IS IT TIME TO MOVE BEYOND THE SIR IN EVALUATING THE IMPACT OF HAI?

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OBJECTIVES

- Identify how the pSIR is calculated
- List one way the pSIR will help in addressing the hospital onset bacteremia rate
- Describe one case where a pSIR should not be used

THE SIR

- Observed/expected with 1.0 being a similar rate than the reference period for that unit
- Can be updated compared to the "Annual Report"
  - You could even rebaseline to one knowing the median SIR for the year
    - Probably too confusing for many
      - "But my SIR was 0.8 and you are saying it is 1.4"

STILL USING 1.0 AS YOUR SIR BASELINE?
HAI PROGRESS REPORTS

HTTPS://WWW.CDC.GOV/NHSN/DATASTAT/PROGRESS-REPORT.HTML#ANCHOR_1700850695274

Table 3. State-specific standardized infection ratios (SIRs) and facility-specific SIR summary measures, NHSN Acute Care Hospitals reporting during 2022

3b. Central line-associated bloodstream infections (CLABSI), critical care locations[1]

			No. of Infections			95% CI for SIR		Facility-specific SIRs			Facility-specific SIRs at Key Percentiles[5]				
State	State NHSN Mandate[2]	No. of Acute Care Hospitals Reporting[3]	Observed	Predicted	SIR	Lower	Upper	No. of hosp with at least 1 predicted CLABSI	% of hosp with SIR sig higher than national SIR[4]	% of hosp with SIR sig lower than national SIR[4]	10%	25%	Median (50%)	75%	90%
Alabama	Yes	67	241	210.248	1.146	1.008	1.298	31	16%	3%	0.279	0.554	0.898	1.294	1.995
Alaska	Yes	7	6	12.279	0.489	0.198	1.016	3	.	.	.	.	.	.	.
Arizona	No	53	215	219.372	0.980	0.855	1.118	39	10%	8%	0.000	0.000	0.695	1.386	1.748
Arkansas	Yes	41	115	119.929	0.959	0.795	1.147	22	9%	0%	0.000	0.188	0.725	1.223	1.723
California	Yes	312	1,015	1,021.369	0.994	0.934	1.056	201	8%	6%	0.000	0.406	0.869	1.487	2.188
Colorado	Yes	48	101	124.529	0.811	0.664	0.981	31	0%	6%	0.000	0.278	0.650	0.998	1.667

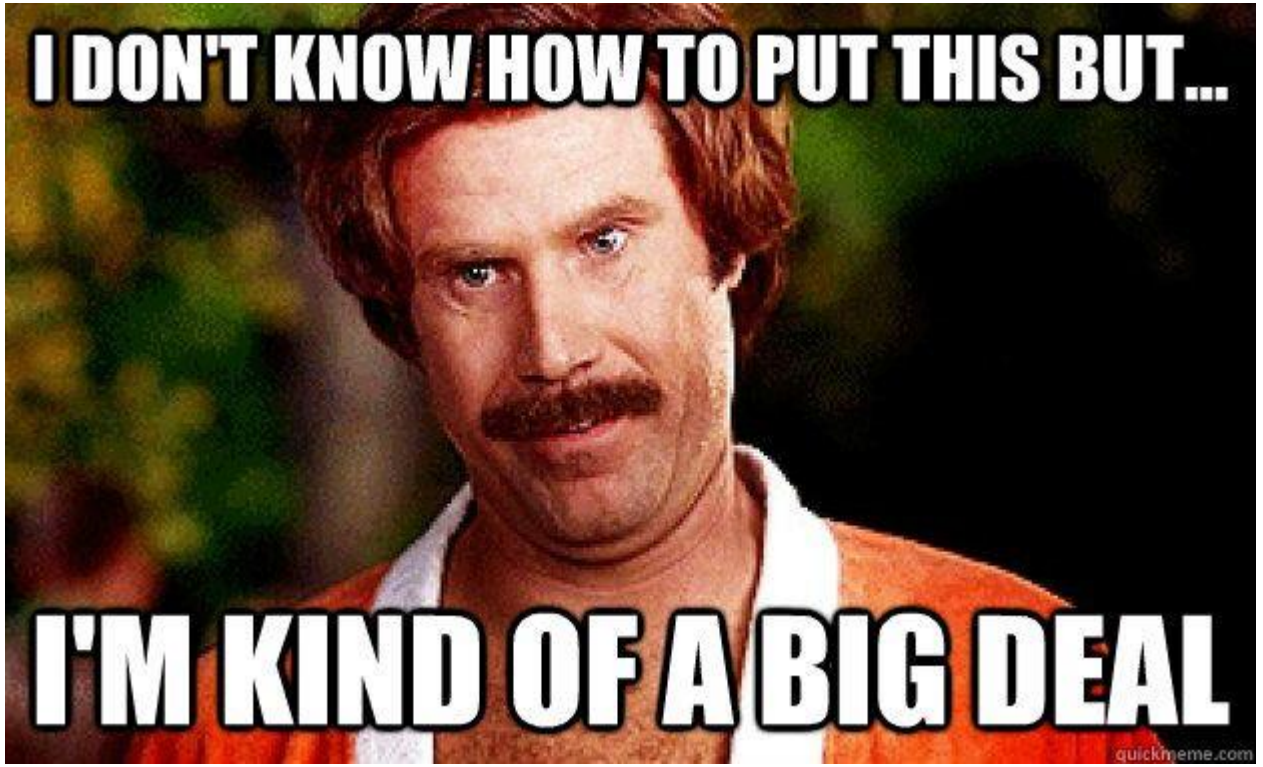
Table 3. State-specific standardized infection ratios (SIRs) and facility-specific SIR summary measures, NHSN Acute Care Hospitals reporting during 2022

3c. Central line-associated bloodstream infections (CLABSI), ward (non-critical care) locations[1]

			No. of Infections			95% CI for SIR		Facility-specific SIRs			Facility-specific SIRs at Key Percentiles[5]				
State	State NHSN Mandate[2]	No. of Acute Care Hospitals Reporting[3]	Observed	Predicted	SIR	Lower	Upper	No. of hosp with at least 1 predicted CLABSI	% of hosp with SIR sig higher than national SIR[4]	% of hosp with SIR sig lower than national SIR[4]	10%	25%	Median (50%)	75%	90%
Alabama	No	81	250	236.743	1.056	0.931	1.193	32	16%	0%	0.256	0.449	0.861	1.748	3.006
Alaska	Yes	10	9	26.969	0.334	0.163	0.612	5	.	.	.	.	.	.	.
Arizona	No	74	221	340.884	0.648	0.567	0.738	40	3%	8%	0.000	0.000	0.509	0.768	1.317
Arkansas	Yes	49	103	148.226	0.695	0.570	0.839	21	5%	0%	0.000	0.245	0.485	0.814	1.563
California	Yes	334	1,248	1,649.137	0.757	0.716	0.800	229	5%	7%	0.000	0.276	0.676	1.138	1.656
Colorado	Yes	57	152	230.544	0.659	0.561	0.771	31	3%	0%	0.015	0.321	0.584	0.822	1.030

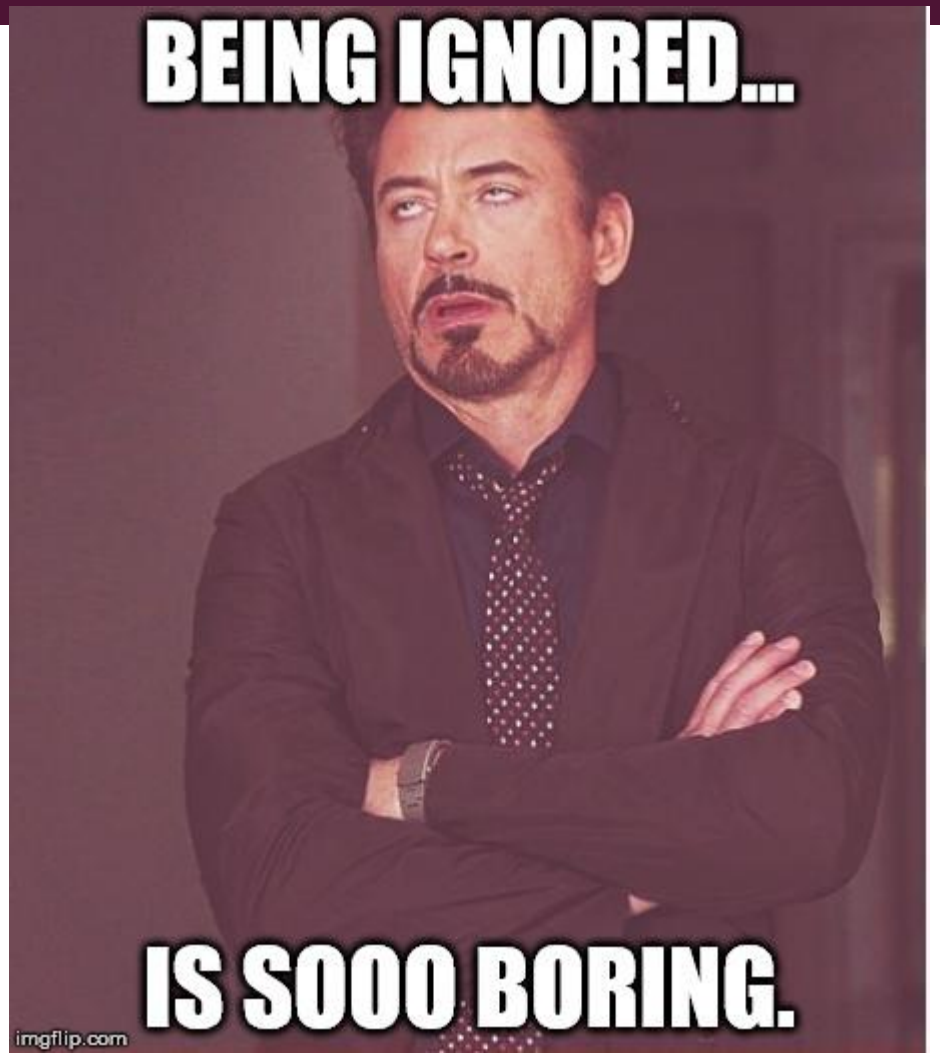
SIR CURRENT IMPORTANCE

- Linked to funding from CMS
- Used in insurance negotiations
- Universal language of HAI performance



SUR (THE POOR COUSIN OF SIR)
STANDARDIZED UTILIZATION RATIO

- Observed line days/expected line days
- Again comparison is against the reference period
  - Can be outdated very quickly
    - External female catheter
      - Regional adoption rates
- Measure for utilization of lines
- Prompts facilities to evaluate whether they are:
  - Overutilizing lines
  - Not pulling lines
- How many people are you putting in harms way?



THE BIG SUR QUESTION (IT ISN'T "HOW IS THE WEATHER?")

- Is it related to acuity ?
- SIR is already related to acuity:
  - Academic teaching hospital surgical ICU
    - One with cancer and transplant
    - One without cancer and transplant
    - Both get the same SIR

THE FUTURE
(HINT: IT ISN'T FLYING CARS)

- Hospital onset bacteremia (HOB)
  - Rate per 1000 admissions (Pushes LOS to be lower- Also makes sense if LTACs or SNFs are the first goals)
  - Observed/expected
    - Unit type
    - Blood cultures done
    - Blood culture contamination rate

CAUSES OF HOB AND PREVENTABILITY

Perceived Preventability of Common HOB sources[3]	
	% Viewed as Preventable (Mean)
Central-line catheters	74%
Peripheral IVs	74%
Surgical-site/Post-invasive procedure complication	67%
Urinary Source (with or without catheter)	66%
Skin and soft tissue	58%
Wounds	56%
Respiratory/pneumonia	54%

https://www.aha.org/system/files/media/file/2023/04/BD_HospitalBacteremia_ebook_040523.pdf

SO CLABSI IS PART OF HOB

- HOB avoids the pitfalls of CLABSI:
  - Gaming (It's not a central line, it's a midline!)
  - PIV (peripheral IV bloodstream infections)
    - More likely to result in serious outcomes
  - Post OP-Sepsis
- Do we only care if the infection was caused by a central line or do we care about all infections?

IS HOB LESS WORK?

- Automated-Yes
- Investigation as to source- More work
  - No longer binary yes CLABSI/No CLABSI
- Where to improve- More work, if doable?
  - No benchmark for PIV, post op sepsis, urosepsis, hospital pnuemonia and with bacteremia, IVAC+ bacteremia

IMPROVE WHAT YOU CAN NOW!
CLABSI, CAUTI ,IVAC+

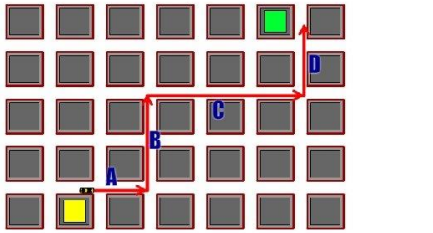
IS THE SIR ENOUGH? UNDERSTANDING THE SIR MEANS STRIPPING IT AND TAKING A HARD LOOK

- SIR for device days measures (CAUTI, CLABSI, VAE, IVAC+) is basically a comparison of your rate compared to the expected rate
  - Like a Standardized Mortality Ratio (SMR) the, the SIR for a hospital is weighted based its unit types and lines the same way an SMR is adjusted by the population age and distribution
- But unlike the SMR and age, the hospital has some control on the number of device days

THE BIG PROBLEM OF THE SIR
REGARDLESS OF WHETHER YOU ARE WORRIED ABOUT HOB

- Let's say hospital A is a community hospital made up of only med/surg floors Hospital B has the same exact population and census
- Let's pretend the national CLABSI rate per 1000 line days is 2/1000 line days
- For the year Hospital A had 6 CLABSI and 3000 line days
  - 6/3000=2/1000 = SIR 1.0
- Hospital B had 1 CLABSI and 500 line days
  - 1/500=2/1000= SIR1.0
- Both of these look identical in their SIRs

MATH ALERT!



WHAT THE SIR DOESN'T TELL YOU EVEN UNDER TORTURE

- For the year Hospital A had 6 CLABSI and 3000 line days
- Hospital B had 1 CLABSI and 500 line days
- Hospital A had 5 more CLABSI (6-1=5) than Hospital B despite having the same census and CLABSI rate and SIR
- Who is doing a better job preventing CLABSI?
- Who will look worse with HOB?

SIR
Still not talking

pSIR IT ISN'T JUST FOR CAUTI

- The pSIR (population SIR)
  - SIR x SUR
- Idea has been kicked around by the CDC
- Concerns about the SUR being a marker for patient acuity
  - The Case-mix index might be a way to adjust for this
  - SIR has always been a marker for acuity
    - UCI no BMT, no transplant, no oncology-UCSD BMT, transplant, oncology
      - Compare academic med surg units
  - If I make devices rarer does the lack of familiarity make outcomes worse? AKA lower SUR results in higher SIR

PUBLICATIONS FOR YOU TO KNOW

- **The case for a population standardized infection ratio (SIR): A metric that marries the device SIR to the standardized utilization ratio (SUR)**
  - https://pubmed.ncbi.nlm.nih.gov/31232260/#:~:text=Conclusion%3A%20Population%20SIR%20accounts%20for,interventions%20to%20reduce%20device%20use
- **Population Standardized Infection Ratio (pSIR): A More Meaningful Reflection of Performance With Reduction in Device Use**
  - **https://www.cambridge.org/core/journals/infection-control-and-hospital-epidemiology/article/population-standardized-infection-ratio-psir-a-more-meaningful-reflection-of-performance-with-reduction-in-device-use/1764734C29581354DE5CA6C69F8A9496**

pSIR FORCES FOCUS ON THE SUR CAUTI DATA

	Unit	SIR	SUR	pSIR	# CAUTI	Difference in pSIR vs SIR	Column1	Number of fewer cases by reducing SUR from 1
2	**UCSDH House-wide**	0.774	0.645	0.499	48	0.275	65.04	-17.04
3	CC	0.742	0.865	0.642	25	0.100	28.375	-3.375
4	Step	0.699	0.525	0.367	11	0.332	16.225	-5.225
5	Step_Onc	0.000	0.28	0.000	0	0.000	0	0
6	Ward	0.980	0.556	0.545	9	0.435	12.996	-3.996
7	Ward_Onc	1.307	1.278	1.670	3	-0.363	2.166	0.834
8	**La Jolla**	0.619	0.663	0.410	22	0.209	29.414	-7.414
9	CC	0.635	0.885	0.562	12	0.073	13.38	-1.38
10	Step	0.612	0.489	0.299	5	0.313	7.555	-2.555
11	Step_Onc	0.000	0.28	0.000	0	0.000	0	0
12	Ward	0.394	0.641	0.253	2	0.141	2.718	-0.718
13	Ward_Onc	1.307	1.278	1.670	3	-0.363	2.166	0.834
14	2 East	2.528	0.488	1.234	4	1.294	6.048	-2.048
15	2 West	.	0.283	#VALUE!	1	#VALUE!	1.717	-0.717
16	3 East	.	0.368	#VALUE!	1	#VALUE!	1.632	-0.632
17	3 West	0.000	0.661	0.000	0	0.000	0	0
18	3A CVICU	0.324	0.909	0.295	1	0.029	1.091	-0.091
19	CVC 3B PCU	.	0.202	#VALUE!	0	#VALUE!	0	0
20	CVC 4A PCU	.	0.327	#VALUE!	0	#VALUE!	0	0
21	CVC 4B PCU	.	0.264	#VALUE!	0	#VALUE!	0	0
22	CVICU2	0.750	0.798	0.599	2	0.152	2.404	-0.404
23	JMC 3F ICU	0.302	0.753	0.227	2	0.075	2.494	-0.494
24	JMC 3G ICU	0.946	0.939	0.888	3	0.058	3.183	-0.183
25	JMC 3H ICU	1.192	1.021	1.217	4	-0.025	3.916	0.084
26	JMC 4F PCU	0.000	0.792	0.000	0	0.000	0	0
27	JMC 4G PCU	0.000	0.976	0.000	0	0.000	0	0
28	JMC 4H PCU	0.000	0.909	0.000	0	0.000	0	0
29	JMC 5F PCU	1.832	1.212	2.220	2	-0.388	1.576	0.424
30	JMC 5G PCU	0.831	1.344	1.117	1	-0.286	0.656	0.344
31	JMC 5H PCU	0.000	0.791	0.000	0	0.000	0	0
32	JMC 6F PCU	.	0.323	#VALUE!	0	#VALUE!	0	0
33	JMC 6G PCU	.	0.244	#VALUE!	0	#VALUE!	0	0
34	JMC 6H PCU	.	0.274	#VALUE!	0	#VALUE!	0	0
35	JMC 10	.	0.687	#VALUE!	0	#VALUE!	0	0
36	JMC 9 Ante	.	0.784	#VALUE!	0	#VALUE!	0	0
37	JMC 9BC	.	0.213	#VALUE!	0	#VALUE!	0	0
38	JMC 9 OBS	.	1.122	#VALUE!	0	#VALUE!	0	0

Number of infections different than if SUR had been 1.0

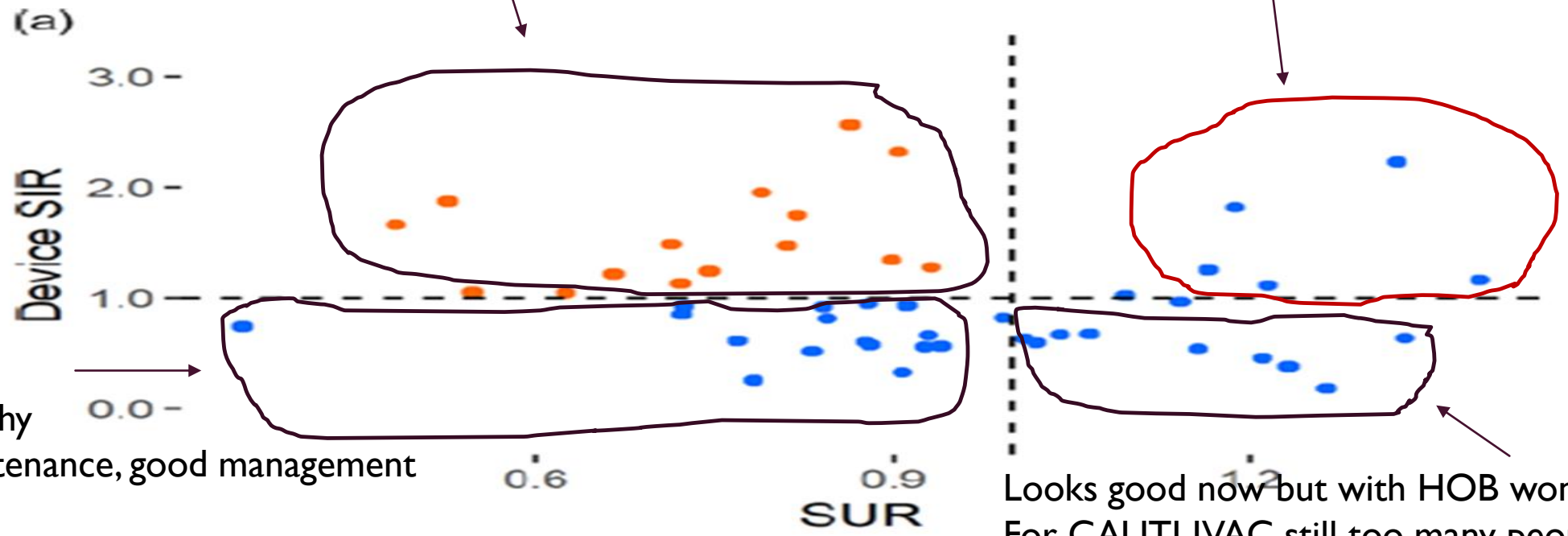
pSIR UNIT BASED

- CAVEATS
  - Do not try pSIR with units that have less than 1 expected infection
    - Example why, 1 infection expected 0.1 SIR=10 so even if you have a great SUR 0.25 you'll still end up with a 2.5 pSIR which amplifies random variation.
    - Do a scatterplot of SIR and SUR and see if they correlate
      - Do units with good SIR have:
        - Low SUR because they provide great care
        - High SUR because they are padding their line days with low risk patients
        - Same distribution as poor SIR

COMPARING

Maybe high acuity

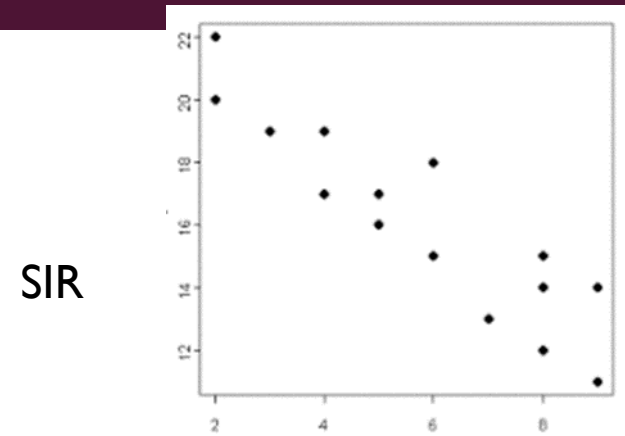
Concern Lots of line days, high SIR



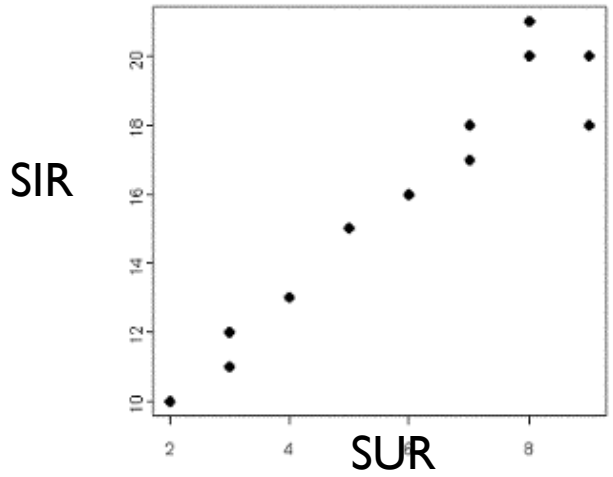
Praise worthy
Good maintenance, good management

Looks good now but with HOB won't
For CAUTI IVAC still too many people getting sick

WHAT TO LOOK FOR IN YOUR SCATTERPLOTS

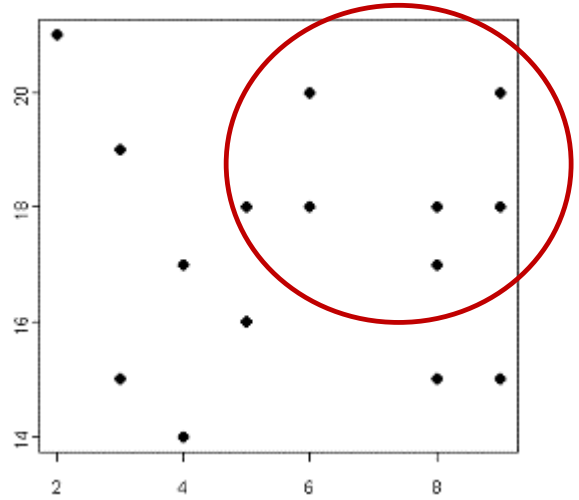


- A trend downward
  - Probable that as you reduce lines only your highest risk patients remain so you end up with a high SIR
- An upward trend SUR People who do poor line care also do a poor job pulling the line



WHERE LIVES NEED MOST PROTECTED
OR YOU COULD JUST BE LAZY AND LOOK AT YOUR pSIR

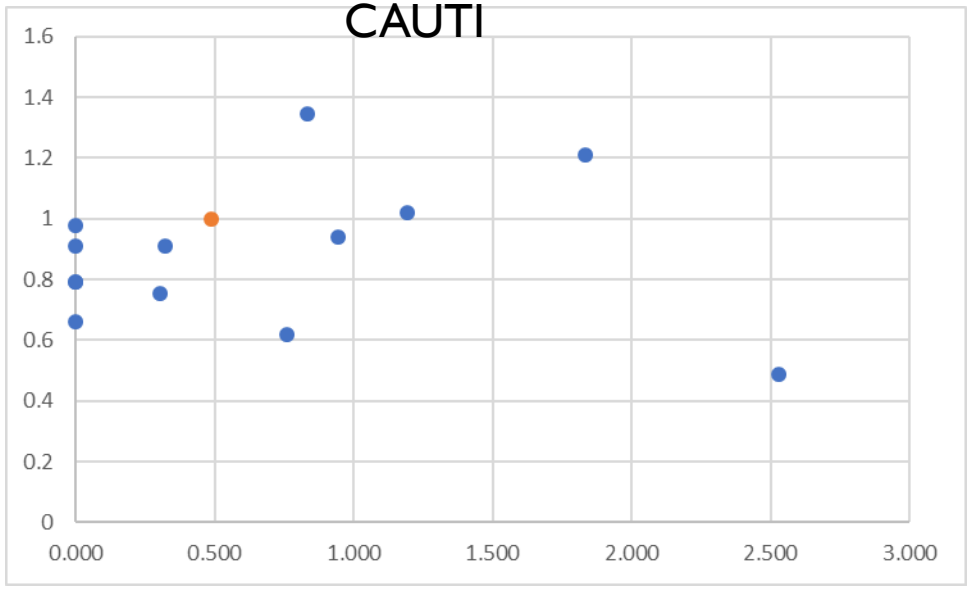
SIR



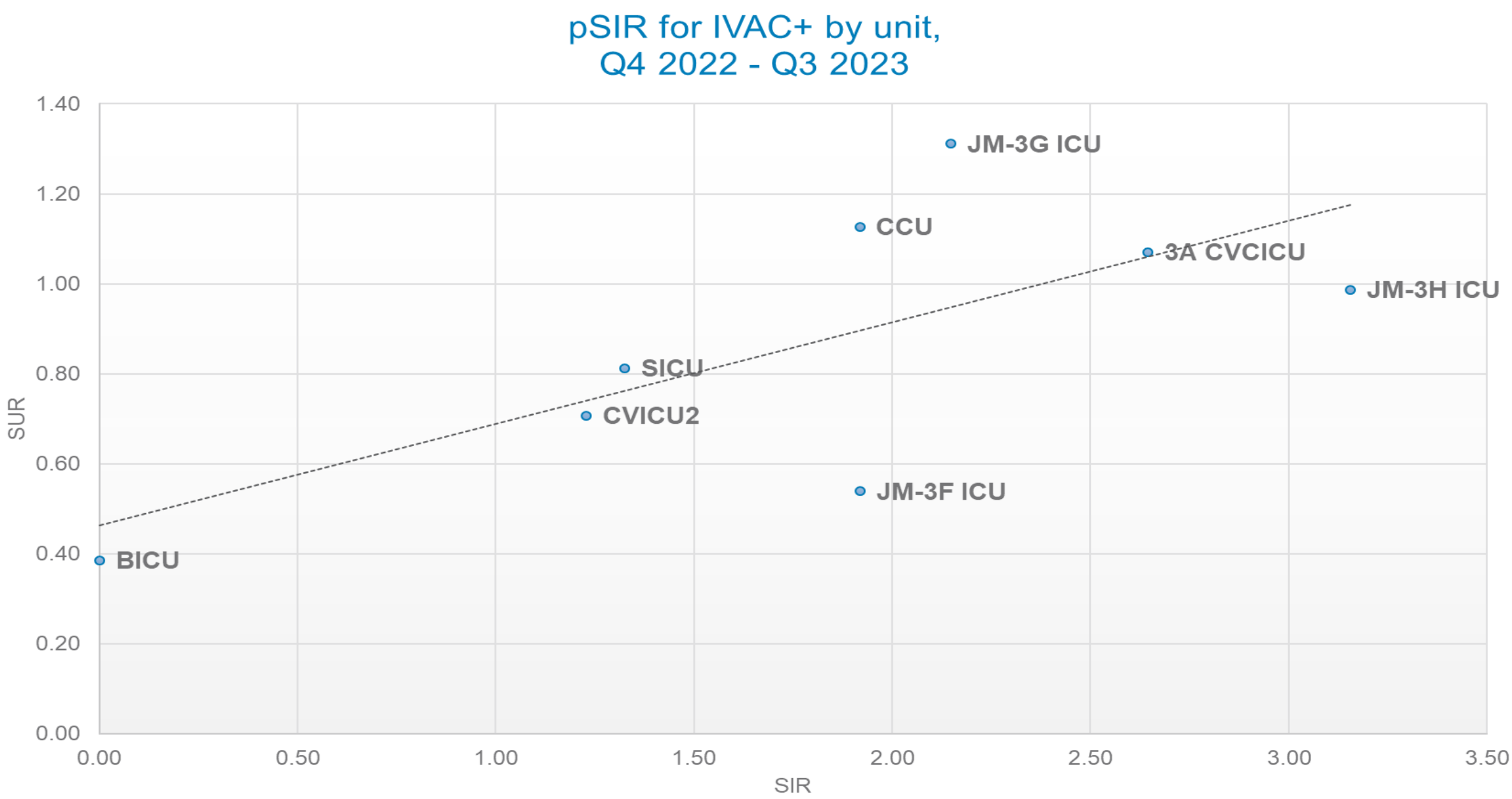
SUR

CAUTI

SIR



SUR



Thanks Loriel Magsino, MPH, CIC!

pSIR CHALLANGES

- You don’t want the pSIR with CLABSI to drive you to using more PIVs and midlines
  - Not an issue with CAUTI or IVAC+

SO IF MY SIR SHOULD BE BELOW 0.869 FOR MY ICU CLABSI AND 0.676 FOR MY WARDS WHAT SHOULD MY pSIR BE?

Table 6. Changes in state-specific standardized utilization ratios (SURs) between 2021 and 2022 from NHSN Acute Care Hospitals

6a. Central line days (CLDs), all locations[1]

	All Acute Care Hospitals Reporting to NHSN				
State[2]	2021 SUR	2022 SUR	Percent Change[3]	Direction of Change, Based on Statistical Significance	p-value
Alabama	0.8476	0.7992	6%	Decrease	0.0000
Alaska	1.1143	1.0007	10%	Decrease	0.0000
Arizona	0.9996	0.9942	1%	Decrease	0.0022
Arkansas	0.8760	0.8397	4%	Decrease	0.0000
California	0.9647	0.9205	5%	Decrease	0.0000
Colorado	1.0056	0.9357	7%	Decrease	0.0000

Wards and ICU combo'ed?

Where is the median?

?

NORMALIZING THE SIR TO 2022

- Pretty easy math take the 2022 SIR 0.869 and your current SIR (using 10 East's SIR 2.033 compared to the 2015 baseline) and divide them so 2.033/0.869= 2.34 SIR when using the 2022 baseline

SO WHAT DOES THE pSIR DO TO MY FOCUS
25 UNITS NEVER MAKE THE LIST

Units (# CLABSI)	SIR>1 2015	SIR> CA (0.869)	pSIR> 1.0	pSIR 2015	pSIR >CA(0.695) 2022 (# CLABSI)	pSIR 2022
10 EAST (3)	2.033	10 EAST	JMC 6G PCU	2.296446	JMC 6G PCU (4)	3.304239
7 WEST IMU (2)	1.371	7 WEST IMU	3A CVCICU	2.010357	3A CVCICU (5)	2.8926
8EHCS (1)	1.271	8EHCS	10 EAST	1.793106	10 EAST (3)	2.580009
3A CVCICU (5)	1.251	3A CVCICU	7 WEST IMU	1.5711667	7 WEST IMU (2)	2.260671
JMC 6G PCU (4)	1.103	JMC 6G PCU	8EHCS	1.21855146	8EHCS (1)	1.753311
SICU-T (4)	1.069	SICU-T	JMC 4F PCU	1.212948	JMC 4F PCU (1)	1.745249
			2 WEST	1.162686	2 WEST (2)	1.672929
			CVC 4B PCU	1.001232	CVC 4B PCU (1)	1.440622
					CVC 3B PCU (1)	1.43034
					11HCEW PCU (2)	1.270688
					JMC 3H ICU (2)	1.192858
					CVICU2 (2)	1.176449
					JMC 3G ICU (2)	1.168
					SICU-T (4)	1.145906

A WAG ON THE CLABSI pSIR

- 0.9205*0.869= 0.7999 For ICU CLABSI
- 0.9205*0.676= 0.6223 For Ward CLABSI

WHERE THE PSIR SHINES- HOW MANY PATIENTS DID WE INFECT OVER THE EXPECTED NUMBERS (UNITS WITH SIR GREATER THAN 1)

	2015 SIR	2022 SIR	2015 pSIR	2022 pSIR
All outlier units	3.9	5.9	7.5	13.1
Just top 6 units	3.9	5.9	7.2	9.9

FOR MATH GEEKS ONLY!!!!! (NOT REALLY, A 6TH GRADER CAN DO THIS)

- To calculate the number of expected infections you need the # of infections on the unit and SIR (or pSIR) of unit
  - Then # Infected/SIR (or pSIR)
  - Example 10 East had 3 Infections and a 2015 SIR of 2.033 so 3/2.033=1.48 expected infections
- Excess infections is # of infections minus expected infections
  - So 10 East had 3 infections with 1.48 infections expected or 3-1.48=1.52

LESSONS LEARNED FROM THE pSIR AT THE UNIT LEVEL

- At UC San Diego Health bad units get worse and good units get better and a little visa versa
  - Maybe an acuity issue
- Prioritize high pSIR over high SIR
- pSIR does a better job looking at the total number of patients we harm above "expected"

PROPOSED NEXT STEPS

- pSIR for the county reporting
- pSIR through Metrics Committee
- Regression on CMI and SUR
- Will it make a difference since money isn't linked?