

# Background

- External benchmarking involves comparing standardized data on HAI rates in one hospital or healthcare facility in relation to others.
- Here we present two epidemiological graphical tools, 2D and 3D benchmarks, which summarize the efficiency in preventing main infections in a Medical/Surgical Intensive Care Unit (MSICU).

# Methods

- The 3D graph considers the incidence density rate of ventilator-associated pneumonias (VAP cases per 1,000 ventilator-days) as the X-Axis, the incidence density rate of central line-associated primary bloodstream infections (CLABSI cases per 1,000 central line-days) as the Y-Axis, and the incidence density rate of urinary catheter-associated urinary tract infections (CAUTI per 1,000 urinary catheter-days) as the Z-Axis.
- Efficiency in preventing infection (e) considers the zero rate to be 100% efficient (e=100%) and the highest available benchmark rate to be "zero" efficiency (RMax: e=0%).
- From this definition, the efficiency of any MSICU (0% ≤ e ≤ 100%) is obtained using a linear interpolation function, from the rate observed in the MSICU under evaluation (Rx):
- $\circ$  e = 100x(RMax Rx)/RMax. If Rx > RMax, then RMax = Rx;
- If Rx > RMax, then RMax = Rx.
- The 3D benchmark is build by calculating the preventing infection (e) for each infection (VAP, CLABSI, and CAUTI) for all benchmarks (Table I) and for the MSICU under evaluation.
- In the 3D Benchmark, three control volumes are created:
- "Infection Control Urgency" volume,
- "Infection Control Excellence" volume, and
- "Infection Prevention Opportunity" volume.

# How to Compare standardized Healthcare-associated Infection (HAI) Rates? Benchmark 2D and 3D

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# Methods

- Benchmark 2D considers only the VAP density rate as X-Axis, and the CLABSI density rate as Y-Axis.
- In this graph, five control regions are created:
- 1=excellence in the control of VAP+CLABSI;
- 2=excellence in VAP control and opportunity for CLABSI prevention;
- $\circ$  3=excellence in CLABSI control and opportunity to prevent VAP;
- 4=opportunity to prevent VAP+CLABSI;
- 5=urgency in infection control.

#### Table I - Benchmarks used for the Medical-Surgical ICUs

	CLABSI cases per 1,000 central line-days		VAP cases per 1,000 ventilator-days		CAUTI per 1,000 urina catheter-days	
Benchmark	Median	90th percentile	Median	90th percentile	Median	90th perce
Dudeck et al., 2015 (NHSN/CDC). National Healthcare Safety Network (NHSN) Report, Data Summary for 2013, Device-associated Module. Am J Infect Control. 2015; 43(3): 206–221.	0.9	2.4	-	-	2.2	5.1
Dudeck et al., 2013 (NHSN/CDC). National Healthcare Safety Network (NHSN) report, data summary for 2012, Device-associated module. Am J Infect Control. 2013; 41: 1148-66.	1.0	3.0	0.9	3.9	2.0	5.2
Dudeck et al., 2011 (NHSN/CDC). National Healthcare Safety Network (NHSN) Report, data summary for 2010, device-associated module. Am J Infect Control 2011;39:798-816.	1.0	3.1	1.1	4.2	1.8	4.6
Boletim Epidemiológico Paulista - BEPA; 2017. <b>Divisão de infecção hospitalar</b> . Boletim Segurança do Paciente e Qualidade em Serviços de Saúde. Volume 14, nº 167-168.	3.4	6.2	3.4	10.0	3.8	9.8
Associação Nacional de Hospitais Privados (Anahp); 2019. <b>Observatório 2019.</b> Publicação Anual, Edição 11, 2019.	2.6	8.8	5.4	20.0	2.0	7.6
A. El-Saed et al.; 2013. Benchmarking local healthcare-associatedinfections: Available benchmarks and interpretation challenges. Journal of Infection and Public Health (2013) 6, 323-330.	7.4	10.3	5.7	10.1	3.7	4.6
GVIMS/GGTES/ANVISA; 2017. Avaliação dos indicadores nacionais das infecções relacionadas à assistência à saúde (IRAS) e resistência microbiana do ano de 2017. Boletim Segurança do Paciente e Qualidade em Serviços de Saúde nº 17.	4.4	10.9	11.5	27.8	4.7	11.8
SONIH 2015.Centro de Vigilância Sanitária do Estado do Paraná. Densidades de incidência de infecções relacionadas à assistência à saúde no Estado do Paraná. Secretaria de Estado da Saúde do Paraná – SESA/PR.	-	15.8	17.4	41.2	3.6	15.1
STARLING et al.; 2019. Keeping Score for healthcare Improvement: benchmarking HAIs in developing countries – The NOIS Project. In: SHEA Spring 2019, Boston, MA, USA.	4.9	16.0	7.0	20.6	2.0	9.4

## Results

• Graph parameters were based on NHSN data from the device-associated module, NOIS Project, Anahp, CQH, and GVIMS/GGTES/ANVISA (Brazilian benchmarks), and El-Saed et al benchmarks (Table I). We applied the 2D/3D benchmarks to Brazilian ICUs (Figures 1.1 to 3.2).

### Conclusion

• 2D and 3D benchmarks are easy to understand and summarize the efficiency in prevention the mains infections of Intensive Care Units.

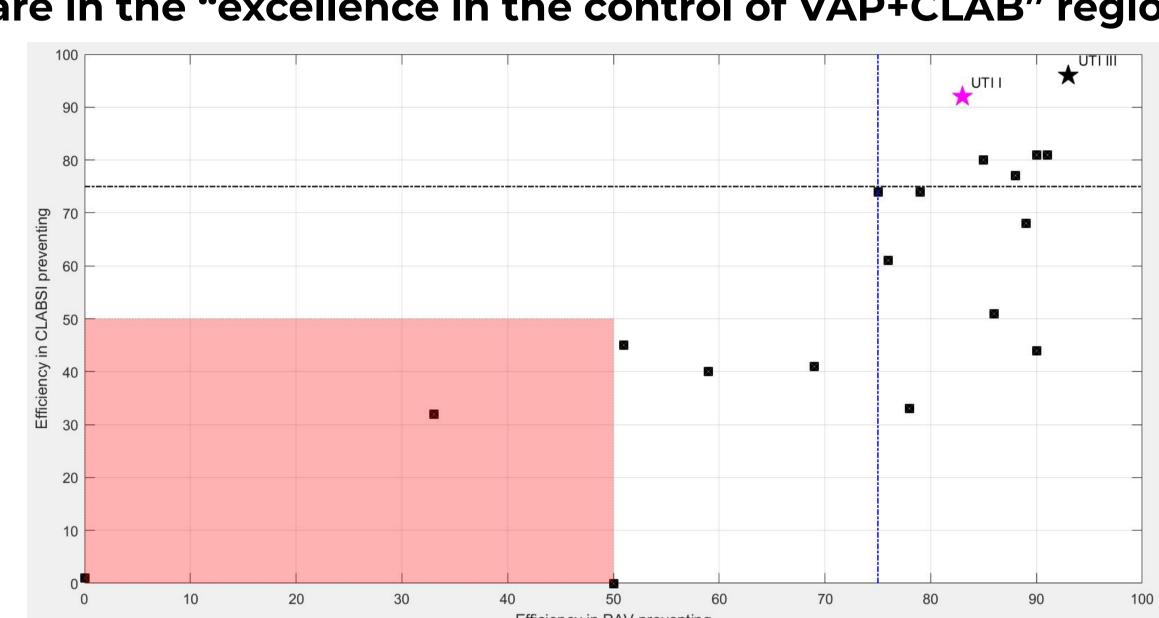


Fig 1.1 - 2D benchmark for Madre Teresa Hospital ICUs, Jan-Jun/2020: both ICUs are in the "excellence in the control of VAP+CLAB" region.

Fig 2.1 - 2D benchmark for Lifecenter Hospital ICUs, Jul-Dec/2019: two ICUs are in the "excellence in CLABSI control and opportunity to prevent VAP" region, and UTI 20 is in the region of "excellence in VAP control and opportunity for CLABSI prevention".

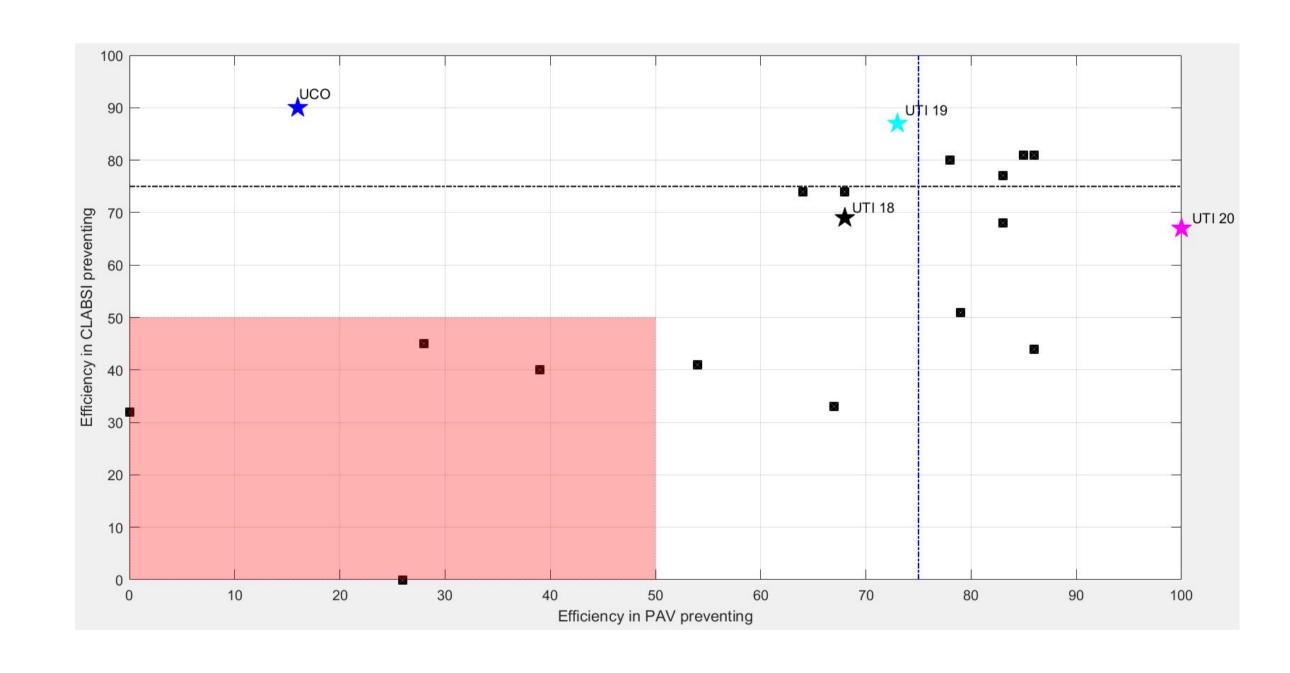


Fig 3.1 - 2D benchmark for Vera Cruz Hospital ICU, Jul-Dec/2019: the ICU is in the "opportunity to prevent VAP+CLABSI" region.

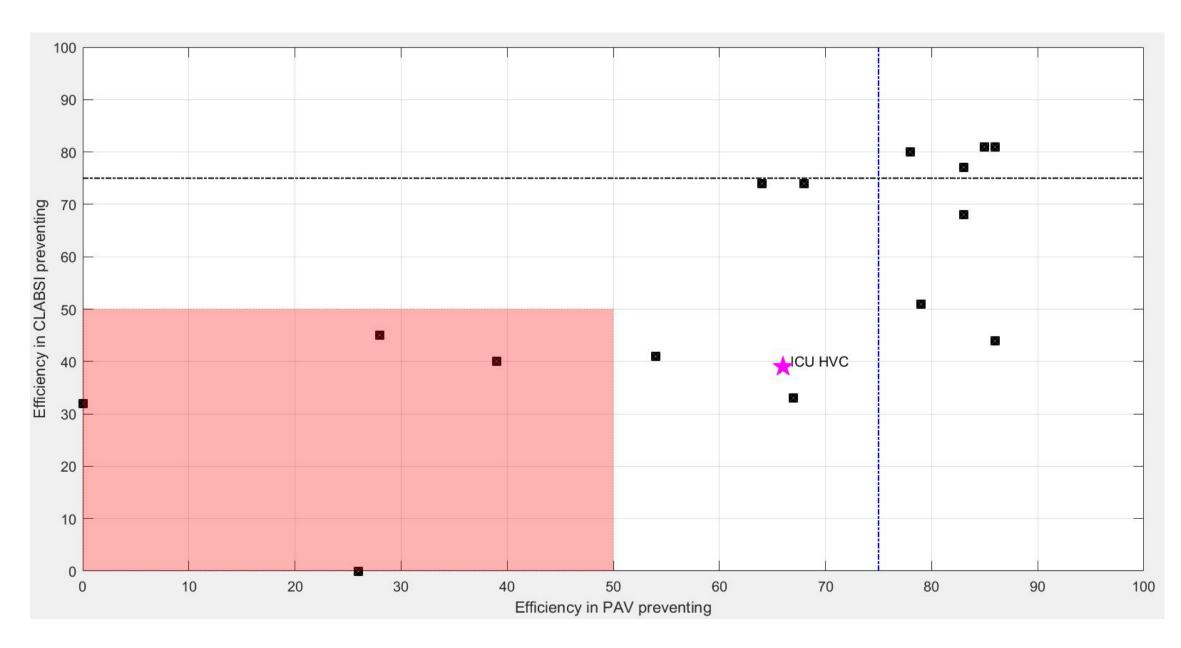






Fig 1.2 - 3D benchmark for Madre Teresa Hospital ICUs, Jan-Jun/2020: both ICUs are in the "Infection Control Excellence" volume .

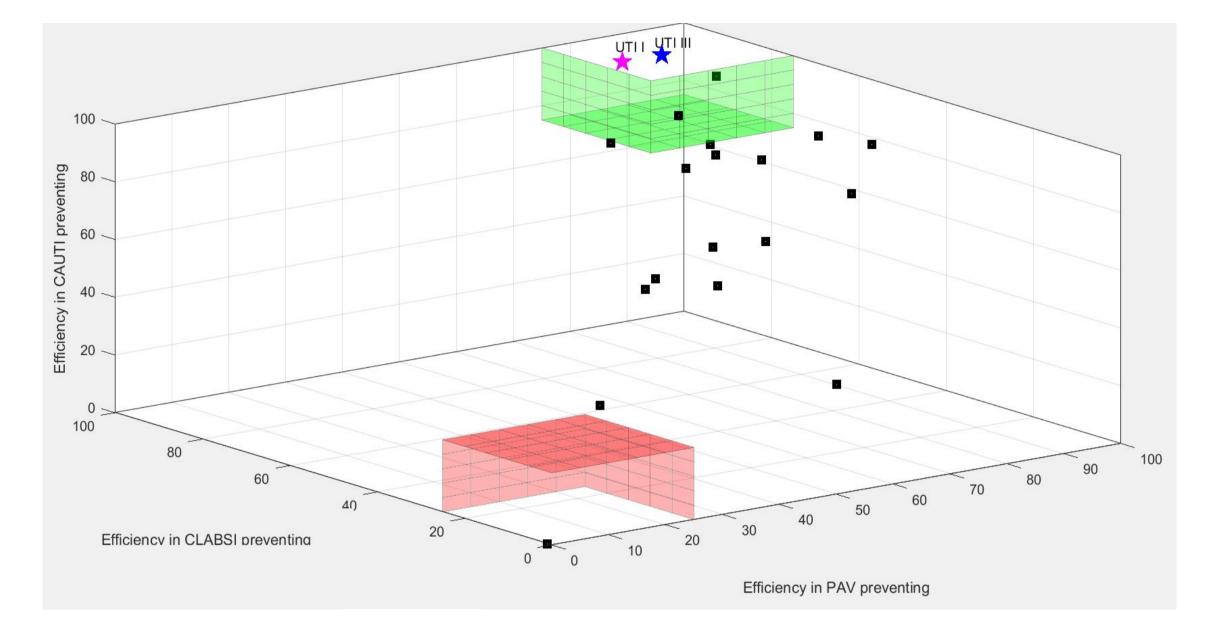


Fig 2.2 - 3D benchmark for Lifecenter Hospital ICUs, Jul-Dec/2019: both ICUs are in the "Infection Prevention Opportunity" volume.

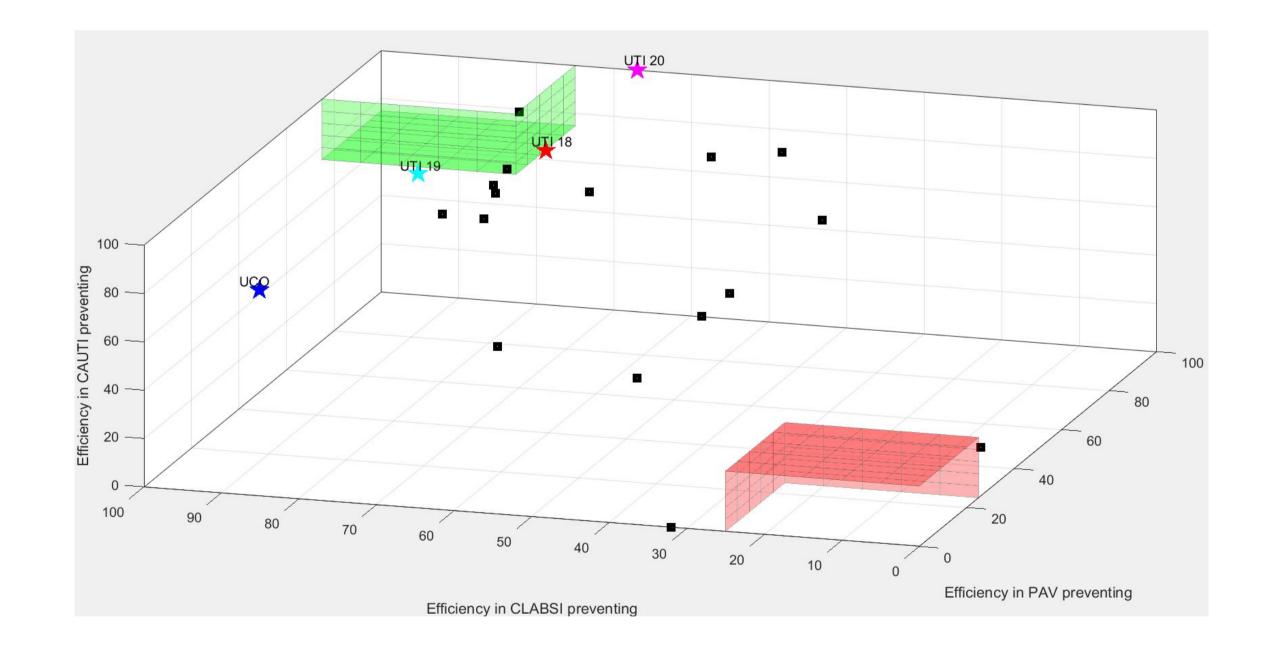


Fig 3.2 - 3D benchmark for Vera Cruz Hospital ICU, Jul-Dec/2019: the ICU is in the "Infection Prevention Opportunity" volume.

