



Journal of **Medical and oral**
biosciences

ISSN (Online): 3007-9551

ISSN (Print): 3007-9543

JMOB
Open Access DOAJ

Research Article
Published: 10/ 05 / 2024

Evaluating the Effect of Acoustic Noise Pollution in Dental Clinics

Sarah Kh.Taha^{1*} 

¹ College of dentistry, Al-Iraqia University, Baghdad, Iraq

ORCID  <https://orcid.org/0009-0006-7910-2844>



OPEN ACCESS

ARTICLE INFO

Received: 25/ 03 / 2024

Revised: 15/ 04/ 2024

Accepted: 06/ 05 / 2024

Publish online: 12/ 05 / 2024

* Corresponding Author : Sarah Kh.Taha

Email: Sarah.Kh.taha@aliraqia.edu.iq

 <https://orcid.org/0009-0006-7910-2844>

CITATION

Sarah Kh.Taha. (2024). Evaluating the Effect of
Acoustic Noise Pollution in Dental Clinics.
JMOB. 1; (1): 09-17.

DOI: <https://doi.org/ 10.58564/jmob.19>

COPYRIGHT



© 2024 Sarah Kh.Taha

This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY-SA 4.0). The use, distribution or reproduction in other forums is allowed, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

Abstract

Dental professionals, especially in teaching dental clinics, face acoustic noise produced by the use of dental equipment by many users simultaneously. This study is designed to evaluate the effect of acoustic noise in dental clinics and its effects on dentists' daily work. A study designed as a comprehensive questionnaire for a group of dentists working in dental clinics. The questionnaire proposed to include many questions for ordinary dealing with pollution during their daily occupation. The responses of the participants were collected and analyzed, and the results were displayed as percentages. The results of this study revealed that 75.4% of respondents indicated the presence of noise sources within the hospital. Moreover, approximately 48.5% of the answers indicated that medical machinery and equipment sounds are the most influential source. At the same time, the respondents suffered from various symptoms during their job attendance in the hospital, with the highest percentage, 31.5%, for excitement and nervous tension as the first symptoms resulting from acoustic noise. Consequently, a high percentage, 49.2%, of respondents indicated that their ability to work was greatly affected by noise. However, approximately 39.2% of respondents indicated scarcely any effect of noise on their workability. In conclusion, this study approved the presence of acoustic noise in dental clinics and its effects on the ability of dental professionals during their routine daily work. This research has established a set of solutions to help reduce noise's effects. The author recommends more future studies in different dental clinics to evaluate their environment from different aspects in order to introduce suitable solutions.

Keywords: Clinic, dental, Noise Pollution, medical machinery

Introduction

Like many other professions, dentistry has unique risks and rewards. Every time a patient or member of the dental staff enters the clinic, they are taking a risk. While some of these risks cannot be avoided, others are unavoidable. Given the significance and diversity of dental professionals' health, there is much knowledge regarding the possible risks associated with noise



exposure in dental offices since the development of high-speed dental drills in the late 1950s (1, 2). All members of society are now concerned about noise pollution. However, dental professionals are significantly affected because they work in an environment where noise pollution can cause noise-induced hearing loss (NIHL). Despite advancements in handpiece technology from micromotor to air-turbine handpieces, exposure to the noise produced by high-level air turbine handpieces over extended periods may be the most harmful for dentists today (3,4).

There are numerous noise sources in dental offices that can contribute to early hearing loss. These include high-pitched turbines, high-velocity suction, ultrasonic teeth and instrument cleaners, mixing devices, and trimmers. Both dental assistants and dentists are exposed to these noises to varying degrees. The impact of this exposure on dentists' hearing has been the subject of extensive research, with studies on the effects of dental drill noise yielding a range of conclusions (5, 6). Dental practitioners work with a range of equipment, each with its own noise level. According to Garner et al., (2002) (7) common sources of noise in a dental office include stone mixers, lab machines, ultrasonic scalers, ultrasonic cleaners, lab electromotor handpieces, high-speed turbine handpieces, low-speed handpieces, and angled-design turbine handpieces. These devices produce sound at levels between 66 and 91 dB. However, some researchers suggest that using air turbines can result in noise levels as high as 100 dB (8).

Dental professionals are subjected to sporadic noise exposure. The kind of scheduled treatments and the equipment used may impact the dentist's noise tolerance. Moreover, there may be a higher noise exposure with older equipment. A 100 dB louder sound may be produced by older drills (9). The maximum duration of exposure is lowered to two hours per day due to the increased intensity. According to Fabry's findings (10), the guidelines established by OSHA (Occupational et al. Act) and suggested by NIOSH (The National Institute for Safety and Health) are not exceeded by a typical dental office. However, hearing loss is still a possibility. According to Garner et al.,(2002) the authors' clinical background suggests enough anecdotal evidence to support the dental team's more proactive approach to hearing conservation (11,12). Review of literature regarding the research on noise pollution in dental clinics in Iraq reveals scarce publications, therefore this study designed to evaluate the acoustic noise pollution of dental clinic and its impact on health and workability of dentists.

Materials and Methods

A questionnaire form (Table. 1) was created that included a set of main questions regarding different aspects of acoustic noise pollution and its different impacts on dentists. The questioner form sent to dentists in different places in Iraq. These places were the Iraqi University/College of Dentistry, Al-Dahalik Health Center/Dental Unit, and Mosul University/College of Dentistry, The participant responses were collected and analysis for each question and the results were displayed as percentages.

Table. 1: shows the designed questionnaire form that used for evolution of acoustic noises in dental clinic.

The question	choices	Percentage of each question	Total number of participants
Do you complain while you are inside the hospital about noise sources?	• Yes • no • to some extent	• 75.4% • 8.5% • 16.2%	130
What are the most disturbing noise sources while you are in the hospital?	• The sounds of medical machines and equipment • Visitor voices • The voices of hospital staff • The sounds of the external and surrounding environment in the hospital	• 48.5% • 23.8% • 23.8% • 3.9%	
Do you suffer from one or more of the following symptoms while you are in the hospital?	• Hearing impairment • Irritability (excitement) and nervous tension • Headache and pain in the head • shortness of breath • Digestive disorders • Loss of focusing • Hypertension • I don't suffer anything	• 5.4% • 31.5% • 21.5% • 0.8% • 0.8% • 19.2% • 5.4% • 20.8%	
Is your ability to work affected by the noise level?	• Yes • No • To some extent	• 49.2% • 11.5% • 39.2%	

Results

The results of this study revealed a variation in response to the questions of the survey. The answer of the first question of the questionnaire, "Do you complain while you are inside the hospital from noise sources?" and the answers indicated approximately 75.4%, and 16.2% with noise and to some extent respectively (Figure. 1). While only 8.5 answered no for complaining from hospital inside noise sources.

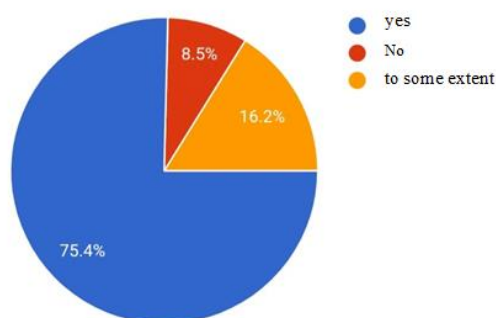


Figure 1 : Shows the percentages of respondents for the question "Do you complain while you are inside the hospital from noise sources?"

The results of this study answered the second question which asked about the most disturbing noise sources while you are in the hospital. Approximately 48.5% of the answers indicated that the sounds of medical machinery and equipment are the most influential source, followed by approximately 23.8% of the answers that referred to the hospital workers' voices and the visitors' voices as another source of noise. The sounds of the external and surrounding environment in the hospital were also considered as sources of noise, but at a lower rate (Figure. 2).

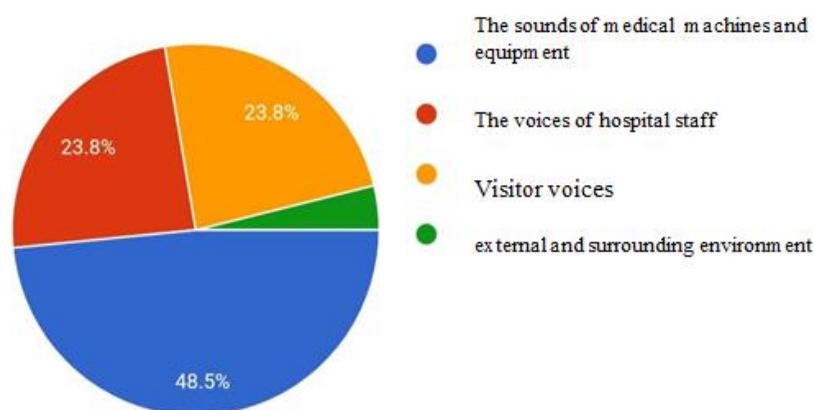


Figure 2 :Shows the percentages of respondents for the question " What are the most disturbing noise sources while you are in the hospital?"

The results also showed the percentages of participant to the question "Do you suffer from one or more of the following symptoms while you are in the hospital?". The highest percentage of responses, approximately 31.5%, indicates that excitement and nervous tension are the first symptoms resulting from noise, then followed by symptoms of headache and head pain by 21.5% and loss of focusing by 19.2% among hospital workers. In addition, other symptoms showed lower rates such as distress in breathing, digestive disorders, and high blood pressure (Figure.3).

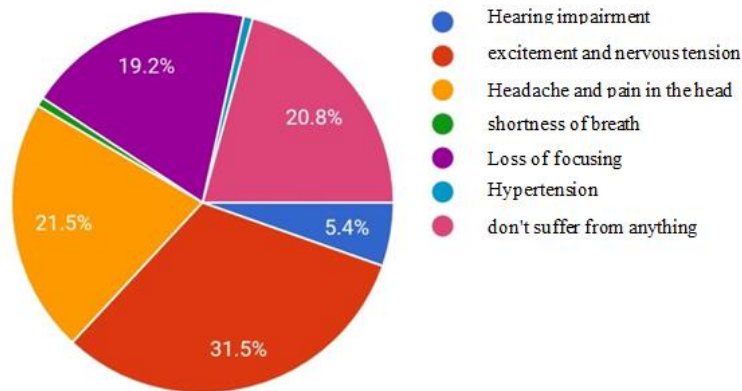


Figure 3: Shows the percentages of respondents for the question " Do you suffer from one or more of the following symptoms while you are in the hospital?"

The responses for the last question " is your ability to work affected by the noise level? , revealed a very high percentage of the answers, approximately 49.2%, indicated that their ability to work was greatly affected by noise, while approximately 39.2% were affected by a small percentage of noise, and a very small percentage indicated that noise did not affect their work efficiency (Figure (4)

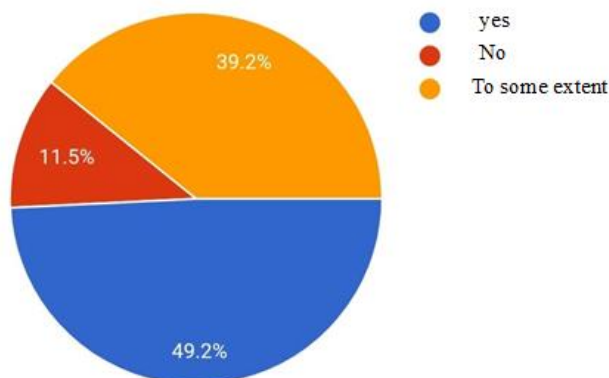


Figure 4: The results of the question " is your ability to work affected by the noise level?"

Discussion

This study's findings regarding dentists' responses to hospital noise sources are compatible with previous research in healthcare settings (12), who study the patients perceptions of sound and acoustic noises in dental clinic. In this study, the high percentage of dentists (75.4%) indicating complaints about noise within the hospital is consistent with studies across various medical specialties, which have consistently reported noise as a prevalent issue in healthcare environments (13, 14). These findings reverberation the distresses raised by both patients and healthcare professionals about the adverse effects of noise on patient comfort and staff productivity. Moreover, 16.2% of dentists indicated complaints to some extent, further emphasizing the nuanced nature of responses to hospital noise. While less obvious than the majority, this subgroup still believes the impact of noise to some degree. These observations agree with previously reported study that showed the variation in responses underscores the complex interplay of individual perceptions and tolerance levels regarding environmental factors such as noise (12). Conversely, the smaller group of dentists (8.5%) responding negatively to complaints about hospital noise sources is also important.

While this group is minor, their viewpoint is not insignificant. In fact, it gives a distinctive chance for further research. Understanding the causes behind their lack of criticism may provide valuable insights into factors such as cultural differences, coping mechanisms, or acceptance of noise as a normal aspect of hospital environments, and these results are compatible with previously published research (15). They mentioned that understanding could potentially lead to more effective strategies for managing hospital noise and improving patient care.

The results of the present study also showed the most disturbing noise sources in hospitals. These results agree with previous research in healthcare environments (15). The significant proportion of respondents (48.5%) identifying medical machinery and equipment as the most influential source of noise agrees with existing literature that highlighting the presence of these sounds in clinical building. Medical apparatus such as ventilators, monitors, and infusion pumps produce continuous noise that can be disruptive to patients' rest and recovery, as well as to the working environment for healthcare providers. Likewise, the acknowledgment by approximately 23.8% of respondents that hospital workers' voices and visitors' voices contribute to noise pollution underscores a well-documented issue in hospitals (16). The conversations among staff and visitors, while necessary for communication and social interaction, can contribute to overall noise levels, particularly in busy areas such as hallways and waiting rooms (15, 16). The consideration of external and surrounding environmental noises as sources of disturbance, albeit at a lower rate, is consistent with broader research on hospital noise. Factors such as construction work, traffic, and ambulance alarms can infiltrate hospital environments, further contributing to overall noise pollution (15). These findings highlight the multifaceted nature of hospital noise and the diverse array of sources that contribute to it. Understanding the specific sources of noise observed as most disturbing by hospital residents is crucial for developing targeted interventions aimed at reducing noise levels and improving the overall patient experience and staff well-being. The findings of this study regarding the symptoms experienced by hospital workers due to noise exposure are compatible with previous research on the impacts of noise pollution in healthcare settings (17, 18). The highest percentage of respondents (approximately 31.5%) reporting excitement and nervous tension as a result of noise agrees with existing literature recording the psychological effects of noise on individuals. Continued exposure to high levels of noise can provoke stress, anxiety, and irritability, which can negatively impact both mental and physical well-being and hearing problem (17,18). Furthermore, the significant proportion of respondents (21.5%) experiencing symptoms of headache and head pain agrees with previous studies highlighting the association between noise exposure and physiological symptoms (19). Noise-

induced headaches are a well-documented phenomenon, with studies suggesting that loud and persistent noise can trigger or exacerbate headache symptoms in susceptible individuals (19). The reported symptoms of loss of focusing (19.2%) among hospital workers further highlight the cognitive impacts of noise pollution. Difficulty concentrating and reduced cognitive performance have been linked to exposure to high levels of noise, particularly in environments where concentration and attention to detail are crucial, such as healthcare settings and these results are compatible with previously reported studies (16, 17, 18, 19). While symptoms such as distress in breathing, digestive disorders, and high blood pressure showed lower rates of occurrence, their inclusion highlights the wide-ranging effects of noise on physical health. Research has demonstrated associations between noise exposure and respiratory problems, gastrointestinal issues, and cardiovascular conditions, emphasizing the widespread impact of noise pollution on overall health outcomes. The findings from the responses to the last question regarding the impact of noise levels on the ability to work are reliable with previous research on the effects of noise pollution in various work environments, including healthcare settings. The high percentage of respondents (approximately 49.2%) indicating that their ability to work was greatly affected by noise showing the significant impact of noise on job performance and efficiency among hospital workers. Likewise, the large proportion of respondents (approximately 39.2%) reporting some degree of impairment in work efficiency due to noise display the universal nature of this issue in hospitals. Noise-induced disruptions, such as difficulty concentrating, communication challenges, and increased stress levels, can compromise the ability of healthcare professionals to perform their duties effectively and efficiently, ultimately affecting the quality of patient care (19). The small percentage of respondents indicating that noise did not affect their work efficiency is noteworthy but not unexpected. Individual differences in sensitivity to noise and coping mechanisms may account for variations in perceived impact among hospital workers. Additionally, it is possible that certain job roles or work environments are less susceptible to the effects of noise, leading to a smaller proportion of respondents reporting significant impairment. In general, the findings of this highlight the significance of addressing the noise pollution in healthcare settings in general and dental clinic in specific, to promote a conducive work environment for hospital staff. Strategies such as implementing soundproofing measures, reducing noise-generating activities during critical tasks, and providing noise-cancelling headphones or earplugs can help mitigate the negative effects of noise on job performance and enhance the overall quality of care delivery. By highlighting noise reduction initiatives, hospitals can support the well-being and productivity of their workforce, ultimately benefiting both staff and patients alike. Review of previous publication (20), and according to the overall results of the current study questionnaire, an extent damage caused by noise, which prompts the researcher to find ways to get rid of or reduce the noise level to preserve human health in general and dentist in particular, as they exposed to a large amount of noise, in addition to helping them to work in the best and with the highest efficiency. Review some of the methods was used to reduce noise. These are included: The most significant feature is that it employs a compressor suppressor, which is presently offered in numerous configurations to regulate noise, selecting appropriate furnishings and furniture, setting white noise generators, use indoor plants as décor, employing Plasterboard Acoustic, use of partitions and acoustic panel, and soundproofing pain.

In Conclusion, the results of the current research has highlighted that the predominant source of noise within hospitals stems from medical machinery and equipment, eliciting common symptoms such as irritability and nervous tension among individuals. However, proactive measures can be implemented to mitigate the impact of this noise, particularly to safeguard the well-being of patients in dental clinics and doctors alike.

DECLARATIONS

Funding

There is no fund received from any third party authorities for doing this research.

Competing interests statement

The author approved no conflict of interest upon publication of this manuscript from any authorities.

Ethics statement

This study approved from ethical committee / College of Dentistry/ Al-Iraqia University (Ethical approval number : ESHER-02-06-05-2024 / Al-Iraqia University-CD).

Author contributions

Author S. Kh. T. designed the study, wrote the protocol ,and managed the analyses of the study

Acknowledgments

I am willing to express my sincere gratitude to the College of Dentistry at the Iraqi University, especially Ruqaya Flayyih Hasan and Maryam Muayad Rashid, whose project completion would not have been possible without their help. Moreover, many thanks to the medical staff at Al-Dahalik Health Center/Dental Unit and to the University of Mosul for their tremendous support and assistance in completing this research topic.

References

1. Hodge B, Thompson J F. Noise pollution in the operating theatre. Lancet. 1990, 335, 891-894.
2. Hasfeldt D, Laerkner E, Birkelund R. Noise in the operating room--what do we know? A review of the literature. J Perianesth Nurs. 2010 Dec;25(6):380-6. doi: 10.1016/j.jopan.2010.10.001. PMID: 21126668.
3. Kühlmann, A.Y.R. The Sound of Medicine: Evidence-Based Music Interventions in Healthcare Practice; Erasmus University Rotterdam: Rotterdam, The Netherlands, 2019.
4. Antoniadou, M. Application of Humanities and Basic Principles of Coaching in Health Studies; Tsiotras Publications: Athens, Greece, 2021.
5. McGeoch PD, Rouw R. How everyday sounds can trigger strong emotions: ASMR, misophonia and the feeling of wellbeing. Bioessays. 2020 Dec;42(12):e2000099. doi: 10.1002/bies.202000099. Epub 2020 Nov 10. PMID: 33174254.
6. Packyanathan, J.S.; Lakshmanan, R.; Jayashri, P. Effect of music therapy on anxiety levels on patient undergoing dental extractions. J. Fam. Med. Prim. Care 2019, 8, 3854-3860.
7. Garner GG, Federman J, Johnson A. Noise induced hearing loss in the dental environment: An audiologist's perspective. J Ga Dent Assoc. 2002;15:17-9.
8. Muppa R, Bhupatiraju P, Duddu M, Penumatsa NV, Dandempally A, Panthula P. Comparison of anxiety levels associated with noise in the dental clinic among children of age group 6-15 years. Noise Health. 2013 May-Jun;15(64):190-3. doi: 10.4103/1463-1741.112371. PMID: 23689302.
9. Ai ZT, Mak CM, Wong HM, Noise level and its influences on dental professionals in a dental hospital in Hong Kong, Build Serv Eng Res Technol, 2017; 38(5): 522–535.
10. Fabry DA. Hearing loss as occupational hazard. Northwest Dent. 1995;74:29-32.

11. Yu JF, Lee KC, Hong HH, Kuo SB, Wu CD, Wai YY, Chen YF, Peng YC. Human amygdala activation by the sound produced during dental treatment: A fMRI study. *Noise Health*. 2015 Sep-Oct;17(78):337-42. doi: 10.4103/1463-1741.165063. PMID: 26356376; PMCID: PMC4900504.
12. Lerato G. Mosoeu, Carien Weyers, Phoka C. Rathebe. Noise exposure among dental assisting students from dental instruments during work-integrated learning: a review. DOI: 10.1109/OI.2019.8908244. Conference: 2019 Open Innovations (OI) 247-251. 978-1-7281-3464-2/19/\$31.00 ©2019 IEEE
13. Tziovara P, Antoniadou C, Antoniadou M. Patients' Perceptions of Sound and Noise Dimensions in the Dental Clinic Soundscape. *Applied Sciences*. 2024; 14(6):2587. <https://doi.org/10.3390/app14062587>
14. de Lima Andrade E, da Cunha E Silva DC, de Lima EA, de Oliveira RA, Zannin PHT, Martins ACG. Environmental noise in hospitals: a systematic review. *Environ Sci Pollut Res Int*. 2021 Apr;28(16):19629-19642. doi: 10.1007/s11356-021-13211-2. Epub 2021 Mar 5. PMID: 33674976; PMCID: PMC7935697.
15. Hartland JC, Tejada G, Riedel EJ, Chen AH, Mascarenhas O, Kroon J. Systematic review of hearing loss in dental professionals. *Occup Med (Lond)*. 2023 Oct 20;73(7):391-397. doi: 10.1093/occmed/kqad084. PMID: 37682842; PMCID: PMC10588782.
16. Alabdul wahhab BM, Alduraiby RI, Ahmed MA et al. . Hearing loss and its association with occupational noise exposure among Saudi dentists: a cross-sectional study. *BDJ Open* 2016;2:16006.
17. Messano GA, Petti S. General dental practitioners and hearing impairment. *J Dent*. 2012 Oct;40(10):821-8. doi: 10.1016/j.jdent.2012.06.006. Epub 2012 Jun 29. PMID: 22750643.
18. Mervine R. "Noise-induced hearing loss in dental offices," *The Academy of Dental Therapeutics and Somatology*, 2008
19. Antoniadou M, Tziovara P, Antoniadou C. The Effect of Sound in the Dental Office: Practices and Recommendations for Quality Assurance-A Narrative Review. *Dent J (Basel)*. 2022 Dec 5;10(12):228. doi: 10.3390/dj10120228. PMID: 36547044; PMCID: PMC9776681.
20. Jiang P, Atherton M, Millar BJ. Dental drill noise reduction using a commercially-available earplug device. *Prim Dent J*. 2023 Mar;12(1):73-78. doi: 10.1177/20501684231155962. PMID: 36916621.