

## Electronic Monitoring of Hand Hygiene:

### Which Factors Should Be Considered When Interpreting the Rates?

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### Disclosures

- Funding for the electronic monitoring system provided by Gojo Industries
- No role in design and interpretation

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## Background

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Electronic monitoring :  
How could it be interesting?

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	Direct observation	Electronic monitoring systems (EMS)
Accuracy	Gold standard ✓	
Large amount of observations	✗	✓
Low human/time resources	✗	✓
Personalized feedback	Limited	Potential ✓
↑ compliance	As part of multimodal strategy <sup>1</sup>	

<sup>1</sup> World Health Organization, 2009

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Types of EMS (electronic monitoring systems)

	Event detection	Confidentiality	Feedback	
 Complexity	Hand hygiene product use (numerator)	Anonymous	Aggregated	Delayed
	Entries/exits (surrogate for moments 1 and 4)	Nominative (e.g. badge)	Individual	Real-time
	Contact with patient zone			

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Questions

**Which factors influence** hand hygiene rates measured by EMS?

How to interpret these rates and how to **define targets?**

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Methods

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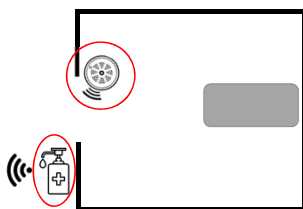
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EMS in 10 single-patient rooms

Data collected 24/7



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Hand Hygiene (HH) Rate =



$$\frac{\text{Number of HH events}}{\text{Number of opportunities}} \times 100$$

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## Methods

Observational study of hand hygiene via EMS to identify factors associated with HH compliance

- No specific intervention to improve hand hygiene
  - No feedback of EMS rates
- Direct observation sessions
  - For data not captured by EMS

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## Results

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### Overall Hand Hygiene Rate

100 days of data in 10 rooms

$$\frac{45\,775 \text{ HH events}}{136\,821 \text{ opportunities}} \times 100 = 33\%$$

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### Room-level results

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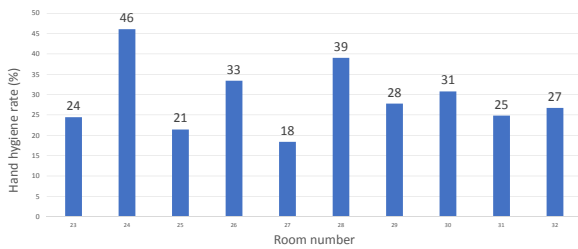
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### Cumulative rate per room



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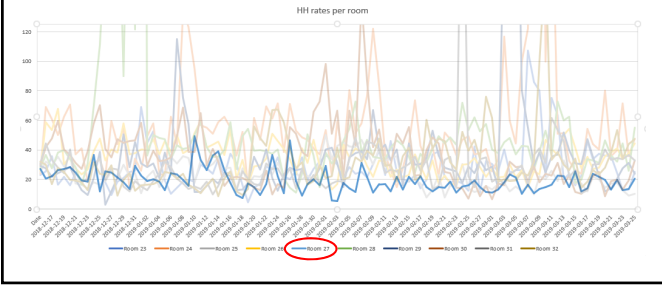
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### Example of « low-performing » room (27)



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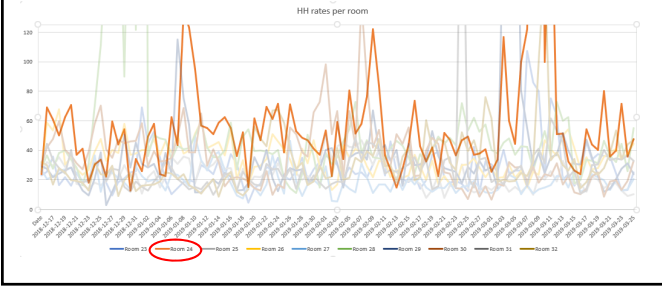
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### Example of « high-performing » room (24)



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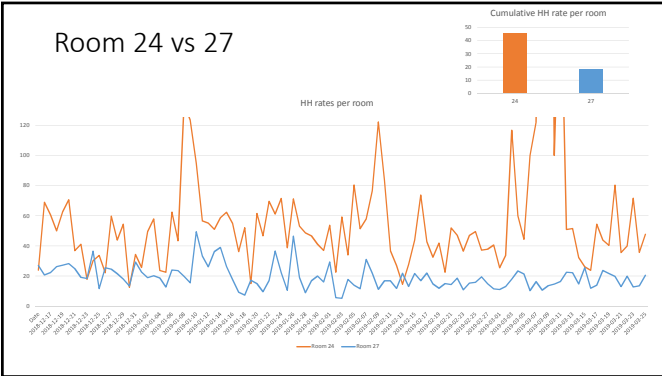
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### Room 24 vs 27



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# Shift-level results

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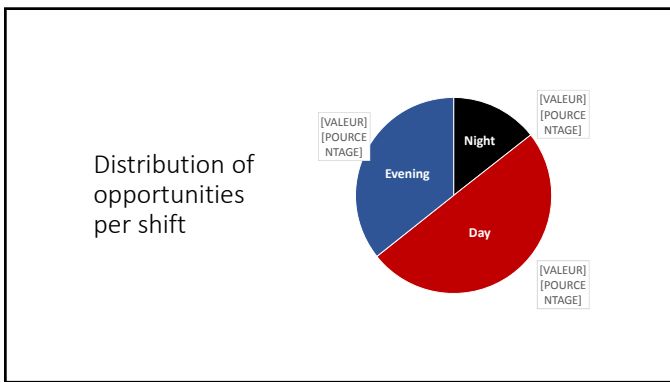
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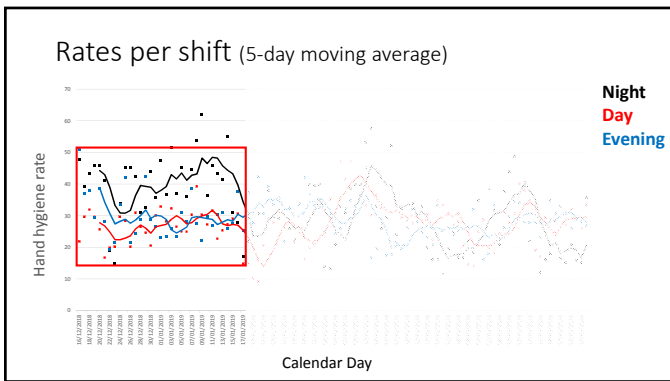
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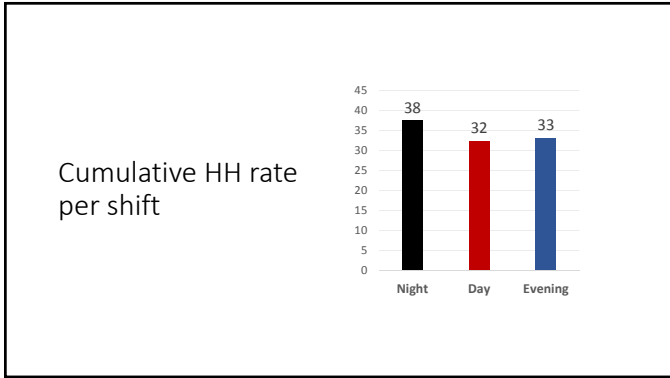
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## Direct Observation

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- ### Direct observation sessions
- Goal: gather behavioral data
- Same rooms as EMS
  - Total observation time : 5½ hours
  
  - 210 opportunities (entries/exits)

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Who comes in and out of rooms?

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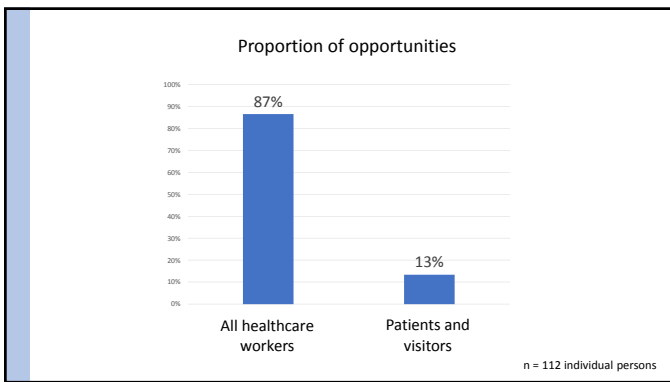
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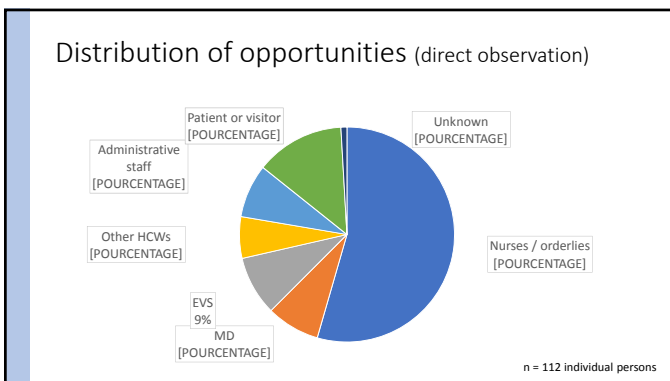
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Did they touch the patient zone?

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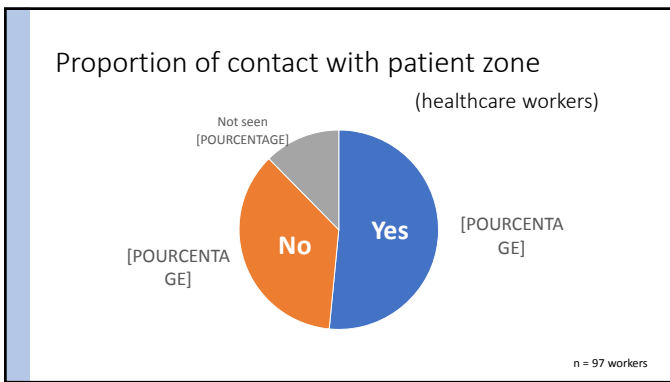
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Attribution of hand hygiene events to a room

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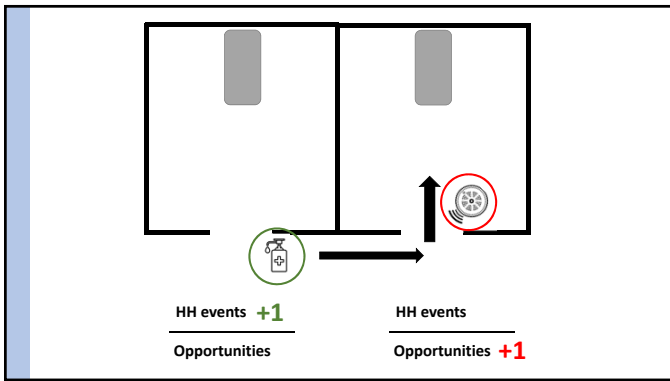
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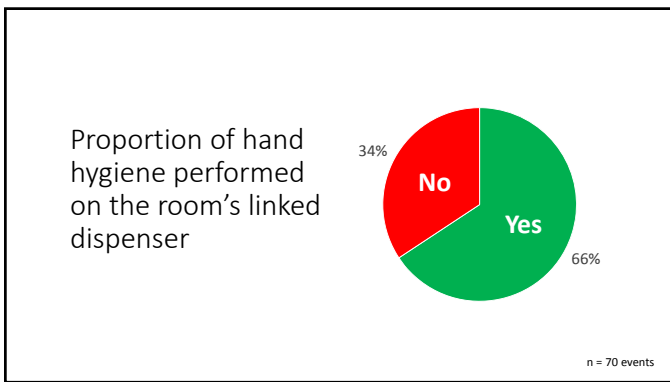
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# Conclusions

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EMS rates are significantly lower than those by WHO method

Hypotheses:

- Significant proportion of entries without **patient zone contact** ( $\geq 36\%$ )
- Proportion of entries from **non workers** (13%)
- No adjustment for **overlapping moments** 4 and 1 ( $\sim 5\%$  <sup>1</sup>)
- Lesser **Hawthorne** effect (1,3-3 fold <sup>2</sup>)
- ...

<sup>1</sup> Boscart et al. 2010  
<sup>2</sup> Filho et al. 2014 and McLaws & Kwok 2018

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EMS acceptance by healthcare workers <sup>1</sup>

- **Measurement accuracy**
- Transparency and confidentiality
- Workers' attitude towards being monitored by technology
- Ease of use

Review of studies using wearable devices

- **Mostly with real-time personalized feedback**
- $\uparrow$  compliance 6-55%

<sup>1</sup> Meng et al. 2018

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Could a nominative system (badge) be the solution to these problems?

- Eliminates patients and visitors from the equation...
- Not a universal solution
  - Cost
  - Confidentiality issues
  - Accuracy issues not completely resolved (patient zone, overlapping moments...)

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### Room-level HH compliance analysis

→ Must be interpreted carefully

Considering:

- Intrinsic HH rate difference between rooms
- Difference between working shifts

Comparing rates between rooms is challenging

There is no universal target for room compliance

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### Future question

Could hand hygiene rates be adjusted for these factors?



If so, room-level feedback might be possible

Accuracy ↑  
Confidentiality preserved

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Thank you

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### References

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- Filho MAO, Marra AR, Magnus TP, et al. Comparison of human and electronic observation for the measurement of compliance with hand hygiene. *Am J Infect Control*. 2014;42(11):1188-1192. doi:10.1016/j.ajic.2014.07.031
- Meng M, Sorber M, Herzog A, Igel C, Kugler C. Technological innovations in infection control : A rapid review of the acceptance of behavior monitoring systems and their contribution to the improvement of hand hygiene. *American*. 2018;000:1-9. doi:10.1016/j.ajic.2018.10.012
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- World Health Organisation (WHO). WHO Guidelines on Hand Hygiene in Health Care: First Global Patient Safety Challenge Clean Care is Safer Care. *World Health*. 2009;30(1):270. doi:10.1086/600379

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### Credits

- Images :
  - Wifi by Adrien Coquet from the Noun Project
  - Liquid soap by Path Lord from the Noun Project
  - Smoke Detector by Patrick Trouvé from the Noun Project
  - Check Mark by Alex Muravev from the Noun Project

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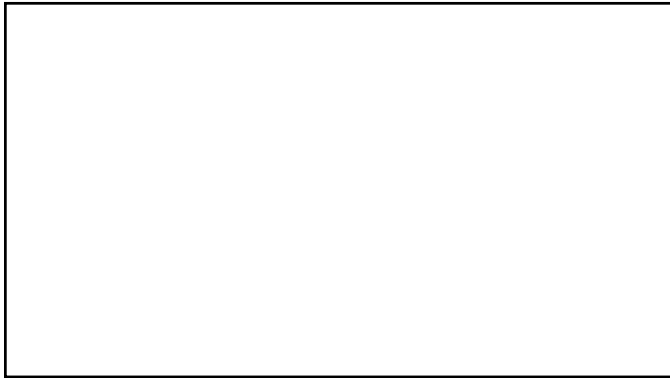
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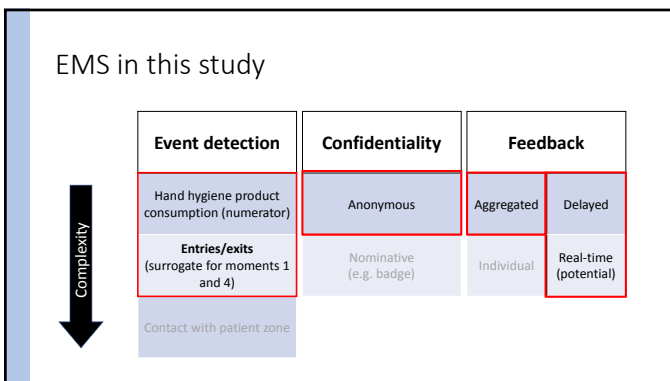
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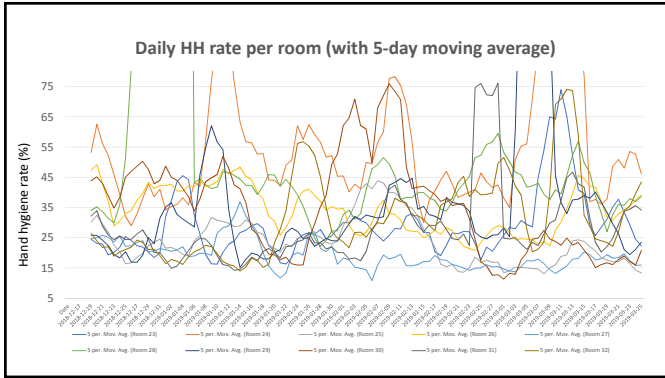
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### Room comparisons (Chi square)

All p < 0,05, except yellow boxes

	23	24	25	26	27	28	29	30	31	32
23	N/A									
24	P < 0,0001 109 (23,24) vs 163 (24,25)	N/A								
25	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	N/A							
26	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	N/A						
27	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	N/A					
28	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	N/A				
29	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	N/A			
30	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	N/A		
31	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	N/A	
32	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	P < 0,0001 109 (23,24) vs 163 (24,25)	N/A

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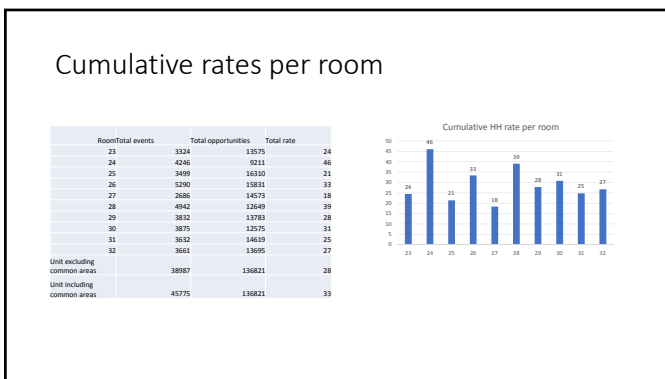
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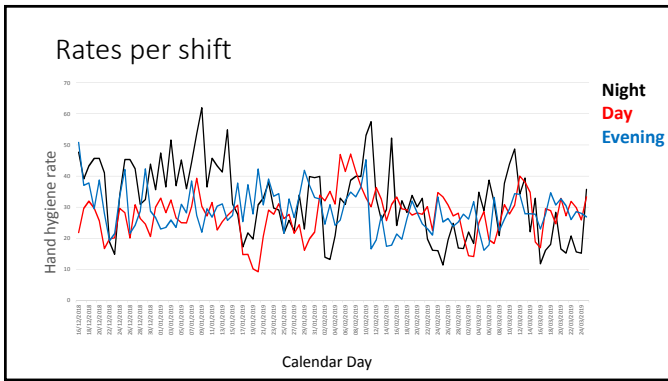
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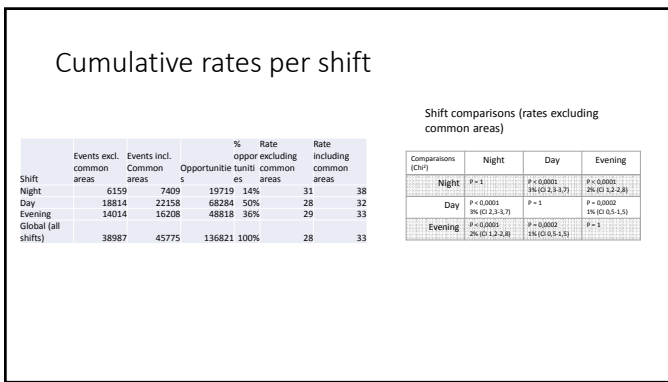
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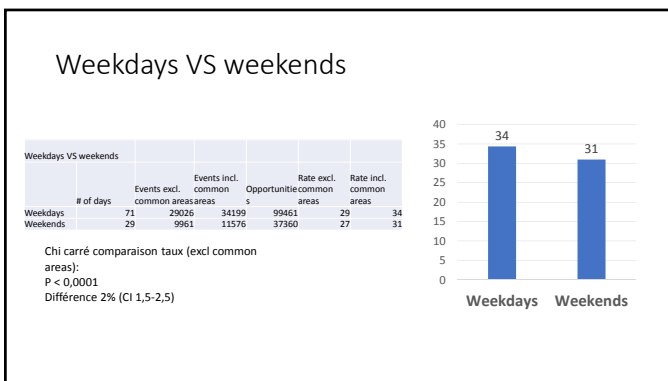
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Results – Weekdays VS weekends

Hand hygiene rate

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