



# Patient Safety Component NHSN mapping challenges of COVID-19

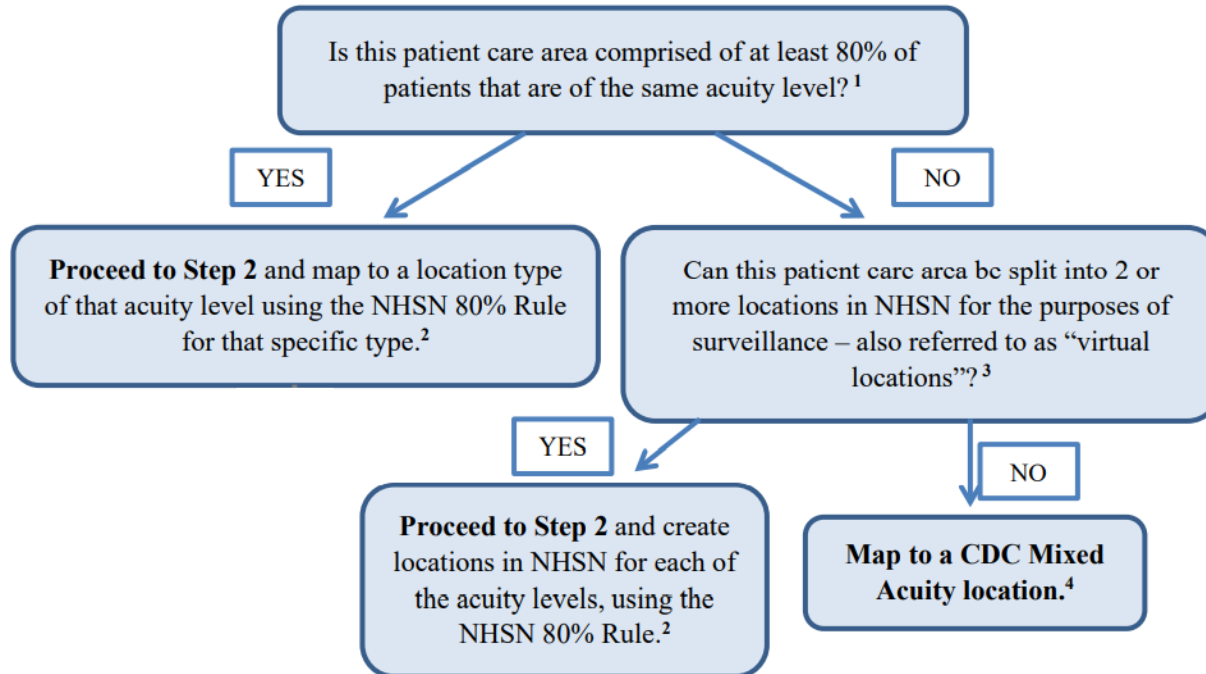
**Sunny Xu, MPH**

**NHSN Methods and Analytics Team**

March 2021

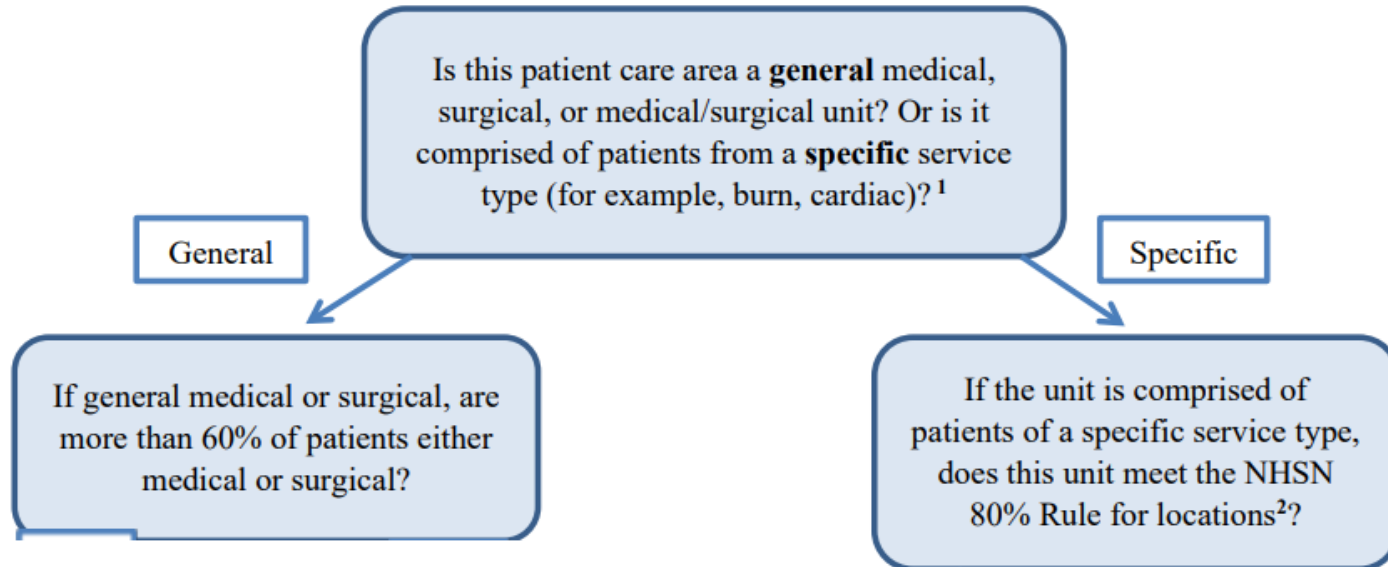
# NHSN Location Mapping Review

## Step 1: Define the acuity level for the location



# NHSN Location Mapping Review

## Step 2: Define the type of service for the location



- CDC Locations and Descriptions and Instructions for Mapping Patient Care Locations: [https://www.cdc.gov/nhsn/pdfs/pscmanual/15locationsdescriptions\\_current.pdf](https://www.cdc.gov/nhsn/pdfs/pscmanual/15locationsdescriptions_current.pdf)

# NHSN Mapping Rules

- 80% rule
  - Use when determining acuity level and specific service type
  - If 80% of patients are of a certain type, then that area is designated as that type of location
- 60/40 rule (applies to general medical, surgical, and med/surg locations)
  - Use when determining general service type
  - If 60% of patients are either general medical or surgical, map to the majority type
    - If not, map to a combined medical-surgical location

# Patient Mix

- The acuity level and service type of the patients that the patient care area is comprised of
- Standard recommendation: When determining the appropriate CDC Location mapping for a unit, facilities should review the patient mix in that unit for the last full calendar year.
- If recommendation cannot be met:
  - Facilities should review patient mix **based on the data they have available for that unit**
  - Every effort should be made to collect and analyze greater periods of time in the future if the unit stays in use

# Patient Mix

- Data to determine patient mix
  - The **acuity billing data** is considered the most accurate depiction of the patient's illness and reason for being admitted to a particular unit
  - **Admission/transfer diagnosis** can also be used to determine location mapping if billing data is not available

## COVID-19 surge

- Surge and/or overflow units, whether newly opened or repurposed from a previously mapped location, should follow NHSN's standard location mapping guidance and be included in facility mapping. Examples of surge/overflow mapping can be found here:  
<https://www.cdc.gov/nhsn/pdfs/covid19/location-mapping-508.pdf>.
- NHSN is working on potential updates to this guidance!

# Things to consider when mapping a unit during COVID-19

- When should a new unit be mapped in NHSN?
  - When a new unit opens
  - When an existing unit's acuity level and/or service changes and no longer meets the 80% rule
    - We recommend facilities review their location mapping at least once a year, but some may need to do so more frequently
- Should temporary units be mapped in NHSN?
  - Yes, NHSN requires that facilities map each patient care area in their facility to one or more locations as defined by NHSN in order to report surveillance data collected from these areas.



# Things to consider when mapping a unit during COVID-19

- NHSN mapping rules
- Does the addition of COVID-19 patients in a previously existing unit change the patient mix of that unit?
  - No
    - In this case, the unit does not need to be re-mapped. All patients housed in the unit should be included in HAI surveillance.
  - Yes
    - Option 1: Map a new location appropriate to the new patient mix
    - Option 2: Use virtual locations to map a location for the beds designated for COVID-19 patients

## Option 1- Mapping a new unit

- Acuity level and service in an existing unit changes and no longer meets the 80% rule
- Once a location has been used for reporting in NHSN, the CDC Location Description **cannot** be changed
- Facility will need to add a new location and map it to the most appropriate CDC location description
- Once data entry for the old unit is complete, facility is recommended to inactive the old location
  - Data from inactive units are still available for analysis
- New unit should be added to appropriate Monthly Reporting Plan(s) for surveillance

## Option 2- Virtual Locations

- Is your facility able to operationalize reporting for virtual locations?
  - Virtual locations are created in NHSN when a facility is unable to meet the 80% rule for location designation in a single physical unit but would like to report their NHSN surveillance data for each of the major, specific patient types in that unit.
  - The use of virtual locations is recommended only for those physical units that are geographically split by patient service or those in which beds are designated by service.
  - The use of virtual locations, if appropriate, can be helpful when mapping patient care areas that may be only be in use for a short period of time.



# Patient Safety Component Using TAP Reports to Target Infection Prevention Goals at the Location Level

Rashad Arcement, MSPH

NHSN Methods and Analytics Team

March 2021

# Difference Between SIR and CAD

- The standardized infection ratio (SIR) is a summary measure used to track HAIs at a national, state, or local level over time.
  - Adjusts for various facility and/or patient-level factors that contribute to HAI risk within each facility
- The Cumulative Attributable Difference (CAD) used to identify facilities and units with higher burden of HAIs
  - Allows specific gaps in infection prevention to be identified and addressed

# Standardized Infection Ratio (SIR)

- The SIR is a measure that compares the number of HAIs reported to NHSN to the number of infections that would be predicted based on national baseline data:

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

- SIR interpretation:
  - 1.0 = same number of infections reported as would be predicted given the US baseline data
  - Greater than 1.0 = more infections reported than what would be predicted given the US baseline data
  - Less than 1.0 = fewer infections reported than what would be predicted given the US baseline data

# Cumulative Attributable Difference (CAD)

- CAD is a measure that shows difference between the number of observed infections and ‘predicted infections multiplied by a SIR goal’ in a defined period

$$\text{CAD} = \text{Observed \# HAIs} - (\text{Predicted \# HAIs} \times \text{SIR goal})$$

- CAD interpretation:
  - Positive CAD = additional burden of infections than what would be predicted with regard to an SIR goal (“excess” infections).
  - Negative CAD = fewer infections than what would be predicted

# Different Hospitals, Different Stories

## Hospital A - Arcement Medical Center

- 400-bed, major teaching acute care hospital
  - 100 ICU beds
  - 300 non-ICU inpatient beds
  - Includes a CMS-certified Inpatient Rehabilitation Facility (IRF) unit that was added in 2015
- Focused its attention on HAI prevention in 2016 after realizing that their CAUTI SIR is higher than other Hospitals
- Began a facility wide initiative to decrease CAUTIs by the end of 2020



# Standardized Infection Ratio (SIR)

## Hospital A

- Reviewing calendar year 2018
- SIR is 18% higher than would be predicted given the U.S Baseline Data

## National Healthcare Safety Network

### SIR for Catheter-Associated UTI Data for Acute Care Hospitals (2015 baseline) - By OrgID

As of February 16, 2018 at 2:00 PM

Date Range: All BS2\_CAU\_RATESALL

Facility Org ID	CCN	Summary YR	Events	Number Predicted	Urinary Catheter Days	SIR	SIR p-value	95% Confidence Interval
10000		2018	65	54.944	39497	1.183	0.1811	0.921, 1.498

# Cumulative Attributable Difference (CAD)

- The CAD translates an **SIR goal** into a numeric HAI prevention goal, providing a concrete goal to drive action

$$\text{CAD} = \text{Observed \# HAIs} - (\text{Predicted \# HAIs} \times \text{SIR goal})$$

Facility Org ID	CCN	Summary YR	Events	Number Predicted	Urinary Catheter Days	SIR	SIR p-value	95% Confidence Interval
10000		2018	65	54.944	39497	1.183	0.1811	0.921, 1.498

# Cumulative Attributable Difference (CAD)

Facility Org ID	CCN	Summary YR	Events	Number Predicted	Urinary Catheter Days	SIR	SIR p-value	95% Confidence Interval
10000		2018	65	54.944	39497	1.183	0.1811	0.921, 1.498

$$\text{CAD} = \text{Observed \# HAIs} - (\text{Predicted \# HAIs} \times \text{SIR goal})$$

$$\text{CAD} = 65 - (54.944 \times \text{SIR goal})$$

- **SIR goal** represents an “HAI Reduction Goal”
- Custom SIR goal = value less than 1
- HHS Action Plan Goals for 2020: <https://health.gov/hcq/prevent-hai-measures.asp>
  - HHS 25% reduction goal for CAUTI → SIR goal = **0.75**

# Cumulative Attributable Difference (CAD)

Facility Org ID	CCN	Summary YR	Events	Number Predicted	Urinary Catheter Days	SIR	SIR p-value	95% Confidence Interval
10000		2018	65	54.944	39497	1.183	0.1811	0.921, 1.498

$$\text{CAD} = \text{Observed \# HAIs} - (\text{Predicted \# HAIs} \times \text{SIR goal})$$

$$\text{CAD} = 65 - (54.944 \times 0.75^*)$$

$$\text{CAD} = 65 - (41.208)$$

$$\text{CAD} = 23.79$$

\*HHS CAUTI Action Plan Goals for 2020 = 0.75

# Hospital A – CAUTI TAP Report

Number of excess infections in each location

Total number of excess infections in the facility

National Healthcare Safety Network  
 TAP Report for CAUTI Data for Acute Care and Critical Access Hospitals (2015 Baseline)  
 Locations Ranked by CAD Within a Facility  
 SIR Goal : HHS Goal = 0.75

A TAP Report is the first step in the CDC TAP Strategy. For more information on the TAP strategy, please visit: <http://www.cdc.gov/hai/prevent/tap.html>  
 As of: February 16, 2019 at 2:00 PM  
 Date Range: All BS2\_CLAB\_TAP summaryYr 2018 to 2018

FACILITY			LOCATION									
Facility Org ID	Facility Name	Facility CAD	Location Rank	Location	CDC Location	Events	Central Line Days	DUR %	CAD	SIR	SIR Test	No. Pathogens (EC, ESP, PA, KS, PS, E)
	Arcelement Medical Center	23.79	1	1 EAST	IN:ACUTE:WARD:M	11	2741	21	8.52	2.98	SIG	12 (5, 0, 1, 1, 0, 1)
			2	NEURO	IN:ACUTE:WARD:N	5	1899	20	4.15	4.40	SIG	7 (0, 0, 1, 0, 0, 3)
			3	2 EAST	IN:ACUTE:WARD:MS	4	2057	13	3.07	3.23	SIG	4 (0, 0, 1, 0, 0, 3)
			4	ICU 1	IN:ACUTE:CC:M	4	5144	50	2.69	2.30		3 (0, 2, 0, 1, 0, 0)
			5	1 WEST	IN:ACUTE:WARD:M	6	1442	13	2.59	1.32		2 (0, 0, 1, 0, 0, 0)
			6	2 WEST	IN:ACUTE:WARD:MS	2	1371	9	1.40	.		2 (0, 0, 0, 0, 0, 0)
			7	BMT	IN:ACUTE:WARD:ONC_HSCT	2	174	9	1.26	.		1 (0, 0, 0, 0, 0, 1)
			8	ONC	IN:ACUTE:WARD:ONC_HONC	2	945	10	1.11	1.69		1 (1, 0, 0, 0, 0, 0)
			9	SICU	IN:ACUTE:CC:S	1	645	67	0.65	0.76		3 (1, 0, 0, 0, 0, 0)
			10	TELE	IN:ACUTE:WARD:TEL	1	1318	9	0.62	0.75		1 (0, 0, 1, 0, 0, 0)

# Cumulative Attributable Difference (CAD)

Facility Org ID	CCN	Summary YR	Events	Number Predicted	Urinary Catheter Days	SIR	SIR p-value	95% Confidence Interval
10000		2018	65	54.944	39497	1.183	0.1811	0.921, 1.498

$$\text{CAD} = \text{Observed \# HAIs} - (\text{Predicted \# HAIs} \times \text{SIR goal})$$

$$\text{CAD} = 65 - (54.944 \times 0.50^*)$$

$$\text{CAD} = 65 - (27.472)$$

$$\text{CAD} = 37.53$$

\*Custom SIR Goal

# CAD and the HAI Reduction Goal

- SIR goal represents an “HAI Reduction Goal”

---

**Hospital A : Observed=65 , Predicted=54.944 , SIR=1.183 in 2018**

---

HHSReduction Goal (Reduction in Reported)	SIR Goal	CAD Formula Observed – (Predicted X SIR goal)	CAD
25% HHSReduction Goal	0.75	$65 - (54.944 \times 0.75)$	23.79
50%	0.50	$65 - (54.944 \times 0.50)$	37.53

---

- Since CAD is an indicator of infections that would need to be prevented, it should be rounded up to the nearest whole number
- The time period of analysis should be included in the CAD interpretation, i.e., 24 infections over the 12 month period to reach an SIR of 0.75

# Different Hospitals, Different Stories

## Hospital B - Patel Community Health

- Facility services small rural area made up of 2 neighboring towns
- 115-bed, acute care hospital
  - 15 ICU beds
  - 100 non-ICU inpatient beds
- Under New Management since May 2018
- Usually can not calculate an SIR for CLABSI data because their number predicted is less than 1



# Standardized Infection Ratio (SIR)

## Hospital B

- Wants to review data from the last 2 quarters of 2018
- The SIR is only calculated if the number predicted (numPred) is  $\geq 1$
- Unlike SIR, CAD is calculated even if the predicted number of events is less than 1

Facility Org ID	CCN	Events	Number Predicted	Urinary Catheter Days	SIR	SIR p-value	95% Confidence Interval
88888		2	0.518	1570	.	.	

# Different Hospitals, Different Stories

## Hospital C – Scott Decker Health Institute

- 300-bed, acute care hospital
  - 75 ICU beds
  - 125 non-ICU inpatient beds
- Always has an SIR less than 1
- Now what?

# Cumulative Attributable Difference (CAD)

Facility Org ID	CCN	Summary YR	Events	Number Predicted	Urinary Catheter Days	SIR	SIR p-value	95% Confidence Interval
99999		2018	50	70.805	28003	0.706	0.0097	0.530, 0.923

$$\text{CAD} = \text{Observed \# HAIs} - (\text{Predicted \# HAIs} \times \text{SIR goal})$$

$$\text{CAD} = 50 - (70.805 \times 0.75^*)$$

$$\text{CAD} = 50 - (53.10375)$$

$$\text{CAD} = -3.10$$

\*HHS Action Plan Goals for 2020 = 0.75

# Cumulative Attributable Difference (CAD)

Facility Org ID	CCN	Summary YR	Events	Number Predicted	Urinary Catheter Days	SIR	SIR p-value	95% Confidence Interval
99999		2018	50	70.805	28003	0.706	0.0097	0.530, 0.923

$$\text{CAD} = \text{Observed \# HAIs} - (\text{Predicted \# HAIs} \times \text{SIR goal})$$

$$\text{CAD} = 50 - (70.805 \times 0.50^*)$$

$$\text{CAD} = 50 - (35.4025)$$

$$\text{CAD} = 14.60$$

\*Custom SIR goal = 0.50

# CAD and the HAI Reduction Goal

- SIR goal represents an “HAI Reduction Goal”

---

**Hospital C : Observed=50 , Predicted=70.805 , SIR=0.706 in 2018**

---

Reduction Goal (Reduction in Reported)	SIR Goal	CAD Formula Observed – (Predicted X SIR goal)	CAD
25% HHS Reduction Goal	0.75	$50 - (70.8 \times 0.75)$	-3.10
50%	0.50	$30 - (70.8 \times 0.50)$	14.60

---

*\*Fictitious data for illustrative purposes only*

- CAD can be Positive or Negative
  - Positive CAD = additional burden of infections than what would be predicted with regard to a SIR goal (“excess” infections)
  - Negative CAD = fewer infections than what would be predicted

## CAD at the Location Level

Hospital C	Observed	Predicted	SIR	SIR goal	CAD
Ward	20	10	2.0	0.50	15
ICU	30	60	0.5	0.50	0
Facility	50	70	0.71	0.50	15

$$\text{Observed \# HAIs} - (\text{Predicted \# HAIs} \times \text{SIR goal}) = \text{CAD}$$

# CAD versus SIR

- CAD is not a comparison metric for performance measurement like SIR
  - CAD detects burden of infection

	Facility 1	Facility 2	Facility 3
Observed no.	30	3	10
Predicted no.	10	1	1
SIR	3	3	10
CAD [Observed – (Predictedx1.0)]	20	2	9

# Summary

- Beginning with the TAP Report and CAD metric, the TAP Strategy efficiently prioritizes healthcare facilities (and locations within a facility) that need enhanced prevention intervention to maximize the impact of given resources
- CAD is a flexible measure that can be applied by individual hospitals as part of their internal quality improvement efforts and by groups such as state health departments, quality improvement organizations, and hospital systems
- CAD is not a comparative metric!