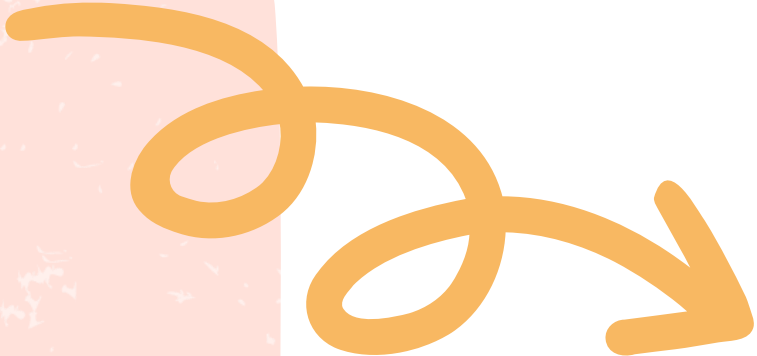




Noise Pollution in ICU: A Multicentre Evaluation and its Link to Alarm Fatigue Among Nurses

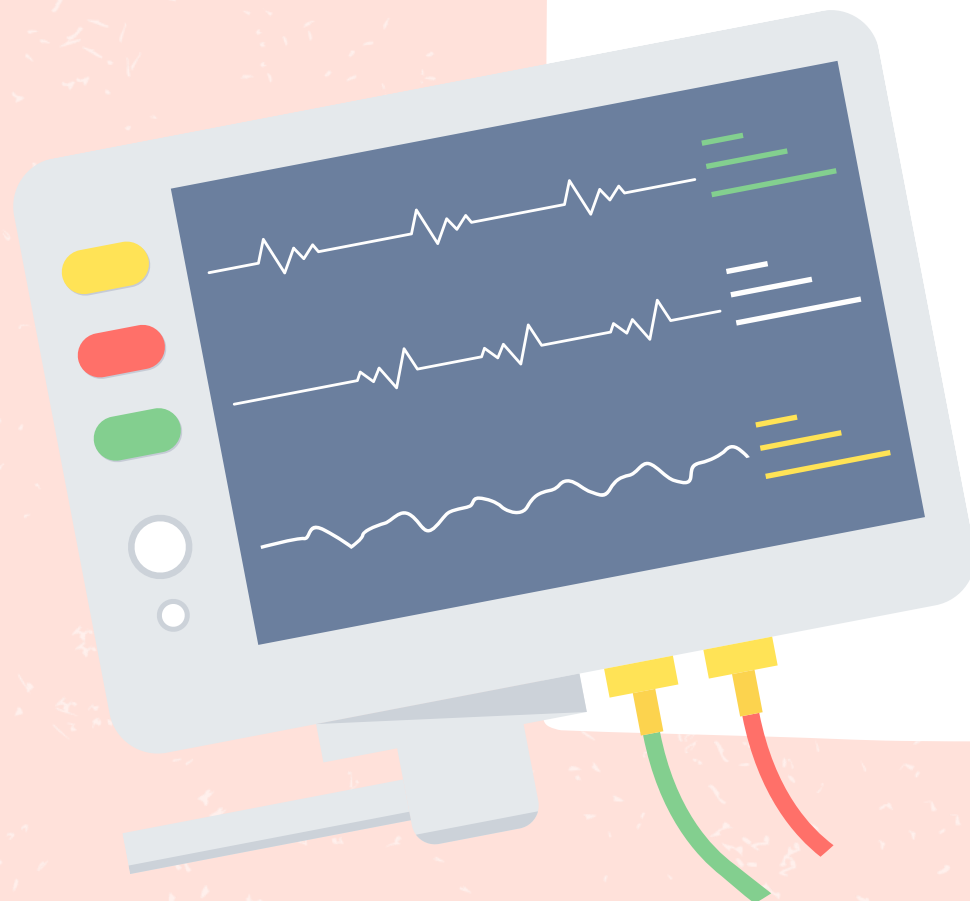
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Nursing in Critical Care Journal | Associate Editor





What is Alarm Fatigue?

It is a **sensory overload** that occurs when healthcare professionals are faced with or exposed to an excessive number of alarm alerts, which can lead to **desensitisation** to alarm sounds and a high rate of missed alarms.

- Stress, irritation, poor communication, and burnout.
- Direct patient safety risk.





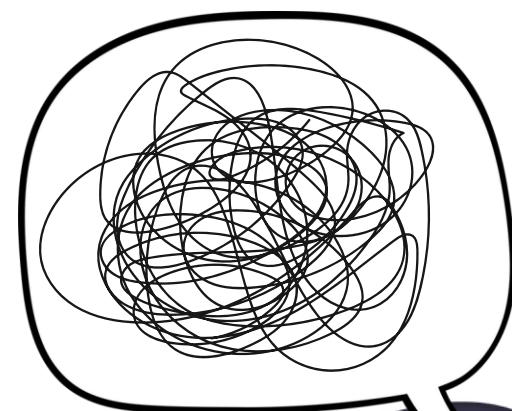
Why this matters?

Alarm Systems in the ICUs

- WHO recommended ICU noise ≤ 35 dB in hospital
- Reality: ICU levels often exceed 55 dB

What does it entail?

Delayed responses, missed alarms, safety risks



Noise Pollution



Cognitive Overload



Alarm Fatigue

Study Gap



Is noise exposure
significantly
associated with
Alarm Fatigue and
cognitive workload?



Study Aim

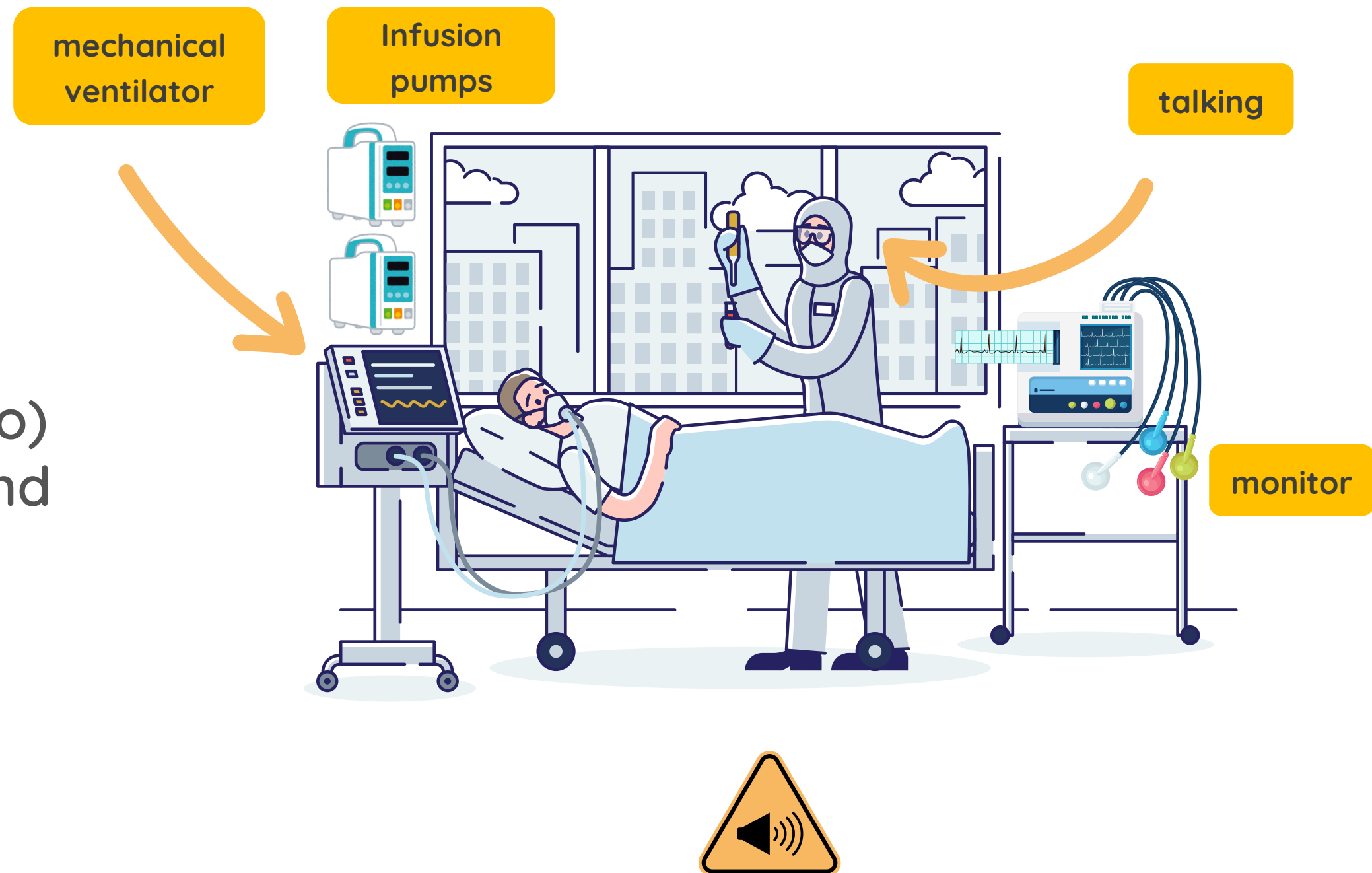
To evaluate noise pollution across multiple ICUs and investigate its association with alarm fatigue among nurses.



Study Design

- 6 tertiary adult ICUs in Italy (Milan, Bologna, Pisa, Rome and Salerno)
- 7 days continuous sound monitoring per ICU
- 178 nurses

Tools: Alarm Fatigue Questionnaire, NASA-TLX



Measuring Alarm Fatigue and Workload

Alarm Fatigue Questionnaire

- Validated self-report tool assessing frequency, perceived urgency, and emotional response to alarms.
- Higher scores = greater desensitisation and delayed responsiveness.

NASA-Task Load Index

- Widely used instrument to assess perceived cognitive workload.
- Measures six dimensions: mental, physical, temporal demand, performance, effort, and frustration.



Methods

Noise data were collected using a **Class 1-meter** following international standards. We recorded:

- Average noise (LAeq)
- Maximum noise (LAm_{ax})
- And compared values across day vs night shifts.

Every second of data was aggregated into 15-minute intervals for analysis.



Phonometer Tiscali

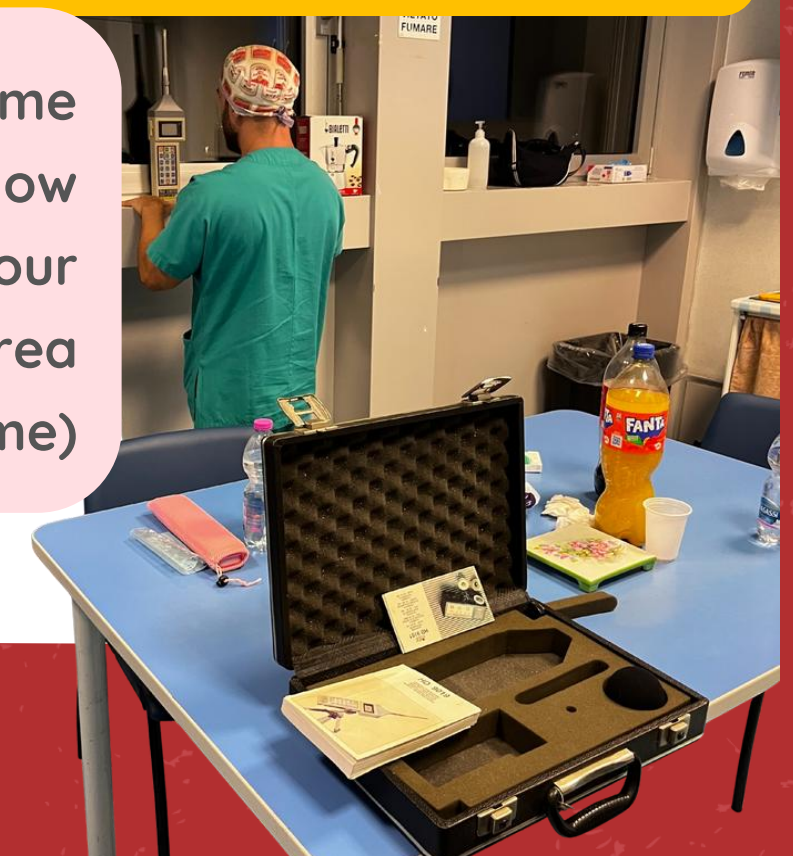


HD 9020 - Class 1



It travelled across the 6 study centres

This was the first time trying to figure out how this “thing” worked in our staff room (Sant’Andrea Hospital, Rome)



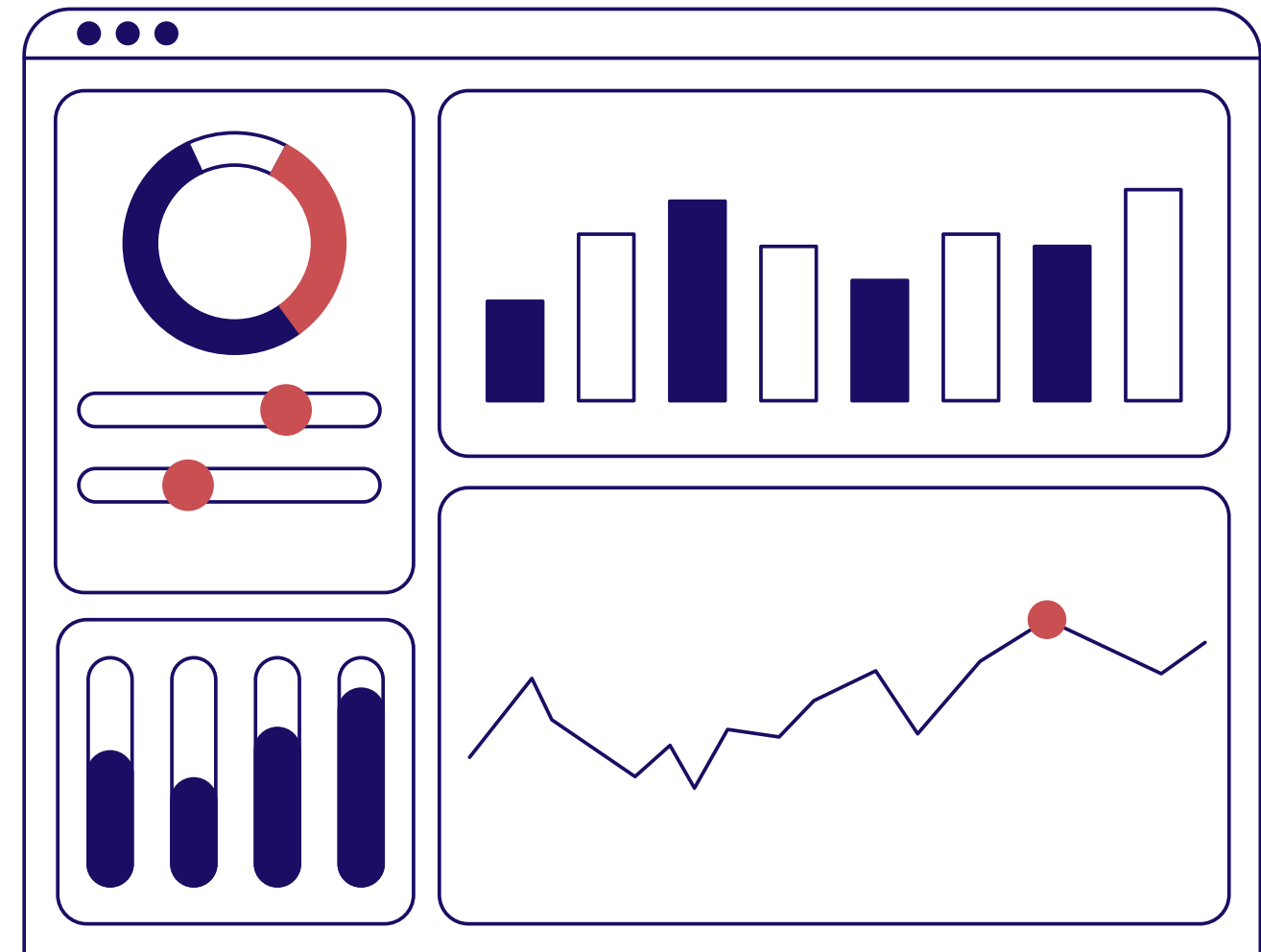
Methods

Statistical Analyses

- Descriptive statistics to summarize noise levels, alarm fatigue, and workload
- T-tests comparing shifts and unit types
- Pearson correlations between noise and alarm fatigue
- And a multivariate linear regression to assess predictors of alarm fatigue while adjusting for multiple variables.

The model included:

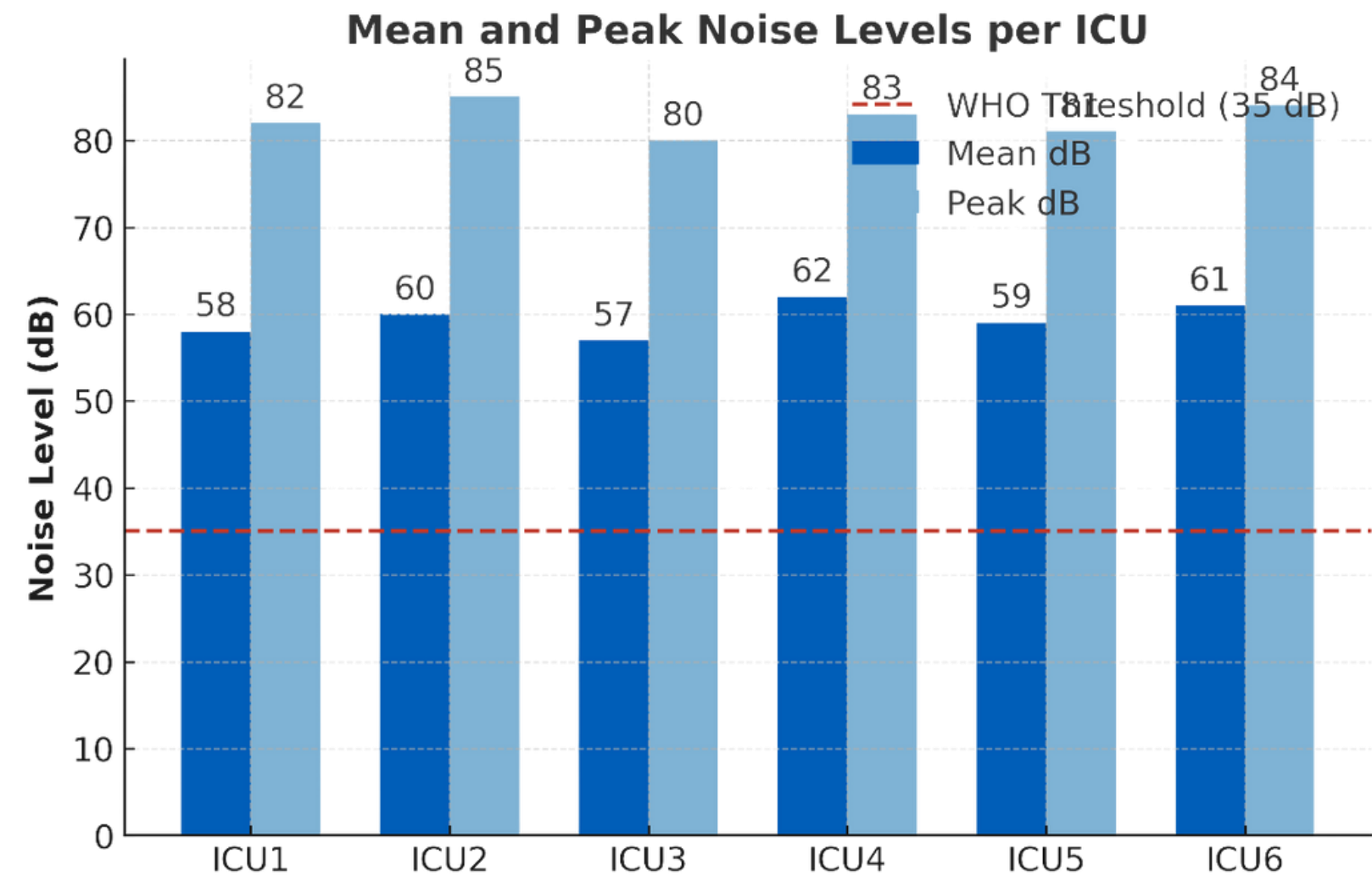
- Noise level (LAeq & LMax)
- Alarm frequency
- NASA-TLX mental demand
- ICU layout
- Nurse experience



Noise Data

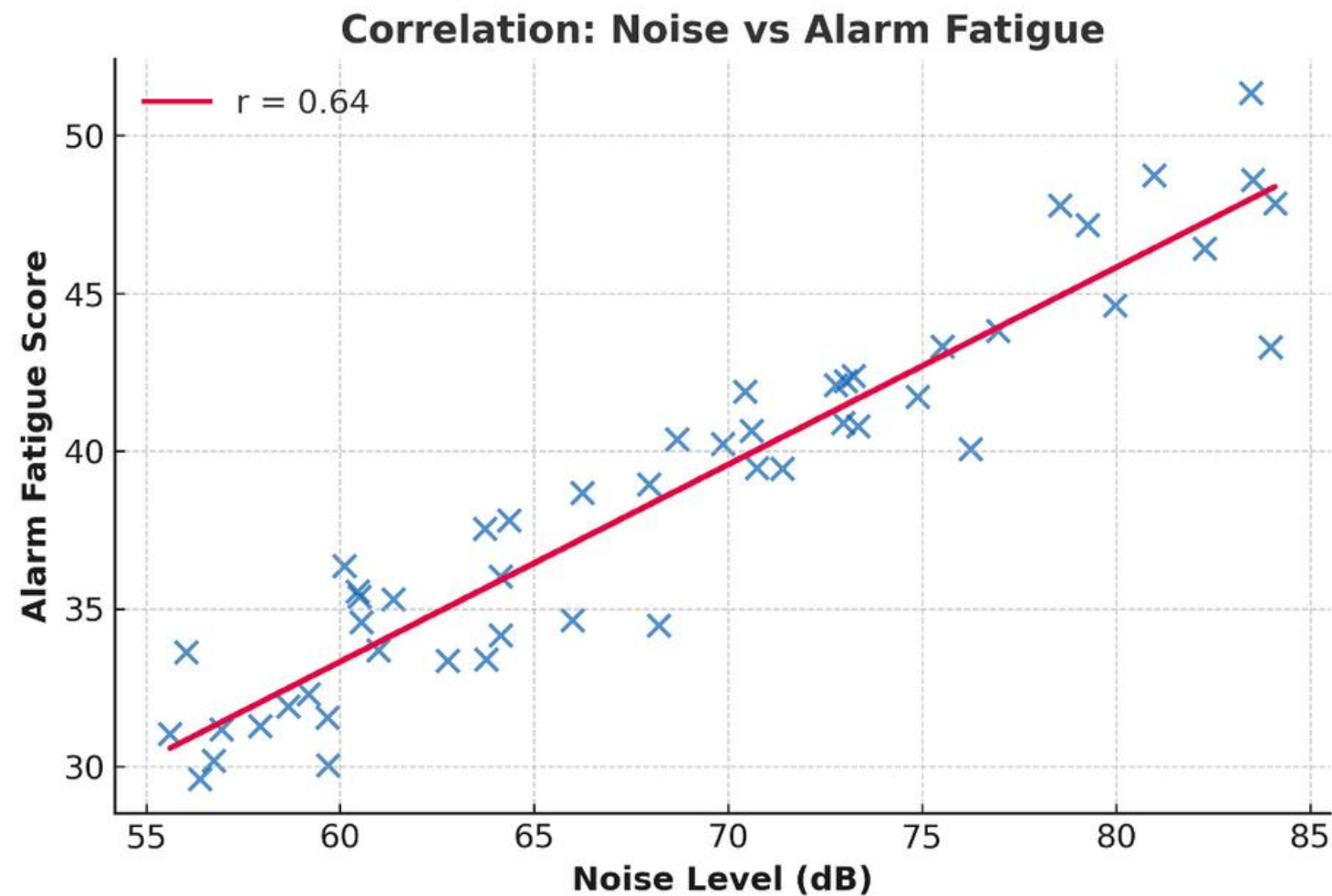
Let's examine mean noise levels per ICU

Average noise levels exceeded WHO recommendations by at least 20 dB, with peaks as high as 85 dB — comparable to standing next to heavy traffic.



Results

Correlation: Noise vs Alarm Fatigue



a

Higher noise levels were associated with higher alarm fatigue scores ($r = .64$, $p < .01$)

b

The link was strong enough to suggest that sound environment directly impacts nurses' responsiveness.

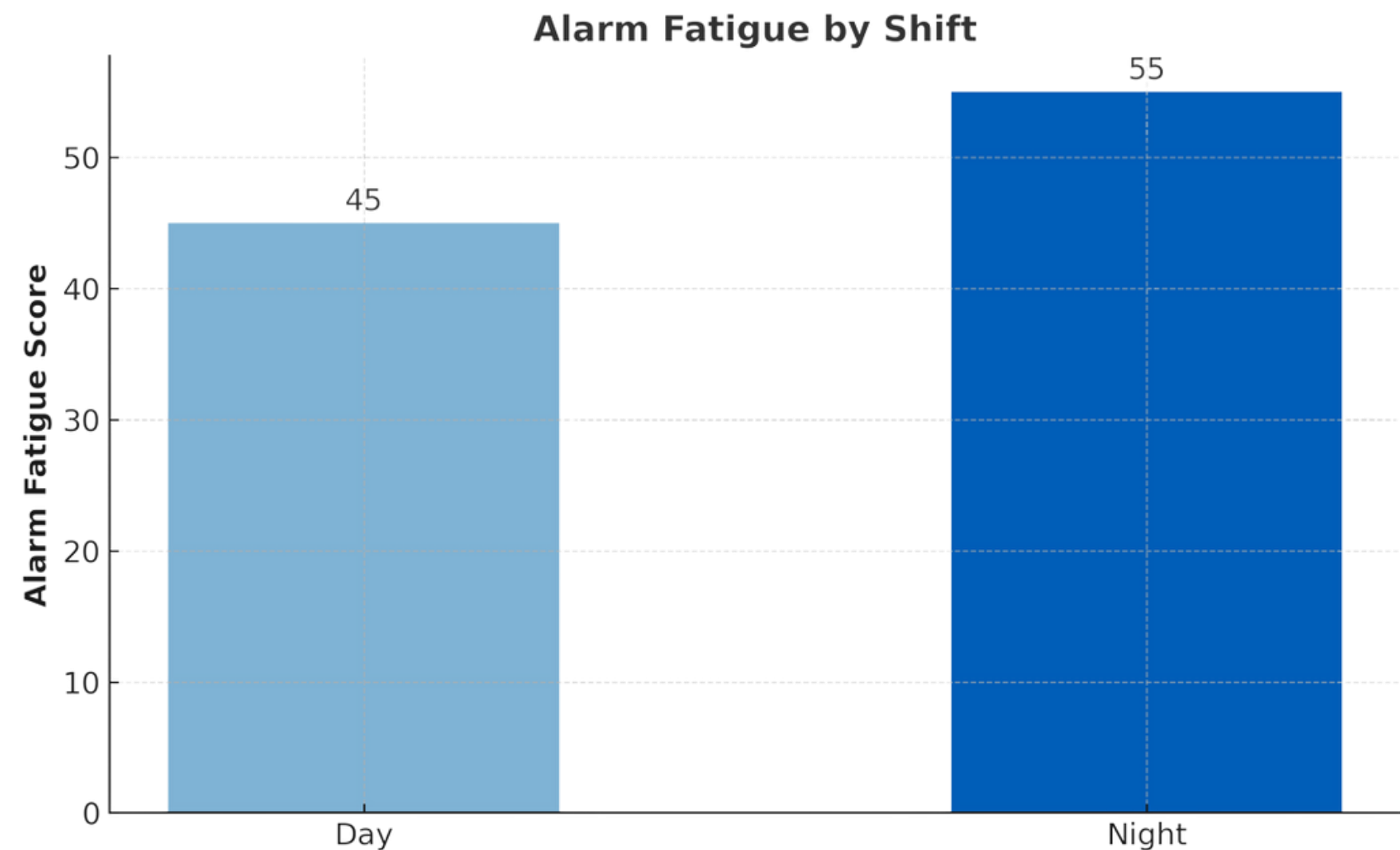
c

NASA-TLX results showing increased mental demand and frustration during high-noise periods.

Results: Night Shift Effect

Night shifts showed more pronounced alarm fatigue.

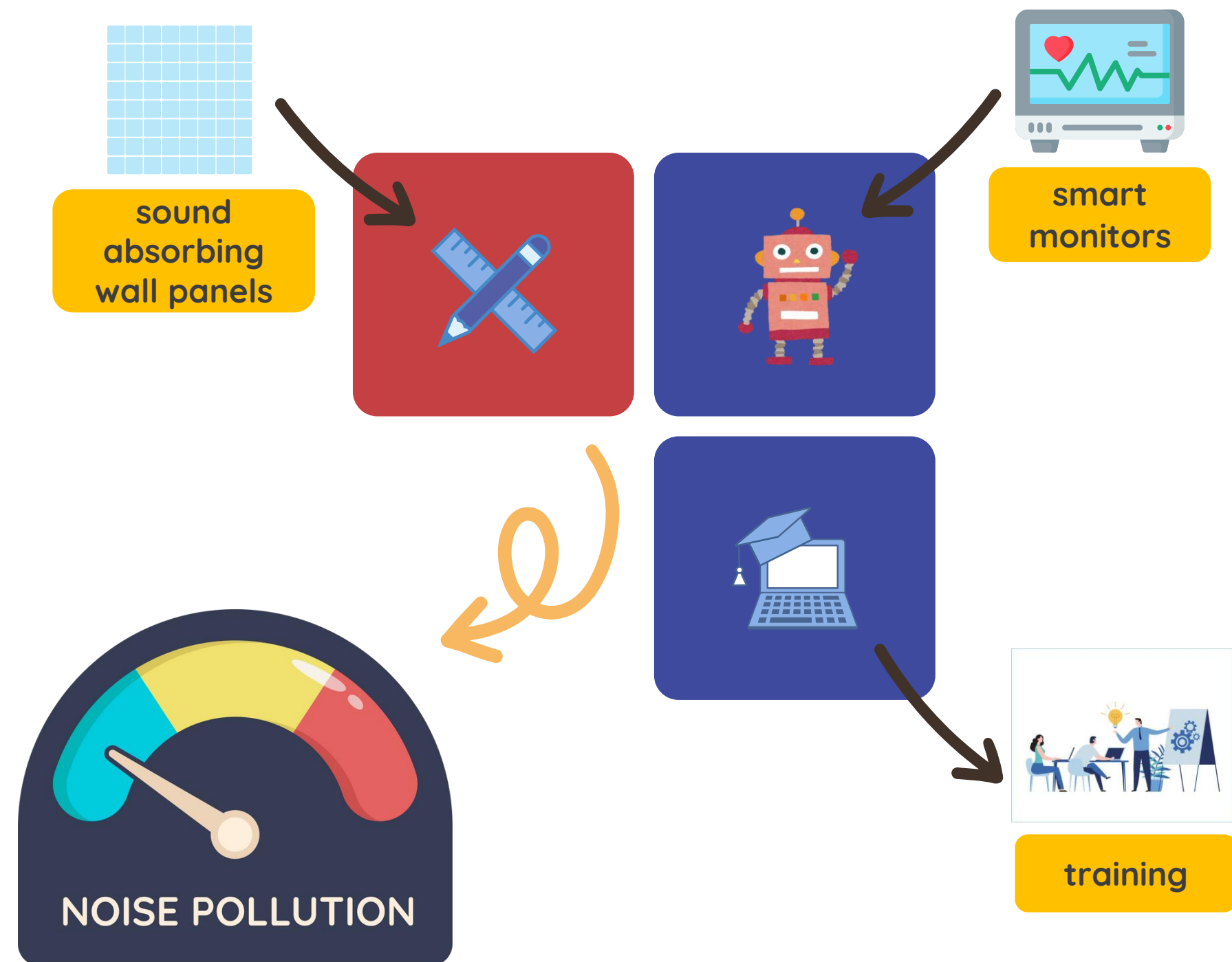
Despite the perception that ICUs are 'quieter' at night, peaks in noise from certain equipment and urgent interventions may actually be more disruptive when baseline noise is lower.



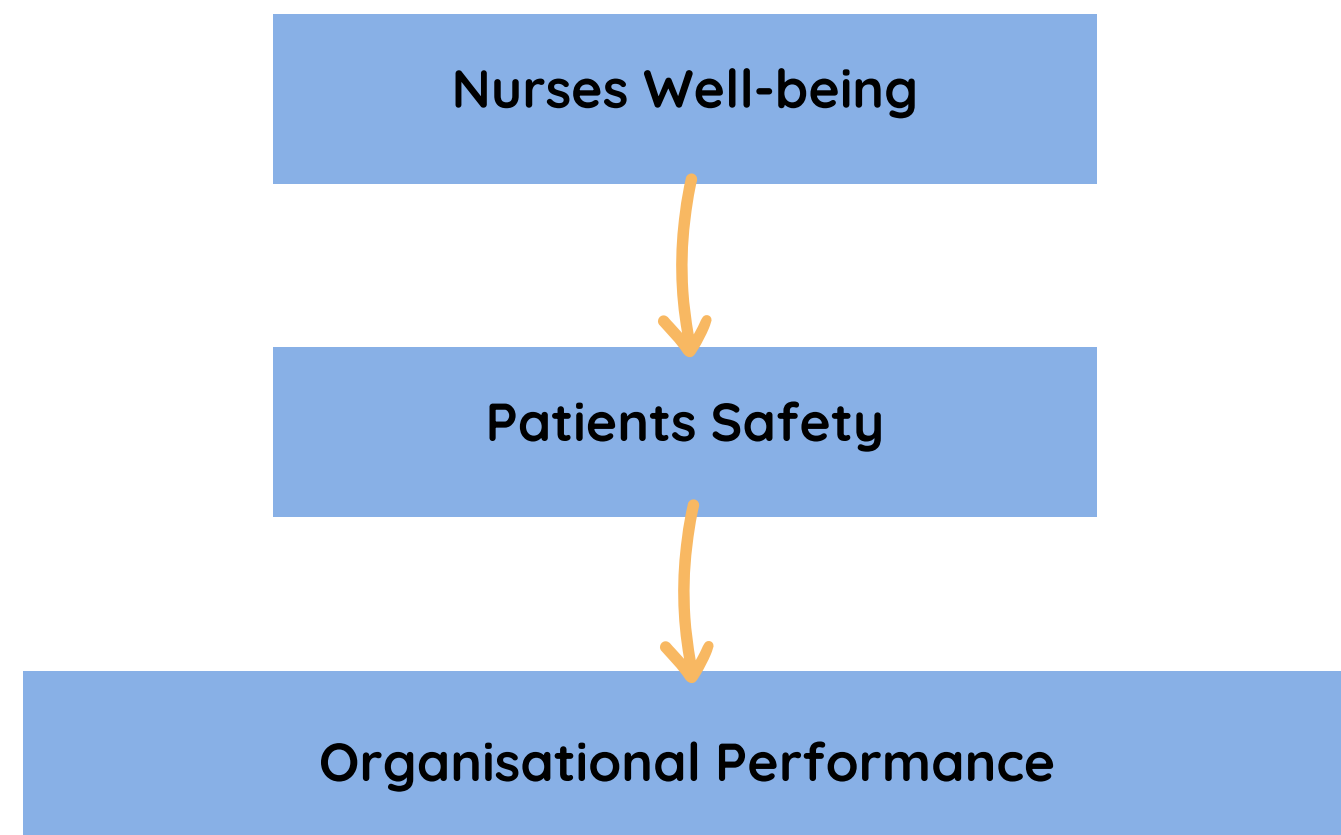
PRACTICE

Lesson Learned: Implications

- Acoustic redesign
- Smart alarm systems
- Alarm management training



Broader Impact



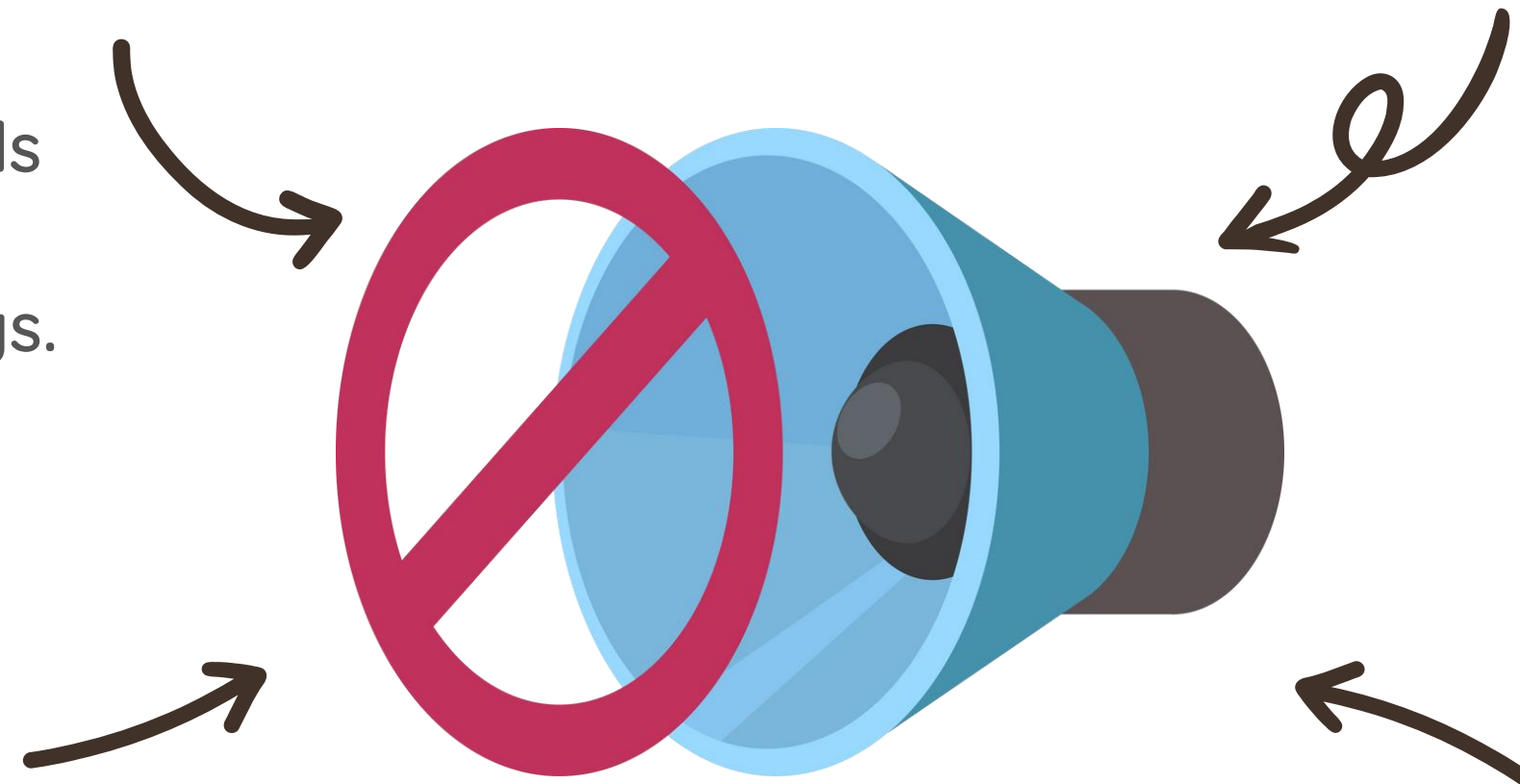
Key Takeaways

Limits

ICU noise exceeds safe limits in all observed settings.

Noise

Higher noise correlates with greater alarm fatigue.



Night Shift

Night shifts may be particularly vulnerable.

Interventions

Integrated interventions are essential.

**What effects
does noise have
on your well-
being during
ICU shifts?**

Let's share!

<https://www.menti.com/al8o99pq8ry3>



SCAN ME!





Thank You!

**Let's design ICUs where alarms
save lives, not steal attention.**

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BAICN
British Association
of Critical Care Nurses