

NHSN's Guide to the 2022 Baseline Standardized Utilization Ratios

A Guide to the SUR Models in the 2022 HAI Rebaseline

Summary: The Standardized Utilization Ratio (SUR) is the primary summary measure used by the National Healthcare Safety Network (NHSN) to compare device utilization at the national, state, or facility level by tracking central line, urinary catheter, and ventilator use. Tracking device use in healthcare settings is essential to measuring exposure for device-associated infections. Highlighting the SUR as part of the new baseline project, this document is intended to serve as both guidance for those who are new to this metric, as well as a useful reference for more experienced infection prevention professionals.

This Guide contains:

- An overview of the SUR metric
- Details of each risk adjustment model under the 2022 national baseline

Use this Guide to:

- Understand how the SUR metric is calculated and interpreted
- Learn which factors are applied to the risk adjustment of each HAI type and for each facility type



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Section 1: Overview of the Standardized Utilization Ratio (SUR)

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This section introduces the standardized utilization ratio (SUR) and its vital role in tracking healthcare-associated infections (HAIs) over time. It explains why rates may not be a sufficient metric for this purpose, outlines the methodology behind SUR calculations, and provides examples of how regression models are used to calculate the number of predicted device days (SUR denominator). Interpretation of SUR values, including statistical results like p-values and confidence intervals, is also discussed. Practical applications in NHSN reports and benchmarking against national standards are also covered, emphasizing the crucial role of SURs in infection prevention and patient safety.

This section contains several acronyms and abbreviations. For descriptions of these terms, please refer to the glossary at the end of the document.

What is the SUR?

The standardized utilization ratio (SUR) is a summary measure used to track device use at a national, state, local, or facility level over time. The SUR adjusts for various facility and/or location-level factors that contribute to device use. The method of calculating an SUR is similar to the method used to calculate the Standardized Infection Ratio (SIR), a summary statistic used in NHSN to track healthcare-associated infections (HAIs). In device-associated HAI data analysis, the SUR compares the actual number of device days reported to what would be predicted, given the standard population (specifically, the NHSN baseline), adjusting for several factors that have been found to be significantly associated with differences in device utilization. In other words, an SUR greater than 1.0 indicates that more device days were observed than predicted; conversely, an SUR less than 1.0 indicates that fewer device days were observed than predicted. SURs are currently calculated in NHSN for the following device types: central lines, urinary catheters, and ventilators.

Why not Device Utilization Ratios?

In the past, NHSN has published device utilization ratios, or DURs, found in the rate table outputs in the Analysis Reports section of the NHSN application. The DUR is a ratio that was previously updated with pooled mean data on a yearly basis. The pooled means were stratified by patient care location and did not reflect differences in other factors that may describe levels of device use. Therefore, DURs lose comparability over time and across entities, although they are still useful for the purposes of tracking device use over shorter periods of time and for internal trend analyses. For example, calculating DURs from two facilities serving entirely different patient populations can lead to an unfair comparison. One solution to this problem is the stratification of DURs, as was done with location-stratified CLABSI and CAUTI rate tables. However, this method only allows for comparison of DURs within strata and does not lend itself to calculating an overall performance metric for a facility.

Instead, SURs allow users to summarize data by more than a single variable (for example, location or medical school affiliation), adjusting for differences in the use of each device type among other variables of importance. For example, NHSN allows users to obtain one central line SUR adjusting for all locations for which patient days and central line days were reported. Similarly, users can also obtain one central line SUR for all intensive care units in their facilities.

Additionally, the SUR allows for a comparison to the national benchmark from a baseline time period and can be used to measure progress from a single point in time. In other words, the SUR permits comparisons between the number of device days experienced by a facility, group, or state to the number of device days that were predicted to have occurred based on national data (specifically, the baseline). This should sound very similar to the reasoning and methodology behind the SIR.

How is the SUR calculated?

The SUR is calculated by dividing the number of observed device days by the number of predicted device days. The number of predicted device days is calculated using multivariable logistic regression models generated from nationally aggregated data during a baseline time period. These models are applied to a facility's denominator data to generate a predicted number of device days. Please refer to Section 2 for more details regarding the models.

$$SUR = \frac{\text{Observed (O) device days}}{\text{Predicted (P) device days}}$$

In order to enforce a minimum precision criterion, **SURs are currently not calculated when the number of predicted device days is less than 1.0**. This rule was instituted to avoid the calculation and interpretation of statistically imprecise SURs, which typically have extreme values.

Calculating the Number of Predicted Device Days

The number of predicted device days in NHSN is calculated based on national HAI aggregate data from a baseline time period using risk-adjustment models which contain significant predictors of device use. NHSN uses a logistic regression model to help derive this calculation.

❖ Example: Logistic Regression Model (Central Line NICUs)

The logistic regression model is the specific type of model that adjusts for factors significantly associated with NICU central line (CL) device use. At a high level, the model uses a set of fixed parameters (adjustment variables or factors) to calculate the log-odds of CL use. To obtain the total number of predicted CL days, the user takes the following steps in NHSN:

1. Calculate the log-odds (logit) of CL use by adding the value of the parameter estimates applicable to your CL summary data.
2. Convert the logit to probability of CL use.
3. Multiply the probability of CL use by the observed patient days for that time frame and location.

The final result is the number of predicted device days for that time frame and location. *Table 1* below shows the factors found to be significant for NICU CL days in NHSN. **Note:** each factor's contribution to the SUR varies and is represented by the parameter estimate for each factor. A parameter estimate describes the relationship (magnitude and directionality) between a variable and device use; positive parameter estimates indicate that the exposure of device use increases with increasing values of the variable. Negative parameter estimates indicate that the exposure of device use decreases with increasing values of the variable.

Table 1. Factors Predicting Unit Level Central Line Use; Central Line SUR, NICU (2022 Baseline)

<u>Parameter</u>	<u>Variable Coding</u>	<u>Parameter Estimate</u>	<u>P-value</u>
Intercept	-	-2.5907	<0.0001
Birthweight	Birthweight Code A= 1	1.4720	<0.0001
	Birthweight Code B= 1	1.1040	<0.0001
	Birthweight Code C= 1	0.7280	<0.0001
	Birthweight Code E= 1	0.2557	<0.0001
	Birthweight Code D= 0	REFERENT	
CDC Location	IN:ACUTE:CC:NURS= 1	0.3202	<0.0001
	IN:ACUTE:CC:NURS_IV= 1	0.7050	<0.0001
	IN:ACUTE:CC_STEP:NURS= 0	REFERENT	
Number of Beds Group	Group 2: >= 312 beds = 1	0.0800	0.0050
	Group 1: <312 beds = 0	REFERENT	
Average Length of Stay Group	Group 2: >= 5.4 days = 1	0.1845	<.0001
	Group 1: <5.4 days = 0	REFERENT	

The parameter estimates from *Table 1* can be plugged into the following general logistic regression formula:

$$\text{logit}(\hat{p}) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_i X_i, \text{ where:}$$

α = Intercept

β_i = Parameter Estimate

X_i = Value of Factor (Categorical variables= 1 if present, 0 if not present. Refer to “Variable Coding” column in Table 1 above.)

i = Number of Predictors

Let us say we have a Level IV NICU summary denominator data record for a general hospital with average length of stay of 5.8 days and a bed size of 200. Patient days for the different birthweight codes were as follows:

- **121 for birthweight code A**
- 151 for birthweight code B

- 84 for birthweight code C
- 55 patient days for birthweight code E
- 22 patient days for birthweight code D.

The number of CL days for the birthweight codes were:

- **101 for birthweight code A**
- 63 for birthweight code B
- 77 for birthweight code C
- 31 for birthweight code E
- 11 for birthweight code D

We can use the model above to plug in these values for each birthweight code as shown below for **birthweight code A**:

1. Calculate the log-odds (logit) of CL use by adding the value of the parameter estimates applicable to the example data.

$$\text{logit}(\hat{p}) = -2.5907 + 0.7050(\text{Level IV NICU}) + 0.0(\text{Number of Beds} < 312) \\ + 0.1845(\text{Average Length of Stay} > 5.4) + 1.4720(\text{BIRTHWEIGHT CODE A})$$

$$\text{logit}(\hat{p}) = -2.5907 + 0.7050(1) + 0(0) + 0.1845(1) + 1.4720(1) = -0.2292$$

The value -0.2292 is the log-odds of central line device use in birthweight code A.

2. To convert this value into the probability of central line use ($\hat{p}$), we must use the formula below:

$$\hat{p} = \frac{e^{\text{logit}(\hat{p})}}{1 + e^{\text{logit}(\hat{p})}}$$

$$\hat{p} = \frac{e^{-0.2292}}{1 + e^{-0.2292}}$$

$$\hat{p} = 0.4430$$

3. Multiply the probability of CL use by the observed inpatient days to obtain the number of predicted CL days:

$$\text{number of predicted central line days} = 0.4430 * 121$$

$$\text{number of predicted central line days} = 53.6030$$

Once all the number of predicted CL days is calculated for each birthweight code, they can be summed. The sum is the total number of predicted CL days for that specific month in the NICU. *Table 2* provides a list of each birthweight code in the same Level IV NICU location example and demonstrates how the total number of predicted central line days is calculated.

Table 2. Central Line SUR for a Level IV NICU

<u>Birthweight Code</u>	<u>Facility Average Length of Stay</u>	<u>Facility Bed Size</u>	<u>Patient Days</u>	<u>Probability of CL use ($\hat{p}$)</u>	<u>Total Predicted Device Days</u>
A	5.8	200	121	0.4430	53.6030
B	5.8	200	151	0.3550	53.6050
C	5.8	200	83	0.7258	60.2414
D	5.8	200	11	0.8093	8.9023
E	5.8	200	31	0.1543	4.7833
Total	-	-	-	-	181.135

Notice in the above table that the number of predicted central line days is different for each birthweight category. Similar to the SIR, the SUR is a scalable measure that allows one to sum the predicted number of device days across more than one location or, as in the example above, multiple birthweight categories.

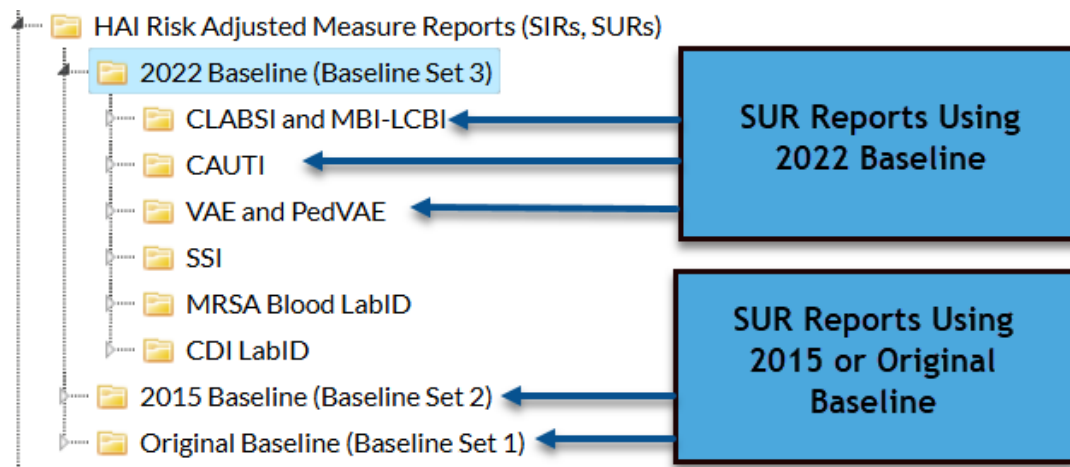
The SUR can now be calculated for the Level IV NICU as follows:

$$SUR = \frac{\text{Observed (O) CL Days}}{\text{Predicted (P) CL Days}} = \frac{283}{181.135} = 1.5624$$

Finding and Interpreting SURs in NHSN

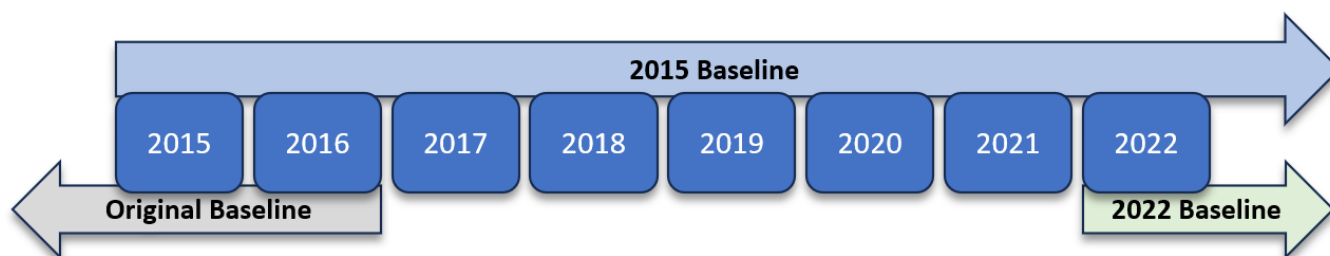
What SUR reports are available?

To run analysis reports in NHSN, users must first generate analysis data sets (Analysis > Generate Data Sets). NHSN recommends users regenerate data sets after entering new data into the application or before creating new reports. After data sets have been regenerated, users can select Analysis > Reports from the NHSN homepage to view HAI-specific folders. The SUR reports located in the Device-Associated Module folder are calculated using the 2022 baseline models. There are SUR reports for central lines, urinary catheters, and ventilators. Among those, each facility type has a different SUR report. SURs are generated for 2022 data and forward. Please refer to the quick reference guide on [How to Run and Interpret SUR Reports in NHSN](#) for more information. The overall process of selecting, modifying, and running SUR Reports has not changed from the 2015 Baseline.



Which Baseline Can I Use?

SURs can be generated for data through 2016 using the original NHSN baselines by running reports in the “Baseline Set 1” folder of the analysis treeview. Data representing January 2015 and forward can be analyzed using SIRs under the 2015 baseline models, and data representing January 2022 and forward can be analyzed using SIRs under the 2022 baseline. Even after the complete implementation of the 2022 baseline, SURs will continue to be available in NHSN under the 2015 baseline, and NHSN users will have a choice about which national baseline to use. See the figure below for a visual representation of these timelines.



SURs calculated under any national baseline cannot be directly compared to SURs calculated under a different national baseline. Additional information about how to determine which baseline to use for various analytic purposes can be found in the [NHSN 2022 HAI Rebaseline Fact Sheet](#).

How do I Interpret the SURs?

SUR

- If the SUR > 1.0, then more device days were observed than predicted, based on the chosen national baseline.
- If the SUR < 1.0, then fewer device days were observed than predicted, based on the chosen national baseline.
- If the SUR = 1.0, then the same number of device days were observed as predicted, based on the chosen national baseline.
- To avoid statistical instability, the SUR is only calculated when the number of predicted device days is at least 1.0. However, this occurrence is rare and would likely occur in those locations with generally low device use (for example, prenatal wards) and/or smaller units with low overall exposure.

P-value

- In the context of the SUR, the p-value is a statistical measure that tells us whether the number of observed device days is statistically different from the number of predicted device days (specifically, whether the SUR is significantly different from 1.0). NHSN calculates p-values using a mid-P exact test.
- Given the widely accepted value of 0.05, if the p-value ≤ 0.05 , we can conclude that the number of observed device days is statistically different than the number predicted.
- If the p-value > 0.05, we conclude that the number of observed device days is **not** statistically different from the number predicted.

95% Confidence Interval

- The 95% confidence interval is a statistical range of values for which we have a high degree of confidence that the true SUR lies within.
- If the confidence interval does not include 1, then the SUR is statistically different than 1 (specifically, the number of observed device days is significantly different from the number predicted).

- Example: 95% confidence interval= (0.85, 0.92)
- If the confidence interval includes the value of 1, then the SUR is not statistically different than 1 (specifically, the number of observed device days is not significantly different from the number predicted).
 - Example: 95% confidence interval= (0.85, 1.24)
- If the SUR is 0.000 (specifically, the number of device days is 0 and the number of predicted device days is ≥ 1.0), the lower bound of the 95% confidence interval will not be calculated.

As an example, let us look at a CL SUR report from NHSN. Below is a table showing the overall CL SUR for a fictitious hospital during the third quarter of 2024.

orgID	ccn	summaryYQ	numCLDays	numPredDDays	numPatDays	SUR	SUR_pval	SUR95CI
10401	000000	2024Q3	2000	1,287.339	4000	1.554	0.0000	1.487, 1.623

- During the third quarter (July - September) of 2024 (“summaryYQ”), there were 2,000 CL days observed in our facility (“numCLDays”) from the locations under surveillance.
- Based on the NHSN 2022 baseline data, 1,287.339 CL days were predicted (“numPredDDays”) in our facility.
- This results in a SUR of 1.554 (2,000/1,287.339), signifying that during this time period, our facility observed approximately 55% more CL days than predicted.
- Because the p-value (“SUR_pval”) is below the significance level of 0.05 and the 95% confidence interval (“SUR95CI”) does not include the value of 1, we can conclude that our facility’s SUR is statistically significant; in other words, our facility did observe a significantly different number of central line days than predicted.

When analyzing these data as a Group user, an additional overall SUR is calculated for all facilities in the group. More information on using the Group function in NHSN can be found on the [NHSN Group Users page](#).

Section 2: Risk Adjustment Factors Included in the SUR Calculation

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Note: This section contains several acronyms and abbreviations. For descriptions of these terms, please reference [the glossary](#) at the end of the document.

This section contains information on the risk factors used in the calculation of the number of predicted events for each HAI and facility type currently available in NHSN under the 2022 baseline. This information is provided in order to aid in the interpretation of the SUR calculations produced by NHSN. The tables displayed in this section list the variables included in each risk adjustment model, as well as parameter estimates and standard errors. For 2022 baseline models, most risk adjustment variables are broken into different levels, or categories (i.e., categorical variables). See below for examples of each variable type. Typically, the level with the lowest risk (for SSI models) or lowest rate (for other HAI models) are chosen as the reference group.

- **Categorical variables:**

Example: “medical school affiliation” in the Central Line ACH model, as shown in table below. For full model details refer to page 13

<u>Parameter</u>	<u>Parameter Estimate</u>	<u>Standard Error</u>	<u>P-value</u>
Medical school affiliation: Major	0.0697	0.0113	<0.0001
Medical school affiliation: No affiliation, Undergraduate, Graduate	REFERENT	-	-

Variables are categorized based on significant differences in device use between the categories. Parameter estimates reflect the nature of the relationship between the variable and amount of device use. In the case of categorical variables, the device use in an individual category is compared to the device use in the “referent” category. A positive parameter estimate indicates that the device use in that category (and therefore, the number of predicted device days) is higher compared to the predicted device days in the referent category. A negative parameter estimate indicates that the predicted device days in that category is lower compared to the HAI risk in the “referent” category.

- **Derived variables:**

Example: The “proportion of total beds that are ICU” in the CAH Urinary Catheter model, as shown in table below. For full model details refer to page 25

<u>Parameter</u>	<u>Parameter Estimate</u>	<u>Standard Error</u>	<u>P-value</u>
Proportion of total beds that are ICU ¹ : <0	0.1332	0.0491	<0.0067
Proportion of total beds that are ICU ¹ : =0	REFERENT	-	-

¹Proportion ICU beds is calculated as: total # of ICU beds / total # of beds.

Derived variables are variables created from two or more variables, and may involve summation, division, or multiplication. Parameter estimates are interpreted as above.

Risk Adjustment Factors Included in the SUR Calculation: Acute Care Hospitals (ACHs)

Central Line

The number of predicted central line days is calculated using a logistic regression model (see page 5 above for more information). If a location is not included in this model, then a SUR will not be calculated for it. In addition, data from Governmental and Non-governmental Public Health Emergency (PHE) facilities (facType as HOSP-PHE/G and HOSP-PHE/NG), will be excluded from SUR calculations. In cases when the number of predicted device days is less than 1.0, the SUR will not be calculated in NHSN. Temporary and permanent central line days, reported from applicable locations, are combined in the SUR.

The number of predicted central line days calculated under the 2022 baseline and is adjusted based on the following variables found to be statistically significant predictors:

Table 1. Central Line Days in Acute Care Hospitals (non-NICU and non-Specialty Care Area Locations)

Parameter	Parameter Estimate	Standard Error	P-value
<i>Intercept</i>	-6.8982	0.1095	<.0001
<u>CDC Location Code: CC Group 1</u> <i>Pediatric Medical Critical Care - IN:ACUTE:CC:M_PED</i> <i>Neurologic Critical Care - IN:ACUTE:CC:N</i> <i>Neurosurgical Critical Care - IN:ACUTE:CC:NS</i> <i>Prenatal Critical Care - IN:ACUTE:CC:PNATL</i>	4.5280	0.0921	<.0001
<u>CDC Location Code: CC Group 2</u> <i>Burn Critical Care - IN:ACUTE:CC:B</i> <i>Pediatric Burn Critical Care - IN:ACUTE:CC:B_PED</i> <i>Medical-Surgical Critical Care - IN:ACUTE:CC:MS</i> <i>Pediatric Medical-Surgical Critical Care - IN:ACUTE:CC:MS_PED</i> <i>Respiratory Critical Care - IN:ACUTE:CC:R</i> <i>Pediatric Respiratory Critical Care - IN:ACUTE:CC:R_PED</i> <i>Trauma Critical Care - IN:ACUTE:CC:T</i> <i>Pediatric Trauma Critical Care - IN:ACUTE:CC:T_PED</i>	5.1805	0.0871	<.0001
<u>CDC Location Code: CC Group 3</u> <i>Medical Cardiac Critical Care - IN:ACUTE:CC:C</i> <i>Medical Critical Care - IN:ACUTE:CC:M</i> <i>Onsite Overflow Critical Care - IN:ACUTE:CC:OF_ONSITE</i> <i>Surgical Critical Care - IN:ACUTE:CC:S</i> <i>Pediatric Surgical Critical Care - IN:ACUTE:CC:S_PED</i>	5.2563	0.0876	<.0001
<u>CDC Location Code: CC Group 4</u> <i>Surgical Cardiothoracic Critical Care - IN:ACUTE:CC:CT</i> <i>Pediatric Surgical Cardiothoracic Critical Care - IN:ACUTE:CC:CT_PED</i>	5.9863	0.0902	<.0001
<u>CDC Location Code: MIXED Group 1</u>	3.9241	0.0895	<.0001

Mixed Age Mixed Acuity Unit - IN:ACUTE:MIXED:ALL Adult Mixed Acuity Unit - IN:ACUTE:MIXED:ALL_ADULT Pediatric Mixed Acuity Unit - IN:ACUTE:MIXED:ALL_PEDS			
CDC Location Code: STEP Group 1	2.1230	0.1399	<.0001
Special Care Nursery (Level II) - IN:ACUTE:STEP:NURS			
CDC Location Code: STEP Group 2	3.8864	0.0881	<.0001
Adult Step-Down Unit - IN:ACUTE:STEP Pediatric Step-Down Unit IN:ACUTE:STEP:PED			
CDC Location Code: WARD Group 2	3.4387	0.0869	<.0001
Gerontology Ward - IN:ACUTE:WARD:GNT Gynecology Ward - IN:ACUTE:WARD:GYN Medical Ward - IN:ACUTE:WARD:M Medical-Surgical Ward - IN:ACUTE:WARD:MS Pediatric Medical-Surgical Ward - IN:ACUTE:WARD:MS_PED Pediatric Medical Ward - IN:ACUTE:WARD:M_PED Neurology Ward - IN:ACUTE:WARD:N Neurosurgical Ward - IN:ACUTE:WARD:NS Pediatric Neurosurgical Ward- IN:ACUTE:WARD:NS_PED Pediatric Neurology Ward - IN:ACUTE:WARD:N_PED Onsite Overflow Ward - IN:ACUTE:WARD:OF_ONSITE Orthopedic Ward - IN:ACUTE:WARD:ORT Orthopedic Trauma Ward - IN:ACUTE:WARD:ORT_PED Rehabilitation Ward (within Hospital) - IN:ACUTE:WARD:REHAB Pediatric Rehabilitation Ward (within Hospital) - IN:ACUTE:WARD:REHAB_PED Stroke (Acute) Ward - IN:ACUTE:WARD:STRK Telemetry Ward - IN:ACUTE:WARD:TEL Orthopedic Trauma Ward - IN:ACUTE:WARD:T_ORT			
CDC Location Code: WARD Group 3	3.6116	0.0885	<.0001
Jail Unit - IN:ACUTE:WARD:JAL Pulmonary Ward - IN:ACUTE:WARD:PULM Surgical Ward - IN:ACUTE:WARD:S Pediatric Surgical Ward - IN:ACUTE:WARD:S_PED Burn Ward - IN:ACUTE:WARD:B Pediatric Burn Ward IN:ACUTE:WARD:B_PED Ear, Nose, Throat Ward - IN:ACUTE:WARD:ENT Gastrointestinal Ward - IN:ACUTE:WARD:GI Genitourinary Ward -IN:ACUTE:WARD:GU Pediatric Genitourinary Ward - IN:ACUTE:WARD:GU_PED Plastic Surgery Ward - IN:ACUTE:WARD:PLS Vascular Surgery Ward - IN:ACUTE:WARD:VS			
CDC Location Code: WARD Group 1	REFERENT		
Antenatal Care Ward - IN:ACUTE:WARD:ANTENAT Behavioral Health/Psych Ward - IN:ACUTE:WARD:BHV Adolescent Behavioral Health Ward - IN:ACUTE:WARD:BHV_ADOL			

<i>Pediatric Behavioral Health Ward - IN:ACUTE:WARD:BHV_PED</i> <i>Labor and Delivery Ward - IN:ACUTE:WARD:LD</i> <i>Labor, Delivery, Recovery, Postpartum Suite -</i> <i>IN:ACUTE:WARD:LD_PP</i> <i>Well Newborn - Nursery (Level I) - IN:ACUTE:WARD:NURS</i> <i>Postpartum Ward - IN:ACUTE:WARD:PP</i> <i>Ophthalmology Ward - IN:ACUTE:WARD:OPH</i>			
Total Number of Beds ¹ : 26-46	0.1679	0.0668	0.0119
Total Number of Beds ¹ : 47-64	0.3489	0.0640	<.0001
Total Number of Beds ¹ : 65-98	0.5484	0.0620	<.0001
Total Number of Beds ¹ : 99-132	0.7021	0.0611	<.0001
Total Number of Beds ¹ : 133-299	0.7855	0.0590	<.0001
Total Number of Beds ¹ : 300-416	0.8485	0.0598	<.0001
Total Number of Beds ¹ : >=417	0.9631	0.0597	<.0001
Average Length of Stay ¹ : <=25	REFERENT		
Average Length of Stay ¹ : >=3.3 and <5.7	0.0978	0.0210	<.0001
Average Length of Stay ¹ : >=5.7 and <6.6	0.1729	0.0240	<.0001
Average Length of Stay ¹ : >=6.6	0.2586	0.0244	<.0001
Average Length of Stay ¹ : <3.3	REFERENT		
Medical School Affiliation ¹ : Major (M)	0.0697	0.0113	<.0001
Medical School Affiliation ¹ : Undergraduate (U), Graduate (G), Non-Teaching (N)	REFERENT		
Facility Type ² : Group 2 HOSP-MIL, HOSP-SURG	0.2404	0.0656	0.0002
Facility Type ² : Group 3 HOSP-GEN, HOSP-WOMCHILD	0.3918	0.0341	<.0001
Facility Type ² : Group 4 HOSP-CHLD	0.4837	0.0468	<.0001
Facility Type ² : Group 1 HOSP-ORTHO, HOSP-WOM, HOSP-VA	REFERENT		

¹ Facility bed size, medical school affiliation, and average length of stay are taken from the [Annual Hospital Survey](#). Major medical school affiliation is defined as a facility that trains medical students, nursing students, and post-graduate residents. Non-major medical school affiliation is defined as anything other than major (including non-teaching facilities). Average length of stay is calculated as: total # of annual patient days / total # of annual admissions.

² Facility type is based on the information reported by the facility during enrollment.

Table 2. Central Line Days in Acute Care Hospitals (NICU locations)

Parameter	Parameter Estimate	Standard Error	P-value
<i>Intercept</i>	-2.5907	0.0414	<.0001
Birth weight code A	1.4720	0.0442	<.0001
Birth weight code B	1.1040	0.0448	<.0001
Birth weight code C	0.7280	0.0455	<.0001
Birth weight code E	0.2557	0.0481	<.0001
Birth weight code D	REFERENT		
CDC Location Code: Neonatal Critical Care (Level III) - IN:ACUTE:CC:NURS	0.3202	0.0282	<.0001

CDC Location Code: Neonatal Critical Care (Level IV) - IN:ACUTE:CC:NURS_IV	0.7050	0.0431	<.0001
CDC Location Code: Neonatal Critical Care (Level II/III) - IN:ACUTE:CC_STEP:NURS	REFERENT		
CDC Location Code: Total Number of Beds ² : >=312	0.0800	0.0285	0.0050
Total Number of Beds ² : <312	REFERENT		
Average Length of Stay ² : >=5.4 days	0.1845	0.0282	<.0001
Average Length of Stay ² : <5.4 days	REFERENT		

¹ The birthweight categories are defined as: A = ≤750 g; B = 751-1000 g; C = 1001-1500 g; D = 1501-2500 g; E = >2500 g.

² Facility bed size and average length of stay are taken from the [Annual Hospital Survey](#). Average length of stay is calculated as: total # of annual patient days / total # of annual admissions.

Table 3. Central Line Days in Acute Care Hospitals (Specialty Care Area Locations)

Parameter	Parameter Estimate	Standard Error	P-value
<i>Intercept</i>	-0.6310	0.0533	<.0001
<u>CDC Location Code: CC Group 1</u>	-0.2867	0.1219	0.0187
<i>Oncology Medical Critical Care - IN:ACUTE:CC:ONC_M</i>			
<i>Oncology Medical-Surgical Critical Care - IN:ACUTE:CC:ONC_MS</i>			
<i>Oncology Pediatric Critical Care - IN:ACUTE:CC:ONC_PED</i>			
<i>Oncology Surgical Critical Care - IN:ACUTE:CC:ONC_S</i>			
<u>CDC Location Code: MIXED/SCA Group 2</u>	-1.0557	0.0866	<.0001
<i>Oncology Mixed Acuity Unit (all ages) - IN:ACUTE:MIXED:ONC</i>			
<i>Dialysis Specialty Care Area - IN:ACUTE:SCA:DIAL</i>			
<i>Solid Organ Transplant Specialty Care Area - IN:ACUTE:SCA:SOTP</i>			
<i>Pediatric Solid Organ Transplant Specialty Care Area - IN:ACUTE:SCA:SOTP_PED</i>			
<u>CDC Location Code: STEP Group 3</u>	-0.6221	0.1462	<.0001
<i>Oncology Step-Down Unit - IN:ACUTE:STEP:ONC</i>			
<u>CDC Location Code: WARD HONC/ST Group 4</u>	-0.9563	0.0500	<.0001
<i>Oncology General Hematology-Oncology Ward - IN:ACUTE:WARD:ONC_HONC</i>			
<i>Oncology Solid Tumor Ward - IN:ACUTE:WARD:ONC_ST</i>			
<u>CDC Location Code: WARD HONC PED Group 5</u>	-0.3450	0.0677	<.0001
<i>Oncology Pediatric General Hematology-Oncology Ward - IN:ACUTE:WARD:ONC_HONC_PED</i>			
<u>CDC Location Code: WARD_OTHER Group 6</u>	REFERENT		
<i>Oncology Hematopoietic Stem Cell Transplant Ward - IN:ACUTE:WARD:ONC_HSCT</i>			
<i>Oncology Pediatric Hematopoietic Stem Cell Transplant Ward - IN:ACUTE:WARD:ONC_HSCT_PED</i>			
<i>Oncology Leukemia Ward - IN:ACUTE:WARD:ONC_LEUK</i>			
<i>Oncology Leukemia/Lymphoma Ward - IN:ACUTE:WARD:ONC_LL</i>			

<i>Oncology Lymphoma Ward - IN:ACUTE:WARD:ONC_LYMPH</i>			
Central Line Type ¹ : Permanent	0.3347	0.0401	<.0001
Central Line Type ¹ : Temporary	REFERENT		
Proportion ICU Beds ² : ≥ 0.177	0.1115	0.0429	0.0093
Proportion ICU Beds ² : < 0.177	REFERENT		

¹ The total central line days used in the SUR calculation are summed from temporary and permanent central line days reported. Temporary is the referent; the Permanent estimate is applied only when a location-month reports no temporary central line days.

² Facility bed size is taken from the [Annual Hospital Survey](#). Proportion ICU beds is calculated as: total # of ICU beds / total # of beds.

Urinary Catheter

The number of predicted urinary catheter days is calculated using a logistic regression model (see [page 5](#) above for more information). If a location is not included in this model, then a SUR will not be calculated for it.

The number of predicted urinary catheter days calculated under the 2022 baseline and is adjusted based on the following variables found to be statistically significant predictors:

Table 4. Urinary Catheter Days in Acute Care Hospitals

Parameter	Parameter Estimate	Standard Error	P-value
<i>Intercept</i>	-7.5751	0.4432	<.0001
<u>CDC Location Code: CC GROUP 1</u>	7.4617	0.4412	<.0001
<i>Surgical Cardiothoracic Critical Care - IN:ACUTE:CC:CT</i> <i>Oncology Medical Critical Care - IN:ACUTE:CC:ONC_M</i>			
<u>CDC Location Code: CC GROUP 2</u>	7.2152	0.4406	<.0001
<i>Medical-Surgical Critical Care - IN:ACUTE:CC:MS</i> <i>Onsite Overflow Critical Care - IN:ACUTE:CC:OF_ONSITE</i> <i>Surgical Critical Care - IN:ACUTE:CC:S</i> <i>Trauma Critical Care - IN:ACUTE:CC:T</i>			
<u>CDC Location Code: CC GROUP 3</u>	7.1325	0.4408	<.0001
<i>Medical Critical Care - IN:ACUTE:CC:M</i> <i>Oncology Medical-Surgical Critical Care - IN:ACUTE:CC:ONC_MS</i> <i>Oncology Surgical Critical Care - IN:ACUTE:CC:ONC_S</i> <i>Respiratory Critical Care - IN:ACUTE:CC:R</i>			
<u>CDC Location Code: CC GROUP 4</u>	6.9354	0.4410	<.0001
<i>Medical Cardiac Critical Care - IN:ACUTE:CC:C</i> <i>Neurologic Critical Care - IN:ACUTE:CC:N</i> <i>Neurosurgical Critical Care - IN:ACUTE:CC:NS</i> <i>Pediatric Surgical Critical Care - IN:ACUTE:CC:S_PED</i>			
<u>CDC Location Code: CC GROUP 5</u>	6.7602	0.4450	<.0001
<i>Burn Critical Care - IN:ACUTE:CC:B</i> <i>Pediatric Burn Critical Care - IN:ACUTE:CC:B_PED</i> <i>Oncology Pediatric Critical Care - IN:ACUTE:CC:ONC_PED</i>			
<u>CDC Location Code: CC GROUP 6</u>	5.2945	0.4424	<.0001

Parameter	Parameter Estimate	Standard Error	P-value
<i>Pediatric Surgical Cardiothoracic Critical Care - IN:ACUTE:CC:CT_PED</i> <i>Pediatric Medical-Surgical Critical Care - IN:ACUTE:CC:MS_PED</i> <i>Pediatric Trauma Critical Care - IN:ACUTE:CC:T_PED</i>			
<u>CDC Location Code: CC GROUP 7</u>	4.9043	0.4610	<.0001
<i>Pediatric Medical Critical Care - IN:ACUTE:CC:M_PED</i> <i>Prenatal Critical Care - IN:ACUTE:CC:PNATL</i>			
<u>CDC Location Code: - Adult Mixed Acuity Unit - IN:ACUTE:MIXED:ALL_ADULT</u>	5.6603	0.4411	<.0001
<u>CDC Location Code: Pediatric Mixed Acuity Unit - IN:ACUTE:MIXED:ALL_PEDS</u>	3.8954	0.4764	<.0001
<u>CDC Location Code: - Surgical Ward - IN:ACUTE:WARD:S</u>	5.4692	0.4408	<.0001
<u>CDC Location Code: MIXED GROUP 1</u>	5.4662	0.4439	<.0001
<i>Mixed Age Mixed Acuity Unit - IN:ACUTE:MIXED:ALL</i> <i>Oncology Mixed Acuity Unit (all ages) - IN:ACUTE:MIXED:ONC</i>			
<u>CDC Location Code: STEP GROUP 1</u>	5.6516	0.4407	<.0001
<i>Adult Step-Down Unit - IN:ACUTE:STEP</i> <i>Oncology Step-Down Unit - IN:ACUTE:STEP:ONC</i>			
<u>CDC Location Code: STEP GROUP 2</u>	2.2469	0.5235	<.0001
<i>Special Care Nursery (Level II) - IN:ACUTE:STEP:NURS</i> <i>Pediatric Step-Down Unit - IN:ACUTE:STEP:PED</i>			
<u>CDC Location Code: WARD GROUP 1</u>	5.8993	0.4442	<.0001
<i>Solid Organ Transplant Specialty Care Area - IN:ACUTE:SCA:SOTP</i> <i>Rehabilitation Ward (within Hospital) - IN:ACUTE:WARD:REHAB</i>			
<u>CDC Location Code: WARD GROUP 2</u>	5.7105	0.4413	<.0001
<i>Burn Ward - IN:ACUTE:WARD:B</i> <i>Genitourinary Ward - IN:ACUTE:WARD:GU</i> <i>Labor and Delivery Ward - IN:ACUTE:WARD:LD</i> <i>Onsite Overflow Ward - IN:ACUTE:WARD:OF_ONSITE</i> <i>Oncology Solid Tumor Ward - IN:ACUTE:WARD:ONC_ST</i> <i>Pediatric Orthopedic Ward - IN:ACUTE:WARD:ORT_PED</i>			
<u>CDC Location Code: WARD GROUP 3</u>	5.3471	0.4413	<.0001
<i>Gynecology Ward - IN:ACUTE:WARD:GYN</i> <i>Orthopedic Ward - IN:ACUTE:WARD:ORT</i>			
<u>CDC Location Code: WARD GROUP 4</u>	5.2555	0.4406	<.0001
<i>Labor, Delivery, Recovery, Postpartum Suite - IN:ACUTE:WARD:LD_PP</i> <i>Medical-Surgical Ward - IN:ACUTE:WARD:MS</i> <i>Neurosurgical Ward - IN:ACUTE:WARD:NS</i> <i>Plastic Surgery Ward - IN:ACUTE:WARD:PLS</i> <i>Vascular Surgery Ward - IN:ACUTE:WARD:VS</i>			

Parameter	Parameter Estimate	Standard Error	P-value
<u>CDC Location Code: WARD GROUP 5</u> <i>Gastrointestinal Ward - IN:ACUTE:WARD:GI</i> <i>Oncology General Hematology-Oncology Ward - IN:ACUTE:WARD:ONC_HONC</i> <i>Oncology Lymphoma Ward - IN:ACUTE:WARD:ONC_LYMPH</i> <i>Stroke (Acute) Ward - IN:ACUTE:WARD:STRK</i> <i>Telemetry Ward - IN:ACUTE:WARD:TEL</i>	5.2044	0.4408	<.0001
<u>CDC Location Code: WARD GROUP 6</u> <i>Ear, Nose, Throat Ward - IN:ACUTE:WARD:ENT</i> <i>Gerontology Ward - IN:ACUTE:WARD:GNT</i> <i>Medical Ward - IN:ACUTE:WARD:M</i> <i>Neurology Ward - IN:ACUTE:WARD:N</i> <i>Postpartum Ward - IN:ACUTE:WARD:PP</i> <i>Pulmonary Ward - IN:ACUTE:WARD:PULM</i> <i>Orthopedic Trauma Ward - IN:ACUTE:WARD:T_OR</i>	5.1046	0.4406	<.0001
<u>CDC Location Code: WARD GROUP 7</u> <i>Dialysis Specialty Care Area - IN:ACUTE:SCA:DIAL</i> <i>Antenatal Care Ward - IN:ACUTE:WARD:ANTENAT</i> <i>Pediatric Burn Ward - IN:ACUTE:WARD:B_PED</i> <i>Jail Unit - IN:ACUTE:WARD:JAL</i> <i>Oncology Hematopoietic Stem Cell Transplant Ward- IN:ACUTE:WARD:ONC_HSCT</i> <i>Oncology Leukemia Ward - IN:ACUTE:WARD:ONC_LEUK</i> <i>Oncology Leukemia/Lymphoma Ward - IN:ACUTE:WARD:ONC_LL</i> <i>Pediatric Surgical Ward - IN:ACUTE:WARD:S_PED</i>	4.6617	0.4436	<.0001
<u>CDC Location Code: WARD GROUP 8</u> <i>Pediatric Solid Organ Transplant Specialty Care Area - IN:ACUTE:SCA:SOTP_PED</i> <i>Pediatric Genitourinary Ward- IN:ACUTE:WARD:GU_PED</i> <i>Pediatric Medical Ward - IN:ACUTE:WARD:M_PED</i> <i>Pediatric Medical-Surgical Ward - IN:ACUTE:WARD:MS_PED</i> <i>Pediatric Neurology Ward - IN:ACUTE:WARD:N_PED</i> <i>Pediatric Neurosurgical Ward - IN:ACUTE:WARD:NS_PED</i> <i>Oncology Pediatric General Hematology-Oncology Ward - IN:ACUTE:WARD:ONC_HONC_PED</i> <i>Oncology Pediatric Hematopoietic Stem Cell Transplant Ward- IN:ACUTE:WARD:ONC_HSCT_PED</i> <i>Pediatric Rehabilitation Ward (within Hospital) - IN:ACUTE:WARD:REHAB_PED</i>	3.3145	0.4442	<.0001
<u>CDC Location Code: WARD GROUP 9</u> <i>Behavioral Health/Psych Ward - IN:ACUTE:WARD:BHV</i> <i>Adolescent Behavioral Health Ward - IN:ACUTE:WARD:BHV_ADOL</i> <i>Pediatric Behavioral Health Ward - IN:ACUTE:WARD:BHV_PED</i> <i>Well Newborn-- Nursery (Level I) - IN:ACUTE:WARD:NURS</i> <i>Ophthalmology Ward - IN:ACUTE:WARD:OPH</i>	REFERENT		

Parameter	Parameter Estimate	Standard Error	P-value
Facility Type ¹ : HOSP-GEN, HOSP-CHLD, HOSP-ONC, HOSP-SURG, HOSP-VA	0.3153	0.0478	<.0001
Facility Type ¹ : HOSP-MIL, HOSP-ORTHO, HOS-WOM, HOSP-WOMCHILD	REFERENT		
Proportion ICU Beds ³ : 0 <= icubedspropn < 0.234	0.0669	0.0128	<.0001
Proportion ICU Beds ³ : 0.234 <= icubedspropn	REFERENT		
Medical School Affiliation ² : Undergraduate (U), Graduate (G), Non-Teaching (N)	0.0540	0.00882	<.0001
Medical School Affiliation ² : Major (M)	REFERENT		

¹ Facility type is based on the information reported by the facility during enrollment.

² Facility bed size and medical school affiliation are taken from the [Annual Hospital Survey](#).

³Proportion ICU beds (icubedspropn) is calculated as: total # of ICU beds / total # of beds. Major medical school affiliation is defined as a facility that trains medical students, nursing students, and post-graduate residents. Non-major medical school affiliation is defined as anything other than major (including non-teaching facilities).

Ventilator

The number of predicted ventilator days is calculated using a negative binomial regression model. Refer to Table 5 below for a list of location types included in the ACH ventilator SUR; if an inpatient location is not included in the model table below, then data from that location type will be excluded from the SUR due to insufficient 2022 baseline data. Please see below for the location type-specific model details.

The number of predicted ventilator days calculated under the 2022 baseline is risk adjusted based on the following variables found to be statistically significant predictors:

Table 5. Ventilator Days in Acute Care Hospitals (non-NICU and non-Pediatric Locations)

Parameter	Parameter Estimate	Standard Error	P-value
<i>Intercept</i>	-6.0986	0.1954	<.0001
<u>CDC Location Code: Critical Care Group 1</u>	2.5657	0.1678	<.0001
<i>Medical Cardiac Critical Care- IN:ACUTE:CC:C</i>			
<i>Pediatric Medical-Surgical Critical Care-IN:ACUTE:CC:MS_PED</i>			
<i>Pediatric Trauma Critical Care- IN:ACUTE:CC:T_PED</i>			
<i>Trauma Critical Care- IN:ACUTE:CC:T</i>			
<u>CDC Location Code: Critical Care Group 2</u>			
<i>Medical Cardiac Critical Care- IN:ACUTE:CC:C</i>	3.1613	0.1002	<.0001
<i>Pediatric Medical-Surgical Critical Care-IN:ACUTE:CC:MS_PED</i>			
<i>Pediatric Trauma Critical Care- IN:ACUTE:CC:T_PED</i>			
<i>Trauma Critical Care- IN:ACUTE:CC:T</i>			
<u>CDC Location Code: Critical Care Group 3</u>			
<i>Medical Cardiac Critical Care- IN:ACUTE:CC:C</i>	3.2585	0.1015	<.0001

Parameter	Parameter Estimate	Standard Error	P-value
<i>Pediatric Medical-Surgical Critical Care- IN:ACUTE:CC:MS_PED</i> <i>Pediatric Trauma Critical Care- IN:ACUTE:CC:T_PED</i> <i>Trauma Critical Care- IN:ACUTE:CC:T</i>			
<u>CDC Location Code: Critical Care Group 4</u> <i>Medical Cardiac Critical Care- IN:ACUTE:CC:C</i> <i>Pediatric Medical-Surgical Critical Care- IN:ACUTE:CC:MS_PED</i> <i>Pediatric Trauma Critical Care- IN:ACUTE:CC:T_PED</i> <i>Trauma Critical Care- IN:ACUTE:CC:T</i>	3.4451	0.1162	<.0001
<u>CDC Location Code: Mixed Adult</u> <i>Medical Cardiac Critical Care- IN:ACUTE:CC:C</i> <i>Pediatric Medical-Surgical Critical Care- IN:ACUTE:CC:MS_PED</i> <i>Pediatric Trauma Critical Care- IN:ACUTE:CC:T_PED</i> <i>Trauma Critical Care- IN:ACUTE:CC:T</i>	2.1643	0.1242	<.0001
<u>CDC Location Code: Step</u> <i>Medical Cardiac Critical Care- IN:ACUTE:CC:C</i> <i>Pediatric Medical-Surgical Critical Care- IN:ACUTE:CC:MS_PED</i> <i>Pediatric Trauma Critical Care- IN:ACUTE:CC:T_PED</i> <i>Trauma Critical Care- IN:ACUTE:CC:T</i>	1.5644	0.1182	<.0001
<u>CDC Location Code: Ward-B/Pulm</u> <i>Medical Cardiac Critical Care- IN:ACUTE:CC:C</i> <i>Pediatric Medical-Surgical Critical Care- IN:ACUTE:CC:MS_PED</i> <i>Pediatric Trauma Critical Care- IN:ACUTE:CC:T_PED</i> <i>Trauma Critical Care- IN:ACUTE:CC:T</i>	1.0941	0.2675	<.0001
<u>CDC Location Code: Ward-Other</u> <i>Medical Cardiac Critical Care- IN:ACUTE:CC:C</i> <i>Pediatric Medical-Surgical Critical Care- IN:ACUTE:CC:MS_PED</i> <i>Pediatric Trauma Critical Care- IN:ACUTE:CC:T_PED</i> <i>Trauma Critical Care- IN:ACUTE:CC:T</i>	REFERENT		
Total Number of Beds ¹ : ≥159 beds	1.1808	0.0949	<.0001
Total Number of Beds ¹ : 64–158 beds	0.8840	0.0966	<.0001
Total Number of Beds ¹ : 45-63 beds	0.2870	0.1144	0.0121
Total Number of Beds ¹ : 1-44 beds	REFERENT		
Average Length of Stay: ≥4.6 days	0.3001	0.0725	<.0001
Average length of stay: 3.0 days =< Average LOS < 4.6 days	0.1858	0.0726	0.0105
Average length of stay: 1.0 days =< Average LOS =< 3.0 days	REFERENT		
Medical School Affiliation: Undergraduate/Graduate/Major	0.1526	0.0391	<.0001
Medical School Affiliation: None	REFERENT		
Facility Type ³ : HOSP-GEN, HOSP-CHLD, HOSP-SURG	0.6644	0.1401	<.0001
Facility Type ³ : Other	REFERENT		

¹ Facility bed size, medical school affiliation, and average length of stay are taken from the [Annual Hospital Survey](#). Major medical school affiliation is defined as a facility that trains medical students, nursing students, and post-graduate residents. Non-major medical school affiliation is defined as anything other than major (including non-teaching facilities). Average length of stay is calculated as: total # of annual patient days / total # of annual admissions.

² Average length of stay is calculated as: total # of annual patient days / total # of annual admissions.

³ Facility type is based on the information reported by the facility during enrollment.

Table 6. Ventilator Days in Acute Care Hospitals (NICU Locations)

Parameter	Parameter Estimate	Standard Error	P-value
Intercept	-3.7324	0.1431	<.0001
Birthweight A	2.3521	2.3521	<.0001
Birthweight B	1.4356	1.4356	<.0001
Birthweight C	0.4558	0.4558	0.0001
Birthweight D/E	REFRENT		
Facility Type ¹ : HOSP-MIL, HOSP-CHLD	0.7740	0.7740	0.1053
Facility Type ¹ : HOSP-GEN, HOSP-WOM, HOSP-WOMCHILD	REFRENT		
Proportion ICU Beds ² : 0.245 ≤ ICUBedsPropn	0.2845	0.0886	0.0013
Proportion ICU Beds ² : 0.245 > ICUBedsPropn	REFRENT		
Total Number of Beds ² : 177-573 beds	0.3618	0.1225	0.0031
Total Number of Beds ² : ≥574 beds	0.6858	0.1325	<.0001
Total Number of Beds ² : 1-176 beds	REFRENT		
Average length of stay ³ : Average LOS ≥ 4.6 days	0.2580	0.0880	0.0034
Average length of stay ³ : Average LOS < 4.6 days	REFRENT		

¹ Facility type is based on the information reported by the facility during enrollment.

² Facility bed size is taken from the [Annual Hospital Survey](#). Proportion ICU beds (ICUBedsPropn) is calculated as: total # of ICU beds / total # of beds.

³ Average length of stay is calculated as: total # of annual patient days / total # of annual admissions.

Table 7. Ventilator Days in Acute Care Hospitals (Pediatric Locations)

Parameter	Parameter Estimate	Standard Error	P-value
Intercept	-4.4105	0.3849	<.0001
CDC Location Code: Critical Care	2.6632	0.3750	<.0001
Pediatric Medical-Surgical Critical Care- IN:ACUTE:CC:MS_PED Pediatric Trauma Critical Care- IN:ACUTE:CC:T_PED Pediatric Medical Critical Care- IN:ACUTE:M_Ped			
CDC Location Code: Mixed/Step	1.3788	0.4639	0.0030
Pediatric Mixed Acuity Unit - IN:ACUTE:CC:ALL_PEDS Pediatric Step-Down Unit- IN:ACUTE:CC:PED			
CDC Location Code: Ward	REFERENT		
Pediatric Medical-Surgical Ward - IN:ACUTE:WARD:MS_PED Pediatric Medical Ward - IN:ACUTE:WARD:M_PED Pediatric Rehabilitation Ward (within Hospital) - IN:ACUTE:WARD:REHAB_PED Pediatric Surgical Ward - IN:ACUTE:WARD:S_PED			
Total Number of ICU Beds ¹ : ≥115 beds	0.4980	0.1461	0.0007
Total Number of Beds ¹ : <115 beds	REFERENT		
Facility type: HOSP-CHLD, HOSP-WOMCHILD	0.6409	0.1414	<.0001

Parameter	Parameter Estimate	Standard Error	P-value
Facility type: HOSP-MIL, HOSP-GEN	REFERENT		
Average Length of Stay ² : ≥5.7 days	0.4212	0.1441	0.0035
Average Length of Stay ² : <2.6 days	REFERENT		

¹ ICU bed size is taken from the [Annual Hospital Survey](#).

² Average length of stay is calculated as: total # of annual patient days / total # of annual admissions.

Risk Adjustment Factors Included in the SUR Calculation: Critical Access Hospitals (CAHs)

Central Line

The number of predicted central line days is calculated using a logistic regression model (see page 5 above for more information). If a location is not included in this model, then a SUR will not be calculated for it. In cases when the number of predicted device days is less than 1.0, the SUR will not be calculated in NHSN. Temporary and permanent central line days, reported from applicable locations, are combined in the SUR.

The number of predicted central line days calculated under the 2022 baseline and is adjusted based on the following variables found to be statistically significant predictors:

Table 1. Central Line Days in Critical Access Hospitals (non-NICU and non-Specialty Care Area Locations)

Parameter	Parameter Estimate	Standard Error	P-value
<i>Intercept</i>	-7.6351	0.8733	<.0001
<u>CDC Location Code: Group 1 CC</u>	5.2685	0.8611	<.0001
<i>Medical Cardiac Critical Care - IN:ACUTE:CC:C</i>			
<i>Medical Critical Care - IN:ACUTE:CC:M</i>			
<i>Medical Surgical Critical Care - IN:ACUTE:CC:MS</i>			
<u>CDC Location Code: Group 2 MIXED/STEP</u>	4.5005	0.8626	<.0001
<i>Mixed Age Mixed Acuity Unit - IN:ACUTE:MIXED:ALL</i>			
<i>Adult Mixed Acuity Unit - IN:ACUTE:MIXED:ALL_ADULT</i>			
<i>Adult Step-Down Unit - IN:ACUTE:STEP</i>			
<u>CDC Location Code: Group 3 WARD_OTHER</u>	4.3810	0.8603	<.0001
<i>Jail Unit - IN:ACUTE:WARD:JAL</i>			
<i>Medical Ward - IN:ACUTE:WARD:M</i>			
<i>Medical Surgical Ward- IN:ACUTE:WARD:MS</i>			
<i>Orthopedic Ward - IN:ACUTE:WARD:ORT</i>			
<i>Rehabilitation Ward (within Hospital) - IN:ACUTE:WARD:REHAB</i>			
<i>Surgical Ward - IN:ACUTE:WARD:S</i>			
<i>Telemetry Ward - IN:ACUTE:WARD:TEL</i>			
<u>CDC Location Code: Group 4 WARD_LD/PP/NURS</u>	REFERENT		

Labor and Delivery Ward - IN:ACUTE:WARD:LD Labor, Delivery, Recovery, Postpartum Suite - IN:ACUTE:WARD:LD_PP Well Newborn-- Nursery (Level I) - IN:ACUTE:WARD:NURS Postpartum Ward - IN:ACUTE:WARD:PP			
Total Number of Beds ¹ : >=12	0.2466	0.1180	0.0367
Total Number of Beds ¹ : <=11	REFERENT		
Average Length of Stay ² : >=2.6 and<4.2	0.3628	0.1101	0.0010
Average Length of Stay ² : >=4.2	0.6200	0.1085	<.0001
Average Length of Stay ² : <2.6	REFERENT		

¹ Facility bed size and average length of stay are taken from the [Annual Hospital Survey](#).

² Average length of stay is calculated as: total # of annual patient days / total # of annual admissions.

Urinary Catheter

The number of predicted urinary catheter days is calculated using a logistic regression model (see [page 5](#) above for more information). If a location is not included in this model, then a SUR will not be calculated for it.

The number of predicted urinary catheter days calculated under the 2022 baseline and is adjusted based on the following variables found to be statistically significant predictors:

Table 2. Urinary Catheters in Critical Access Hospitals

Parameter	Parameter Estimate	Standard Error	P-value
Intercept	-3.4121	0.3184	<.0001
CDC Location Code: CC Medical Cardiac Critical Care - IN:ACUTE:CC:C Medical Critical Care - IN:ACUTE:CC:M Medical Surgical Critical Care - IN:ACUTE:CC:MS	2.6652	0.3190	<.0001
CDC Location Code: MIXED/STEP Mixed Age Mixed Acuity Unit - IN:ACUTE:MIXED:ALL Adult Mixed Acuity Unit - IN:ACUTE:MIXED:ALL_ADULT Adult Step-Down Unit - IN:ACUTE:STEP	1.6641	0.3221	<.0001
CDC Location Code: WARD GROUP 1 Jail Unit - IN:ACUTE:WARD:JAL Labor and Delivery Ward - IN:ACUTE:WARD:LD Labor, Delivery, Recovery, Postpartum Suite - IN:ACUTE:WARD:LD_PP Medical Ward - IN:ACUTE:WARD:M Medical- Surgical Ward - IN:ACUTE:WARD:MS Rehabilitation Ward (within Hospital) - IN:ACUTE:WARD:REHAB Surgical Ward - IN:ACUTE:WARD:S Telemetry Ward - IN:ACUTE:WARD:TEL Orthopedic Ward - IN:ACUTE:WARD:ORT	1.5662	0.3178	<.0001
CDC Location Code: WARD GROUP 2	REFERENT		

<i>Postpartum Ward - IN:ACUTE:WARD:PP</i> <i>Well Newborn-Nursery (Level I) - IN:ACUTE:WARD:NURS</i>			
Proportion ICU Beds ¹ : 0 < ICUBedsPropn	0.1332	0.0491	0.0067
Proportion ICU Beds ¹ : ICUBedsPropn = 0	REFERENT		

¹ Facility bed size is taken from the [Annual Hospital Survey](#). Proportion ICU beds (ICUBedsPropn) is calculated as: total # of ICU beds / total # of beds.

Ventilator

The number of predicted ventilator days is calculated using a negative binomial regression model. Refer to Table 3 below for a list of location types included in the CAH ventilator SUR; if an inpatient location is not included in the model table below, then data from that location type will be excluded from the SUR due to insufficient 2022 baseline data. Please see below for the location type-specific model details.

The number of predicted ventilator days calculated under the 2022 baseline is risk adjusted based on the following variables found to be statistically significant predictors:

Table 3. Ventilator Days in Critical Access Hospitals

Parameter	Parameter Estimate	Standard Error	P-value
Intercept	-5.6557	0.4302	<.0001
<u>CDC Location Code: CC</u> <i>Medical Critical Care - IN:ACUTE:CC:M</i> <i>Medical Surgical Critical Care - IN:ACUTE:CC:MS</i>	3.0249	0.444	<.0001
<u>CDC Location Code: WARD/STEP/OTHER</u> <i>Adult Mixed Acuity Unit - IN:ACUTE:MIXED:ALL_ADULT</i> <i>Adult Step-Down Unit - IN:ACUTE:STEP</i> <i>Labor and Delivery Ward - IN:ACUTE:WARD:LD</i> <i>Labor, Delivery, Recovery, Postpartum Suite - IN:ACUTE:WARD:LD_PP</i> <i>Medical Ward - IN:ACUTE:WARD:M</i> <i>Medical-Surgical Ward - IN:ACUTE:WARD:MS</i> <i>Telemetry Ward - IN:ACUTE:WARD:TEL</i> <i>Orthopedic Ward - IN:ACUTE:WARD:ORT</i> <i>Rehabilitation Ward (within Hospital) - IN:ACUTE:WARD:REHAB</i>	REFERENT		

Risk Adjustment Factors Included in the SUR Calculation: Long-Term Acute Care Hospitals (LTACHs)

Central Line

The number of predicted central line days is calculated using a logistic regression model (see page 5 above for more information). If a location is not included in this model, then a SUR will not be calculated for it. In cases

when the number of predicted device days is less than 1.0, the SUR will not be calculated in NHSN. Temporary and permanent central line days, reported from applicable locations, are combined in the SUR.

The number of predicted central line days calculated under the 2022 baseline and is adjusted based on the following variables found to be statistically significant predictors:

Table 1. Central Line Days in Long-Term Acute Care Hospitals

Parameter	Parameter Estimate	Standard Error	P-value
Intercept	-1.9909	0.1425	<.0001
Total Number of Beds: 1-24	0.8823	0.1520	<.0001
Total Number of Beds: 25-91	0.3982	0.1004	<.0001
Total Number of Beds: ≥92	REFERENT	.	.
Average Length of Stay: 1≤ and <26.3	0.6710	0.1220	<.0001
Average Length of Stay: 26.3≤ and <46.3	0.3899	0.1072	0.0003
Average Length of Stay: ≥46.3	REFERENT	.	.
Proportion of Annual Admissions with Hemodialysis ¹ : ≥0.036	0.2978	0.1184	0.0119
Proportion of Annual Admissions with Hemodialysis ¹ : <0.036	REFERENT	.	.
CDC Location Type: CC	0.5447	0.1124	<.0001
CDC Location Type: WARD	REFERENT	.	.
Proportion ICU Beds ¹ : ≥0.103	0.1713	0.0833	0.0396
Proportion ICU Beds ¹ : <0.103	REFERENT	.	.
Proportion of Annual Admissions on a Ventilator ¹ : ≥0.054	0.3334	0.1284	0.0094
Proportion of Annual Admissions on a Ventilator ¹ : <0.054	REFERENT	.	.

¹ Proportion of ICU beds, proportion of admissions on hemodialysis, proportion of admissions on a ventilator, and average length of stay are calculated using values reported on the [Annual LTACH Survey](#). Average length of stay is calculated as: total # of annual patient days / total # of annual admissions.

Urinary Catheter

The number of predicted urinary catheter days is calculated using a logistic regression model (see [page 5](#) above for more information). If a location is not included in this model, then a SUR will not be calculated for it.

The number of predicted urinary catheter days calculated under the 2022 baseline and is adjusted based on the following variables found to be statistically significant predictors:

Table 2. Urinary Catheter Days in Long-Term Acute Care Hospitals

Parameter	Parameter Estimate	Standard Error	P-value
Intercept	-1.9474	0.1323	<.0001
Total Number of Beds ¹ : < 96	0.7476	0.0822	<.0001
Total Number of Beds ¹ : ≥ 96	REFERENT	.	.
Proportion of Annual Admissions with Hemodialysis ² : < 0.020	0.5226	0.1519	0.0006
Proportion of Annual Admissions with Hemodialysis ² : ≥0.061	0.6418	0.1229	<.0001
Proportion of Annual Admissions with Hemodialysis ² : 0.020 ≤ prop_Hemo < 0.061	REFERENT	.	.

Proportion of Annual Admissions on a Ventilator ² : < 0.142	-0.2126	0.0758	0.005
Proportion of Annual Admissions on a Ventilator ² : ≥0.390	-0.1727	0.0694	0.0129
Proportion of Annual Admissions on a Ventilator ² : 0.142 ≤ prop_vent < 0.390	REFERENT		
CDC Location Type: CC_LTAC	0.6191	0.0893	<.0001
CDC Location Type: WARD_LTAC	REFERENT		

¹ Facility bed size is taken from the [Annual LTACH Survey](#).

² Proportion of admissions on hemodialysis and proportion of admissions on a ventilator are calculated using values reported on the [Annual LTACH Survey](#).

Ventilator

The number of predicted ventilator days is calculated using a negative binomial regression model. Refer to Table 3 below for a list of location types included in the LTACH ventilator SUR; if an inpatient location is not included in the model table below, then data from that location type will be excluded from the SUR due to insufficient 2022 baseline data. Please see below for the location type-specific model details.

The number of predicted ventilator days calculated under the 2022 baseline is risk adjusted based on the following variables found to be statistically significant predictors:

Table 3. Ventilator Days in Long-Term Acute Care Hospitals

Parameter	Parameter Estimate	Standard Error	P-value
Intercept	-2.7461	0.1754	<.0001
Proportion of Annual Admissions on Ventilator ¹ : 0.161 ≤ prop_vent < 0.265	0.8755	0.2003	<.0001
Proportion of Annual Admissions on Ventilator ¹ : 0.265 ≤ prop_vent	1.5658	0.1653	<.0001
Proportions of Annual Admissions on Ventilator ¹ : 0 ≤ prop_vent < 0.161	REFERENT		
CDC Location Type: CC_LTAC	1.4215	0.1424	<.0001
CDC Location Type: WARD_LTAC	REFERENT		
Average Daily Census: 35.3 ≤ avgcensus	0.3566	0.1139	0.0017
Average Daily Census: 3 ≤ avgcensus < 35.3	REFERENT		
Proportion of Single Occupancy Rooms: 0 ≤ prop_singOcc < 0.921	0.339	0.1189	0.0044
Proportion of Single Occupancy Rooms: 0.921 ≤ Prop_singOcc	REFERENT		
Share Housing-Skilled Nursing: FREE-STD ShareSNF	0.6388	0.1557	<.0001
Share Housing-Skilled Nursing: HOSP/FREE-STD NO ShareSNF	REFERENT		

¹ Proportion of annual admissions on ventilator is taken from the [Annual LTACH Survey](#). It is calculated as: number of admissions on a ventilator / total # of annual admissions.

Risk Adjustment Factors Included in the SUR Calculation: Inpatient Rehab Facilities (IRFs)

Central Line

The number of predicted central line days is calculated using a logistic regression model (see page 5 above for more information). If a location is not included in this model, then a SUR will not be calculated for it. In cases when the number of predicted device days is less than 1.0, the SUR will not be calculated in NHSN. Temporary and permanent central line days, reported from applicable locations, are combined in the SUR.

The number of predicted central line days calculated under the 2022 baseline and is adjusted based on the following variables found to be statistically significant predictors:

Table 1. Central Line Days in Inpatient Rehabilitation Facilities

Parameter	Parameter Estimate	Standard Error	P-value
<i>Intercept</i>	-3.7165	0.1321	<.0001
Proportion of Annual Admissions with Orthopedic Conditions ¹ : >=0 to <0.100	0.6635	0.0901	<.0001
Proportion of Annual Admissions with Orthopedic Conditions ¹ : >=0.100 to <0.211	0.4892	0.0844	<.0001
Proportion of Annual Admissions with Orthopedic Conditions ¹ : >=0.211 to <0.323	0.3113	0.0866	0.0003
Proportion of Annual Admissions with Orthopedic Conditions ¹ : >=0.323	REFERENT		
Proportion of Annual Admissions with Other Neurologic Conditions ¹ : >=0.040	0.1256	0.0578	0.0298
Proportion of Annual Admissions with Other Neurologic Conditions ¹ : >=0 to <0.040	REFERENT		
Total Number of Beds ² : >=12	0.2637	0.0881	0.0028
Total Number of Beds ² : >=1 to <12	REFERENT		
CDC Location Code: IN:ACUTE:WARD:REHAB	0.1533	0.0473	0.0012
CDC Location Code: IN:ACUTE:IRF / IN:ACUTE:IRF:PED / IN:ACUTE:WARD:REHAB_PED	REFERENT		
Proportion of Annual Admissions with Stroke ¹ : >=0.328	0.3622	0.0576	<.0001
Proportion of Annual Admissions with Stroke ¹ : >=0 to <0.328	REFERENT		

¹ Proportion of admissions with orthopedic conditions, proportion of admissions with other neurologic conditions, and proportion of admissions with stroke are calculated using values reported on the [Annual IRF Survey](#).

² Facility bed size is taken from the [Annual IRF Survey](#).

Table 2. Urinary Catheter Days in Inpatient Rehabilitation Facilities

Parameter	Parameter Estimate	Standard Error	P-value
Intercept	-2.8482	0.0453	<.0001
Proportion of Annual Admissions with Other Neurologic Conditions ¹ : >=0.158	0.2231	0.0393	<.0001
Proportion of Annual Admissions with Other Neurologic Conditions ¹ : >=0 to <0.158	REFERENT		
Proportion of Annual Admissions with Stroke ¹ : >=0 to <0.280	0.1745	0.0379	<.0001
Proportion of Annual Admissions with Stroke ¹ : >=0.280	REFERENT		
Proportion of Annual Admissions that are Pediatric ¹ : >=0 to <0.003	0.1116	0.0429	0.0092
Proportion of Annual Admissions that are Pediatric ¹ : >=0.003	REFERENT		
Average Daily Census ² : >=0 to <6.2	0.1907	0.0527	0.0003
Average Daily Census ² : >=6.2	REFERENT		

¹ Proportion of admissions with other neurologic conditions, proportion of admissions with stroke, and proportion of annual admissions that are pediatric are calculated using values reported on the [Annual IRF Survey](#).

² Average daily census is taken from the [Annual IRF Survey](#).

*Proportion of annual admissions with primary diagnoses are taken from the [Annual IRF Survey](#) and are calculated as: # of admissions with the primary diagnosis (stroke, or traumatic/non-traumatic spinal cord dysfunction) / total # of annual admissions.

Table 3. Ventilator Days in Inpatient Rehabilitation Facilities

Parameter	Parameter Estimate	Standard Error	P-value
Intercept	-5.1525	0.4816	<.0001

Using an Intercept-Only Model to Calculate the Number of Predicted Device Days

Some of the regression models from the 2025 national baseline are “intercept-only models.” For the Inpatient Rehabilitation Facility (IRF) Ventilator SUR, none of the investigated variables were found to have a significant association with the incidence of ventilator days in IRFs. Therefore, the number of predicted device days is calculated by applying the following intercept-only formula:

$$\text{Number of Predicted Device Day} = \left[\frac{\exp(\text{intercept value})}{(1 + \exp(\text{intercept value}))} \times \text{Patient Days} \right]$$

Let us say an IRF had 1,300 total patient days during a select time period. The number of predicted ventilator days would be calculated as:

$$\text{Number of Predicted Ventilator Days} = \left[\frac{\exp(-4.9639)}{1 + \exp(-4.9639)} \times 1300 \right]$$

$$\text{Number of Predicted Ventilator Days} = 9.0183$$

Additional Resources

➤ Information about Transitioning to the 2022 National Baseline:

- [2022 NHSN HAI Rebaseline homepage](#)
- [2022 Rebaseline Analysis and Training](#)
- [Rebaseline Implementation Guide and Change Log](#)
- [2022 HAI Rebaseline Progress Tracker](#)

➤ Information about the 2015 Baseline:

- [NHSN Rebaseline webpage](#)
- [NHSN Rebaseline Webinar, Part 2 \(Nov 2016\)](#)
- [NHSN's 2015 Baseline SUR Guide](#)

➤ NHSN Analysis Trainings & Other Resources:

- [Analysis Resources, Trainings, and NHSN Data Dictionary](#)
- [Quick Reference Guides](#)
- [How to run and interpret SUR Reports NHSN](#)
- [NHSN Annual Hospital Survey](#)
 - [Instructions for NHSN Annual Hospital Survey](#)
- [NHSN Annual LTACH Survey](#)
 - [Instructions for NHSN Annual LTACH Survey](#)
- [NHSN Annual IRF Survey](#)
 - [Instructions for NHSN Annual IRF Survey](#)
- [NHSN Location Mapping](#)

Glossary

Acronym or Abbreviation	Definition
ACH	Acute Care Hospital
CAH	Critical Access Hospital
CL	Central Line
CMS	Centers for Medicare and Medicaid Services
DUR	Device Utilization Ratio
HAI	Healthcare-Associated Infection
ICU	Intensive Care Unit
IRF	Inpatient Rehab Facility
LOS	Length of Stay
LTACH	Long-Term Acute Care Hospital
NHSN	National Healthcare Safety Network
NICU	Neonatal Intensive Care Unit

PHE facility	Public Health Emergency facility
SCA	Specialty Care Area
SUR	Standardized Utilization Ratio
UC	Urinary Catheter