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Relationship Between Work-Related Factors and the Use of Hearing Protection Devices in Noisy Workplaces: A Cross-Sectional Study

Gürültülü İşyerlerinde İşle İlgili Faktörler ve İşitme Koruyucu Cihaz Kullanımı Arasındaki İlişki: Kesitsel Araştırma

Kübra ÖZMEN[a], Merve DENİZ SAKARYA[a], Eda ÇAKMAK[a], Gizem GÜNER[a]

[a]Başkent University Faculty of Health Sciences, Department of Audiology, Ankara, Türkiye

This study was presented as an oral/poster presentation at II. Spring Symposium: Hearing Problems Beyond the Audiogram, 2024 May 2-4, Ankara, Türkiye.

ABSTRACT Objective: This study investigates the factors influencing the use of hearing protection devices (HPDs) in noisy workplaces, focusing on behavior motivation, hearing protection constraints, and risk justification. It also examines how these factors are linked to employees' risk-taking behaviours, workplace social performance, and social- and innovation-oriented lifestyles. **Material and Methods:** A cross-sectional study was conducted with 423 employees from various industrial sectors. Data collection involved a Demographic Data Form, the Turkish adaptation of the Hearing Protection Assessment Scale, and a research scale assessing risk-taking behavior, social-oriented lifestyle, innovation-oriented lifestyle, and workplace social performance. For data analysis, Spearman's rho correlation tests, the Mann-Whitney U test, the Kruskal-Wallis H test, and the chi-square test were used. **Results:** Significant relationships were found between risk-taking behaviors and barriers to HPD use, as well as between workplace social performance and factors supporting HPD use. A social-oriented lifestyle (SOL) ($r=0.183$, $p<0.01$) and an innovation-oriented lifestyle ($r=0.121$, $p<0.05$) were positively associated with behavior motivation for HPD use. A SOL played a dual role, promoting supportive factors while mitigating barriers to HPD use ($r=-0.103$, $p<0.05$). Additionally, industry type, education level, hearing protection training, and type of preferred hearing protection significantly influenced attitudes toward HPD use. **Conclusion:** Risk-taking behaviors negatively impact HPD use, whereas workplace social performance and social- and innovation-oriented lifestyles encourage safer behaviors. Organizational support, training, and a positive workplace culture enhance hearing protection compliance. Strategies to improve HPD adoption should integrate both individual and workplace-level interventions, emphasizing safety culture, peer influence, and behavioral motivation.

Keywords: Noise; occupational; protective devices; risk-taking; occupational health

ÖZET Amaç: Bu çalışma, gürültülü işyerlerinde çalışan işçilerin işitme koruyucu cihazları (İKC) kullanmasını etkileyen faktörleri özellikle davranış motivasyonu, işitme koruma kısıtlamaları ve risk gerekçelendirme yönünden ele alarak incelemektedir. Belirtilen bu faktörlerin çalışanların risk alma davranışları, işyeri sosyal performansı ve sosyal ile yenilik odaklı yaşam tarzlarıyla ilişkisi araştırılmıştır. **Gereç ve Yöntemler:** Çalışma, farklı endüstriyel sektörlerde çalışan 423 katılımcı ile gerçekleştirilmiştir. Veri toplama sürecinde Demografik Bilgi Formu, İşitme Koruması Değerlendirme Ölçeği'nin Türkçe uyarlaması ve çalışanların risk alma davranışlarını, sosyal odaklı yaşam tarzlarını, yenilik odaklı yaşam tarzlarını ve işyeri sosyal performansını değerlendiren araştırma ölçeği kullanılmıştır. Veri analizinde, Spearman korelasyon testi, Mann-Whitney U, Kruskal-Wallis ve ki-kare testleri kullanılmıştır. **Bulgular:** Risk alma davranışları ile İKC kullanımını engelleyen faktörler arasında anlamlı bir ilişki bulunmuştur. Ayrıca, işyeri sosyal performansı, İKC kullanımını destekleyen faktörlerle pozitif ilişkilidir. İKC kullanımına yönelik davranış motivasyonu ile sosyal odaklı yaşam tarzı ($r=0,183$, $p<0,01$) ve yenilik odaklı yaşam tarzları ($r=0,121$, $p<0,05$) pozitif ilişki göstermektedir. Sosyal odaklı yaşam tarzı, İKC kullanımını teşvik eden faktörleri desteklerken, aynı zamanda engelleyici faktörleri de azaltıcı bir rol oynamaktadır ($r=-0,103$, $p<0,05$). Ayrıca, sektör türü, eğitim seviyesi, işitme koruma eğitimi alma durumu ve tercih edilen işitme koruma türü, çalışanların İKC kullanımına yönelik tutumlarını önemli ölçüde etkilemektedir. **Sonuç:** Risk alma davranışları, İKC kullanımını olumsuz etkilerken; işyeri sosyal performansı, sosyal ve yenilik odaklı yaşam tarzları daha güvenli davranışları teşvik etmektedir. Örgütsel destek, eğitim ve olumlu bir işyeri kültürü, işitme koruma uyumunu artırmaktadır. İKC kullanımını teşvik eden stratejiler, güvenlik kültürü, akran etkisi ve davranış motivasyonuna odaklanan bireysel ve işyeri düzeyinde müdahaleleri içermelidir.

Anahtar Kelimeler: Gürültü; mesleki; koruyucu gereçler; risk alma; iş sağlığı

Correspondence: Kübra ÖZMEN
Başkent University Faculty of Health Sciences, Department of Audiology, Ankara, Türkiye
E-mail: kubraozmen2017@gmail.com

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Some personal traits and environmental factors influence hearing protection behavior among workers in noisy workplaces, either supporting or discouraging the use of personal hearing protection devices (HPDs). Several studies suggest that ecological models can identify the factors responsible for occupational noise-induced hearing loss and help develop interventions to promote hearing protection behavior. Some qualitative studies have utilized the social-ecological model to describe workers' hearing protection behaviour.[1-3] Tantranont et al. identified three factors that influence health behavior: intrapersonal, interpersonal, and organizational.[2] Similarly, Robertson et al. comprehensively examined the factors affecting workers' hearing protection behaviour across three levels of the social environment: macrosystem, exosystem, and microsystem.[1] Finally, Reddy et al. analyzed different levels of hearing protection behavior, including individual, societal (family, peers, and workmate networks), and organizational (policies, norms, and values endorsed by workers).[3]

Reddy et al. identified factors influencing risk-taking in the workplace, including the impact of HPDs, awareness of danger, motivation, and safety culture.[4] Employee behaviour and perceptions, along with colleague and employer interactions, affect risk-taking. Commonly, risk-taking behavior involves weighing rewards against losses and considering both short-term and long-term outcomes.[5] Those with a higher propensity for risk are more likely to engage in unsafe noise behaviours. Connections exist between an individual's risk-taking tendencies, their awareness of noise-related dangers, and their perceptions of these risks.[6] Risk perception is crucial in predicting the use of HPDs.[7-9] Additionally, personal attitudes and subjective norms influence risk-taking, affecting the intention to use HPDs.[10]

The social-oriented lifestyle (SOL) includes interactions with colleagues, such as chatting, sharing thoughts, and making friends at work.[11] Employees with stronger social tendencies exhibit more positive behaviors, suggesting a positive relationship between this lifestyle and the use of hearing protective devices (HPDs).[12] For instance, Thai workers in noisy industries are encouraged to use HPDs by coworkers and supervisors. Additionally, cultural respect for authority and social norms can influence adherence to HPD regulations.[2] These factors align with the ecological model's interpersonal, organizational, and policy levels. However, communication difficulties negatively affect hearing protection behavior. Doutres et al. explored these behaviors over time, identifying communication challenges as key factors affecting HPD use.[13]

Lifestyles oriented towards innovation involve sharing new knowledge related to work, bringing in and adopting innovative ideas in the workplace, and the individual's attitudes and perspectives toward innovation.[11] Workers who are unaware of or do not perceive hearing loss risks are often reluctant to use HPDs. Nevertheless, experience and training can change their thoughts and behaviors, leading them to use HPDs.[1-2] The organization itself may provide training or be found by employees independently of the organization, reflecting organizational and intrapersonal factors. Workers willing to learn about new information and regulations may use HPDs.

The social environment of the workplace is related to the importance and commitment to ethical and legal requirements in the workplace.[14] It plays a vital role in establishing a safe climate. The integration of clear safety policies, organizational attitudes, and workplace responses to safety fosters a safety climate.[15] Although organizational factors are less considered in improving health behaviors, the availability of personal protective equipment in the workplace, the feedback provided to employees regarding their compliance with safety protocols, and the social/physical setting of the workplace play a role in safety behavior like the use of HPDs.[16]

Research indicates that a positive safety climate in the workplace promotes better HPD usage.[17-20] Arezes and Miguel found that HPD use correlates indirectly with the safety climate, influenced by factors like risk perception and noise effect perception.[7] Adequate time and access to protective devices are crucial for fostering a supportive work environment,

leading to increased HPD usage among employees.[16] A focus group with workers in noisy settings highlighted the importance of organizational factors, such as providing protective devices, training, information dissemination, noise monitoring, and regular hearing tests, in enhancing HPD utilization.[2] Consequently, effective training to improve HPD use should address these organizational elements.[21] A strong safety climate also boosts the effectiveness of such training initiatives.[22]

Culture may also play a role in the relationship between the social environment of the workplace and the use of HPD.[23] It has been discussed that organizational influences that determine HPD use may have a critical role, especially in countries where respect is based on authority.[19]

To promote the use of hearing protectors, this study incorporates variables that significantly impact employees' perceptions of their work environment. These variables include workers' (a) risk-taking behaviors, (b) social-oriented lifestyles, (c) innovation-oriented lifestyles, and (d) social performance in the workplace. The study highlights four variables that indicate the relationship between employees and their workplace and are believed to influence hearing protection behavior. Additionally, it will explore how workplace social performance and employee traits, such as risk-taking behaviors, sociability, and innovation-oriented lifestyles, affect hearing protection behavior. By evaluating hearing protection behaviour from the employees' viewpoint and examining their perceptions of the workplace environment and employer actions, we aim to obtain a more comprehensive understanding of the findings. Based on the studies mentioned above, the following research questions are addressed in the current study:

1. Do the factors that encourage or discourage workers from using hearing protectors vary based on the duration of noise exposure, industry, and professional experience?

2. Is there a correlation between the factors encouraging or discouraging workers from using hearing protectors, their risk-taking behavior, social lifestyles, innovation-focused lifestyles, and workplace social dynamics?

MATERIAL AND METHODS

RESEARCH DESIGN AND SAMPLING

The study focuses on individuals working in industrial environments with 85 dBA or higher noise levels. A cross-sectional study design was employed to gather data at a single time to examine the relationship between various factors. A purposeful sampling method was adopted to select industries with such noise levels. The participants were selected based on the inclusion criteria for being employed in an industrial sector and the willingness to participate in the study.

The study's hypotheses are based on qualitative data and will be analyzed using the chi-square test. Statistical analysis will be conducted at a significance level of 0.05. To determine the appropriate sample size for the study's hypotheses, G*Power3.1 software was used. Based on the research hypothesis effect size of 0.30, an α level of 0.05, a 95% confidence interval, and a test power of $(1-\beta)=0.80$, a minimum total sample size of 122 individuals was recommended.

ETHICAL CONSIDERATIONS

The study was approved by the Başkent University Institutional Review Board and Ethics Committee (no: KA22/506) with decision 23/08 dated January 18, 2023 and supported by the Başkent University Research Fund. It complied with the principles outlined in the Declaration of Helsinki. The participants were provided with necessary information about the research, and written informed consent was obtained from them.

INSTRUMENTS

Turkish Adaptation of Hearing Protection Assessment Scale

The Hearing Protection Assessment (HPA-2) scale, developed by Reddy et al. was created by combining 2 scales that include the factors that support and barrier the use of HPDs. The structure of HPA-2 consists of 5 subdimensions.[4] These are (a) risk justification, (b) HPD constraints, (c) hazard recognition, (d) behavior motivation, and (e) safety culture.

Cronbach's alpha reliability coefficients for the barriers scale and the supports scale were reported as 0.74-0.77, respectively.

The current study used the Turkish version of the HPA-2 (HPA-2-Tr), adapted and validated by Özmen et al. to measure employees' attitudes toward using HPDs.[24] In this version, the exploratory factor analysis yielded a 3-dimensional structure of the HPA-2-Tr scale consisting of 18 items and KR-20 value of the scale was found to be 0.881: (a) behavior motivation [behavior motivation (BM), 9 items, KR-20: 0.930], (b) HPD constraints (HPDC, 4 items, KR-20: 0.756), and (c) risk justification [Risk Justification (RJ), 5 items, KR-20: 0.758].

The Research Scale for "Risk-Taking Behavior of Employees, Variables of Lifestyles and Social Performance of the Workplace"

The research scale (RS), compiled from various sources and translated into Turkish by Durmuş, was used in this study to evaluate employees' risk-taking behaviour (RTB), SOL, innovation-oriented lifestyle (IOL), and social performance of the workplace (SPW). The author permitted the use of the research scale.[11] The RS consists of 18 items, and Cronbach's alpha reliability coefficients for each scale are given in Table 1.

THE DEMOGRAPHIC DATA FORM

Data regarding participants' age, gender, education level, occupation, industry sector they work in, and duration of professional experience (in years) was collected via the Demographic Data Form (DDF) prepared by the researchers. The DDF consists of 15 items related to participants' HPD use.

TABLE 1: The Content of the RS

Subscales	n	Cronbach's alpha	Source
RTB	4	0.771	Taatila&Down
SOL	5	0.826	Koshksaray et al.
IOL	4	0.841	Koshksaray et al.
SPW	5	0.870	Zhang et al.[14]

RTB: Employees' Risk-Taking Behaviour; SOL: Employees' Social-Oriented Lifestyle; IOL: Employees' Innovation-Oriented Lifestyle; SPW: Social Performance of the Workplace

DATA COLLECTION

Data was collected from Ankara and Tekirdağ for convenience purposes. The data collectors were given training to introduce the research purpose, encourage participants to participate willingly, and help them complete the consent form, DDF, and HPA-2-Tr. A standard procedure text was formulated for each data collector to follow, and an observer always accompanied the data collection process to ensure the internal reliability threat of data collector bias was controlled.

DATA ANALYSIS

Statistical data analysis was performed using SPSS 25.0 (SPSS Statistics version 25.0. IBM Corp., Armonk, NY). The Kolmogorov-Smirnov test was used to determine if the data had a normal distribution, and the Levene test was used to check the homogeneity of variances. To compare the variables based on subfactors of the HPA-2-Tr and RS, the Mann-Whitney U test and Kruskal-Wallis test were used, while the chi-square test was used to examine whether the items of the HPA-2-Tr differed for different variables. Finally, the Spearman-rho correlation coefficient was used to test the relationship between the scales. It is important to note that statistical significance was set at $p<0.05$ to ensure accurate results.

RESULTS

The study included 423 participants, with 41 females (10%) and 382 males (90%). The average age of the participants was 36.88±10.21 years. Of the participants, 147 worked in the automotive industry (35%), 109 in healthcare (26%), 157 in manufacturing (37%), and 2% in other sectors. The study found significant differences in HPA-2 and its subfactors, particularly in relation to hearing protection type and training status. Table 2 provides detailed information on the participants' demographics and their comparative results concerning the subfactors of HPA-2-Tr and the RS.

Significant differences were found in the total HPA-2-Tr score, BM and HPDC subfactors, and RS's subfactor SPW scores according to gender. Female participants had significantly lower total HPA-2-Tr and BM scores than male participants, but

TABLE 2: Comparison of the subfactors of HPA-2-Tr and the RS regarding demographics

	n (%)	HPA-2-Tr	BM	HPDC	RJ	RS	SOL	IOL	RTB	SPW
						p value				
Gender										
Female	41 (10)	**0.018**[U]	**0.002**[U]	**0.004**[U]	0.701[U]	0.176[U]	0.105[U]	0.273[U]	0.365[U]	**0.025**[U]
Male	382 (90)									
Educational level										
Primary	77 (18)									
Secondary	209 (50)									
Vocational school	65 (15)	0.220[KW]	0.209[KW]	0.083[KW]	**0.039**[KW]	0.759[KW]	0.323[KW]	**0.025**[KW]	**0.001**[KW]	0.163[KW]
University	72 (17)									
Industry										
Automotive	147 (35)									
Health	109 (26)									
Manufacturing	157 (37)	0.512[KW]	0.694[KW]	**<0.001**[KW]	**0.016**[KW]	**0.001**[KW]	**0.044**[KW]	0.169[KW]	**0.009**[KW]	**<0.001**[KW]
Others (textile, electronics)	10 (2)									
Job experience in noisy workplaces										
0-2 years	93 (22)									
3-5 years	86 (20)	0.100[KW]	0.181[KW]	0.449[KW]	0.667[KW]	0.878[KW]	0.659[KW]	0.846[KW]	**0.040**[KW]	0.760[KW]
6 years and above	244 (58)									
Daily noise exposure										
0-2 hours	53 (13)									
3-5 hours	72 (17)	0.260[KW]	0.314[KW]	0.561[KW]	0.403[KW]	**0.001**[KW]	**0.029**[KW]	**0.041**[KW]	0.641[KW]	**<0.001**[KW]
6-8 hours	297 (70)									
Hearing protection training										
Yes	291 (69)	**<0.001**[U]	**<0.001**[U]	**<0.001**[U]	**0.026**[U]	**0.013**[KW]	**0.014**[U]	**0.045**[U]	0.372[U]	**0.003**[U]
No	132 (31)									
Type of preferred hearing protection										
Ear caps	27 (8)									
Earplugs	161 (49)									
Earmuff	73 (22)	**<0.001**[KW]	**<0.001**[KW]	**<0.001**[KW]	**0.001**[KW]	**0.009**[KW]	**0.003**[KW]	**0.001**[KW]	**0.014**[KW]	0.160[KW]
Earplugs and Earmuff	67 (21)									
Use of hearing protection										
Yes	274 (65)	**<0.001**[U]	**<0.001**[U]	**0.014**[U]	**0.151**[U]	**<0.001**[U]	**0.007**[U]	**0.020**[U]	0.155[U]	**<0.001**[U]
No	147 (35)									
Frequency of hearing protection usage										
Rarely or never	136 (32)									
Sometimes	112 (27)									
Often	6 (1)	**<0.001**[KW]	**<0.001**[KW]	0.095[KW]	0.586[KW]	**0.046**[KW]	0.095[KW]	**0.009**[KW]	0.344[KW]	**<0.001**[KW]
Usually	64 (15)									
Almost always	34 (8)									
Always	71 (17)									

[U]Mann-Whitney U test; [KW]Kruskal-Wallis test. HPA-2-Tr: Turkish Adaptation of Hearing Protection Assessment; BM: Behavior motivation; HPDC: Hearing protection device constraints; RJ: Risk justification; RS: Research Scale; SOL: Social-oriented lifestyle; IOL: Innovation-oriented lifestyle; RTB: Risk taking behavior; SPW: Social performance of workplace

higher HPDC scores. However, when evaluating the results, it should be considered that the number of female participants (n=41) is much lower than the number of male participants (n=382).

IOL and RTB scores showed significant differences according to educational level. HPA-2-Tr's RJ score significantly differed across educational levels (p=0.039). The participants' mean RJ score is the

same and highest at the primary and secondary levels, while it gradually decreases at the vocational school and university levels.

There were significant differences found in HPA-2-Tr's subscores HPDC ($p<0.001$), RJ ($p=0.016$), the other scale RS ($p=0.001$), RS' subscales SOL ($p=0.044$), RTB ($p=0.009$), and SPW ($p<0.001$) scores according to industry. HPDC mean scores gradually decreased for manufacturing, automotive, and health industries, while RJ mean scores gradually decreased for health, automotive, and manufacturing industries. Note that the manufacturing industry had the highest HPDC mean score and the lowest RJ mean score. On the other hand, the health industry had the lowest HPDC mean score and the highest RJ mean score.

Job experience in noisy workplaces only significantly affected RTB ($p=0.040$). Daily noise exposure did not cause a significant difference in the total HPA-2-Tr score and none of its subfactors ($p>0.05$) but showed significant differences in RS ($p=0.001$) and its subscales SOL ($p=0.029$), IOL ($p=0.041$) and SPW ($p<0.001$).

There were significant differences found in the total HPA-2-Tr score ($p<0.001$), its subfactors BM ($p<0.001$), HPDC ($p<0.001$), RJ ($p=0.026$), and the other scale RS ($p=0.013$) and RS' subscales SOL ($p=0.014$), IOL ($p=0.045$) and SPW ($p=0.003$) scores according to hearing protection training. Hearing protection training increased the total HPA-2-Tr ($\mu_{yes}=14.87$ vs. $\mu_{no}=11.24$), BM ($\mu_{yes}=7.09$ vs. $\mu_{no}=3.28$), and RJ ($\mu_{yes}=1.51$ vs. $\mu_{no}=1.15$) but HPDC ($\mu_{yes}=6.27$ vs. $\mu_{no}=6.80$) scores.

The type of preferred hearing protection showed a significant difference in all (sub)factors except SPW ($p>0.05$). P-values were 0.009, 0.003, 0.001, and 0.014 for RS, SOL, IOL, and RTB, respectively. The type of preferred hearing protection also significantly affected the total HPA-2-Tr score ($p<0.001$) and its subfactors BM ($p<0.001$), HPDC ($p<0.001$), and RJ ($p=0.001$) scores. The total HPA-2-Tr score was highest for the ear caps group and gradually decreased for earmuffs and earplugs, with a minimum observed for both earplug and earmuff-preferred participants. The order for the BM score was as follows: only earmuffs, only ear caps, only earplugs, and both earplugs and earmuffs. Based on the HPDC mean score, the groups ranked from highest to lowest were earplugs and earmuffs, only ear caps, only earplugs, and only earmuffs. According to the RJ mean score, the ranking was: only ear caps, only earplugs, only earmuffs, and both earplugs and earmuffs.

There were significant differences found in the total HPA-2-Tr score ($p<0.001$), its subfactors BM ($p<0.001$), HPDC ($p=0.014$), and the other scale RS ($p<0.001$) and RS' subscales SOL ($p=0.007$), IOL ($p=0.020$) and SPW ($p<0.001$) scores according to use of hearing protection. Use of hearing protection increased the total HPA-2-Tr ($\mu_{yes}=15.06$ vs. $\mu_{no}=11.21$) and BM ($\mu_{yes}=7.26$ vs. $\mu_{no}=3.33$) but HPDC ($\mu_{yes}=6.31$ vs. $\mu_{no}=6.64$).

There were significant differences found in the total HPA-2-Tr score ($p<0.001$) and its sub-factor BM ($p<0.001$) and the other scale RS ($p=0.046$), and RS subscales IOL ($p=0.009$), SPW ($p<0.001$) scores according to the frequency of hearing protection usage. According to the total HPA-2-Tr score, the highest to the lowest groups were found to be almost always, always, usually, often, sometimes, rarely, or never. According to the BM score, the highest to the lowest groups were almost always, often, usually, always, sometimes, rarely, or never.

A weak correlation ($r=0.154$) was observed between the HPA-2-Tr scale and RS. The Spearman rho correlation coefficients between the scales' subfactors are given in Table 3.

As a result of the Spearman-rho correlation analysis, there was a weak positive correlation between HPA-2-Tr and a SOL ($r=0.129$; $p<0.001$) and a weak positive correlation with SPW ($r=0.222$; $p<0.001$). No statistically significant relationship was found between HPA-2-Tr and IOL or RTB ($p>0.05$). Among the subscales, a weak positive correlation was observed between BM and SOL, IOL, and SPW ($r=0.183$, $r=0.121$, $r=0.236$, respectively), and a weak negative correlation was found with RTB ($r=-0.123$; $p<0.05$). There was a weak negative correlation between HPDC and SOL ($r=-0.103$; $p<0.01$) and a weak positive correlation between RJ and RTB ($r=0.125$; $p<0.01$).

TABLE 3: Spearman-rho correlations between subscales of HPA-2-Tr and RS

	HPA-2-Tr	BM	HPDC	RJ	SOL	IOL	RTB	SPW
HPA-2-Tr	-	0.764**	0.671**	0.643**	0.129**	0.095	-0.065	0.222**
BM		-	0.176**	0.163**	0.183**	0.121*	-0.123*	0.236**
HPDC			-	0.656**	-0.103*	0.023	-0.048	0.090
RJ				-	0.040	-0.062	0.125**	-0.085
SOL					-	0.623**	-0.134*	0.338**
IOL						-	-0.188**	0.387**
RTB							-	-0.197**
SPW								-

*p<0.05; **p<0.001. HPA-2-Tr: Turkish Adaptation of Hearing Protection Assessment; BM: Behavior motivation, HPDC: Hearing protection device constraints; RJ: Risk justification; SOL: Social-oriented lifestyle; IOL: Innovation-oriented lifestyle; RTB: Risk taking behaviour; SPW: Social performance of workplace

DISCUSSION

This study found a significant positive relationship between risk justification, a barrier to the use of HPDs, and risk-taking behaviors in noisy workplaces. Additionally, a negative correlation was found between the HPA-behaviour motivation subscale, which reflects individual and organizational support for hearing protection, and risk-taking behaviors. This indicates that individuals with high risk-taking behaviors are more inclined to rationalize their risk-taking, thus hindering the use of hearing protection while being less likely to embrace supportive rationales. Snapp et al. noted that those with high general risk-taking tendencies are more prone to engage in risky noise behaviour.[6] Previous studies have also identified risk perception as a key predictor of HPD use in noisy workplaces.[7-9]

Personal and environmental factors affecting hearing protection behaviors and social-oriented lifestyles correlate with the study's behavioural motivation and HPD constraint subscales. A SOL positively influences behavioural motivation, suggesting that when both are present, workers are more likely to use HPDs. Social ties strongly link to health outcomes through various pathways, with evidence supporting their beneficial effects on overall health and specific conditions like cardiovascular diseases.[25,26]

The behavioural motivation factor in this study includes elements of ecological models. Maintaining health for the family and considering co-workers' warnings relate to a social-oriented lifestyle. Social ties instill a responsibility toward others' health and well-being and encourage health-promoting behaviours.[25] This phenomenon, referred to as the family effect, motivates behavior. Social interactions also inform and shape norms affecting health behavior, which can be positive or negative. For example, Latino's "tough guy" mentality discourages the use of health promotion devices (HPDs).[1] Thus, there's a positive relationship between a SOL and supportive behaviour motivation for HPD use.

Furthermore, a SOL has a negative relationship with the HPD constraints factor. This can be explained by the fact that workers with a socially oriented lifestyle may be able to fulfill social needs outside of work or cope effectively with noise and communication limitations in the workplace. Social connections (family and friends) are one of the important coping strategies for workers.[27] Moreover, social ties help to preserve and support mental and physical health. It is also possible that sufficient, supportive social regulations provided by organizations decrease the willingness of workers to socialize during work hours and alleviate the perceived constraints of workers.[25]

As expected, a SOL has a negative relationship with HPD constraints. Communication limitations are one of the major factors that create barriers to workers' HPD use.[13] It negatively affects people who have a SOL because HPD use brings social isolation and reduces social interaction in the workplace. That finding is consistent with the "barrier" classification of the HPD constraint subscale.

The innovation-focused lifestyle refers to workers sharing new knowledge and practices with others and seeking innovative solutions to problems.[11] It's not surprising that an innovation-focused lifestyle and a SOL are observed together. Several studies have presented findings supporting this topic from various perspectives.[28-29] According to the correlation results, this study has shown a positive relationship. The most relevant item of behavior motivation factor with an innovation-focused lifestyle is thought to be HPD use trainee because it may increase knowledge and encourage knowledge sharing. Additionally, co-worker warnings can also be considered innovative interactions.

This study found a significant positive relationship between behavior motivation, a factor encouraging employees to use hearing protection, and the social performance of the workplace. The HPA-behaviour motivation subscale incorporated items related to workplace guidance, rules, and training on hearing protection, expecting an association with the overall safety climate. A positive, safe work environment supports the use of hearing protection, as many studies link a strong safety climate to higher usage of HPDs.[2,16-20] The behaviour motivation subscale also includes individual motivations for using HPDs, such as wanting to protect one's hearing for personal and family well-being. Thus, a positive work climate can enhance individual motivations to adopt safety behaviours.[30]

The hypothesis test results can only be generalized to people working in noisy conditions. Studies indicate that the use of HPD and even the factors affecting it may vary across different occupational sectors (e.g. fire fighters).[21] This study could not examine its convergent validity since there is no other measurement tool in our language for individuals working in noisy workplaces.

Hearing protection behaviors may be influenced by financial concerns in some cultures. A qualitative study found that Latino construction workers prioritize job acceptance and may accept unsafe conditions.[1] In Türkiye, workers often hesitate to voice demands for fear of job loss, especially among an increasing number of migrant workers. Future qualitative studies could further explore this issue, potentially adapting the HPA-2 scale to Arabic to investigate barriers to HPD use among migrants.

Risk-taking behavior in the workplace is associated with barriers affecting HPD use, while social performance at the workplace is related to supportive parameters affecting HPD use. The lifestyles evaluated in this study are closely related. Social- and innovation-oriented lifestyles relate to the supportive factor of behavioral motivation. Moreover, the SOL has a dual impact, acting as both an effective promoter of supportive factors for HPD use and an impediment against barriers.

Despite the valuable insights offered by this study, several limitations must be acknowledged. First, the cross-sectional design restricts causal interpretations, limiting the ability to establish the directionality of observed associations. The reliance on self-reported data may also introduce social desirability or recall bias, particularly concerning sensitive constructs such as risk-taking behavior. Additionally, the sample's geographic confinement to 2 industrial regions in Türkiye limits the generalizability of findings across diverse occupational settings. Future research should adopt longitudinal designs to clarify causal relationships and explore behavioral changes over time. Incorporating mixed-methods approaches, including qualitative interviews, would enrich the interpretation of contextual and cultural dimensions. Expanding the research to include diverse sectors, countries, and vulnerable populations such as migrant workers is also warranted. Furthermore, adapting the HPA-2 scale into additional languages and validating it across various cultural contexts would enhance its utility. Finally, intervention-based studies are recommended to assess the effectiveness of educational programs, workplace policies, and emerging technologies in promoting sustained hearing protection compliance.

CONCLUSION

This study highlights the complex interplay of personal, environmental, and workplace factors influencing hearing protection behaviours among industrial workers. The findings indicate that while

risk justification and constraints negatively impact HPD use, motivational factors and a strong workplace safety culture promote compliance. Employees with higher risk-taking tendencies are less likely to prioritize hearing protection, underlining the necessity for targeted interventions that address risk perception.

A critical insight from this study is the significant role of workplace social performance in promoting HPD use. A supportive work environment, characterized by safety-focused policies, training programs, and peer influence, can enhance compliance. Social and innovation-oriented lifestyles also encourage hearing protection by fostering knowledge-sharing and adherence to safety norms.

To boost HPD adoption, organizations should provide thorough safety training, promote positive workplace norms, and incorporate social and innovation strategies into their health programs. Future research should examine how cultural and economic factors affect hearing protection behaviors in various work environments. Addressing individual and organizational factors is crucial for sustaining safety behaviors in noisy workplaces.

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Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Kübra Özmen, Merve Deniz Sakarya, Eda Çakmak;* ***Design:*** *Kübra Özmen, Eda Çakmak;* ***Control/Supervision:*** *Kübra Özmen;* ***Data Collection and/or Processing:*** *Kübra Özmen, Merve Deniz Sakarya, Eda Çakmak, Gizem Güner;* ***Analysis and/or Interpretation:*** *Kübra Özmen, Merve Deniz Sakarya, Eda Çakmak, Gizem Güner;* ***Literature Review:*** *Kübra Özmen, Merve Deniz Sakarya, Gizem Güner;* ***Writing the Article:*** *Kübra Özmen, Merve Deniz Sakarya, Eda Çakmak, Gizem Güner;* ***Critical Review:*** *Kübra Özmen;* ***References and Fundings:*** *Kübra Özmen.*

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