The psychological burden of Hospital noise on healthcare workers: Evidence from intensive care units at Mohammed VI university hospital, Morocco

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Abstract:

Noise pollution within intensive care units is a major environmental issue, documented for its delirious effects on the care quality and patient well-being. However, it specific repercussions on the mental health of healthcare professionals remain understudied. The present study , conducted at the Mohammed VI university Hospital in Oujda , aimed to evaluate noise levels , identify their primary sources , and analyze their psychological impact on 84 healthcare professionals .a mixed-methods approach was used ,combining objective acoustic measurements via a sound level meter with a subjective evaluation using a questionnaire , which included the depression , anxiety , and stress scale (DASS-21). The study's findings reveal that average noise levels in the intensive care units (50.8 dB(A) to 60.3 dB(A)) systemically exceed the world health organization's recommendations .Alarms from medical equipment (84 responses) and patient cries (64) are identified as the predominant noise sources. The analysis of psychometric data showed a significant correlation between the intensive care unit department and depression symptoms among caregivers (p=0.044) and depression (p=0.033). Scores are more pronounced in female staff , suggesting an increased psychological vulnerability .These conclusions highlights the urgency of developing targeted prevention and intervention strategies to improve the sonic environment and preserve the mental health of caregivers in these critical settings.

Keywords: noise pollution; intensive care units; healthcare providers; mental health.

1. Introduction

The sound environment of intensive care units (ICUs) is characterized by a persistent and often intense level of noise, generated by medical equipment, alarms, and routine care activities. Chronic exposure to this acoustic pollution can have detrimental effects on individual's physical and mental health, including auditory impairment, cardiovascular issues, and psychological conditions such as anxiety and depression. Indeed, noise is a chronic stressor capable of impairing concentration, inducing increased cognitive fatigue, and heightening the risk of medical errors. Research has highlighted significant links between exposure to hospital noise and the onset of sleep disorders or even depression among healthcare providers (Kebapcı & Güner, 2021; Yang et al., 2025).

This issue is particularly concerning in ICUs , where rapid decision-making and constant vigilance are crucial for patient survival .The world Health Organization (WHO) sets noise thresholds for hospital environment at 30 dB (A) during the day and 25 dB(A) at night in patient care areas (Berglund, 1999), values that are rarely respected in clinical practice. Studies in the ICU setting show that these thresholds are frequently exceeded, sometimes reaching peak sound levels of 80 to 90 dB, particularly during alarms or invasive procedures (Darbyshire & Young, 2013; Lee & SONG, 2024). A recent study revealed that sound levels in intensive care units exceed recommended limits 75% of the time (Lee & SONG, 2024), creating a noisy, stressful, and potentially pathogenic work environment for caregivers.

This study aims to evaluate the prevalence of noise pollution in five intensive care units at the Mohammed VI University Hospital in Oujda, and to quantify its effects on the well-being of the healthcare staff. The specific objectives are to: (1) measure diurnal and nocturnal sound levels: (2) identify the noise sources most perceived by the staff ; and (3) analyze the correlation between noise exposure and levels of stress , anxiety , and depression among caregivers.

2. Materials and Methods

2.1 Study setting

The study was conducted at the Mohammed VI University Hospital in Oujda, Morocco, within the general, burn, neonatal, pediatric, and maternity intensive care units.

2.2 Population and sample

The study included 84 voluntary healthcare staff members (nurses and physicians) who had been working in the target departments for at least six months. Convenience sampling was used due to the logistical constraints of the hospital environment.

2.3 Data collection

Data were collected between March and June 2025 using a self-administered questionnaire and objective physical noise measurements.

Acoustic measurements were performed using a TESTSL01 sound level meter, which was used to measure precise average sound levels in decibel (dB (A)) during both diurnal and nocturnal periods. Measurements were taken at a distance of more than 3 meters from fixed sources, and the device was calibrated before each session.

Information from healthcare providers was collected through a structured questionnaire with four sections. These sections were designed to gather sociodemographic data (sex, age, years of

experience, department),staff's perception of noise, the effects of noise on performance and sleep, and scores from the Depression, Anxiety, and Stress Scale (DASS-21) (Lovibond & Lovibond, 1995). This widely recognized and validated psychometric tool consists of 21 self-administered items, divided into three distinct seven-item-sub-scales for Depression, Anxiety, and Stress. The scale measures the severity and frequency of emotional and physiological symptoms experienced over the past week. Participants rate each item on a 0-to-3 Likert scale, and the scores are then used to provide an objective and standardized quantification of psychological distress among staff.

2.4 Statistical analysis

Data were analyzed using Microsoft Excel and SPSS software (version 25.0).Frequencies and percentages were calculated for descriptive variables. Correlation analyses were perfumed using the Fisher-Haltonexact test, with a significance level set at $p<0.05$.

3. Results

3.1 Sample characteristics

The sample of 84participants was predominantly female (58.3%) and consisted mainly of nurses (67.9%).The most represented age group was 25-35 years old (59.5%), and the majority of the staff had between 1 and 5 years of seniority. The distribution of participants by department is detailed in Table 1.

Table 1. Sociodemographic and professional characteristics of participants

Characteristic	Category	N (%)
Gender	Female	49 (58.3%)
	Male	35 (41.7%)
Age Group	20-24 years	12 (14.3%)
	25-35 years	50 (59.5%)
	>35 years	22 (26.2%)
Profession	Nurse	57 (67.9%)
	Physician	27 (32.1%)
Seniority	<1 year	16 (19.0%)
	1-5 years	48 (57.1%)
	>5 years	20 (23.8%)
Department	General ICU	25 (29.8%)
	Burn ICU	15 (17.9%)
	Neonatal ICU	18 (21.4%)
	Pediatric ICU	14 (16.7%)
	Maternity ICU	12 (14.2%)

3.2 Acoustic measurements and noise perception

Objective day and night measurements in the various intensive care units revealed from 50.8 dB (A) to 60.3 dB (A), with a significant peak at night in the polyvalent intensive care unit (60.3dB (A)).See Figure1.
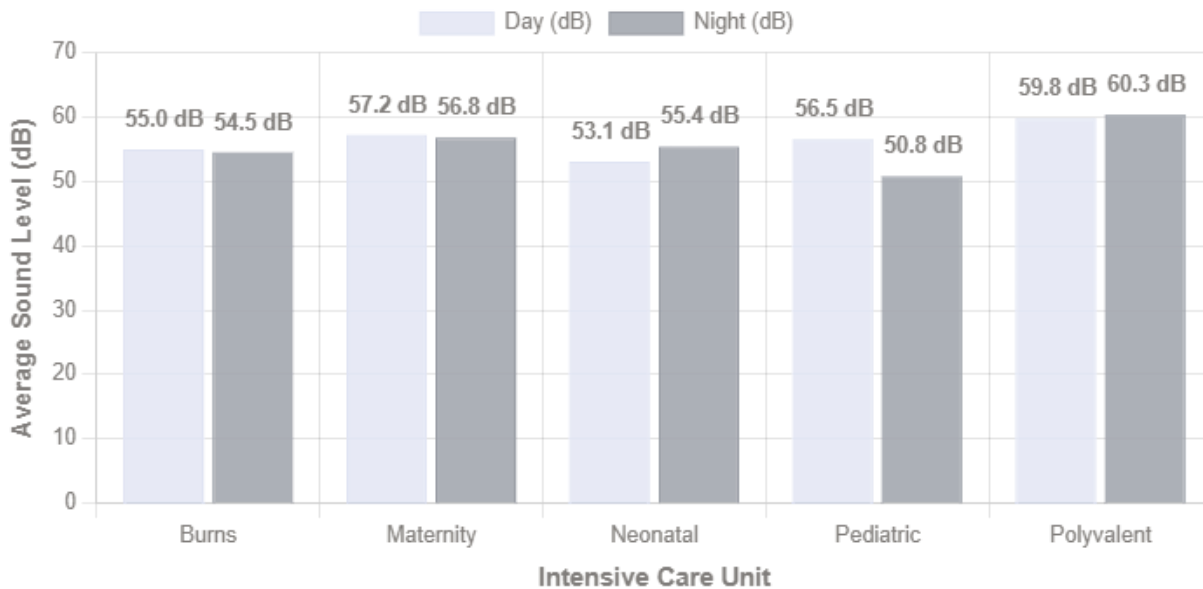
Figure 1. Average sound levels by intensive care department at Mohammed VI University Hospital (dB).

The analysis of noise of perception indicates that alarms (84 responses) are the most bothersome noise source, followed by patient cries (64) and discussions among colleagues (52). See Figure 2.
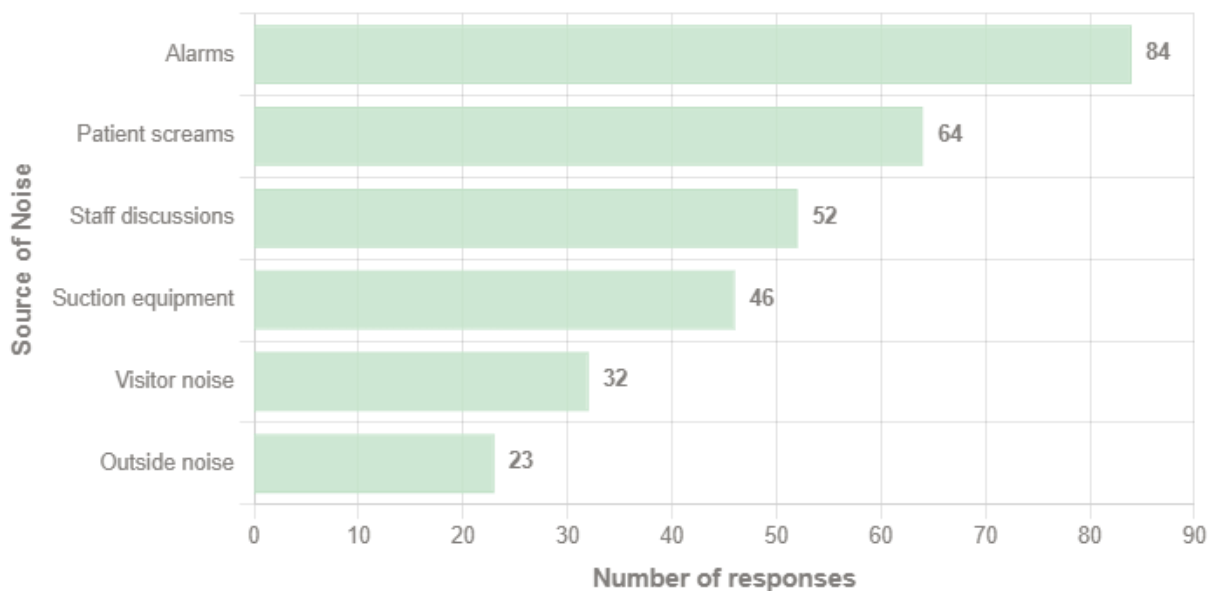

Figure 2. Most perceived noise sources in intensive care units at Mohammed VI University Hospital.

Healthcare professional perceive noise as a significant nuisance. Over 65% of respondents rated, the noise as "bothersome" or "very bothersome" and none considered it "acceptable".
The perception of noise ubiquity was also strong, with 63 out of 84 healthcare workers perceiving it "very often."

3.3 Effects on Staff Well-being

Noise exposure affects both professional performance and sleep. Table2 presents the details of the average scores for these impacts.
Table 2. Impact of noise on Staff performance and sleep.

Perceived Effect	Mean	Median
Noise affects my ability to make decisions	2,06	2,00
Noise makes communication difficult.	2,35	2,00
Noise slows my reactivity in emergency situations	2,33	2,00
Noise affects my sleep after work	2,86	3,00

3.4 Levels of stress, anxiety, and depression

The analysis of DASS-21 scores indicates a high psychological distress prevalence. The distribution across hospital departments reveals significant disparities. The neonatal intensive care unit (NICU) shows the highest rates of severe to extremely sever stress, anxiety, and depression, at 55%, 65%, and 55%, respectively. In contrast, the maternity intensive care unit exhibits the lowest rates.

A comparison of the distribution of stress, anxiety, and depression levels between men and women indicates a greater vulnerability among women. Scores for "sever to extremely severe stress were nearly four times higher in women than in men. Similarly, the proportion of women with "sever to extremely severe" anxiety and depression scores was significantly greater than that of men, suggesting a higher psychological burden among female staff.

Table 3. Results of statistical correlation tests

Analyzed Correlation	Fisher-Freeman-Halton Test (p-value)	Interpretation
Stress vs. Department	0,059	Not significant
Anxiety vs. Department	0,054	Not significant
Depression vs. Department	0,044	Significant
Anxiety vs. Gender	0,149	Not significant
Depression vs. Gender	0,033	Significant
Stress vs. Gender	0,040	Significant

Statistical tests confirmed a significant correlation between depression levels and the intensive care unit (p=0.044), as well as between the gender of caregivers and the presence of both stress (p=0.040) and depression (p=0.033) (Table 3).

4. Discussion

The measured sound levels in the intensive care units of the Mohammed VI University Hospital Center are comparable to those documented in the international, literature where values commonly exceed 50 dB (A) (Venhard et al., 1997). The peak of 60.3 dB (A) recorded at night is all the more concerning as it occurs during a period meant to promote patient rest and recovery , but which also effects staff. These results confirm the role of noise pollution as an occupational stressor, which impairs decision-making and communication, two functions essential to patient safety (Vreman et al., 2020).

The identification of alarms and discussions as primary noise sources is consistent with research by Darbyshire et al and Kalfon et al (Darbyshire & Young, 2013; Kalfon, 2010). The predominance of alarms highlights a technological dependence that, without adequate prioritization, generates chronic stress and staff desensitization .Discussions between colleagues, although essential for collaboration;

contribute significantly of the soundscape, suggesting the need for awareness regarding discreet behavior.

Analysis of DASS-21 scores revealed high levels of stress, anxiety, and depression, particularly within the neonatal intensive care unit. Fisher-Freeman-Halton's test, while not significant for stress and anxiety by department ($p>0.05$), showed as statistically significant association with depression ($p=0.044$). This suggests that while noise may be a diffuse stressor and anxiety factor, it could play a more direct role in the development of depressive disorders, possibly due to long-term professional burnout. It is worth noting that Moroccan healthcare staff are increasingly predominantly female, a relevant factor for this analysis .The increased vulnerability of women to stress and depression, as observed in our study, is widely documented and may be linked to hormonal and sociocultural factors (Altemus et al., 2014; Liu et al., 2021).

This study has limitations inherent to its methodology. The cross-sectional design prevents the establishment of a formal causal link between noise exposure and psychological distress. The self-administrated nature of the questionnaire may introduce a subjectivity bias. Finally, while the sample size is relevant, it does not allow for complete generalization to all university hospitals in the country.

Conclusion

In conclusion, this study highlights the significant impact of noise pollution on the well-being of healthcare personnel in intensive care. The measured sound levels are unsafe and contribute to stress, anxiety and depression among staff, with repercussions on their performance, sleep and the quality of care.

To address this situation, we highlight the need for: a) improving the sound environment by installing sound-absorbing materials (acoustic panels, curtains), reducing alarm volume by prioritizing them, and integrating visual alerts; b) awareness and training by organizing training sessions for staff on the effects of noise and promoting more discreet communication practices and calmer behavior within the team; and b) psychological support by offering appropriate psychological counseling and stress management workshops for healthcare providers , particularly those in the highest-risk departments.

These targeted actions are essential to preserve the physical and mental health of caregivers and to improve the quality of life and safety of patients in intensive care.

The present study, by its approach combining a quantitative evaluation of sound level with a subjective analysis of its effects on healthcare providers, not only corroborated the conclusions of the international literature but also established the relevance of this issue in the specific context of the Mohammed VI University Hospital of Oujda. By quantifying the psychological and cognitive effects of noise using validated scales such as the DASS-21, it provided a concrete demonstration of the effectiveness of this methodological approach in highlighting an increased vulnerability among female staff.

This work thus constitutes a solid foundation and opens the way for multiple research perspectives. Future studies could adopt a longitudinal approach to establish more precise causal relationships between sound exposure and its long-term clinical consequences, while also evaluating the effectiveness of noise mitigation strategies. A promising research avenue would also consist of correlating noise pollution with indicators of clinical performance and medical errors, thereby enriching the understanding of noise's impact not only on the well-being of caregivers but also on patient safety.

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