



# Occupational Noise Exposure in a South Jersey Pediatric Dental Setting

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## Introduction:

In the United States, hearing loss is the third most common chronic physical health condition according to the NIOSH.<sup>3</sup> Amongst those with hearing loss, 1 in 4 are due to occupational exposure.<sup>3</sup> In a systematic review, 82% of the studies found a positive correlation between hearing loss and dental personnel, with more years of experience being the greatest risk factor.<sup>4</sup>

Throughout the day, pediatric dentists are exposed to various sources of loud sounds such as the high speed suction, handpieces, isolation devices with high speed evacuation systems, as well as varying noise levels from patient cries and screams, all of which present a risk for hearing loss.<sup>5</sup>

OSHA states that a time-weighted average exceeding 85 dBA requires implementation of a hearing protection program.<sup>3</sup> However, the World Health organization suggests, noise should not exceed 75 dBA in order to avoid any risk of hearing impairment.<sup>7</sup> According to the American Public Health Association's Policy on Noise as a Public Health Hazard, even moderate noise levels are known to cause non-auditory effects such as sleep disturbance and decrease in morale.<sup>6</sup>

The aim of this study was to understand just how much noise pediatric dentists are exposed to on a daily basis. This study is essential to determine if personal protective equipment for dentists may begin to include noise canceling earbuds to protect from long term health effects. By investigating noise levels in the pediatric dental office we can help to provide a more comfortable and satisfactory work environment for all dental personnel exposed to sounds that exceed the threshold set by OSHA on a daily basis.

## Methods:

In this cross-sectional study, a sound level meter was employed to record noise levels in various treatment settings. A sound level meter was placed in each treatment setting (private operative treatment room, open hygiene bay, private exam room, and sedation room) for four to six days each. Each day will consist of morning sessions (8:00 am-12:30 pm) and afternoon sessions (1:30 pm-4:30pm).

The sound level meter was placed on a tripod mount within 2 feet of the operator and 4 feet above ground to approximate ear level when sitting and the meter was left stationary throughout recording. Location for tripod positioning was marked to ensure repeatable positioning for each day. This positioning is determined by OSHA Technical Manual Section 3 Chapter 5 that states SLM should be placed within the operator's hearing zone which is defined as a 2-foot sphere surrounding the operator's head.

In the open hygiene bay the sound level meter was placed in the same dimensions from the operator of the chair that is at the halfway point of the area. Sound level meter recorded baseline sound for one night in each setting to obtain control sound level readings. The sound level meter was set to the A-weighted slow setting as indicated by OSHA guidelines for measuring sound levels at the workplace and will record data at 30 second intervals.

## Figures:

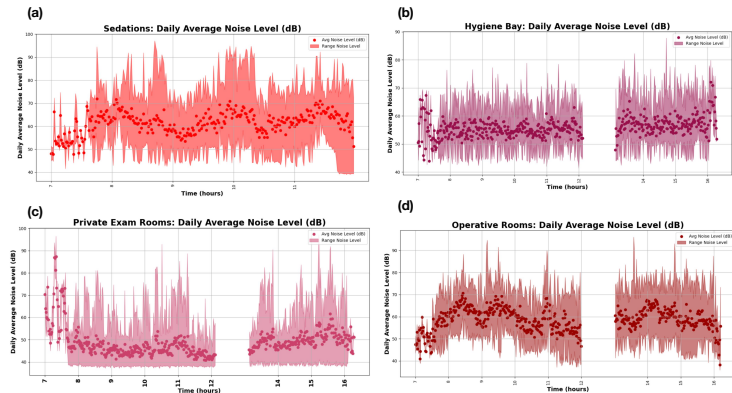


Figure 1. Multiple-day recorded noise levels (dB) ranges throughout the workday in four different treatment settings, as well as expected averages (a) sedations, (b) hygiene bay, (c) private exam rooms and (d) operative rooms.

## Distribution of Noise Levels (dB) Across Treatment Settings

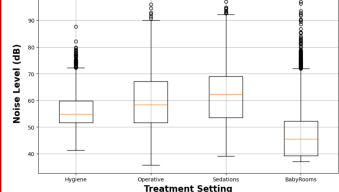


Figure 2. Total noise level (dB) data distribution for all four different treatment settings.

## Results:

Four to six morning and afternoon sessions were recorded for each treatment setting with the exception of sedations which are only performed in the morning. Recordings were taking every 30 secs at an A-weighted decibel setting on the sound level meter.

Comparative analysis using an ANOVA test was utilized yielding  $p < 0.001$  amongst treatment groups. Turkey's HSD test was utilized to determine the difference amongst each of the treatment groups specifically which demonstrated that the greatest difference was amongst the private exam rooms and sedations with a difference of 14.08 dB with a  $p < 0.001$ . Sedation rooms having the overall highest noise level with average of 2.78 dB and 6.13 dB ( $p < 0.001$ ) louder than operative and hygiene, respectively.

The mean sound level was highest in sedation treatment rooms at 62.12 dB and lowest in baby rooms at 48.04 dB with a standard deviation of 10.07 dB in sedation and 6.47 dB in the hygiene bay.

As a percentage of time compared to OSHA standards, sedation rooms had 21.60% of the time above 70 dB, hygiene 2.51% of the day, operative 15.40% and private exam rooms only 4.25% of the day.

The maximum noise level was 97.1 dB and was obtained in both sedation treatment rooms and private exam rooms, followed by 96.0 dB in operative and 87.7 dB in the hygiene bay.

## Conclusion

This study demonstrates the variation in noise levels throughout various treatment settings. OSHA's 8-hour noise level standard states workplace exposure should not exceed a time weighted average of 85 dB. While the collected data does not demonstrate that exceed the occupational noise level limits we can determine that noise levels vary significantly between treatment settings.

Sedation treatment rooms demonstrated the highest noise levels with 21% of the time above safe levels of 75 dB. While these levels do not necessitate auditory protection according to OSHA, they do exceed levels considered to be safe and emphasizes the need to further consider the long term effects of occupational noise exposure for dental professionals. The WHO states that sounds over 75 dB can be known to cause hearing impairment, indicating that although dental offices are in compliance with OSHA standards, levels experienced by dental personnel likely do have an effect on long term hearing damage.

It is important to note a significant limitation is that sound level meters are designed to detect noise in the environment but do not follow the provider throughout, indicating that between patients the sound level meter continued to record even when there was no provider or patient in the room. Further research is needed using wearable devices such as noise dosimeters in order to more accurately determine the exposure of each particular provider throughout the day.

Setting 1	Setting 2	Mean Difr. (dB)	P-value adj.	Lower Difr. (dB)	Upper Difr. (dB)	Reject
Private exam	Hygiene	7.9575	0.0	7.4288	8.4863	True
Private exam	Operative	11.3004	0.0	10.7986	11.08021	True
Private exam	Sedations	14.0834	0.0	13.515	14.6518	True
Hygiene	Operative	3.3428	0.0	2.8411	3.8445	True
Hygiene	Sedations	6.1258	0.0	5.5575	6.6942	True
Operative	Sedations	2.783	0.0	2.2397	3.3264	True

Table 1. Turkey-HSD: Multiple Comparison of Means

## References:

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