Arch Health Sci Res. 2026;13:1-6
DOI: 10.5152/ArcHealthSciRes.2026.25189

Original Article

Impact of Varied Noise Exposure on Workers' Quality of Life and Work: A Multi-Environment Study

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Cite this article as: Avcı NB, Ali C, Nterntiman A, Ferat OM, Taşdemir Gürşen İ, Bulut E. Impact of varied noise exposure on workers' quality of life and work: A multi-environment study. *Arch Health Sci Res.* 2026, 13, 0189, doi: 10.5152/ArcHealthSciRes.2026.25189.

What is already known on this topic?

- *Occupational noise exposure above 85 dBA is known to negatively affect workers' health and psychological well-being, causing hearing loss, tinnitus, sleep disorders, anxiety, and decreased quality of daily life.*
- *Increased occupational noise levels are associated with lower job satisfaction and reduced general, physical, and psychological components of quality of work life.*

What this study adds on this topic?

- *While noisy indoor environments (e.g., hospital laboratories) negatively impacted workers' overall perception of quality of daily life, this study uniquely highlights that workers in noisy outdoor environments (e.g., street markets, industrial estates) were not significantly affected.*
- *It provides comparative data on quality of daily life and health outcomes among workers exposed to different noise levels across 4 distinct work environments.*

ABSTRACT

Objective: This study aims to comparatively evaluate the quality of daily life and quality of work life among employees working in environments with different noise exposure levels to explore the potential impact of occupational noise on overall well-being.

Methods: This cross-sectional study was conducted in the audiology department at Trakya University between April and July 2024. The study included 86 employees who worked in an industrial estate, street market, hospital laboratory, and office. Noise levels in the environments were measured with a sound level meter, and participants were asked to complete the Short-Form 12 Questionnaire (SF-12) and the Quality of Work Life (QWL).

Results: Average noise levels were highest in the street market (73.63 dBA) and lowest in the office (55.80 dBA). A significant difference was found between laboratory employees and street market workers in the physical component of the SF-12 and between industrial estate workers and office employees in the mental component ($P < .05$). The QWL scores did not differ significantly by group. Regression analyses revealed that age significantly predicted Physical Component Score-12 scores, while both age and work environment were significant predictors of Mental Component Score-12; however, no predictors were associated with QWL.

Conclusion: Even when below legal limits, noise exposure in various work environments has negative impacts on employees' quality of daily life. It is important that occupational health and safety policies address not only loud noises but also common "noisy" working conditions. Regular noise measurements, encouraging the use of protective equipment, and awareness training could play a critical role in improving employees' quality of daily and work life.

Keywords: Environment, laboratories, occupational noise, quality of life

Introduction

Noise is generally defined as unwanted and disturbing sound.[1] While exposure to various sounds in daily life is inevitable, not all sounds can be considered noise. Noise pollution is defined as sounds that are particularly unwanted by people and have adverse effects on individuals' physical, psychological, and social health.[2] This pollution is not limited to a specific location; it occurs in a wide variety of environments, such as city centers, industrial areas, highways, railways, and airports. Factors such as traffic, construction activities, industrial production, population density, and outdoor activities, especially in urban centers, contribute to high levels of noise pollution.

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Received: July 24, 2025
Revision Requested: August 24, 2025
Last Revision Received: October 27, 2025
Accepted: October 29, 2025
Publication Date: January 26, 2026

Noise pollution also poses a significant problem in the workplace. Various work environments, including factories, industrial estates, entertainment venues, and hospitals, may expose employees to constant or intense noise. This type of pollution can negatively affect employees' hearing health, as well as their overall health, and reduce work performance and quality of daily life.[3,4] Numerous studies in the literature indicate that noise exposure leads to health problems such as hearing loss, tinnitus, sleep disturbances, difficulty concentrating, stress, anxiety, and depression.[2] Furthermore, noise has been reported to harm cognitive functions, leading to consequences such as distraction, decreased memory, and problem-solving abilities.[5] Long-term exposure to loud noise can trigger the body's stress response, leading to increased heart rate, blood pressure, and stress hormone release.[6]

Individuals define quality of life as their overall experience of daily life satisfaction and well-being, encompassing physical, psychological, social, and environmental factors. Quality of work life (QWL), on the other hand, refers to an individual's perception of the physical and psychological conditions in the work environment and the impact of these conditions on job performance, motivation, and overall satisfaction.[7] Otoghile et al[8] (2018) found that increased occupational noise levels exposed to sawmill workers were negatively correlated with decreased general, physical, and psychological quality of daily life components. Systematic reviews demonstrate that occupational noise significantly increases the risk of decreased job satisfaction and well-being.[9]

Although many studies have examined the impact of occupational noise on hearing health and psychological outcomes, limited attention has been given to how noise exposure affects both daily life quality and work life quality simultaneously. In addition, comparative studies that investigate differences across employees exposed to varying levels of occupational noise remain scarce. Addressing this gap, the present study aims to evaluate how different noisy work environments influence employees' perceptions of daily life quality and work life quality.

Noise is a significant environmental factor that negatively impacts the QWL and is thought to have an impact on employees' work productivity and stress levels. This study aims to examine the quality of daily life and QWL of employees in different noisy work environments. The research questions are as follows:

- How does occupational noise exposure affect employees' overall quality of daily life and QWL?
- Is there a significant difference in the quality of daily life and work life quality among employees working in different noise-exposed environments?

Methods

This study is a cross-sectional study conducted at Trakya University Faculty of Health Sciences Audiology Department between April and July 2024. Ethical committee approval was received from Faculty of Medicine Non-Interventional Scientific Research Ethics Committee of Trakya University (Approval No.: 2024/87, Date: March 4, 2024). Written informed consent was obtained from all participants in this study.

Participants

The inclusion criteria for participants required them to be between the ages of 18 and 60 and to have worked in the same location for at least 2 years. Exclusion criteria included the presence of neurological, psychiatric, or metabolic diseases; physical or cognitive disabilities; and known hearing loss or ear-related conditions. The study recruited a total of 86 participants aged 18-59 who worked in various noisy environments.

A priori power analysis for one-way ANOVA was conducted using G*Power (version 3.1.9.7). Based on a large effect size (Cohen's f = 0.4094131) derived from previous studies,[10] an alpha level of 0.05, and a desired power of 0.80, the analysis indicated that at least 76 participants were required, distributed across the 4 work environment groups. The final sample size (N = 86) exceeded this requirement, ensuring adequate statistical power. No participants were excluded from the study, and there were no missing data.

Study Protocol

Four different noise-sensitive work environments were selected for the study: an industrial estate, a street market, a hospital laboratory, and an office environment. The Edirne Province industrial estate was selected as the industrial estate, the Edirne Ulus Bazaar as the street market, the central laboratory of the Trakya University Health Practice and Research Center as the hospital laboratory, and the personnel affairs unit of the Trakya University Health Practice and Research Center as the office environment. Noise measurements were taken in these environments, and participants were asked to complete the Short-Form 12 questionnaire (SF-12) for quality of daily life and the QWL for work life's quality.

Noise Measurement

Ambient noise levels were measured with the CEM DT-815 Sound Level Meter (IEC 61672-1 Class 2, CEM Instruments, China), which is a device that follows specific standards and was set to measure sound in a way that reflects how humans hear it (A frequency weighting and slow time weighting). Measurements were made with the device positioned 1.5 m above the floor (at ear level). Three 5-minute measurements were taken at 3 different locations in each environment, and the average and maximum values were recorded.

Assessment Tools

Personal Data Collection Form: Contains information on the participants' age, gender, occupation, years of employment, comorbidities, and presence of hearing loss.

The QWL: This is a 16-item, 7-point Likert-type scale assessing 7 basic needs (health and safety, economic and family, social, esteem, self-actualization, knowledge, and aesthetics). Higher scores indicate better QWL. The Cronbach's alpha reliability coefficient for the Turkish version is 0.88.[11] In the present study, the internal consistency coefficient (Cronbach's alpha) of the QWL Scale was 0.81.

The SF-12: This is a 12-item quality of daily life measurement tool that includes 8 subscales: physical functioning, physical role, bodily pain, general health, energy, social functioning, emotional role, and mental health. The Physical Component Score-12 (PCS-12) is derived from the subscales of general health, physical functioning, physical role, and bodily pain, while the Mental Component Score-12 (MCS-12) is derived from the subscales of social functioning, emotional role, mental health, and energy. Both the PCS-12 and MCS-12 scores range from 0 to 100, with higher scores representing better health. The Cronbach's alpha coefficient for the Turkish version was determined to be 0.73.[12]

Statistical Analysis

The normality of numerical data was assessed using the Shapiro–Wilk test and histogram plots. The numerical data in the study were normally distributed, with numerical data presented as mean and SD and categorical data presented as number (n) and percentage (%). An independent sample *t*-test was used to compare numerical data for 2 independent groups, and one-way analysis of variance and post hoc tests were used to compare multiple independent groups. A multiple linear regression analysis was conducted to

Table 1. Characteristics of Work Environments and Measured Noise Levels

Work Environment	Number of Participants	Age (Mean ± SD)	Years of Employment (Mean ± SD)	Noise Measurement	
				Average Noise Level (dB SPL)	Maximum Noise Level (dB SPL)
Street market	25 (14 F, 11 M)	44.76 ± 10.69 (min: 23, max: 59)	17.48 ± 11.52 (min: 2, max: 40)	73.63	92.00
Hospital laboratory	21 (14 F, 7 M)	42.12 ± 7.57 (min: 30, max: 55)	18.25 ± 8.48 (min: 4, max: 33)	67.76	77.80
Industrial estate	20 (20 M)	34.30 ± 7.27 (min: 24, max: 50)	12.15 ± 8.17 (min: 3, max: 30)	63.96	75.00
Office environment	20 (9 F, 11 M)	42.29 ± 8.83 (min: 29, max: 59)	17.59 ± 10.78 (min: 2, max: 38)	55.80	71.50

dB, decibel; F, female; M, male; max,maximum; min, minimum; SPL, sound pressure level.

examine whether work environments, age, and years of employment predicted QWL, PCS-12, and MCS-12 scores. Since gender distribution was not balanced across the work environment groups, gender was not included as a covariate in the regression analyses. Analyses were conducted using IBM SPSS Statistics version 27 (IBM SPSS Corp.; Armonk, NY, USA). *P* values of .05 and below were considered statistically significant.

Results

The participants in this study consisted of 86 individuals (37 females and 49 males) aged 23-59 with a mean age of 41.00 ± 9.64 who worked in environments with 4 different levels of noise. Twenty-five of the participants (14 females, 11 males) worked in a street market, 20 (20 males) in an industrial estate, 21 (14 females, 7 males) in a hospital laboratory, and 20 (9 females, 11 males) in an office environment. The participants' average years of employment were determined to be 16.29 ± 10.10 (minimum: 2, maximum: 40). One street market worker and 3 laboratory employees indicated the use of hearing protection, whereas other workers reported its absence.

Three 5-minute measurements were taken from different locations in the work environments, and the average was calculated. The maximum sound level was also recorded during the measurements. The characteristics of environments and noise measurement results are shown in Table 1.

Participants' SF-12 physical component scores (PCS) and mental component scores (MCS) were determined. Table 2 presents the means of PCS-12, MCS-12, and QWL for participants in various work environments, along with comparisons between these different work environments.

When examining the QWL scores, no statistically significant difference was found between the groups ($P = .544$). However, it was observed that laboratory employees, who are more prone to stable noise, had lower scores. A significant difference was found between the groups in the subcomponents of the SF-12 ($P < .05$). Post hoc tests were applied to determine which groups were statistically significant (Table 3). A statistically significant difference was found between the street market workers and the laboratory employees for the PCS-12 and between the industrial estate workers and office employees for the MSC-12 ($P < .05$).

When the relationship between the questionnaires was examined, a weak positive correlation was found between the MCS-12 and the QWL scores (r: 0.237, $P = .037$), suggesting a modest relationship between mental well-being and perceived QWL. No statistically significant relationship was found between the PCS-12 and the MCS-12, nor between the PCS-12 and the QWL ($P > .05$).

A weak but statistically significant negative correlation was observed between participants' age and PCS-12 scores ($r = -0.306$, $P = .006$), indicating that physical health tends to decline modestly with age in this sample. No significant correlation was found between age and MCS-12 or QWL scores ($P > .05$). Additionally, no correlation was observed between the participants' SF-12 and QWL questionnaire scores and their years of employment ($P > .05$).

The regression model was not statistically significant ($F(5,72) = 0.93$, $P = .465$, $R^2 = 0.061$) in QWL. This suggests that participants' QWL scores did not differ meaningfully according to age, years of employment, or work environments. For PCS-12 scores, the regression model was statistically significant ($F(5,72) = 4.12$, $P = .002$, $R^2 = 0.222$), indicating that approximately 22.2% of the variance was explained by the predictors. Among the variables, age emerged as a significant negative predictor ($\beta = -.493$, $P = .005$), indicating that older participants tended to report lower physical health-related quality of life. Work environment and years of employment were not significant predictors ($P > .05$). For MCS-12 scores, the regression model was also significant ($F(5,72) = 3.87$, $P = .004$, $R^2 = 0.212$). Age ($\beta = .515$, $P = .004$) and working in an industrial estate ($\beta = .476$, $P = .001$) were significant positive predictors. This indicates that mental well-being scores were higher among older participants and those working in industrial estates. The years of employment were not significant ($P > .05$).

Table 2. Comparison of Physical Component Score-12, Mental Component Score-12, and Quality of Work Life Scores Across Different Work Environments

	PCS-12 (mean ± SD)	MCS-12 (mean ± SD)	QWL (mean ± SD)
Street market workers	46.73 ± 7.53	51.38 ± 9.37	80.32 ± 13.86
Laboratory employees	39.83 ± 7.24	46.62 ± 8.57	77.43 ± 16.76
Industrial estate workers	46.42 ± 8.79	53.67 ± 8.26	83.35 ± 7.56
Office employees	44.24 ± 7.05	45.63 ± 11.56	80.41 ± 7.29
*P**	**.034**	**.034**	.544

MCS, Mental Component Score; PCS, Physical Component Score; QWL, Quality of Work Life.
*One-way ANOVA. Bold indicates statistically significant values.

Table 3. Pairwise Comparisons of Physical Component Score-12 and Mental Component Score-12 Between Groups

	P* for PCS-12
Street market workers - Laboratory employees	**.033**
Street market workers - Industrial estate workers	.999
Street market workers - Office employees	.737
Laboratory employees - Industrial estate workers	.062
Laboratory employees - Office employees	.363
Industrial estate workers - Office employees	.829
	P* for MCS-12
Street market workers - Laboratory employees	.403
Street market workers - Industrial estate workers	.852
Street market workers - Office employees	.225
Laboratory employees - Industrial estate workers	.128
Laboratory employees - Office employees	.990
Industrial estate workers - Office employees	**.050**

MCS, Mental Component Score; PCS, Physical Component Score.
*Post hoc Tukey test. Bold indicates statistically significant values.

Discussion

This study examined how different occupational noise environments affect employees' physical and mental health-related quality of daily life and their perceived QWL. The findings revealed significant differences in the physical and mental components of health across work environments, while overall work-related quality of life did not significantly vary among groups. Age was found to be an important factor influencing physical health, with older employees reporting lower scores, whereas mental well-being tended to be higher among older participants and those working in industrial settings. These results highlight that both environmental and individual factors contribute to variations in well-being among workers exposed to different noise conditions.

Numerous studies in the literature, conducted across various sectors and lines of business, reveal that occupational noise exposure negatively impacts employees' health, psychological well-being, and social life.[2,4] Karaiskos et al[13] (2025) state that occupational noise exposure negatively impacts work life and overall quality of daily life, increases burnout symptoms even in individuals without hearing loss, and leads to adverse health outcomes. Some studies report that various health problems, such as hearing loss, tinnitus, dizziness, sleep disorders, attention deficit, and anxiety, are more common in factory workers working in noisy environments above 85 dBA.[14,15] Sumardiyono et al[16] (2019) reported that among textile and industrial workers, the quality of daily life significantly decreases as noise exposure increases. Contrary to this, Pommerehn et al[17] (2016) conducted a study with gas station workers, but despite acknowledging the noisy environment, they reported no health problems or discomfort. Although participants scored lower in the environment domain of the World Health Organization Quality of Life assessment, no significant differences were observed in the other domains when compared to the control group. This evidence suggests that the overall perception of quality of daily life remained relatively stable and that workers were able to adapt to their noisy environment. This study also found that, similar to the station environment, the overall perception of quality of life of workers working in noisy outdoor environments such as street markets and industrial estates was not affected, but the overall quality of daily life of those working in noisy indoor environments such as laboratories was affected.

From a healthcare sector perspective, it is noteworthy that noise levels measured in laboratory environments are often above recommended limits.[18] Although Silva et al[10] (2013) did not observe a significant difference in overall quality of life scores, it reported that employees working in these environments were at increased risk of hearing loss, experienced reduced work performance, auditory fatigue, and higher stress levels. Furthermore, high noise exposure in laboratory and healthcare employees has negative effects on many levels, including decreased motivation, attention, and cognitive functions; deterioration in professional performance; and quality of patient care.[19-22] It has been suggested that prolonged exposure to noise, particularly in hospital environments, has serious effects on emotional burnout and psychological stress and that training in noise control can mitigate these effects.

These findings highlight the importance of preventive approaches, as the adverse effects of noise exposure are further compounded by the limited use of protective measures in such noisy environments. Studies conducted in Türkiye have shown that the rate of hearing protection use in workplaces is low, citing personal awareness, workplace policies, and lack of environmental support as key reasons.[23] International studies have also found that hearing protection use is generally below 50%, with factors such as awareness of the risk of hearing loss and the comfort of the equipment being the determining factors among wearers.[24] Workers who use hearing protection significantly reduce symptoms such as hearing loss, tinnitus, and auditory fatigue.[25] Conversely, inadequate use of hearing protection increases the susceptibility to hearing loss or functional impairment, resulting in a significant reduction in QWL.[26] The environments with varied noise levels in this study did not exceed legal noise limits. However, considering that studies have adopted a level of 50 dBA as the comfort level,[27] they fall outside the comfort level limits in terms of noise. Only 4 of the participants reported using hearing protection. Therefore, since increased use of hearing protection has the potential to reduce noise-related symptoms, future studies evaluating its effectiveness will be valuable.

Beyond its physical and auditory consequences, noise exposure also affects psychosocial domains, influencing employees' overall quality of work and daily life. Research shows that QWL is an important determinant of overall quality of daily life; positive experiences in work life increase the overall quality of daily life, while negativities can decrease it.[7,28] In models explaining the relationship between these 2, it has been stated that the overall quality of daily life is at the base of a cone, and the QWL is at the top, with satisfaction with work and life positioned between these 2 extremes. In other words, satisfaction with work life is a part of and a determinant of the general quality of daily life.[7] This study findings show that as the quality of working life increases, the general quality of daily life also increases in terms of social, emotional, and mental aspects. These results prove that the quality of working life is a determinant of the general quality of daily life.

This research indicated that physical well-being demonstrated a weak yet statistically significant negative correlation with age, supported by regression analyses that identified age as a significant negative predictor. This suggests that, even in settings where noise levels are within legal limits, older employees generally report a diminished quality of life related to physical health. Studies show that the link between employees' physical health and age is complicated and affected by both biological and work-related factors. A comprehensive longitudinal and cross-sectional study indicates that physical well-being generally deteriorates linearly with advancing age among employees, whereas mental well-being tends to enhance with age.[29] On the other hand, some employee groups show a positive link between age and physical well-being, which means that older workers may have a better quality of daily life when it comes to their physical health.[30] This could be because of factors related to their job or the situation that make this link stronger. These findings indicate that subsequent research should examine the mechanisms through which occupational and contextual factors may alleviate age-related declines in employees' physical well-being. It is noteworthy that neither the work environment nor the duration of employment significantly predicted physical well-being in these models. This suggests that age may have a more substantial impact on physical health than short- to mid-term occupational exposures in various noisy environments.

Conversely, mental well-being exhibited a positive correlation with QWL, and regression analyses revealed age and working in an industrial estate as significant positive predictors. These findings indicate that mental well-being may be preserved or even improved in specific occupational settings, potentially attributable to adaptive coping mechanisms, familiarity with the environment, or social support within the workplace. Even though there was not a big difference in QWL scores between work environments, their connection to mental health shows how important psychosocial and occupational factors are in shaping how happy employees are with their daily lives. Prior research indicates that an enhanced QWL—encompassing elements

such as supportive work environments, equitable compensation, work-life balance, and positive job engagement—is correlated with improved mental health outcomes, including reduced depression, anxiety, and stress, alongside increased emotional well-being and job satisfaction.[31-33] Also, work-life balance is a very good indicator of mental health in industrial settings, and policies that promote reasonable working hours and job satisfaction are linked to higher levels of happiness and quality of life.[34] On the other hand, bad working conditions, long hours, and stress at work raise the risk of burnout and lower mental health.[35] Interventions aimed at enhancing employee well-being must encompass both physical and mental health, age-related susceptibilities, and the psychosocial attributes of the workplace.

Strengths and Limitations

This study offers a unique perspective by comparing not only high noise levels but also the effects of different environments frequently encountered in daily life, considered noisy but generally below legal limits. This approach provides a more realistic and broader perspective on the effects of noise on employees' physical and mental health and QWL. Being one of the few studies comparing different work environments, it will make significant contributions to the development of the field and the shaping of occupational health and safety policies.

The study also has several limitations. Firstly, the limited sample size and the inclusion of only 4 different work environments limit generalizations. Furthermore, because a cross-sectional design was used, changes in noise effects and long-term outcomes could not be monitored. Because noise measurements were taken at specific times in each environment, the use of personal dosimeters, which would fully reflect participants' individual exposure, was limited. Finally, other environmental and individual factors in the work environment, such as stress, workload, and social support, were not controlled and could have influenced the results. Considering these limitations, future research is recommended using larger participant groups, longer-term study designs, and methods that accurately measure individual exposure.

In conclusion, this study demonstrates that the quality of daily life of employees exposed to varied noise levels is negatively impacted. Indoor laboratory environments with constant noise exhibit a more pronounced effect than open-air marketplaces and industrial zones. Even at noise levels below legal limits, workplace noise has multifaceted and often negative impacts on employees' physical and psychological health and social lives. The findings emphasize that occupational health and safety policies should focus not only on high noise levels but on all commonly encountered "noisy" work environments. Regular measurement of noise levels in workplaces, implementation of protective measures, and awareness-raising training are critical for improving quality of daily life through preventive health services.

Data Availability Statement: The data that support the findings of this study are available on request from the corresponding author.

Ethics Committee Approval: Ethical committee approval was received from Faculty of Medicine Non-Interventional Scientific Research Ethics Committee of Trakya University (Date: March 4, 2024; Protocol no.: 2024/87).

Informed Consent: Written informed consent was obtained from all participants in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Conception – N.B.A., E.B.; Design – N.B.A., İ.T.; Supervision – N.B.A., İ.T., E.B.; Materials – C.A., A.N., O.M.F.; Data Collection and/or Processing – C.A., A.N., O.M.F.; Analysis and/or Interpretation – N.B.A., İ.T.; Literature Review – N.B.A., C.A., A.N., O.M.F., İ.T.; Writing Manuscript – N.B.A., İ.T.; Critical Review – E.B.

Declaration of Interests: The authors declare that they have no competing interests.

Funding: This study was supported by the Scientific and Technological Research Council of Turkey (TÜBİTAK) under the 2209-A – Research Project Support Program for Undergraduate Students.

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