

Chronic Noise Exposure with Normal Hearing is Related to Adverse Quality of Life and Burnout

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Doi: [10.19044/esipreprint.1.2024.p214](https://doi.org/10.19044/esipreprint.1.2024.p214)

Approved: 08 January 2024

Posted: 10 January 2024

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Cite As:

Karaiskos C., Vlastos I., Farantos G., Rachiotis G., Simou E. & Dounias G. (2024). *Chronic Noise Exposure with Normal Hearing is Related to Adverse Quality of Life and Burnout*.

ESI Preprints. <https://doi.org/10.19044/esipreprint.1.2024.p214>

Abstract

Aims and scope: Occupational noise exposure is a well-known factor of hearing loss and other health related problems. Its contribution on burnout and health related quality of life, particularly when there is no hearing loss is less well studied. Herein we aim to study the effect of noise on the responses of normal hearing industrial workers on validated instruments. Methods: 384 industrial workers from three pharmaceutical companies with normal hearing were stratified into two groups: a noise-exposure group (n=195) and a non-exposure group (n=125). In addition to basic demographic characteristics, factors such as smoking, and BMI were examined alongside responses to the Oldenburg Burnout Inventory (OLBI) and SF-36 questionnaire. Findings: The noise-exposure group exhibited a higher prevalence of smokers (p<0.01), a slightly elevated median BMI (p=0.04) and reported more pronounced exhaustion as measured by the OLBI (p=0.03). Furthermore,

they exhibited poorer responses in various dimensions of the SF-36 questionnaire, particularly in bodily pain ($p<0.01$), physical functioning ($p=0.03$), physical role functioning ($p=0.02$) and emotional role functioning ($p<0.01$) scales. Conclusion: Occupational noise exposure, even in the absence of hearing loss, is associated with a higher prevalence of burnout symptoms and an overall reduced health-related quality of life among industrial workers. These insights underscore the need for proactive measures to mitigate noise exposure's adverse impact on employee well-being and productivity in noisy work environments, independently of the findings in their audiometric results.

Keywords: Noise exposure, quality of life, burnout, exhaustion

Introduction

Noise exposure is widely recognized as a significant contributor to various health-related issues, extending beyond mere hearing impairment. While its association with conditions like cardiovascular disease (Babisch, 2014; van Kempen et al., 2018; Vienneau et al., 2015), and sleep disturbances (Basner & McGuire, 2018; Hume, 2010; Munzel et al., 2014; Yang et al., 2018) is well-established, emerging evidence also points towards a potential link with depression and rheumatoid arthritis. Acknowledging the pervasive impact of noise on occupational settings, authoritative bodies such as the National Institute for Occupational Safety and Health and the Occupational Safety and Health Administration have acknowledged its role in precipitating adverse events and have formulated guidelines to mitigate its effects. Consequently, it is hypothesized that noise exposure could exert a detrimental influence on health-related quality of life, while the relationship with burnout remains a comparatively less explored territory.

Despite the accumulating evidence, large-scale epidemiological studies often overlook critical confounding factors that could interplay between noise exposure and burnout. Factors such as perceived noise levels, presence of pre-existing clinical depression, or even hearing loss can influence the perceived association. Furthermore, existing cross-sectional investigations centered around specific occupational domains frequently lack comprehensive analyses of the intricate facets of health-related quality of life and the specific dimensions of burnout. This gap necessitates a closer examination of the potential interplay between noise exposure and these dimensions.

This scientific paper aims to address these gaps by examining noise exposure as an independent stressor within industrial settings, seeking to establish a potential correlation with adverse quality of life and burnout, while factoring out the influence of hearing loss. Going beyond a mere

association, this study also intends to delve into specific elements of burnout and quality of life that could be particularly susceptible to the impacts of noise exposure. A more nuanced understanding of the intricate interrelationships between noise, burnout, and quality of life can potentially lead to refined interventions and policy guidelines for improving the well-being of individuals in noisy occupational environments.

Methods

This is a cross-sectional census study of the industrial workers of three pharmaceutical industries in Attica, Greece, conducted from July 2020 to March 2023. A formal hearing test (audiogram) was performed. Demographic data, basic lifestyle factors (smoking, BMI), and responses to Oldenburg Burnout Inventory (OLBI) and SF-36 were recorded at the time of the audiogram. From the total of 510 industrial workers of these 3 plants 470 workers accepted to participate. The study has been approved by the scientific and ethical committee of the University of West Attica, School of Public health (No 53028/06-07-2021) and the principles of the Helsinki Declaration were followed.

Criteria for entering an employee into the study were be full-time salaried employees and be workers in the industrial area with noise exposure >85 dB or without noise exposure, but in an equivalent industrial worker job position. Study exclusion criteria were a history of ear procedure or a hearing loss of more than 25dB in at least on frequency (250-4000Hz) in one ear. Thus, in total 320 normal hearing people have been included and separated in two groups: Noise exposure group (n=195) consisted of those who have worked at least the last year in a noisy industrial environment (exposure exceeds 85dB), thus being at risk for occupational hearing loss. Non-exposure group (n=125) consisted of employees who work in more quiet occupational environments (e.g. small logistic centers or maintenance department where noise is less than 85 dB). Mann-Whitney test was used for comparisons of continues variables that do not follow a normal distribution and chi-square for categorical variables.

Results

Of the study participants 152 (47.5%) were male and 168 (52.5%) female. The mean age for those exposed to noise was 43 years (37 – 51) and 42 years (33 – 47) for the non-exposed group. Comparisons between noise exposure and non-exposure groups with normal hearing are shown in tables 1 and 2. The same characteristics and values for those with a hearing loss are shown in supplementary table. Although workers with a hearing loss seem to report worse results on OLBI and SF-36 further analyses were not performed since it is beyond the scope of this research project. Regarding comparisons

between normal hearing groups with and without occupational noise exposure, noise-exposure group has more smokers ($p<0.01$), a slightly increased median BMI ($p=0.04$), and worst responses in exhaustion dimension of OLBI ($p=0.03$) and bodily pain ($p<0.01$), physical functioning ($p=0.03$), physical role functioning ($p=0.02$) and emotional role functioning ($p<0.01$) scales of SF-36.

Discussion

Few studies assessing the quality of life of industrial workers, especially in relation to noise, were found. The reviewed studies consistently demonstrate that quality of life deficits among industrial workers are closely tied to multiple dimensions, including vitality, physical functioning, general health, environment, and psychological well-being (Santos et al., 2020). This highlights the intricate interplay between the work environment and employees' overall quality of life. The scarcity of research in this realm underscores the need for more comprehensive investigations to fully comprehend the nuanced effects of noise exposure on the holistic well-being of workers in various industrial sectors.

Even fewer studies have examined burnout in relation to noise exposure. In this study, we employed the Oldenburg Burnout Inventory (OLBI), a well-established tool known for its applicability across diverse working environments beyond academia and the health sector. The OLBI captures burnout through two distinct dimensions: the Exhaustion Dimension and the Disengagement Dimension (Cynicism). The Exhaustion Dimension represents the emotional and physical depletion experienced due to work-related demands, indicating a decrease in overall energy levels. On the other hand, the Disengagement Dimension reflects a withdrawal from work, characterized by a detached and negative attitude. Our utilization of the OLBI has allowed us to delve into the complexities of burnout in relation to noise exposure and ascertain its distinct facets among industrial workers.

The findings of this study underscore a significant association between noise exposure and both reduced health-related quality of life and burnout. Crucially, these correlations remain independent of hearing loss, shedding light on the potent influence of noise as a standalone stressor. Our results resonate with existing theories positing that noise exposure can induce stress, thus contributing to a spectrum of health-related challenges. In addition, they conform to previous studies showing a correlation of occupational noise exposure with worst lifestyle indices such as smoking (McCullagh et al., 2022). Thus, a chronic state of emotional and physical exhaustion that can be easily recorded in validated scales such as OLBI and SF-36 can be induced by the cumulative effect of noise-exposure and other possibly depended factors.

Several limitations must be considered when interpreting the results of this study. Notably, this investigation did not encompass a large-scale population study, potentially limiting the ability to discern subtle differences in continuous outcomes due to sample size constraints. While our findings demonstrate associations between occupational noise exposure, burnout, and reduced health-related quality of life, factors such as noise sensitivity or annoyance were not examined within the scope of this study. These factors, although significant, require a more extensive sample size to yield adequately powered results. Furthermore, our study did not distinguish between occupational and non-occupational noise exposure, such as road traffic noise, which may hold particular relevance in the living environments of industry workers and could contribute to an accumulative effect on well-being. Despite these limitations, the observed correlations between noise exposure, burnout, and diminished health-related quality of life offer an indirect indication of the pronounced impact of occupational noise on workers' overall well-being.

Considering our study findings, both research and policy implications emerge. Our study accentuates the importance of incorporating noise exposure as a pivotal consideration in the assessment of occupational environments, echoing the established principles of occupational health and safety. Integrating noise management strategies into workplace policies could serve as a potent tool to mitigate the negative impact of noise exposure on employee well-being. Moreover, recognizing the role of noise exposure in burnout emphasizes the significance of early interventions, as part of comprehensive employee assistance programs. These programs could be tailored to encompass noise management strategies alongside stress-coping techniques, ultimately enhancing employees' resilience in the face of the challenges posed by noisy work settings.

Furthermore, the discovery of an autonomous association between noise exposure and health-related quality of life underscores the necessity for workplaces to prioritize noise reduction measures as a fundamental component of their efforts to create conducive and healthy work environments. Exploring innovative architectural designs, sound insulation, and technological solutions can contribute to reducing noise pollution and fostering a more comfortable workspace. Ultimately, cultivating a culture of awareness and education regarding the potential consequences of noise exposure empowers employees to proactively engage in protecting their own well-being.

Conclusion

Our study deepens the understanding of the intricate connections between noise exposure, health-related quality of life, and burnout. By

highlighting these relationships as independent of hearing loss, our findings advocate for an increased focus on addressing noise exposure as a critical occupational stressor. This research enriches the growing body of evidence concerning the multifaceted impacts of noise on health, while simultaneously providing actionable insights that hold the potential to reshape workplace policies and interventions to promote employee well-being in the face of escalating noise pollution.

Human Studies: The study has been approved by the Scientific and Ethical Committee of the University of West Attica, School of Public health (No 53028/06-07-2021) and the principles of the Helsinki Declaration were followed.

Conflict of Interest: The authors reported no conflict of interest.

Data Availability: All of the data are included in the content of the paper.

Funding Statement: The authors did not obtain any funding for this research.

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Appendix

	Noise exposure group (n=195)	Non-exposure group (n=125)	P-value
Male	87	65	0.24 ($\chi^2=1.38$)
Female	108	60	
Age	43 (37-51)	42 (33-47)	0.07
Smoking	104	36	<0.01 ($\chi^2=17.2$)
Non-smoking	91	88	
BMI	24.7 (23-26.9)	23.9 (21.7-26.1)	0.04

Table 1. Differences between groups on basic demographic and other factors. Values are medians with 25% and 75% quartiles in parenthesis.

	Noise exposure group (n=195)	Non-exposure group (n=125)	P-value
OLBI- Disengagement	12 (10-13)	11 (10-13)	0.28
OLBI- Exhaustion	12 (10-13)	11 (10-12)	0.03
OLBI-Total	23 (21-25)	23 (20-25)	0.06
SF36-physical functioning	95 (95-100)	100 (95-100)	0.03
SF36-physical role functioning	100 (100-100)	100 (100-100)	0.02
SF36-emotional role functioning	100 (90-100)	100 (100-100)	<0.01
SF36-vitality	100 (90-100)	95 (90-100)	0.77
SF36-mental health	100 (92-100)	100 (92-100)	0.77
SF36-social role functioning	100 (97-100)	100 (100-100)	0.09
SF36-bodily pain	95 (90-100)	100 (90-100)	<0.01
SF36-general health perceptions	95 (90-95)	95 (90-95)	0.13

Table 2. Comparisons of OLBI and SF36 subscales between the two group of normal hearing employees. Median values are being presented and 25% and 75% quartiles are shown in parenthesis. Statistically significant differences are marked with bold letters.

	Workers with hearing loss (n=150)
Age: median (25% and 75% quartiles)	54 (45-58)
Gender: number of males (and percentage%)	92 (61)
Smokers (or ex-smokers): number (and percentage %)	89 (59)
BMI: median (25% and 75% quartiles)	25.3 (23.1-27.8)
OLBI- Disengagement	12 (10-13)
OLBI- Exhaustion	12 (10-13)
OLBI-Total	23 (21-25)
SF36-physical functioning	95 (95-100)
SF36-physical role functioning	100 (100-100)
SF36-emotional role functioning	100 (90-100)
SF36-vitality	100 (90-100)
SF36-mental health	100 (92-100)
SF36-social role functioning	100 (97-100)
SF36-bodily pain	95 (90-100)
SF36-general health perceptions	95 (90-95)

Supplementary table. Basic demographic and other characteristics, including OLBI and SF-35 subscales results, of workers with hearing loss.