

## Research Article

# Noise in the Operating Room: A Prospective Study in Mohammed V Military Hospital, Rabat

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## Introduction

The noise is defined as disagreeable and unwanted sound. Environmental noise pollution is contemplated as general stressor, augmenting mental stress, favors the development of cardiovascular disease and hearing loss [1,2].

The noise effects in the Operating Room (OR) were first noticed in the 1970's. In 1972, Shapiro and Baland [3] recorded noise levels in the OR and found that he is equaled the noise of a freeway. They defined noise in the OR as "third pollution" and thereby equated noise with air and water pollution. Since then, the noise is considered as a major problem in the OR like sterilization and air pollution, furthermore, scientists focused on studying noise levels, his effects on both patients and staff, also, they studied the ways we can decrease high noise levels in the OR and respect WHO threshold.

## Abstract

**Introduction:** The article delves into an in-depth analysis of the noise levels within the Operating Rooms (OR) at the Military Hospital of Rabat. It emphasizes the significance of a quiet environment during surgical procedures for the well-being of patients and the focus of the surgical team.

**Materials and Methods:** The study conducted at the Military Hospital of Rabat involved comprehensive monitoring and measurement of noise levels within the OR. Data collection methods, which included the use of a sonometre, were employed to assess the sources and intensities of noise.

**Results:** The study included 30 patients. Among the various noise sources examined, the most notable contributors were the instrument boxes and the ventilators. These sources consistently reached peak noise levels of 78 decibels (dB).

**Discussion:** The article discusses the various sources of noise in the operating rooms, ranging from equipment alarms and background chatter to the clinking of surgical instruments.

It delves into the potential impacts of noise on patient outcomes, including increased stress levels and the potential for communication breakdowns among surgical staff. The discussion also covers strategies and technologies employed to mitigate noise, such as soundproofing materials and innovative communication systems.

**Conclusion:** this study underscores the critical importance of managing noise levels in the operating rooms in our hospital. It emphasizes that reducing noise can enhance patient safety and surgical team performance.

**Keywords:** Noise; Operating room; Patients; OR staff; Noise reduction program

These days, high noise levels in the OR are frequent and exceed the threshold of 30dB fixed by World Health Organization [4], the American occupational Safety, and Health Administration Standard [5]. Nevertheless, noise levels in operating rooms have been shown to be high [average 50-75 dB, maximum peak 80-120 dB] and exceed the WHO levels [3].

Noise pollution in the OR affect in a negative way patient's safety and staff well-being [6]. Patients are vulnerable to high noise levels because of their situation in the hospital that's made it hard for them to deal with stress [7]. Moreover, the high noise levels especially the impaired communication impacts negatively the OR staff performance [8-10]. The purpose of our study was to register the noise levels in the operating rooms of our hospital in the induction phase of general anes-

thetia, the main sources of noise, the effects of noise on patients and staff, and the means of prevention.

**Materials and Methods**

This descriptive quantitative and observational study took place in the operating rooms of the Military training hospital Mohammed V –Rabat.

All the operating rooms were included: 2 orthopedic operating theatres, 1 neurosurgery, 1 ophthalmology, 1 stomatology, 1 ENT, 2 visceral surgery, 1 thoracic surgery, and 1 gynecology-obstetrics. 10 operating rooms were included in this study, with collection of data for one week. The emergency operating room is excluded.

The measurements were done with a phone application named Sonometre. The sound level meter was placed preoperatively 1.5 m above the ground and 2 m from the anesthesia unit toward the surgical field, taking care to maintain the surgical area’s sterility and not disrupt the surgical procedure. Measurements were performed on weekdays.

To register noise, we divided the operating rooms into three areas:

-First area: near the tables containing surgical instruments, we measured the noise coming from instruments, conversations, and phones rings.

-Second area: near the respirator and scope, we measured the noise of the alarms.

-Third area: all the room, the Sonometre is placed in the room’s corner and measures all the noise.

When the patient arrives, we start general anesthesia induction in the presence of physician anesthesiologist and the nurse, in the same time the surgical team prepares the surgical boxes and operating table. Also, we verify his medical folder and identity. The monitoring is installed and the venous line is taken.

Trainees and residents are always present at the moment of induction.

**Results**

The number of people present in each room varies between 6 and 10 persons, with a total of 30 patients concerned by the study. The median room noise level measured was 65 dB and the maximum noise level reached 68,5 dB.

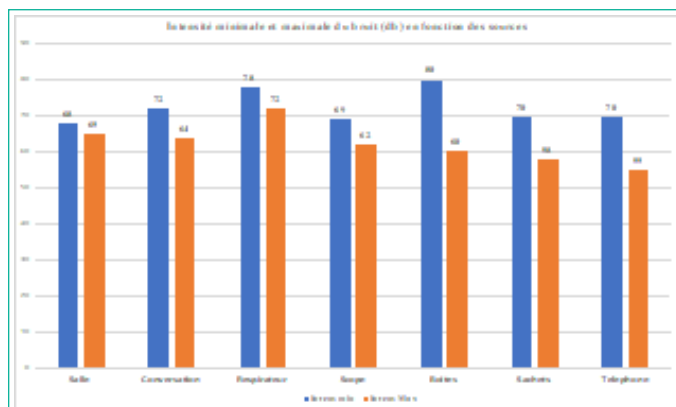
The noise emanating from instrument boxes (78dB) and ventilator (78 dB) were the highest, and the lowest noise levels were coming from phones (55 dB) and the opening of the bags (58 dB) (Figure 1).

In addition, the conversation between staff generates moderate noise level (72 dB) (Figure2).

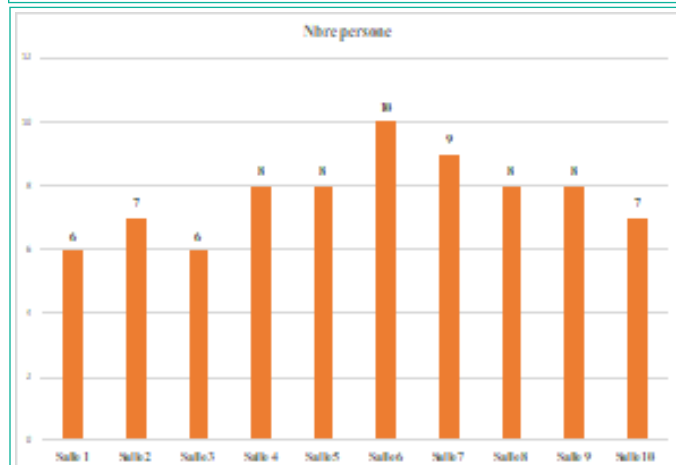
22 patients recalled the induction phase, especially the noise that comes from ventilator and scope alarms and conversation between staff, furthermore, 3 patients (10%) rated the annoyance of the noise as very high, however, 5 patients werenot at all bothered by the noise (Figure 3).

**Discussion**

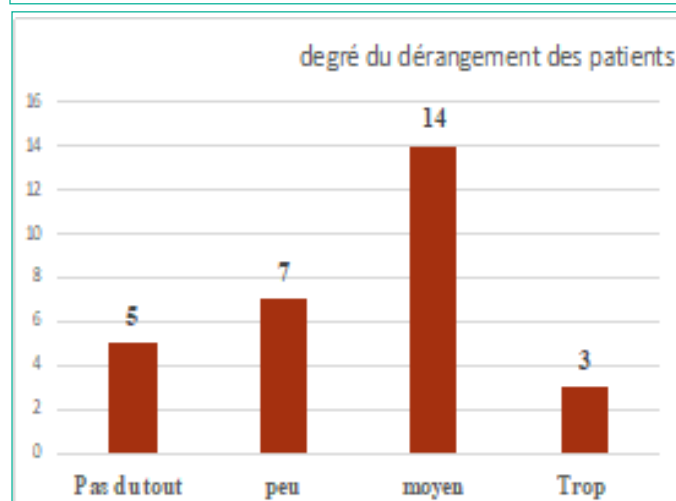
Noise is unwanted sound considered unpleasant, loud, or disruptive to hearing.



**Figure 1:** Minimum and maximum noise intensity depending on the sources.



**Figure 2:** Number of people per room.



**Figure 3:** degree of patients disturbance.

Operating Rooms (OR) are noisy environments with noise pollution levels that regularly exceed the maximum of 55 dB noise limit for task requiring high mental concentration.

In several studies the median levels of noise varies between 51 and 75 dB, and the maximum peak varies between 80 and 119 dB [7,10-14]. The noisiest room was orthopedic surgery, and the noisiest period proved to be induction of anesthesia [14-16].

In literature, the most frequent sources of noise were opening instrument boxes, moving trolleys, Ventilator and scope alarms, Doors opening, metal tools, conversation between staff, and suction.

Staff-related activities are proved to be the noisiest source in the OR [9,14-18], especially surgical instruments and alarms

[19], finally, Christensen and al. [17], revealed that the noise levels increase if the number of staff present in the OR increases.

Hasfeldt and al. found that 10% of the patients rated the noise level as very high in the OR [20]. In our study, the average noise intensity in the Operating Room (OR) was 65.5 dB and a Maximum peak at 68.5 dB, which is very high in comparison with WHO recommendations (30dB) and the American Occupational Safety, and Health Administration Standard [3,4]. The results of our study remain satisfactory in comparison with the literature.

In our study we found that the sources of noise were instrument boxes, ventilator and scope, conversation between staff, opening of the bags, and phones.

The noise emanating from the instrument boxes and ventilator was the highest, and the lowest noise levels were phones and the opening of the bags. In comparison with literature, we conclude that the main noise sources are instrument boxes, alarms and conversations between staff, but noise levels in our study remain lower than literature.

In our study we found that 73% of the patients recalled the induction phase, and 10% rated the annoyance of the noise as very high, in comparison with literature, Hasfeldt et al. found the same results.

Noise is considered as a general stressor that can impact a patient's autonomic nervous system, leading to an increase in blood pressure and heart rate, this physical reaction provokes a psychological stress response [14,21-23]. Furthermore, high noise levels proved to be correlated to surgery site infection, this can be explained by the distraction of the surgeons in a noisy environment [24-26]. Moreover, the need for anesthetic drugs is increased with the increase of noise levels [27]. Finally, exposure to high noise levels in the OR could cause hearing damage to both patients and OR staff [28].

Noise pollution is not suitable for optimal performance of the OR staff, it's been proved to cause more errors, irritation and stress, reduced auditory performance, and interfere with communication. Moreover, noise pollution leads to exhaustion, elicits physical and psychological stress response and impairs cognitive performance [29].

Noise induced hearing damage of OR staff, especially orthopedic surgeons with a prevalence of 50% [30,31].

In the literature we found that the reduction of concentration and performance of the OR staff was associated to impaired communication, consequently, the surgeons and anesthesiologists need to raise their voice to communicate, which increases the noise levels even more [9,10,16,32,33]. This failure of communication increases the rate of patients' complications, especially the surgery site infection [25,29].

In a study led by Tsiou and al. he found that anesthesiologists are more affected by noise than other OR staff, this can be explained by the fact that anesthesia induction phase is the noisiest period [9]. Noisy environment reduces anesthesiologist's mental efficiency and short-term memory, and more importantly, noise exposure decreases their speed to react to patients' changes [29]. Finally, staff workload levels significantly increase with the increasing of noise levels [34]. To fight against noise pollution and prevent its harmful effects, several measures can be established:

Noise reduction program [35] can reduce noise by 50%, and post-operative complication rate. Moreover, the program reduces salivary cortisol by 20% as well as electro-dermal potential peaks indicative of stress by 60% of the surges.

Noise reduction program consisted of a comprehensive educational program directed at all staff members, including discussions about noise pollution and the impact of noise on patients and the working environment. In addition, the program provided suggestions for modifying the behavior causing the most frequently occurring noises.

Intra-operative music proved its beneficial effects on reducing the negative impacts of noise pollution. Several studies proved that music through headphones decreases unwanted noise pollution for both patients and OR staff [36]. and finally, inventing quieter surgical equipment in the future, can reduce noise levels in OR [34].

## Conclusion

Noise pollution in operating theaters is a problem that exists all over the world hospitals, however, most studies discuss noise levels in OR without focusing on the negative effects and the measures to prevent it. Future studies should focus on how we can reduce noise levels and prevent its negative impacts on both patients and OR staff.

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