Original Article

Assessment of attitudes and behaviors toward noise's exposures and its effect on hearing in Al-Qassim, Saudi Arabia: a cross-sectional study

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ABSTRACT

Background: Noise-induced hearing loss (NIHL) stands as a significant health challenge that is both common and preventable. It calls for a profound understanding of exposure patterns, commitment to ear protection, and the influence of demographic factors. This cross-sectional study sets out to explore these elements among a varied group of participants.

Methodology: A cross-sectional study engaged 252 individuals who provided demographic details and completed a structured questionnaire evaluating their noise exposure frequency, compliance with ear protection during various activities, and demographic variables. Data analysis utilized descriptive statistics, chi-square tests, and analysis of variance (ANOVA).

Results: The demographic analysis revealed a notable representation of females 172 (68.3%) and diverse occupational backgrounds. Participants aged 20-30 years constituted the majority with 169 individuals (67.1%). Exposure frequency demonstrated variations across different scenarios, with a substantial percentage reporting never being exposed to loud noises. Adherence to ear protection varied, with low utilization reported in certain activities. The relationship between adherence and demographics indicate gender, age, marital status, and occupation-related differences.

Conclusion: The study provides valuable insights into the demographic factors influencing noise exposure and adherence to ear protection. The observed patterns align with existing literature on NIHL, emphasizing the need for targeted interventions and educational campaigns to promote consistent hearing protection behaviors. Understanding demographic influences on hearing health is crucial for tailoring interventions and mitigating the risk of noise-induced hearing loss across diverse populations. The findings contribute to public health initiatives and workplace safety programs aimed at fostering a culture of proactive hearing health.

Keyword: Noise exposure, Hearing loss, Public awareness, Attitude, Saudi Arabia.

Introduction

Noise-induced hearing loss (NIHL) poses serious implications for individuals across all demographics, age groups, genders, and ethnicities [1]. Characterized as sensorineural deafness stemming from extended exposure to high decibel levels, NIHL ranks as the second most prevalent cause of acquired hearing loss globally after presbycusis [2]. The National Institute for Occupational Safety and Health has established

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an acceptable daily noise exposure limit at 85 A-weighted decibel (dBA) over an eight-hour period; exceeding this threshold risks cochlear damage from either abrupt incident like gunfire or chronic high-volume environments leading to gradual NIHL progression. Recreational venues such as clubs or sports arenas often exceed safe sound levels, rendering them equally hazardous as traditional industrial noise exposures [1]. Long term high intensity noise can harm sensory hair cells within the inner ear, resulting in permanent shifts in auditory thresholds alongside diminished speech perception amid background sounds. Additionally, frequent noise exposure correlates strongly with tinnitus development a condition possibly related to alterations in central auditory processing [3]. In adults, NIHL substantially impacts quality of life by restricting access to employment opportunities within hearing sensitive fields while contributing to social isolation through impaired communication capabilities with family members or colleagues. As populations age and individuals continue working longer, NIHL's socioeconomic ramifications are expected to cascade further into societal challenges related both to age associated hearing loss and nonage related forms. Despite being largely preventable through early detection via audiometric screenings aimed at raising awareness about risk factors associated with NIHL [4], treatment options remain limited, primarily to cochlear implants or hearing aids [1]. One effective model involves implementing comprehensive four-part programs addressing source identification, sound control measures, and employee education initiatives about potential hazards associated with excessive noise exposure coupled with using personal protective equipment (PPE), which fosters better communication outcomes. With insufficient research focusing explicitly on NIHL's dynamics within specific regional contexts, including Qassim province, we endeavor here to elucidate attitudes toward its effects on auditory function among residents.

Methods

We adopted a cross-sectional study design. The study was conducted in the central province of Saudi Arabia, specifically in Qassim, from July 2023 to January 2024, to explore the attitudes of individuals exposed to noise regarding its impact on hearing and the potential for causing hearing loss. Inclusion criteria involved Saudi individuals who agreed to take part and completed the full questionnaire, while exclusion criteria encompassed non-Saudi residents, individuals who refused participation, and did not complete the entire questionnaire. All participants who met the inclusion criteria were included in the study. A sample size of 252 was determined using the Raosoft calculator (Raosoft Inc., Seattle, WA) at 95% CI and 5% margin of error. A simple random sampling method was employed to ensure that each person in the target population had an equal probability of being selected for the study. The data collection questionnaire was developed using Google Forms and distributed via social media platforms. The questionnaire consists of five domains. The first domain is socioeconomic, which includes questions regarding gender, age, nationality, marital status, and occupation. The second domain is the frequency of exposure to loud noises- environment. The third domain is the average time to be exposed to a noisy environment. The fourth domain is about adherence to using earplugs when using noise instruments. The fifth domain is the relation between adherence to use ear protection and demographic factors. The questionnaire was evaluated and demonstrated satisfactory construct validity. A comprehensive review of tools from prior research, along with expert consultation was done. For data management and analysis, all collected data were meticulously cleared, coded, and entered into the Statistical Package for the Social Sciences (SPSS) version 27 (Statistical Product and Service Solutions, SPSS Inc., Chicago, IL, USA). The results were presented using tables and graphs, indicating frequencies and percentages. Statistical tests of significance were applied, with a p-value of 0.05 or less considered indicative of association. Ethical approval was granted by the ethics committee at Qassim University, located in Qassim, Saudi Arabia (approval number: IRB-24-75-19). All participants were provided information before obtaining consent. Informed consent was secured before data collection, and participant confidentiality was strictly maintained.

Results

(Table 1) outlines the demographic characteristics of the study participants, a total of 252 individuals were included in the analysis. The gender distribution indicates a notable representation of females, accounting for 68.3% (172 participants) of the total sample, while males constituted 31.7% (80 participants). Age distribution showed that the majority of respondents, 67.1% (169 participants), fell within the 20-30 age bracket, with 14.7% (37 participants) in the 30-40 age group, 15.1% (38 participants) in the 40-50 age range, and 3.2% (8 participants) aged over 50 years. Marital status revealed that 67.1% (169 participants) of the participants were single, 31.3% (79 participants) were married, and a small percentage of 1.6% (4 participants) reported being divorced. Occupational distribution provided insights into the diverse backgrounds of the participants, with 49.6% (125 participants) identifying as students, 12.7% (32 participants) as housewives, 13.9% (35 participants) as teachers, 9.5% (24 participants) as office workers, 2.4% (6 participants) engaged in military work, 4.0% (10 participants) in medical professions, 6.0% (15 participants) in other occupations, and 2.0% (5 participants) not currently working. (Table 2) outlines the frequency of participants' exposure to loud noises in diverse environments over the past year. The majority reported never being around shooting or firearms (89.7%), while exposure to loud noises during paid employment varied, with 69.0% reporting never being exposed. Participants also demonstrated varied exposure to other loud noises such as electrical tools or music, with 34.1% reporting no exposure. Regarding non-paid use of power tools, 61.5% reported never engaging in such activities. The majority reported never driving heavy equipment (83.7%) or attending events with subwoofers (58.7%). Similarly, 77.8% reported never driving loud vehicles. For activities like flying aircraft, engaging in hunting, or playing musical instruments, the majority reported never being exposed. Exposure through headphones varied, with 34.1% reporting never being exposed, while exposure from speakers in the car or at home was reported as never by 29.0%. As illustrated in (Figure 1), participants were asked about their employment during the summer months involving exposure to loud noises, such as in construction, farming, or car wash. The majority (86.9%) responded negatively, indicating that a substantial portion of participants did not work in jobs with loud noises during the specified period. In (Figure 2), participants who played a musical instrument were asked to specify the type. The responses reveal a varied distribution, with the oud being the most commonly reported instrument (51.6%), followed by the piano (25.8%), the guitar (19.4%), and drums (3.2%). (Table 3) presents the average time participants were exposed to various noise environments, categorized by different activities. Notably, for exposure to power tools, 67.4% reported exposure for less than one hour, with smaller percentages reporting higher durations (8 hours or higher - 6.3%, 4-8 hours - 8.4%, 1-4 hours - 17.9%). In the case of loud equipment, the majority reported exposure for less than one hour (37.5%), while 30.0% reported exposure for 1-4 hours. Events with subwoofers and loud music systems showed a distinct pattern, with 52.9% reporting exposure for 1-4 hours and 23.5% for 4-8 hours. Exposure to a loud vehicle exhibited a similar trend, with 36.4% reporting exposure for less than one hour and 32.7% for 1-4 hours. Airplane-related exposure predominantly occurred for 1-4 hours (48.7%). Music instrument-related exposure varied, with 51.0% reporting exposure for less than one hour. Listening via headphones showed diverse exposure durations, with 46.1% reporting exposure for less than one hour. (Table 4) presents the adherence of participants to using earplugs during various activities involving noise exposure. For activities such as using power tools, the majority reported never using earplugs (78.1%), while 17.7% reported using earplugs sometimes, and 4.2% reported always using them. Similarly, for driving or using loud equipment, 53.8% reported never using earplugs, 41.0% sometimes, and 5.1% always. Attending events saw 71.0% never using earplugs, 27.0% sometimes, and 2.0% always. In the case of driving a loud vehicle, 54.5% reported never using earplugs, 38.2% sometimes, and 7.3% always. Riding or flying in airplanes showed 61.0% never using earplugs, 29.9% sometimes, and 9.1% always. Being around or shot with firearms exhibited 72.1% never using earplugs, 23.3% sometimes, and 4.7% always. For playing a musical instrument, 81.8% reported never using earplugs, 6.8% sometimes, and 11.4% always. Finally, being around loud noises demonstrated 78.9% never using earplugs, 18.3% sometimes, and 2.8% always. (Table 5) displays the relationship between participants' adherence to using ear protection and various demographic factors, providing valuable insights into potential associations. The mean scores represent the average level of adherence, with a higher score indicating greater adherence to using ear protection. The analysis reveals significant differences in adherence based on gender, with males showing a higher mean adherence score of 4.84 compared to females with a score of 2.69 (p-value = 0.000*). Age-related differences show a trend of decreasing adherence with increasing age, although statistical significance is not reached (p-values: 20-30 years = 0.122, 30-40 years = 0.158, 40-50 years = 0.176, > 50 years = 0.176). Marital status demonstrates a potential association, with single individuals exhibiting a higher mean adherence score (3.70) compared to married (2.72) and divorced (2.25) participants, although statistical significance is not fully established

Table 1: The demographic characteristics of the study participants, (n=252 individuals).

Demographic factors of the participants		Count	Column N %
Gender	Male	80	31.7%
	Female	172	68.3%
Age	20-30	169	67.1%
	30-40	37	14.7%
	40-50	38	15.1%
	> 50 years	8	3.2%
Marital status	Single	169	67.1%
	Married	79	31.3%
	Divorced	4	1.6%
Occupation	Student	125	49.6%
	Housewife	32	12.7%
	Teacher	35	13.9%
	Office worker	24	9.5%
	Military work	6	2.4%
	Medical work	10	4.0%

	Other	15	6.0%
	Not working	5	2.0%

Table 2: The frequency of participants' exposure to loud noises in diverse environments over the past year.

During the past year, how many times have you been:	Never		Every few months		Monthly		Weekly		Daily	
	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %
Around a shooting or shot using firearms such as rifles, handguns, etc.	226	89.7%	19	7.5%	3	1.2%	1	0.4%	3	1.2%
Exposed to loud noises while working a paid job?	174	69.0%	45	17.9%	11	4.4%	11	4.4%	11	4.4%
Exposed to any other types of loud noises, such as electrical tools, lawn equipment, or loud music?	86	34.1%	95	37.7%	28	11.1%	32	12.7%	11	4.4%
Used power tools, saws, or other equipment (such as blacksmithing, carpentry tools, etc.) in a non-paid job?	155	61.5%	69	27.4%	16	6.3%	8	3.2%	4	1.6%
Driven heavy equipment or use loud machinery	211	83.7%	22	8.7%	10	4.0%	7	2.8%	2	0.8%
Attended a car/truck race, high school/trade sporting events, a song or dance recital, or any event where there was a subwoofer and music playback system	148	58.7%	88	34.9%	8	3.2%	5	2.0%	3	1.2%
Driven a loud vehicle such as: a motorcycle, jet ski, quad bike, snow bike, or four-wheeler	196	77.8%	36	14.3%	14	5.6%	3	1.2%	3	1.2%

flown or flown aircraft (small or private/public aircraft)	173	68.7%	62	24.6%	8	3.2%	3	1.2%	6	2.4%
Engaged in activities such as hunting with firearms such as rifles, handguns, etc.?	208	82.5%	30	11.9%	9	3.6%	1	0.4%	4	1.6%
Played a musical instrument	200	79.4%	35	13.9%	9	3.6%	5	2.0%	3	1.2%
Listened to music, radio programs, etc. using headphones or earbuds	86	34.1%	31	12.3%	22	8.7%	39	15.5%	74	29.4 %
Listened to music, radio programs, etc. from speakers in the car or at home	73	29.0%	49	19.4%	26	10.3%	54	21.4%	50	19.8 %

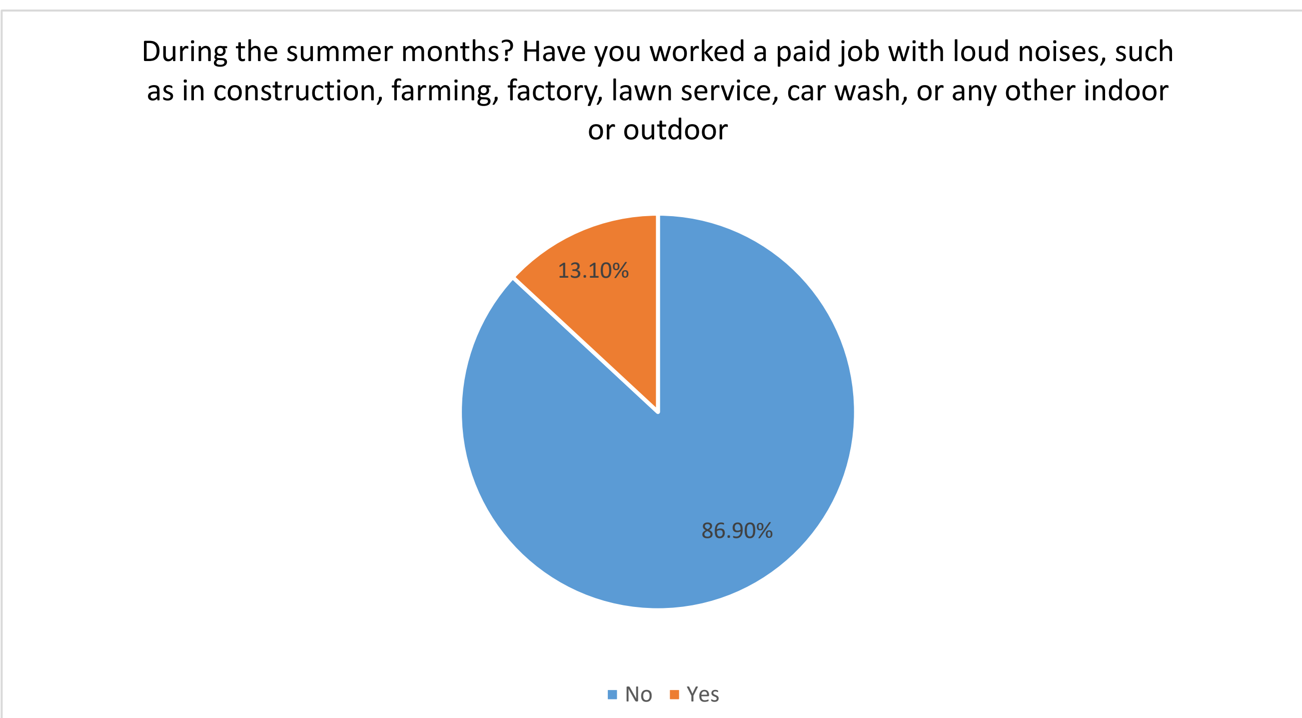

Figure1: Prevalence of Summer Employment in Noise-Exposed Jobs Among Participants

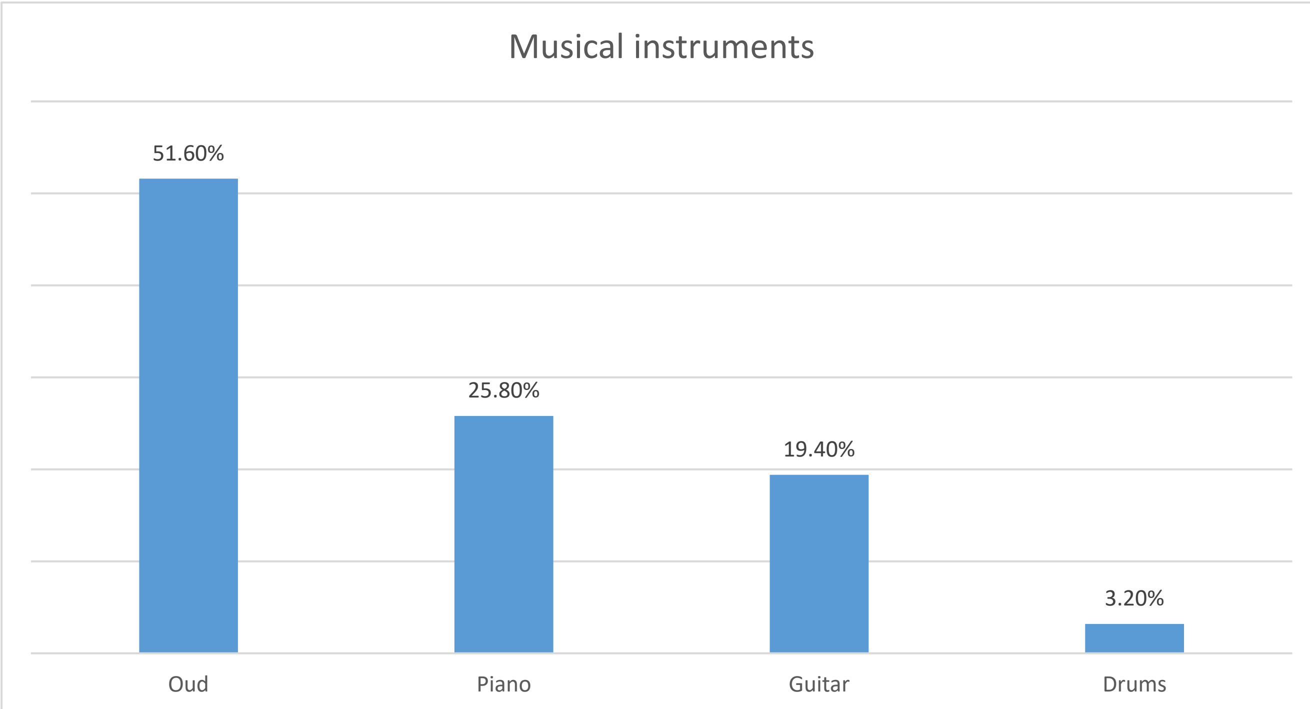

Figure 2: Distribution of Musical Instruments Played by Participants

Table 3: The average time participants were exposed to various noise environments, categorized by different activities.

Average time to be exposed to noise by	8 hours or higher		4-8 hours		1-4 hours		Less than one hour	
	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %
Power tools	6	6.3%	8	8.4%	17	17.9%	64	67.4%
loud equipment	3	7.5%	10	25.0%	12	30.0%	15	37.5%
Events	6	5.9%	24	23.5%	54	52.9%	18	17.6%
A loud vehicle	3	5.5%	14	25.5%	18	32.7%	20	36.4%
Airplanes	7	9.0%	18	23.1%	38	48.7%	15	19.2%
Music instrument	3	5.9%	7	13.7%	15	29.4%	26	51.0%
Listening via headphones	22	9.5%	38	16.4%	65	28.0%	107	46.1%

Table 4: The adherence of participants to using earplugs during various activities involving noise exposure.

Adherence to using earplugs during	Never		Sometime		Always	
	Count	Row N %	Count	Row N %	Count	Row N %
Using power tools	75	78.1%	17	17.7%	4	4.2%
Driving or using loud equipment	21	53.8%	16	41.0%	2	5.1%
Attending events	71	71.0%	27	27.0%	2	2.0%
Driving a loud vehicle	30	54.5%	21	38.2%	4	7.3%
Riding or flying airplanes	47	61.0%	23	29.9%	7	9.1%
Being around or shot firearms	31	72.1%	10	23.3%	2	4.7%
Playing a musical instrument	36	81.8%	3	6.8%	5	11.4%
Being around loud noises	142	78.9%	33	18.3%	5	2.8%

Table 5: The relationship between participants' adherence to using ear protection and various demographic factors, providing valuable insights into potential associations.

Demographic factors		Using protection (Higher score indicating higher adherence)		
		Mean	Standard Deviation	P-value
Gender	Male	4.84	3.98	0.000*
	Female	2.69	2.82	
Age	20-30	3.73	3.61	0.122
	30-40	2.65	2.80	
	40-50	2.63	2.74	
	> 50 years	2.63	2.45	
Marital status	Single	3.70	3.58	0.084
	Married	2.72	2.89	
	Divorced	2.25	1.50	
Occupation	Student	3.50	3.33	0.021*
	Housewife	3.03	3.67	
	Teacher	3.09	3.42	
	Office worker	2.17	1.37	

	Military work	7.67	5.32	
	Medical work	4.20	4.18	
	Other	3.93	3.17	
	Not working	1.40	0.89	

*Significant value at P <0.05

(p-values: Single vs. Married = 0.084, Single vs. Divorced = 0.063). Occupation-related differences are notable, with students showing higher adherence (3.50) compared to other occupations, and military workers exhibiting the highest mean adherence score (7.67) among all categories, with statistical significance for student adherence (p-value = 0.021*).

Discussion

The detrimental effects of noise exposure on hearing have been a growing concern in public health, as prolonged or excessive exposure to loud sounds can lead to irreversible hearing damage [5–7]. The finding of this study highlight that noise exposure remains prevalent in various settings and adherence to ear protection is still suboptimal. These observations emphasise the urgent need for targeted interventions to reduce the risk of noise induced hearing loss. These findings are consistent with previous studies [5–7, 9–13], which also reported relatively low exposure rates among general populations. Such agreement supports the notion that limited engagement in high-noise environments may reduce the prevalence of noise-induced hearing loss. Regarding adherence to ear protection, a substantial percentage never used earplugs: 78.1% during power tool use, 71.0% at events, and 72.1% around firearms [8–11]. This low adherence aligns with findings from previous studies [8–10, 13–15], which also reported poor compliance with hearing protection. However, some studies have documented higher adherence in occupational settings with mandatory safety regulations [15], indicating contextual differences. Overall, our results agree with the literature emphasizing the need for enhanced education and awareness to promote consistent ear protection use. Regarding demographic factors influencing adherence, males had higher mean adherence scores (4.84) than females (2.69), in agreement with studies showing gender-based differences in risk perception and protective behavior [16,17]. However, our results partially disagree with findings from [18–20], where females demonstrated higher HPD use under specific conditions, suggesting that adherence may vary across contexts. The observed age-related trends—showing younger adults as more receptive to HPDs—are consistent with the literature [17,20,23,24]. Similarly, higher adherence among military personnel aligns with studies highlighting strict enforcement of hearing protection in high-noise occupations [23,25]. The moderate adherence among students also agrees with previous reports emphasizing the role of educational campaigns in improving HPD use [23,25]. Educational level influenced HPD adoption, with higher-educated individuals more likely to use protective devices, attributed to enhanced problem-solving skills, cognitive abilities, and access to resources [23,25–27]. However, some studies reported no significant correlation between education and HPD use [26]. In agreement with other researchers, future research should incorporate objective measurements of noise exposure and adherence [5–7,28]. Additionally, the effectiveness of educational campaigns across diverse populations warrants further investigation [13–15,28].

Conclusion

This study contributes to our understanding of noise exposure, adherence to ear protection, and their relationships with demographic factors. The findings underscore the need for targeted interventions that consider gender, age, occupation, and marital status variations. Developing and implementing effective educational campaigns can play a pivotal role in raising awareness and promoting consistent adherence to ear protection across diverse scenarios. Integrating these results into public health initiatives and workplace safety programs holds significant potential in reducing the burden of noise-induced hearing loss in the population.

Conflict of Interest

None

Funding

None

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