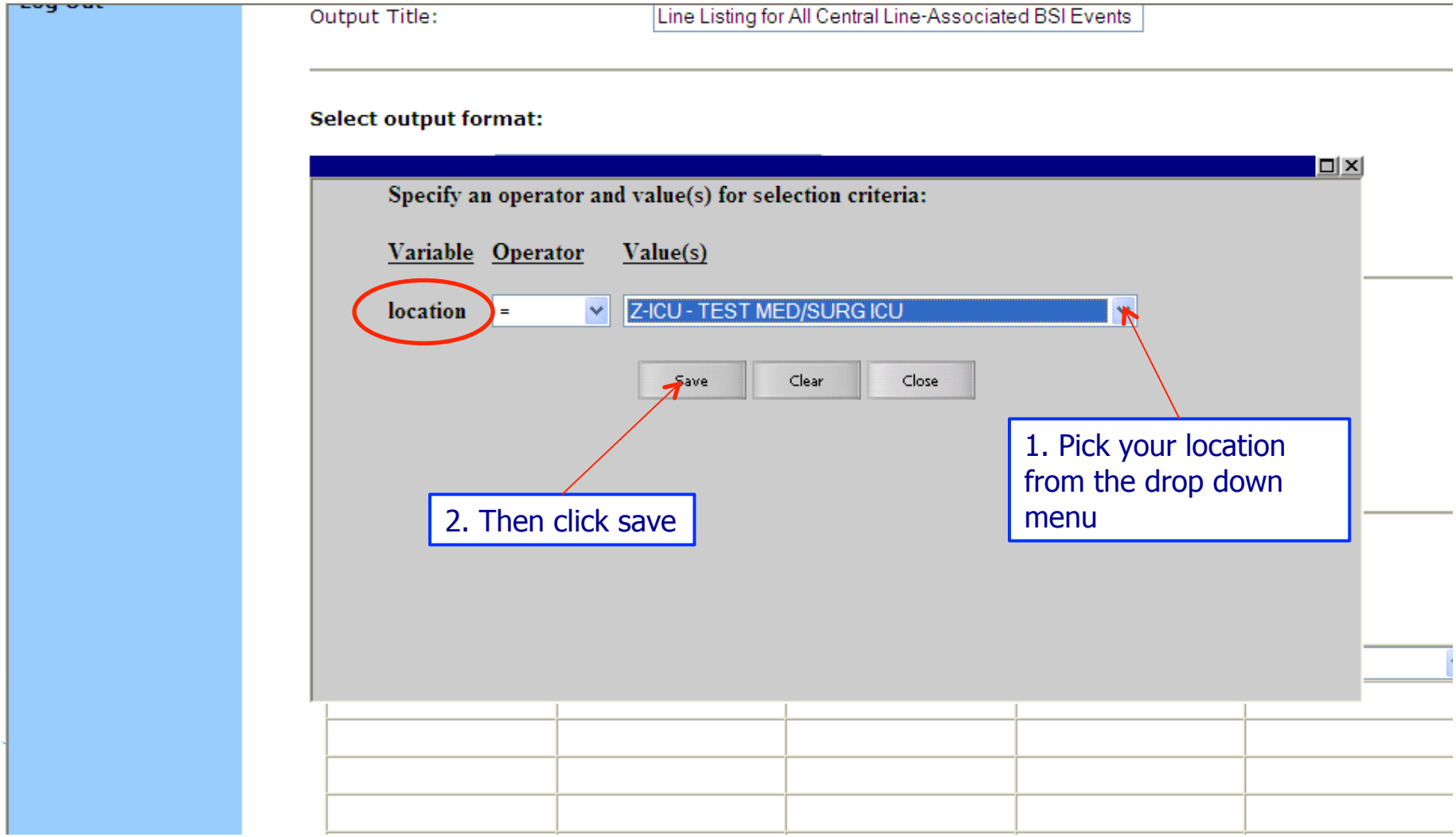


Analysis Date Variables

When entering date variables, use defined formats

Specify by	Date variable	Beginning	Ending
Date	eventDate	01/01/2009	12/31/2009
Year*	evntDateYr	2009	2009
Half-year*	evntDateYH	2009H1	2009H2
Quarter*	evntDateYQ	2009Q1	2009Q4
Month	evntDateYM	01/2009	12/2009

Filtering Data



Analysis Filtering Terms

Various operators can be selected to modify the output.

Operator	Meaning
=	Equal to
>	Greater than
>=	Greater than or equal to
<	Less than
<=	Less than or equal to
~=	Not equal to
In	In a set of defined values
~In	Not in a set of defined values
Between	Within a range of defined values

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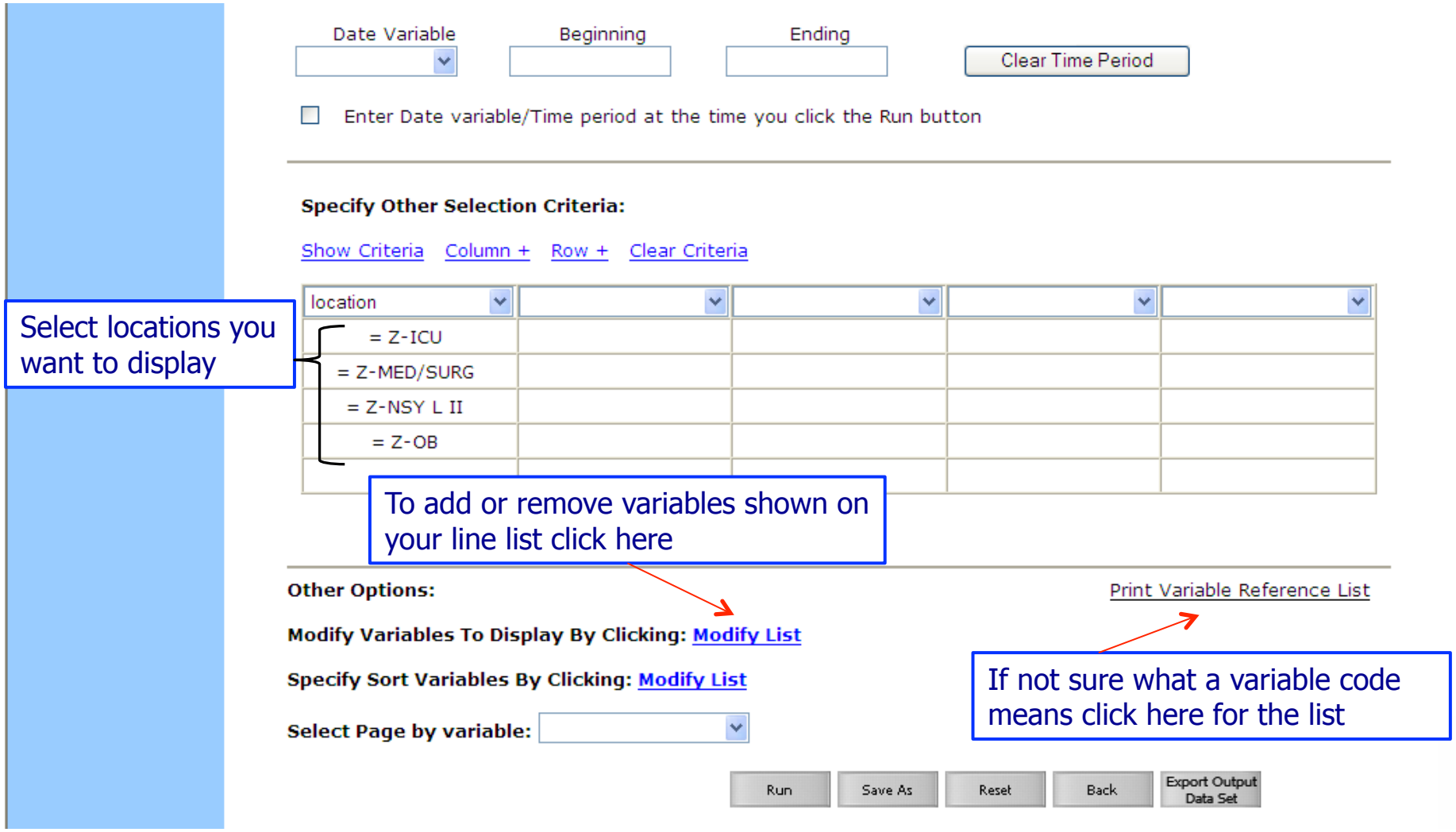
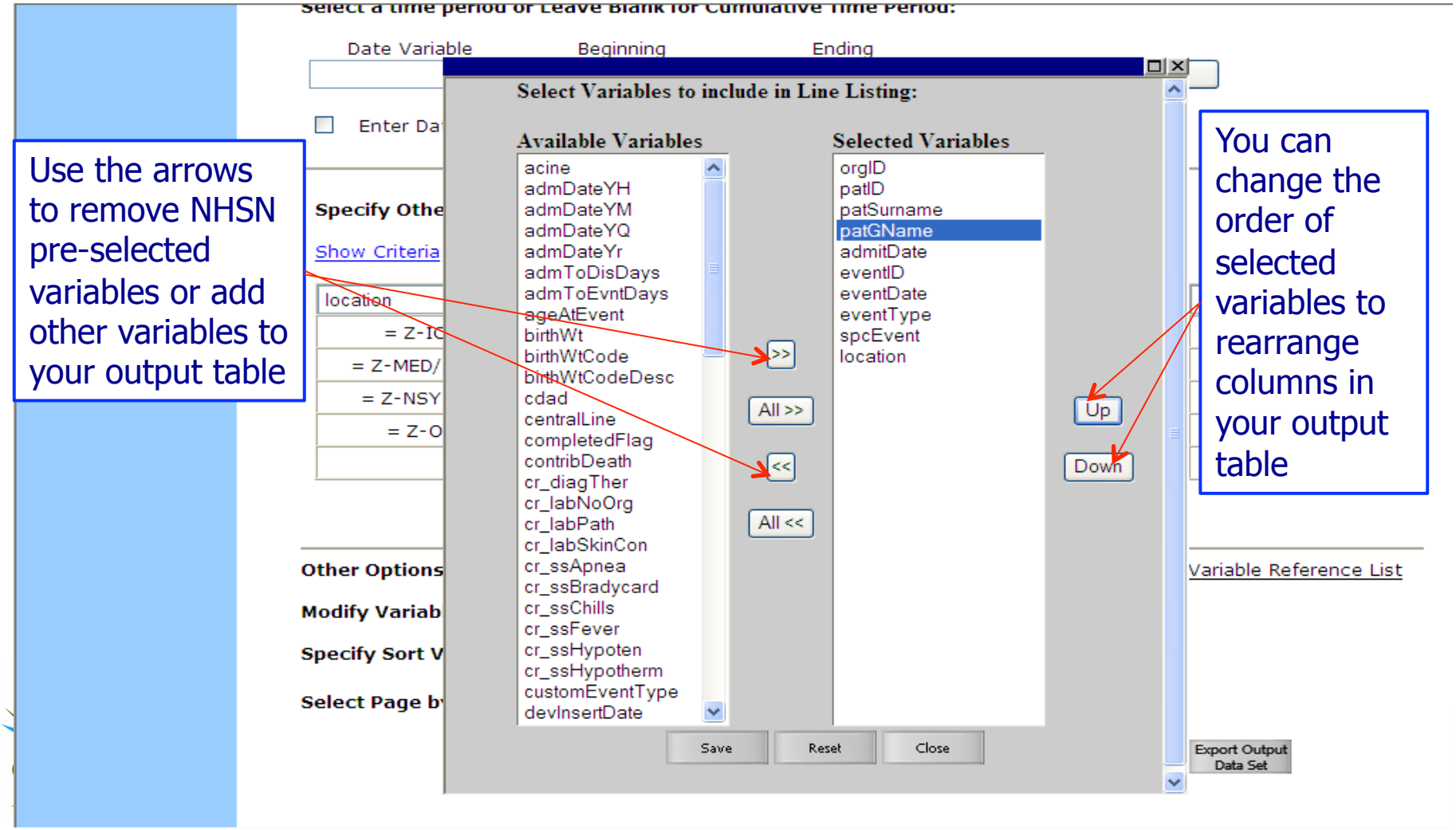
Specify Additional Criteria



Modify Variables Displayed in Report



CLABSI Line List in Excel (sample data)

Line Listing for All Central Line-Associated BSI Events

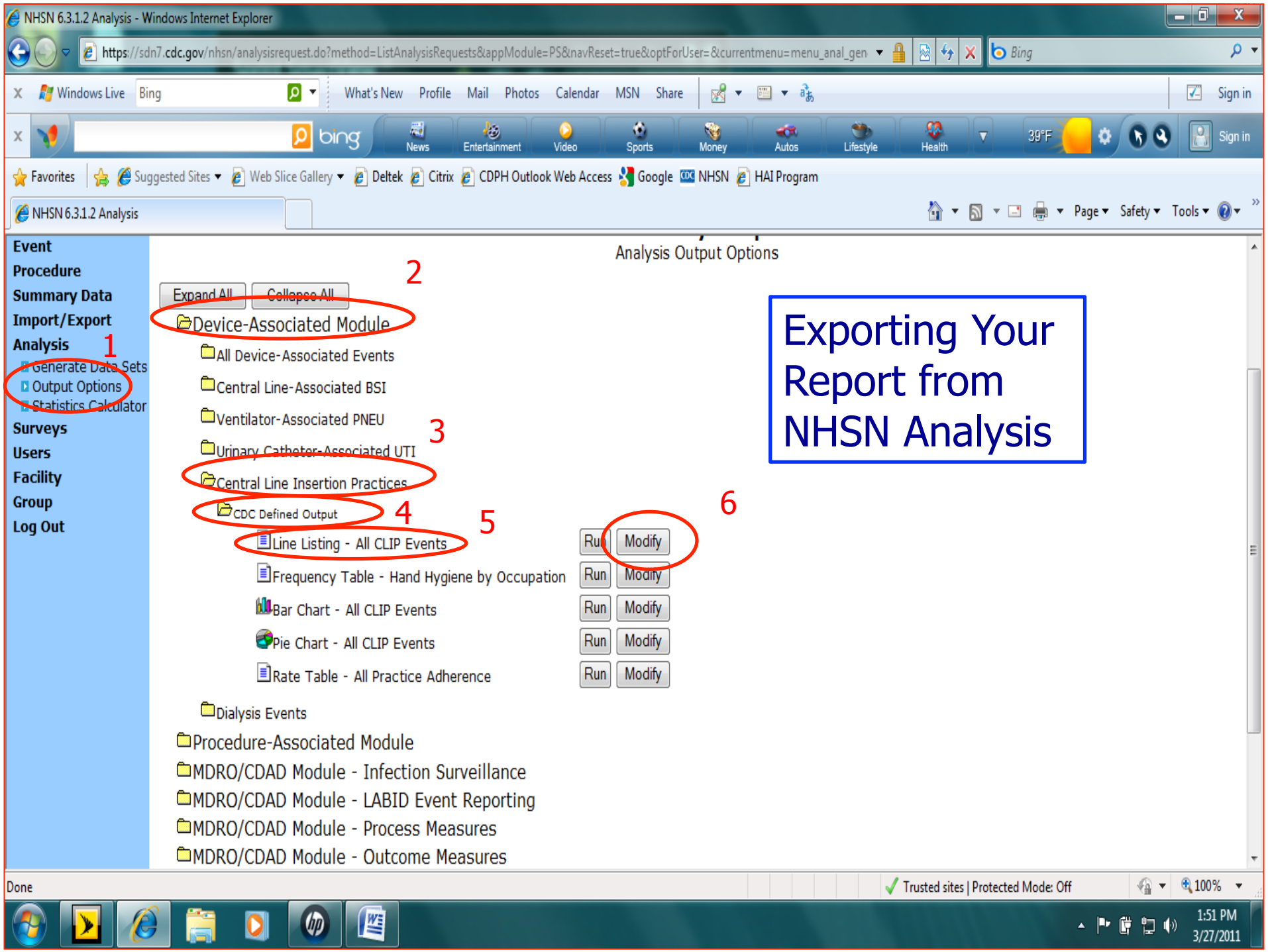
As of:
October 26 2010 at 6:35 PM

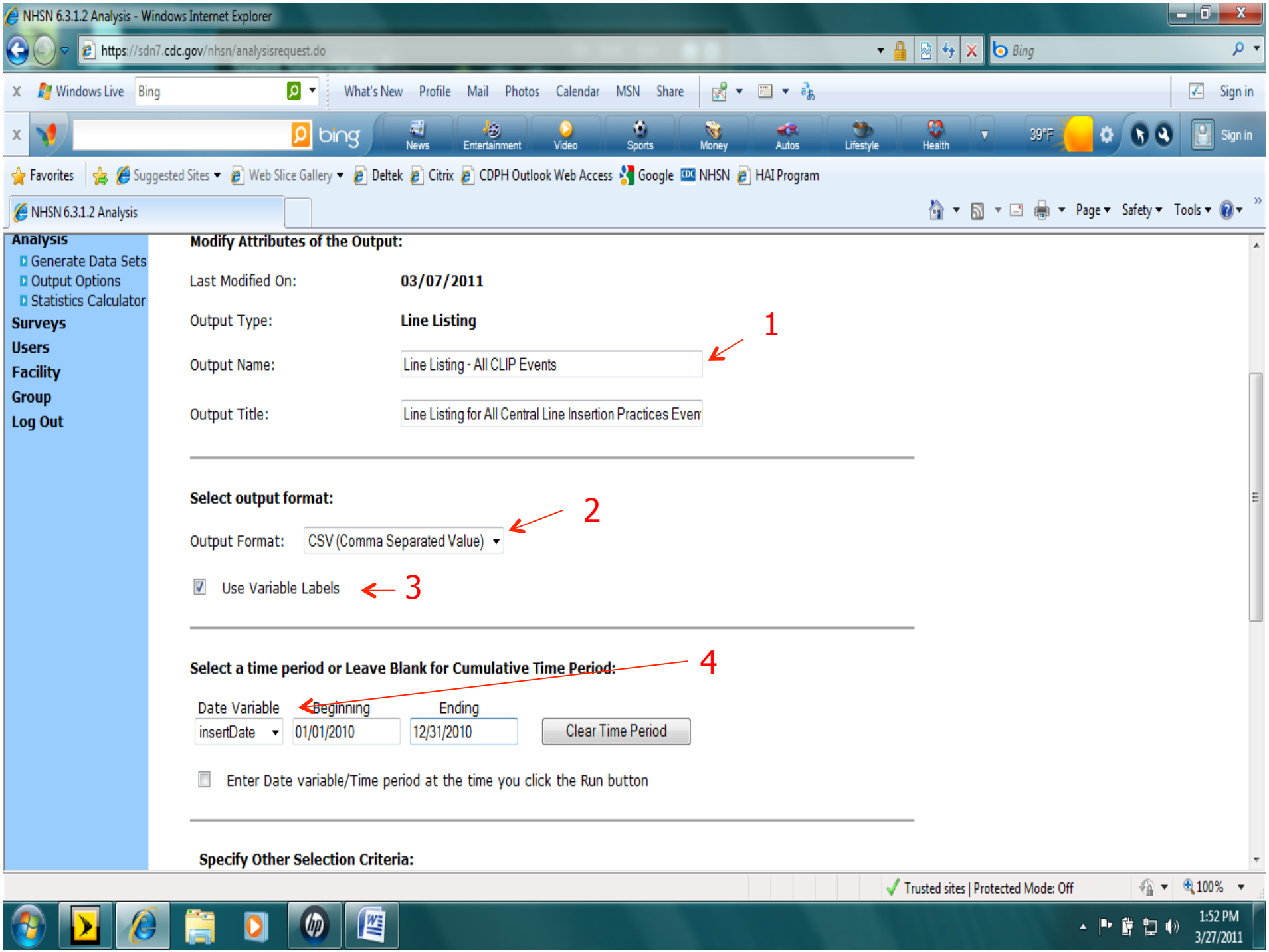
Date Range: All CLAB_EVENTS

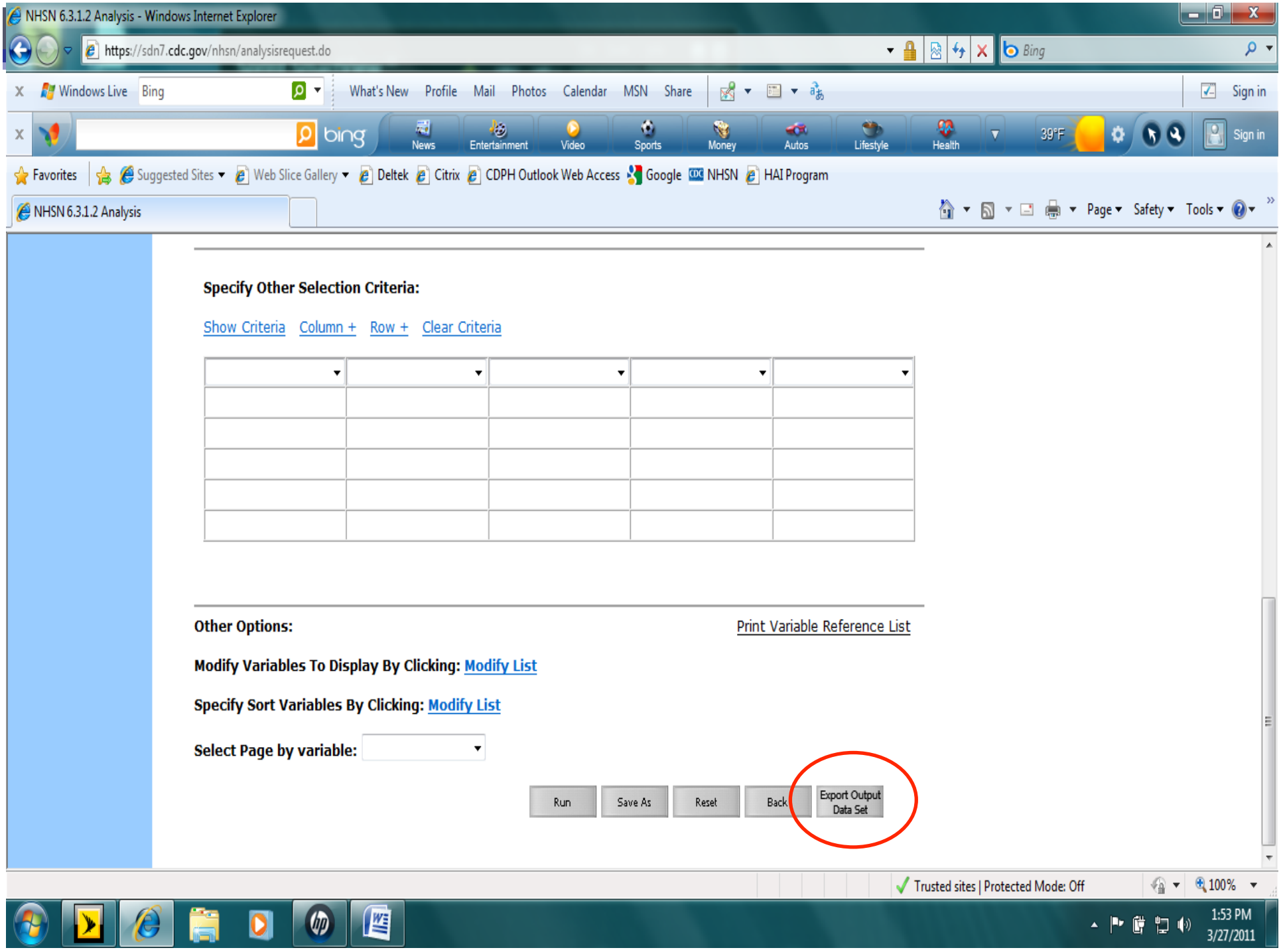
orgID	patID	patsurname	patgname	location	admitDate	eventID	eventDate	eventType	spcEvent
15633	Z-TEST012	Rosenguns	Jon	Z-ICU	8/1/2010	3739747	8/2/2010	BSI	LCBI
15633	Z-TEST001	BOTTOMS	RUSTY	Z-ICU	8/2/2010	3739668	8/13/2010	BSI	LCBI
15633	Z-TEST008	Starr	Twinkle Lil	Z-OB	8/5/2010	3739724	8/18/2010	BSI	LCBI
15633	Z-TEST009	Wicker	Linda	Z-ICU	8/4/2010	3739732	8/18/2010	BSI	LCBI
15633	Z-TEST015	Willingsly	Kate	Z-ICU	8/2/2010	3739760	8/24/2010	BSI	LCBI
15633	Z-TEST003	GODMOTHER	FAIRY	Z-ICU	9/17/2010	3752048	9/20/2010	BSI	LCBI
15633	Z-TEST004	JANSTER	LYNN	Z-MED/SURG	10/1/2010	3739433	10/12/2010	BSI	LCBI
15633	Z-TEST002	LAWYER	ANITA	Z-ICU	10/8/2010	3734183	10/13/2010	BSI	LCBI

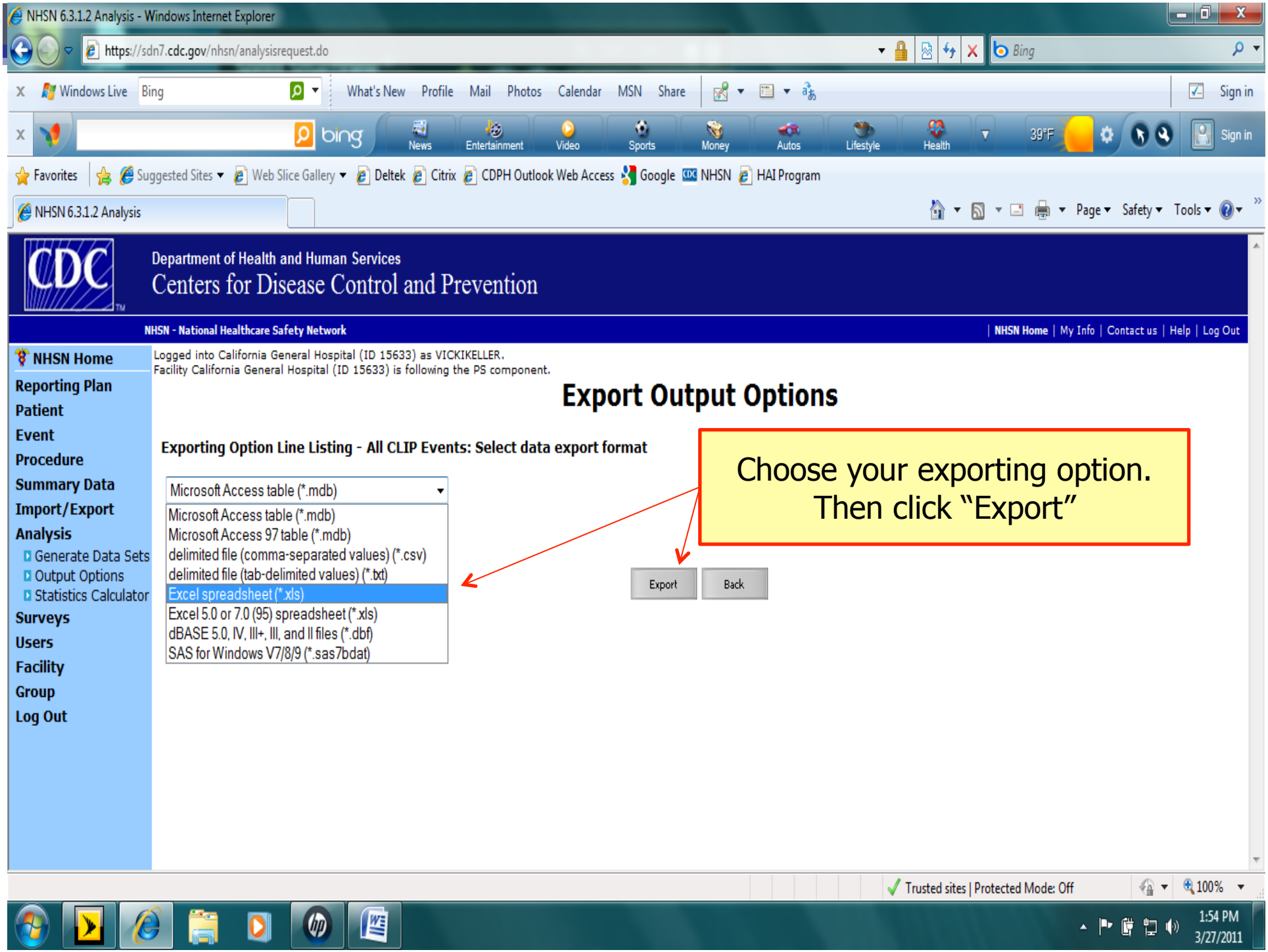
If you enter patient names, you can include them in your line list

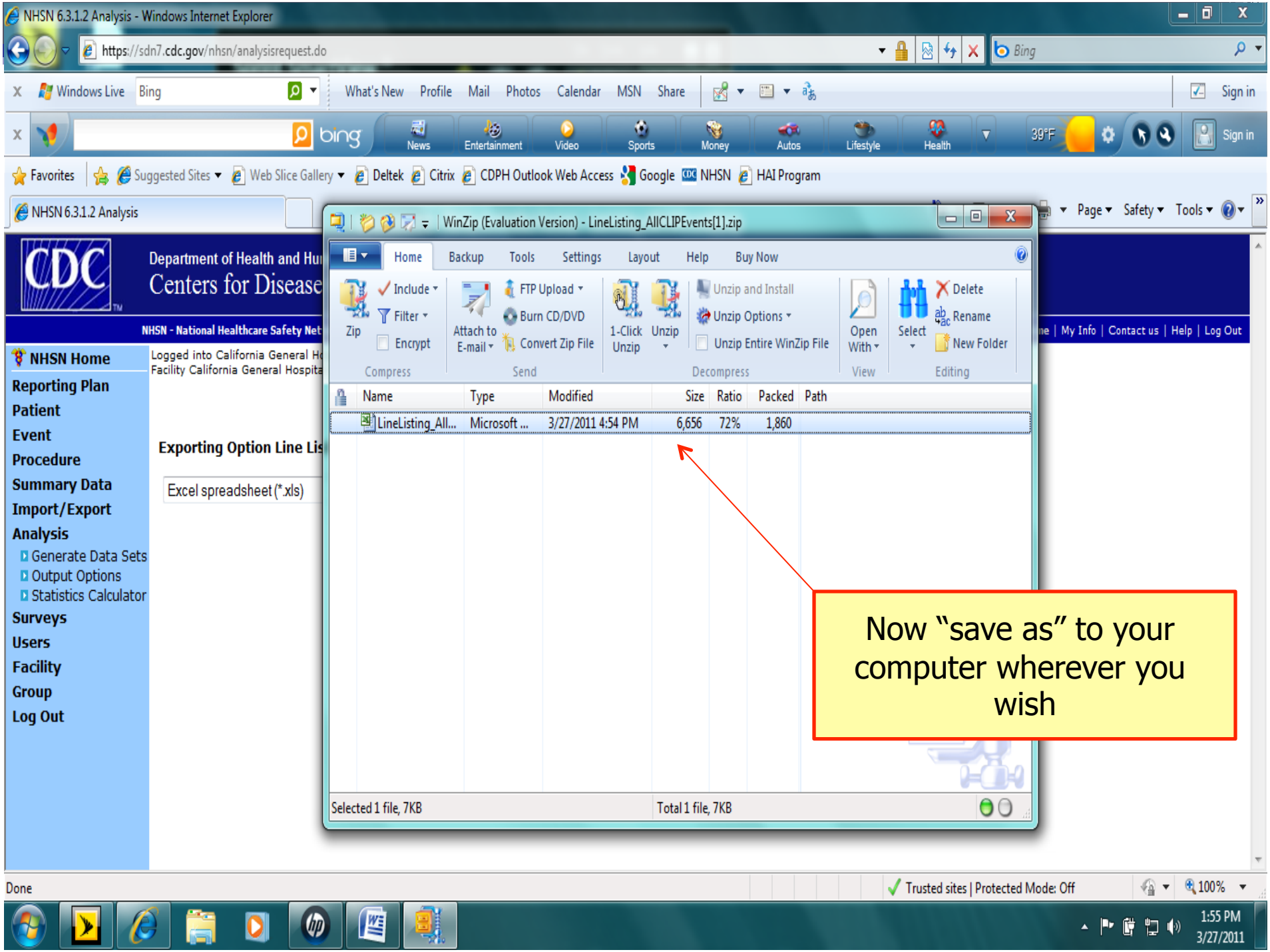
As long as you did not confer rights to patient identifiers, CDPH will not see


NHSN 6.3.1.2 Analysis - Windows Internet Explorer
https://sdn7.cdc.gov/nhsn/analysisrequest.do?method=ListAnalysisRequests&appModule=PS&navReset=true&optForUser=&currentmenu=menu_anal_gen
Bing
Windows Live
What's New
Profile
Mail
Photos
Calendar
MSN
Share
Sign in
News
Entertainment
Video
Sports
Money
Autos
Lifestyle
Health
39°F
Favorites
Suggested Sites
Web Slice Gallery
Deltek
Citrix
CDPH Outlook Web Access
Google
NHSN
HAI Program
NHSN 6.3.1.2 Analysis
Page
Safety
Tools
Event
Procedure
Summary Data
Import/Export
Analysis
Generate Data Sets
Output Options
Statistics Calculator
Surveys
Users
Facility
Group
Log Out
1
Analysis Output Options
2
Expand All
Collapse All
Device-Associated Module
All Device-Associated Events
Central Line-Associated BSI
Ventilator-Associated PNEU
Urinary Catheter-Associated UTI
3
Central Line Insertion Practices
CDC Defined Output
4
5
6
Line Listing - All CLIP Events
Frequency Table - Hand Hygiene by Occupation
Bar Chart - All CLIP Events
Pie Chart - All CLIP Events
Rate Table - All Practice Adherence
Run
Modify
Dialysis Events
Procedure-Associated Module
MDRO/CDAD Module - Infection Surveillance
MDRO/CDAD Module - LABID Event Reporting
MDRO/CDAD Module - Process Measures
MDRO/CDAD Module - Outcome Measures
Exporting Your Report from NHSN Analysis
Done
Trusted sites | Protected Mode: Off
100%
1:51 PM
3/27/2011


NHSN 6.3.1.2 Analysis - Windows Internet Explorer
https://sdn7.cdc.gov/nhsn/analysisrequest.do
NHSN 6.3.1.2 Analysis
Analysis
Generate Data Sets
Output Options
Statistics Calculator
Surveys
Users
Facility
Group
Log Out
Modify Attributes of the Output:
Last Modified On: 03/07/2011
Output Type: Line Listing
Output Name: Line Listing - All CLIP Events
Output Title: Line Listing for All Central Line Insertion Practices Even
1
Select output format:
Output Format: CSV (Comma Separated Value)
2
Use Variable Labels
3
Select a time period or Leave Blank for Cumulative Time Period:
4
Date Variable
Beginning
Ending
insertDate
01/01/2010
12/31/2010
Clear Time Period
Enter Date variable/Time period at the time you click the Run button
Specify Other Selection Criteria:
Trusted sites | Protected Mode: Off
100%
1:52 PM
3/27/2011


NHSN 6.3.1.2 Analysis - Windows Internet Explorer
https://sdn7.cdc.gov/nhsn/analysisrequest.do
Bing
Windows Live
Bing
What's New
Profile
Mail
Photos
Calendar
MSN
Share
Sign in
News
Entertainment
Video
Sports
Money
Autos
Lifestyle
Health
39°F
Favorites
Suggested Sites
Web Slice Gallery
Deltek
Citrix
CDPH Outlook Web Access
Google
NHSN
HAI Program
NHSN 6.3.1.2 Analysis
Page
Safety
Tools
Specify Other Selection Criteria:
Show Criteria
Column +
Row +
Clear Criteria
Other Options:
Print Variable Reference List
Modify Variables To Display By Clicking: Modify List
Specify Sort Variables By Clicking: Modify List
Select Page by variable:
Run
Save As
Reset
Back
Export Output Data Set
Trusted sites | Protected Mode: Off
100%
1:53 PM
3/27/2011


NHSN 6.3.1.2 Analysis - Windows Internet Explorer
https://sdn7.cdc.gov/nhsn/analysisrequest.do
Department of Health and Human Services
Centers for Disease Control and Prevention
NHSN - National Healthcare Safety Network
NHSN Home | My Info | Contact us | Help | Log Out
NHSN Home
Reporting Plan
Patient
Event
Procedure
Summary Data
Import/Export
Analysis
Generate Data Sets
Output Options
Statistics Calculator
Surveys
Users
Facility
Group
Log Out
Logged into California General Hospital (ID 15633) as VICKIKELLER.
Facility California General Hospital (ID 15633) is following the PS component.
Export Output Options
Exporting Option Line Listing - All CLIP Events: Select data export format
Microsoft Access table (*.mdb)
Microsoft Access table (*.mdb)
Microsoft Access 97 table (*.mdb)
delimited file (comma-separated values) (*.csv)
delimited file (tab-delimited values) (*.txt)
Excel spreadsheet (*.xls)
Excel 5.0 or 7.0 (95) spreadsheet (*.xls)
dBASE 5.0, IV, III+, III, and II files (*.dbf)
SAS for Windows V7/8/9 (*.sas7bdat)
Choose your exporting option.
Then click "Export"
Export
Back
Trusted sites | Protected Mode: Off
100%
1:54 PM
3/27/2011


NHSN 6.3.1.2 Analysis - Windows Internet Explorer
https://sdn7.cdc.gov/nhsn/analysisrequest.do
NHSN 6.3.1.2 Analysis
WinZip (Evaluation Version) - LineListing_AllCLIPEvents[1].zip
Home
Backup
Tools
Settings
Layout
Help
Buy Now
Name
Type
Modified
Size
Ratio
Packed
Path
LineListing_All...
Microsoft ...
3/27/2011 4:54 PM
6,656
72%
1,860
Selected 1 file, 7KB
Total 1 file, 7KB
NHSN Home
Reporting Plan
Patient
Event
Procedure
Summary Data
Import/Export
Analysis
Generate Data Sets
Output Options
Statistics Calculator
Surveys
Users
Facility
Group
Log Out
Exporting Option Line Lis
Excel spreadsheet (*.xls)
Now "save as" to your computer wherever you wish

Select Output Type – Rate Table

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Sample Rate Table

Review your Data!

Check that all your infections are listed AND ensure there is Summary data for each unit each month!

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Rate Table for Central Line-Associated BSI Data for ICU-Other												
2	Date Range: All CLAB_RATESICU												
3	Location	Summary Yr/Mon	CLA BSI Count	Central Line Days	CLA BSI Rate	NHSN CLAB Pooled Mean	Incidence Density p-value	Incidence Density Percentile	Patient Days	CL Util Ratio	NHSN Line DUPooled Mean	Proportion p-value	Proportion Percentile
4	Z-ICU	2010M07	0	250	0	1.5	0.6928	25	450	0.56	0.51	0.0182	72
5	Z-ICU	2010M08	4	300	13.3	1.5	0.0011	100	400	0.75	0.51	0	93
6	Z-ICU	2010M09	1	300	3.3	1.5	0.3562	87	325	0.92	0.51	0	96
7	Z-MED/SURG	2010M07	0	275	0	1.2	0.7218	50	400	0.69	0.16	0	100
8	Z-MED/SURG	2010M08	0	250	0	1.2	0.7435	50	425	0.59	0.16	0	100
9	Z-MED/SURG	2010M09	0	300	0	1.2	0.7007	50	550	0.55	0.16	0	100
10	Source of aggregate data: NHSN Report					Am J Infect Control 2009;37:783-805							

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Sample Rate Table

Shows your CLABSI rate and p-value to determine if significantly higher or lower as compared to NHSN rate (>0.05 NS)

Shows where your rate falls in the percentile distribution of all NHSN hospital rates

Shows your device utilization ratio compared to all similar hospital units in NHSN data 2006-2008

	A	B	C	D	E								
1	Rate Table for Central Line-Associated BSI Data for ICU-Other												
2	Date Range: All CLAB_RATESICU												
3	Location	Summary Yr/Mon	CLA BSI Count	Central Line Days	CLA BSI Rate	NHSN CLAB Pooled Mean	Incidence Density p-value	Incidence Density Percentile	Patient Days	CL Util Ratio	NHSN Line DUPooled Mean	Proportion p-value	Proportion Percentile
4	Z-ICU	2010M07	0	250	0	1.5	0.6928	25	450	0.56	0.51	0.0182	72
5	Z-ICU	2010M08	4	300	13.3	1.5	0.0011	100	400	0.75	0.51	0	93
6	Z-ICU	2010M09	1	300	3.3	1.5	0.3562	87	325	0.92	0.51	0	96
7	Z-MED/SURG	2010M07	0	275	0	1.2	0.7218	50	400	0.69	0.16	0	100
8	Z-MED/SURG	2010M08	0	250	0	1.2	0.7435	50	425	0.59	0.16	0	100
9	Z-MED/SURG	2010M09	0	300	0	1.2	0.7007	50	550	0.55	0.16	0	100
10	Source of aggregate data: NHSN Report					Am J Infect Control 2009;37:783-805							

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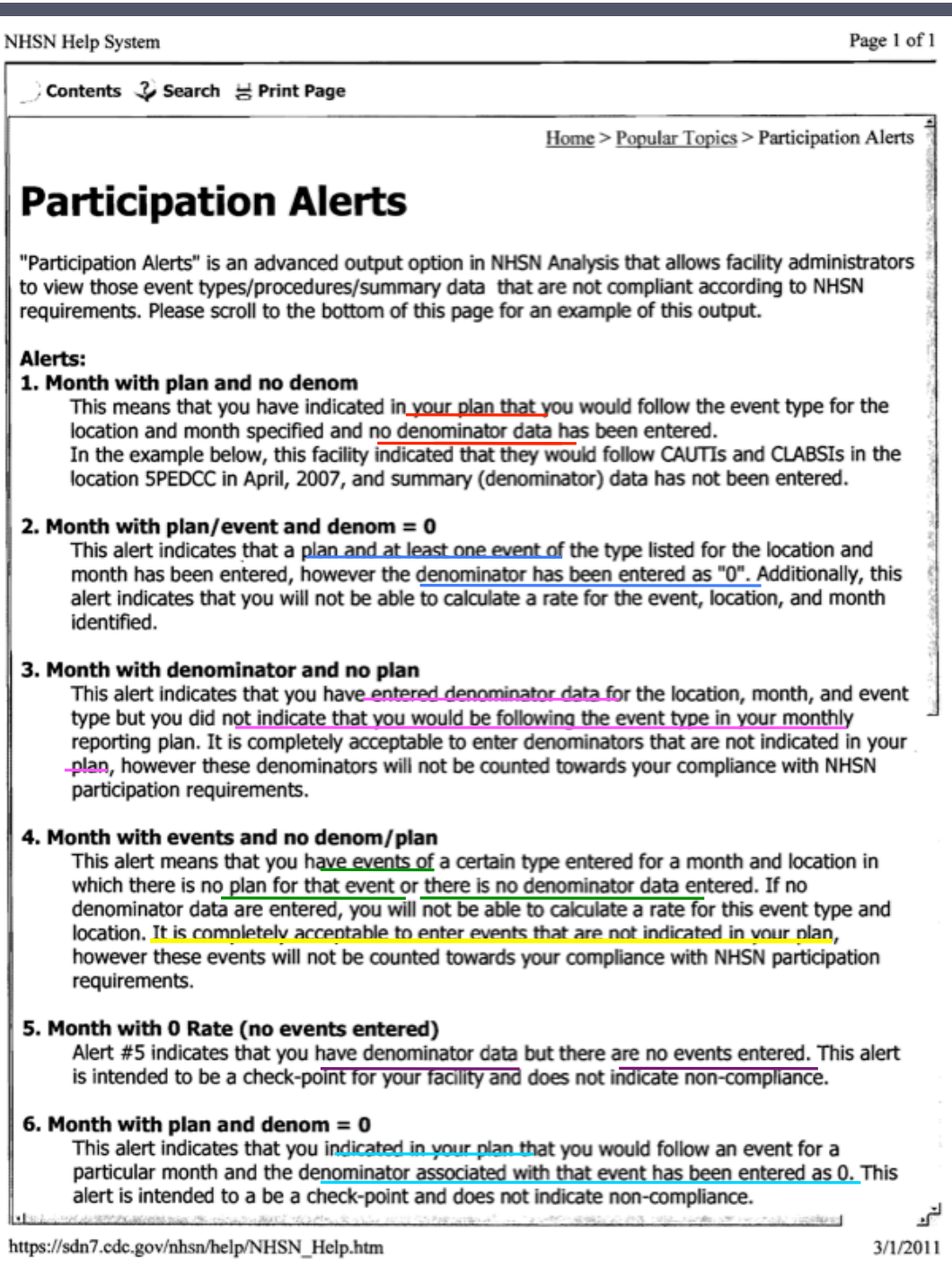
Another Self-Check of Your NHSN Data

- New Report in NHSN Analysis
- Under "Advanced," "Facility-Level" data, "Participation"
- Allows review of your Event, Procedure, Summary data that is misaligned with your Reporting Plan



Participation Alerts

"Participation Alerts" is an advanced output option in NHSN Analysis that allows facility administrators to view those event types/procedures/summary data that are not compliant according to NHSN requirements. Please scroll to the bottom of this page for an example of this output.

Alerts:

1. Month with plan and no denom

This means that you have indicated in your plan that you would follow the event type for the location and month specified and no denominator data has been entered.
In the example below, this facility indicated that they would follow CAUTIs and CLABSIs in the location 5PEDCC in April, 2007, and summary (denominator) data has not been entered.

2. Month with plan/event and denom = 0

This alert indicates that a plan and at least one event of the type listed for the location and month has been entered, however the denominator has been entered as "0". Additionally, this alert indicates that you will not be able to calculate a rate for the event, location, and month identified.

3. Month with denominator and no plan

This alert indicates that you have entered denominator data for the location, month, and event type but you did not indicate that you would be following the event type in your monthly reporting plan. It is completely acceptable to enter denominators that are not indicated in your plan, however these denominators will not be counted towards your compliance with NHSN participation requirements.

4. Month with events and no denom/plan

This alert means that you have events of a certain type entered for a month and location in which there is no plan for that event or there is no denominator data entered. If no denominator data are entered, you will not be able to calculate a rate for this event type and location. It is completely acceptable to enter events that are not indicated in your plan, however these events will not be counted towards your compliance with NHSN participation requirements.

5. Month with 0 Rate (no events entered)

Alert #5 indicates that you have denominator data but there are no events entered. This alert is intended to be a check-point for your facility and does not indicate non-compliance.

6. Month with plan and denom = 0

This alert indicates that you indicated in your plan that you would follow an event for a particular month and the denominator associated with that event has been entered as 0. This alert is intended to a be a check-point and does not indicate non-compliance.

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NHSN Analysis - Summary

- Use NHSN Analysis features to
  - Check your data for complete and accurate reporting
  - Calculate rates (& SIR) to compare your data
- Feedback your analyzed data to hospital units and medical/surgical services (not only the ICC)
- Use your HAI data for infection prevention

Don't be afraid to "play with" NHSN Analysis.
You can't break anything!

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Healthcare-associated Infections HAI Elimination

Standardized Infection Ratio (SIR)

- Driven by need for a **summary measure** (replacing multiple rate comparisons)
  - SIR calculations added to NHSN Oct 2010
- SIR **adjusts for differences in levels of infection risk** in your patients (e.g. by unit type for CLABSI)
- SIR compares # of HAIs reported by your hospital with the "predicted" # based on NHSN data
  - NHSN data (2006-08) used for national predicted values
- SIR **value of 1.0** means your hospital is observing HAIs as national data predict (i.e. **not different**)

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Interpreting SIR

The **value 1.0** indicates the number of HAIs observed in your hospital is the **same as predicted** number of HAIs as seen in the national baseline data

- A value less than 1.0 means there are fewer HAIs observed than predicted
- A value greater than 1.0 means more HAIs than predicted

SIR will only be calculated for your hospital if the expected number of HAIs is >1

(because can't have less than a whole person infected!)

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Healthcare-associated Infections HAI Elimination

Special Edition!

October 2010, Updated December 2010

NHSN National Healthcare Safety Network

evention (CDC) News

Your Guide to the Standardized Infection Ratio (SIR)

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

STANDARDIZED INFECTION RATIO (SIR)

What is a standardized infection ratio (SIR)?

The standardized infection ratio (SIR) is a summary measure used to track HAIs at a national, state, or local level over time. The SIR adjusts for patients of varying risk within each facility. The method of calculating an SIR is similar to the method used to calculate the Standardized Mortality Ratio (SMR), a summary statistic widely used

$$SIR = \frac{\text{Observed HAIs}}{\text{Predicted HAIs}}$$

Examples:

If your hospital has 2 CLABSI per 1000 line days and national data predict 2.0 CLABSI per 1000 line days:

$$SIR = \frac{2}{2.0} = 1.0$$

If your hospital has 4 SSI per 100 Hip prosthesis procedures and national data predict 2.5 SSI:

$$SIR = \frac{4}{2.5} = 1.6$$

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Terminology is Important

$$\text{SIR} = \frac{\text{Observed HAIs}}{\text{Predicted HAIs}}$$

- SIR is not a rate
  - It is a ratio, comparing 1 number to another
  - Refer to it as a value
- Try to use term "predicted" rather than "expected", although you will still see the terms used interchangeably
  - "Expected" to a consumer raises concern of complacency, i.e. we expect HAI to occur so we are not doing enough to prevent them
  - "Expected" is also not aligned with the paradigm shift that we can achieve HAI Elimination

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NHSN Published Report (Dec 2009)

www.ajicjournal.org
Vol. 37 No. 10

Table 3. Pooled means and key percentiles of the distribution of laboratory-confirmed central line–associ
central line utilization ratios, by type of location, DA module, 2006 through 2008

Type of location	No. of locations*	No. of CLABSI	Central line-days	Central line–associated BSI rate† Pooled mean	Percentile 10%	25%	50% (median)	75%	90%
Critical care units					0.0	1.2	3.1	7.5	11.8
Burn	390	70,932	5.5		0.0	0.0	1.3	2.5	4.6
Medical cardiac	876	436,409	2.0		0.1	1.1	2.3	3.7	5.2
Medical major teaching	1410	549,088	2.6		0.0	0.0	1.0	2.4	4.3
Medical all others	687	362,388	1.9		0.0	0.6	1.7	2.9	4.6
Medical/surgical major teaching	1474	699,300	2.1		0.0				
Medical/surgical all others ≤15 beds	1130	755,437	1.5		0.0				
Medical/surgical all others >15 beds	1449	986,982	1.5		0.0				
Neurologic	61	45,153	1.4						
Neurosurgical	396	160,879	2.5						

Edwards JR et al. Am J Infect Control 2009;37:783-805.

The NHSN pooled means ARE the predicted numbers of CLABSI per 1000 central-line days

Example: The NHSN Medical cardiac ICUs experienced 876 CLABSI in 436,409 line days

$$\frac{876}{436{,}409} \times 1000 = 2.0$$

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Summary of Multiple Hospital Units

Hospital A

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

If 2.0 CLABSI per 1000 line days is predicted by NHSN data, what is the predicted # of CLABSI for the 380 line days in Hospital A's Medical cardiac ICU - **?**

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Welcome to freshmen algebra!!!

Solve for x to get the # Expected

$$\frac{x}{380} = \frac{2.0}{1000}$$

$$x = \frac{2.0 \times 380}{1000}$$

$$x = 0.76$$

From previous slide –

This is Expected # CLABSI in Hosp A's Med cardiac ICU if it is no different than national Med cardiac ICU data

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Calculating Hospital's CLABSI SIR

Observed in Hosp A

Expected in Hosp A

Hospital A

Type of ICU Location	# CLABSI	# Central line-days	CLABSI Rate	NHSN Rate	p-value	Expected # of CLABSI
Medical cardiac	2	380	5.26	2.0	0.09	0.76
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Neurosurgical	2	712	2.81	2.5	0.32	1.78
Total	*8*	*1976*		---	---	*4.15*

Overall CLABSI SIR = Observed/Expected = 8/4.15 = 1.93

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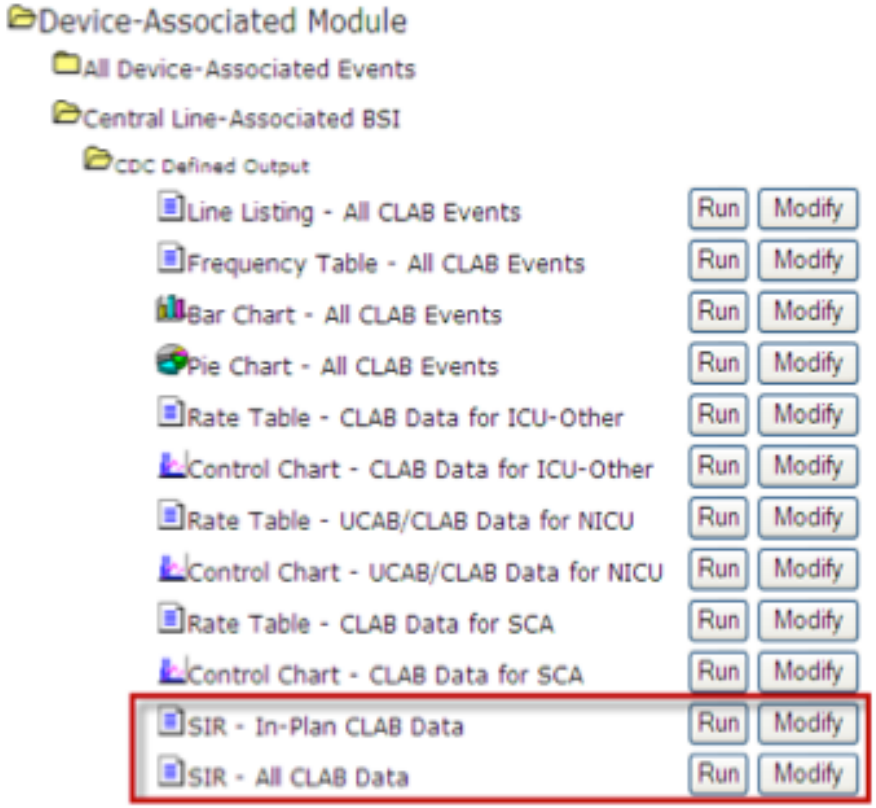
What is the advantage of using CLABSI SIRs instead of CLABSI rates?

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



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How do I interpret the CLABSI SIR?

Example: Overall CLABSI SIR

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

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

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

How do I interpret whether our SIR is significantly different (higher or lower) than the NHSN predicted value of 1.0?

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

1. If the p-value is above 0.05, the observed difference is not statistically significant.

2. If the 95% Confidence interval overlaps 1.0, the observed difference is not statistically significant.

If the p-value is not significant, the confidence interval won't be significant either and vice versa

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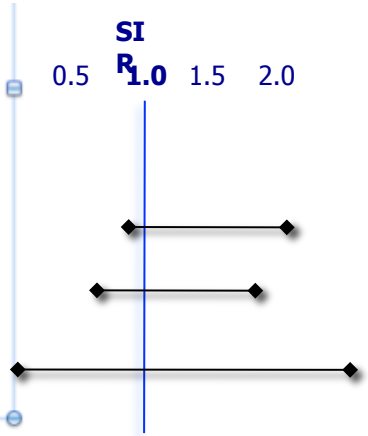
How do I teach others what the SIR means? How is the SIR being used by other hospitals?

Example: **Children's Hospital Boston**

Children's Hospital Boston
Central Line-Associated Bloodstream Infection Rates in ICUs
For Public Reporting

Time period covered: July 2008 – June 2009

Location	#CLABSI	CLABSI /1000 CVL Days	CLABSI expected (per Ped CICU national benchmark)	SIR*	95% confidence intervals	Interpretation
CICU	27	4.59	19.39	1.39	0.92, 2.03	Statistically not different from expected
MSICU	15	3.47	12.99	1.16	0.65, 1.91	Statistically not different from expected
MICU	1	1.17	1.11	0.90	0.01, 5.01	Statistically not different from expected



*SIR = standardized infection ratio = Observed CLABSI / Expected CLABSI

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How is the SIR being used by CDC?

State HAI Summary Report

Table 2. State-specific Standardized Infection Ratios (SIRs) for States Using NHSN to Comply With a Legislative Mandate* to Report Central Line-Associated Bloodstream Infections to the State Health Department: January 2009 – June 2009.

State	No. of Facilities Reporting	Observed	Predicted	SIR	95% CI for SIR Lower	95% CI for SIR Upper	Graphic Representation of SIR† 0 1.0 2.0
Colorado	50	64	94.25	0.68	0.52	0.87	
Connecticut §	30	65	69.46	0.94	0.72	1.19	
Delaware	8	20	33.84	0.59	0.36	0.91	
Illinois	140	301	333.46	0.90	0.80	1.01	
Maryland §	48	234	179.95	1.30	1.14	1.48	
Massachusetts	70	124	211.44	0.59	0.49	0.70	
New Hampshire	24	13	22.93	0.57	0.34	0.90	
New Jersey	72	183	222.97	0.82	0.71	0.95	
New York §	182	604	610.22	0.99	0.91	1.07	
Oklahoma	48	59	118.95	0.50	0.38	0.64	

More "surveillance experience"* results in tighter confidence intervals and higher precision

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* *# of surveillance months, # of exposure (line) days, or in this case, # of hospitals in a State contributing line days*

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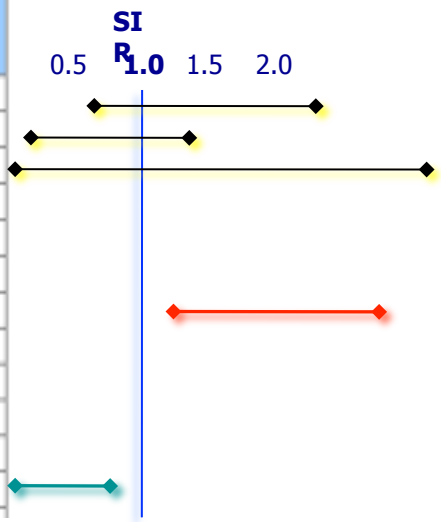
How is the SIR being used by other states?

Example: **New Jersey**

Table 1. Central Line-Associated Bloodstream Infections (CLABSIs) in 2009, New Jersey

Hospital Name	Observed Number of CLABSIs (O)	Expected Number of CLABSIs (E)	SIR = O/E	National Comparison (1)*	Number of Central Line-days	95% Confidence Interval***
AtlantiCare Regional Medical Center-City	9	6.84	1.32	Similar to Expected	2,474	(0.60, 2.50)
AtlantiCare Regional Medical Center-Mainland	5	8.26	0.61	Similar to Expected	5,014	(0.20, 1.41)
Bayonne Medical Center	2	1.78	1.13	Similar to Expected	888	(0.14, 4.07)
Bayshore Community Hospital	1	3.26	0.31	Similar to Expected	2,174	(0.01, 1.71)
Bergen Regional Medical Center	0	1.10	0.00	Similar to Expected	579	(---, 3.35)
Cape Regional Medical Center	1	2.42	0.41	Similar to Expected	1,612	(0.01, 2.30)
Capital Health System at Fuld	13	6.16	2.11	Higher than Expected	4,108	(1.12, 3.61)
Capital Health System at Mercer	5	3.09	1.62	Similar to Expected	2,062	(0.52, 3.77)
CentraState Medical Center	1	2.76	0.36	Similar to Expected	1,455	(0.01, 2.02)
Chilton Memorial Hospital	1	0.47	2.12	Similar to Expected**	315	(0.05, 11.79)
Christ Hospital	2	3.18	0.63	Similar to Expected	2,121	(0.08, 2.27)
Clara Maass Medical Center	4	11.80	0.34	Lower than Expected	5,875	(0.09, 0.87)



NOTE: CDPH has **NOT** determined if SIR will be used in California for public reporting of HAIs

Central Line-Associated Bloodstream Infection (CLABSI) at all Maryland hospitals

Timeframe: Jul 2009 - Jun 2010
Last Updated: 10/20/2010

Hospitals are displayed by SIR (lowest to highest) within each category: better than national experience; no different than national experience; and, worse than national experience. When the SIR is the same for more than one hospital, the hospitals are ordered from highest to lowest number of central line days.

Example:
Maryland

Adult and Pediatric Intensive Care Units

Symbol	
●	Better than National Experience
△	No different than National Experience
♦	Worse than National Experience

Hospital	Number of Infections	Number of Central Line Days (CLD)	Number of Infections Predicted by National Experience	Ratio of Actual to Predicted Infections (SIR) What is this?	Hospital Performance What is this?
Howard County General Hospital	0	2162	3.24	0.00	△
Carroll Hospital Center	0	1265	1.90	0.00	△
Calvert Memorial Hospital	0	445	0.67	0.00	△
Fort Washington Hospital	0	336	0.50	0.00	△
Chester River Hospital Center	0	281	0.42	0.00	△
Johns Hopkins Bayview Medical Center	30	6624	17.58	1.71	♦
University Of Maryland Medical Center	119	26653	68.50	1.74	♦
Prince George s Hospital Center	21	5501	11.42	1.84	♦
Peninsula Regional Medical Center	15	4934	7.40	2.03	♦
Shady Grove Adventist Hospital	10	3072	4.62	2.16	♦

NOTE: CDPH has **NOT** determined if the SIR will be used in California for public reporting of HAIs

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How is the SIR being used by other states?

Example: **Illinois**

CLABSI in Adult Medical ICUs, Jan-Dec 2009

Hospital	City	Observed (O) Number of CLABSIs	Number of Central Line Days[b]	Statistically "Expected" (E) Number of CLABSIs[c]	Unit-specific SIR=O/E	95% Confidence Interval (CI)[d]		Statistical Interpretation
						Lower Bound	Upper Bound	
ADVOCATE CHRIST HOSPITAL & MEDICAL CENTER	OAK LAWN	2	4182	10.87	0.18	0.02	0.66	Lower
DELNOR HOSPITAL	GENEVA	0	964	1.83	0.00	0.00	0.38	Lower
NORTHWESTERN MEMORIAL HOSPITAL	CHICAGO	6	5633	14.65	0.41	0.15	0.89	Lower
TRINITY REGIONAL HEALTH SYSTEM	ROCK ISLAND	0	999	1.90	0.00	0.00	0.37	Lower
ADVOCATE ILLINOIS MASONIC MEDICAL CENTER	CHICAGO	3	1860	4.84	0.62	0.12	1.81	Similar
ADVOCATE TRINITY HOSPITAL	CHICAGO	1	1889	3.59	0.28	0.00	1.55	Similar
CROSSROADS COMMUNITY HOSPITAL	MOUNT VERNON	0	146	0.28	0.00	0.00	2.53	Similar
LORETTO HOSPITAL	CHICAGO	5	1125	2.14	2.34	0.75	5.46	Similar
LOYOLA UNIVERSITY MEDICAL CENTER	MAYWOOD	6	4023	10.46	0.57	0.21	1.25	Similar
MEMORIAL HOSPITAL	CHESTER	0	71	0.13	0.00	0.00	5.21	Similar
SAINT ANTHONY HOSPITAL	CHICAGO	4	974	1.85	2.16	0.58	5.53	Similar
SOUTH SHORE HOSPITAL	CHICAGO	2	1018	1.93	1.03	0.12	3.73	Similar
UNIVERSITY OF CHICAGO MEDICAL CENTER	CHICAGO	12	2910	7.57	1.59	0.82	2.77	Similar
NORTHSHORE UNIV HS SKOKIE HOSPITAL	SKOKIE	5	754	1.43	3.49	1.12	8.14	Higher

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NOTE: CDPH has **NOT** determined if SIR will be used in California for public reporting of HAIs

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CLABSI SIR Interpretation - Example 1

Pretend this is our hospital.

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

To discuss these findings:

1. "We had 9 CLABSI; 7.2 were expected. Our SIR is 1.25 or 25% higher than what would be predicted from national data."
2. "However, this difference is not significantly different than the national hospital data because our estimate is not very precise." *
3. "In fact, our SIR may be anywhere from 35% below to more than double the predicted value (.65 – 2.2)."
4. "We will continue to monitor CLABSIs. Observations over time (and more line days) will help us better understand how we compare. Our ultimate goal is to prevent all CLABSIs."

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* Due to limited surveillance experience, e.g. too few line days across hospital units with predicted low rates.

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CLABSI SIR Interpretation - Example 2

Pretend this is our hospital.

Org ID	Summary Yr/Half	infCount	Number Expected	Central Line Days	SIR	SIR p-value	95% Confidence Interval
15331	2009H1	74	26.606	10065	2.78	0.0000	2.184, 3.492

To discuss these findings:

1. "We saw 74 CLABSI in 10,065 line days; 26.6 were predicted."
2. The SIR is 2.78 or nearly 3 times higher than what would be predicted from national data."
3. "This difference is significantly different than the national hospital data."
4. "In fact, the precision of this estimate shows that our hospital is between 2 and 3 ½ times higher than predicted (C.I. 2.2 – 3.5)."
5. "We need to implement a CLABSI prevention program immediately."

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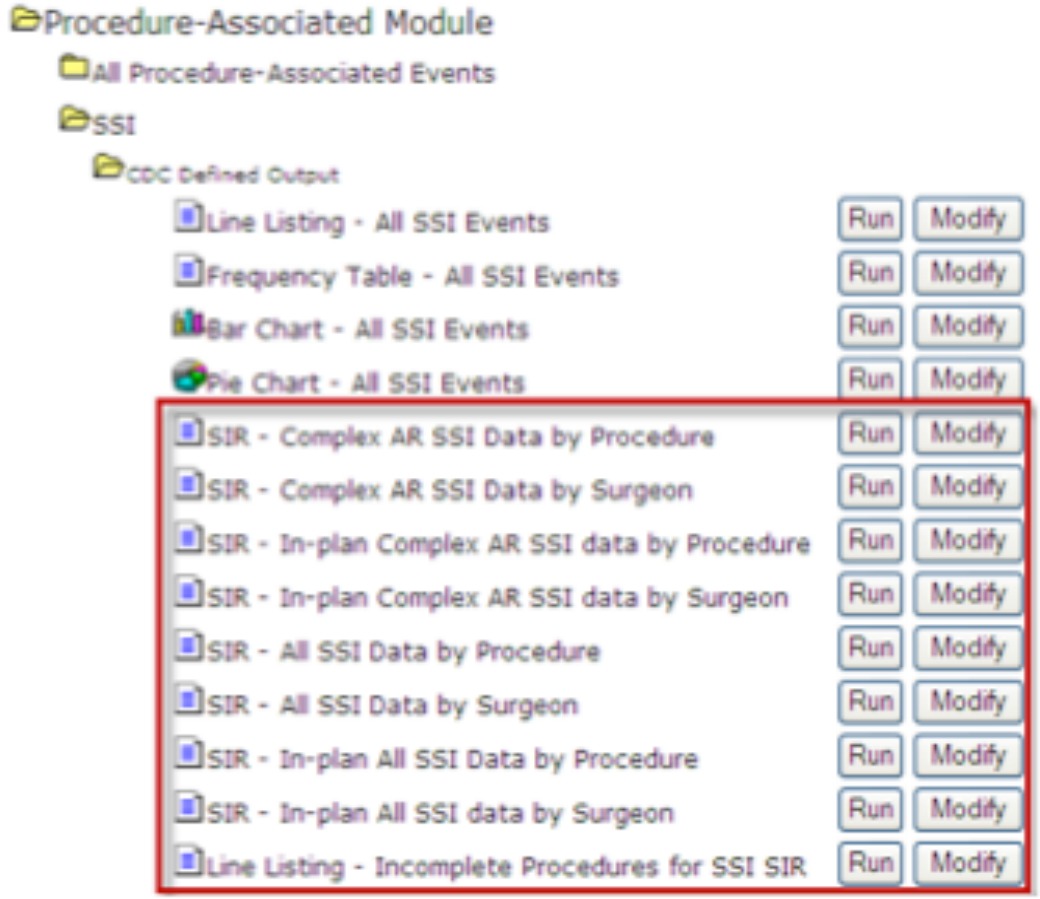
SSI and SIR

- For SSI comparisons, NHSN will now apply the SIR
  - Risk models developed for each procedure
  - Model includes only those factors associated with increased risk of infection for that specific procedure
  - Allows risk factors to be weighted based on contribution to SSI risk
- Hospitals may still calculate SSI rates based on the Risk Index
  - Will need to compare to published data
  - *NHSN Summary Report, AJIC, Dec 2009*

What SSI SIR options are available?

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



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

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

- Old way: Used a 0-3 Risk Index to stratify patient risk for all procedures
  Based on ASA, Wound class, Duration >75th percentile
- New Way: Adjusts for individual patient risk using only those variables found to be associated with SSI risk for each procedure type (determined by logistic regression models)

Example: SSI risk factors for HPRO

Age, Anesthesia type, ASA score, surgical duration, HPRO type, Medical School affiliation, number of beds, trauma status

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How do I interpret the SSI SIR?

Example #1: Overall SSI SIR

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

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

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

Org ID	Procedure Code	Summary Yr/Half	Procedure Count	infCountAll	All SSI Model Number Expected	All SSI Model SIR	All SSI Model SIR p-value	All SSI Model 95% Confidence Interval
10018	HPRO	2009H1	26	1	0.295			
[redacted]								

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

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Example: Logistic Regression Model

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

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

The *intercept* represents underlying infection risk when none of the risk factors in the model are present

Factors in this model that add to SSI risk are

- Age equal to or younger than 44 years
- ASA score of 3, 4, or 5
- Duration of surgery longer than 100 minutes (incision to close time)
- Procedure done at hospital affiliated with a medical school (from Annual Facility Survey)

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

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

Interpreted as a 5.0% risk of SSI for patient 1

Probability of SSI is calculated for each surgical patient

The SSI probabilities are added together to get the predicted (expected) number of SSI for this surgical patient population

SSI SIR is not different than predicted
- 3 SSI observed
- 2.9 SSI expected

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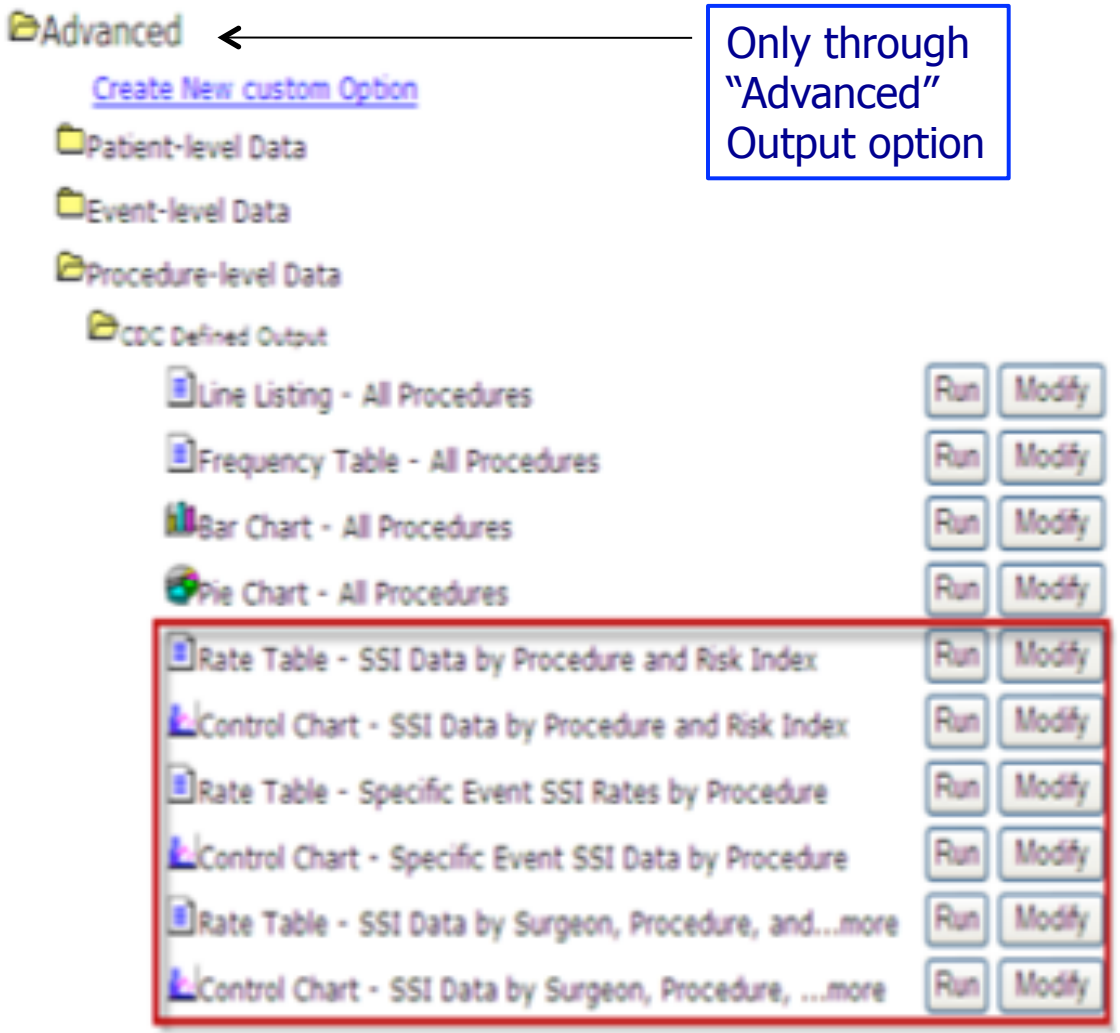
Will I still be able to obtain SSI rates from NHSN?



Only through "Advanced" Output option

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SIR

****Important Take Away Points****

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

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HAI Program Website

CA.GOV California Department of Public Health CDPH

www.cdph.ca.gov/hai

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Healthcare Associated Infections (HAI) Program

The Healthcare Associated Infections (HAI) Program is one of three programs in the Center for Health Care Quality of the California Department of Public Health. The Program is responsible for the surveillance and prevention of infections in California's general acute care hospitals as mandated by Senate Bills 739, 1058, and 158. The Program was authorized in December 2009.

HAIs are the most common complication of hospital care and are listed among the top ten leading causes of death in the United States. It is estimated that each year there are more than 1.7 million infections, 99,000 deaths, and $3.1 billion dollars in excess healthcare costs in acute care hospitals alone. Based on this data it is estimated that approximately 200,000 patients develop infections in California hospitals each year with an annual cost of about $600 million. The vision of the HAI Program is to eliminate HAI's for California patients.

With the assistance of a grant from the American Recovery and Reimbursement Act (ARRA) of 2009, Program staff are actively involved in assisting hospitals in infection surveillance, prevention and reporting procedures. The HAI Program is advised by a committee of healthcare professionals and public advocates from throughout California who recommend methods for publicly reporting cases of hospital acquired infections and process measures for preventing the spread of HAIs based on national guidelines.

HAI Program Activities
- Healthcare-associated Infections NEW!
- Healthcare Personnel Influenza Vaccination NEW!
- The California Antimicrobial Stewardship Program Initiative
- HAI Advisory Committee
- Contact the HAI Program

Information for Infection Prevention Programs
- AFLs, Legislation, and Regulations
- Current Reporting and Data Collection--Forms and Information
- Healthcare Associated Infections and Infection Control Guidelines
- NHSN Guidance Specific to California Hospitals

Information for Consumers
- HAI Program Healthcare-associated Infections NEW!
- Patient Guides to Healthcare Associated Infections
- Influenza Vaccination Information for Consumers
- Infection Control Guidelines for Adult and Pediatric Patients

HAI Program Reports
- Technical Report: Healthcare-associated Bloodstream Infections in California Hospitals -- 2009-2010 (PDF, New Window) NEW!
- Brief Report: Healthcare-associated Clostridium difficile Infections in California Hospitals 2009-2010 (PDF, New Window) NEW!
- California Hospital Employee Influenza Vaccination Report -- 2009-2010 (PDF, New Window) NEW!
- California Hospital Employee Influenza Vaccination Report -- 2008-2009 (PDF, New Window)

CDC-CDPH Influenza Vaccination Reporting Pilot Project
- CDC-CDPH Pilot Project: Healthcare Personnel Influenza Vaccination Reporting

Resources
- Association of Professionals in Infection Control and Hospital Epidemiology (APIC)
- California APIC Coordinating Council (CACC)
- CDC Infection Control Guidelines
- CDC National Healthcare Safety Network (NHSN)
- CDC-SHEA Online Curriculum--Fundamentals of Healthcare Epidemiology: Essentials for Preventing Healthcare Associated Infections
- Get Smart for Healthcare -- CDC Resource for Improving Antibiotic Use in Healthcare Facilities

Healthcare-associated Infections HAI Elimination

Questions ?

HAI Liaison Program

See list of designated Liaison IPs at

www.cdph.ca.gov/hai