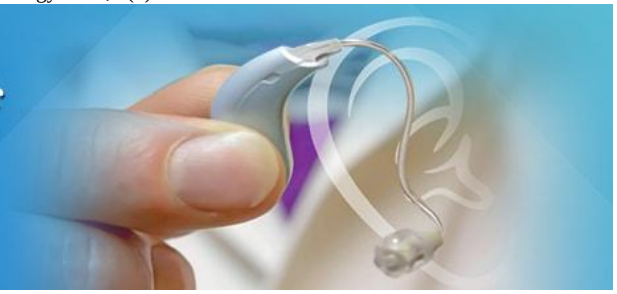
International Journal of Speech and Audiology



E-ISSN: 2710-3854
P-ISSN: 2710-3846
IJSA 2025; 6(2): 13-18

Journal's Website
Received: 06-04-2025
Accepted: 04-05-2025

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Effect of noise on industrial and non-industrial worker

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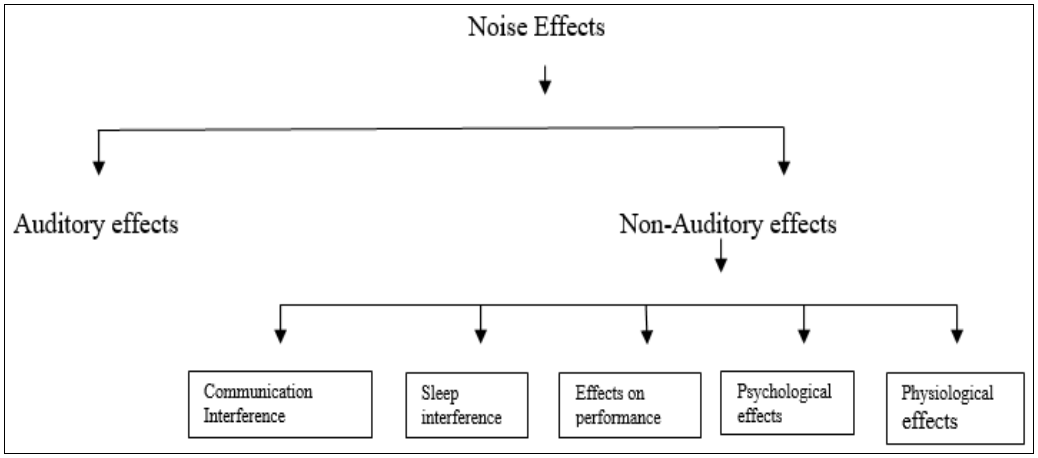
Abstract
Noise pollution is considered as more important environmental problem, especially in the industrialized and developed countries. Industrial noise is an important source of noise pollution, which annoys and disrupts the daily activities of workers. This study is to investigate and compare the activities and participation of industrial and non-industrial worker with hearing impairment. The current research is a descriptive research using a purposive sample of 300 males in the age range of 30-45 years in two groups. Group-A 150 Industrial workers and 150 Non-industrial workers. Demographic data and information about health status was obtained using structure interview and questionnaire method. Questionnaire was completed by 300 workers during this study in order to determine the physical, physiological, and psycho-social impacts. The results of this study shows that the industrial workers experience more somatic difficulties, while non-industrial workers appear to be more concerned about the personal-social impact of their impairment.

Keywords: Noise, industrial noise, exposure to noise, workers, hearing impairment

Introduction
Noise is one of the physical environmental factors affecting our health in today's world. Noise is generally defined as the unpleasant sounds which disturb the human being physically and physiologically and cause environmental pollution by destroying environmental properties.
Noise appropriately shares a common Latin root with the word "nausea", and its disturbing influence on people has existed even in the distant past. It is often quoted that "one man"s music may be another man's poison." Noise is generally accepted as sound of any kind which is undesired by the recipient at a given time and place.
The term noise such as background noise, classroom noise, industrial noise etc. refers to any auditory disturbances that interference with what listeners want to hear. In physical terms, noise may be defined as a sound, generally of a random nature, the spectrum of which does not exhibit distinct frequency component. The effects of noise physiologically, psychologically, or socially depend on the complex relationship between its spectral and temporal characteristics.
There is fairly consistent evidence that noise above 80dBA causes reduced helping behavior, and that loud noise also increases aggressive behavior in individuals predisposed to aggressiveness. It has been shown mainly in workers (industrial) that noise can diversely affects performances of cognitive tasks. Cognitive performance substantially deteriorates for more complex tasks. Reading, attention, problem solving and memorization are most strongly affected by noise.
An adverse effect of noise is defined as a change in morphology and physiology of an organism which results in impairment of functional capacity or impairment of capacity to compensate for additional stress or increase in susceptibility to the harmful effects of other environmental influences (WHO Guidelines on Community Noise, Schwela (1998). It includes physical and physiological alteration of underlying neural processes of auditory systems like reduction, temporal summation, and poor speech discrimination. Other effects are sleep disturbances, effects on cardiovascular functioning and mental heath, effects on performance, annoyance, etc. Among these, physical and physiological alteration in cochlea leads to noise induced hearing loss (NIHL). Given the range of adverse effects and the severity of the problem encountered with exposure to noise, it is necessary to examine the issue at length.



- **Non-auditory effects**

Non-auditory effects include stress related physiological and behavioral effects, and safety concerns. Noise health effects are the health consequences of elevated sound levels. Elevated workplace or other noise can cause hearing impairment, hypertension, ischemic heart disease, annoyance and sleep disturbance. Changes in the immune system and birth defects have been attributed to noise exposure Noise exposure has also been known to induce tinnitus, hypertension, vasoconstriction and other cardiovascular impacts. Beyond these effects, elevated noise levels can create stress, increase workplace accident rates, and stimulate aggression and other anti-social behaviors. The most significant causes are vehicle and aircraft noise, prolonged exposure to loud music, and industrial noise. Road traffic causes almost 80% of the noise annoyances in Norway. There may be psychological definitions of noise as well. Firecrackers may upset some animals or noise-traumatized individuals. The most common noise traumatized persons are those exposed to military conflicts, but often loud groups of people can trigger complaints and other behaviors about noise.

- **Communication interference:** While noise may not be intense to damage hearing, its temporary interference with proper functioning of the auditory system during daily work and social activities leads to communication interference.
- **Sleep disturbance:** The depth, continuity and duration of sleep are all affected by noise. Empirical evidences leads to the conclusion that persons sleep level is altered when he is exposed to noise as low as 55dBA.
- **Effects on performance:** There are certain characteristics of noise that potentially affects a person's performance more than others. Tasks requiring higher order mental faculties are highly susceptible to noise disruption, and ability to retrieve previous thoughts is often slowed down in noisy environment. Noise has been thought to be aggravating behavioral disorders.
- **Psychological effects:** A noise is said to be annoying if an exposed individual or a group of individuals would either reduce the noise level or move away from the noisy area to a quieter acoustic environment for a fear of any medical pathology or economic loss. Thus, noise affects ones well-being and quality of life. Max Stanley (2007) [16] said that, "the greatest effect of hearing loss is psychological". The potential psychological problems that have been reported as arising, directly or indirectly, from hearing loss of all types and degrees are: stress, anxiety, distrust, paranoia, insecurity, superior/inferior complex, lowered self-esteem, denial and disbelief, defensiveness, anger, frustration, social withdrawal, isolation, socially inappropriate behavior or responses, bitterness, resentment, overly aggressiveness, lethargy, resignation, passivity, cognitive dysfunction, emotionally driven hypertension.
- **Physiological effects:** Physiologically there is no way to shut the perception of hearing off completely. Man's auditory privacy is thus constantly challenged and invaded by unwanted sounds. Given the same noise intensity and source human annoyance varies considerably. However, there is consensus of opinion that regardless of social differences, annoyance increases as noise level increases, and the level of annoyance does not appears to diminish with time.

- **Auditory Effects**

It is generally accepted that the most serious consequences of exposure to noise is loss of hearing sensitivity because of physical damage to the inner ear, which results in a multitude of problems for the individual. Auditory effects include hearing impairment resulting from excessive noise exposure. Noise-induced permanent hearing loss is the main concern related to occupational noise exposure. Acoustic trauma is the immediate organic damage to the ear by exposure to extremely intense sounds. This may occur after a single exposure or after few exposures at very high sound levels. Noise-induced Temporary Threshold Shift (NITTS) occurs immediately following exposure to high noise levels. In this case the loss of hearing is temporary and can be reversed. However, the speed and extent of recovery is dependent on the type of noise exposure, the extent or severity of shift in hearing thresholds and individual susceptibility. The amount and type of direct hair cell damage depends on the intensity of the sound. Above a certain minimum of frequency and intensity, the outer hair cells show signs of metabolic exhaustion with drooping of the stereo cilia. This correlates with the common phenomenon of temporary threshold shift (TTS), which usually recovers within a few hours. Noise Induced Permanent Threshold Shift (NIPTS) refers to the loss of hearing resulting from exposure to noise which is permanent and is irreversible. The hearing loss usually occurs gradually and the rate and extent of hearing loss depends on the intensity and duration of exposure to noise, and to a large extent also depends on individual's susceptibility. The hair

cells in the organ of corti may be damaged directly or indirectly by very high levels of continuous sound, which causes vasoconstriction of the vessels of the stria vascular is in the cochlea blood supply. This renders the hair cells relatively anoxic and thus secondarily damage the hair cells in the basal coil of the cochlea which is the most sensitive to noise and are responsible for transducing higher frequencies. This usually results in high frequency hearing loss. Exposure to excessive noise is the major avoidable cause of permanent hearing impairment worldwide. In a developed country, it is at least partially the cause in more than one third of those with hearing impairment and, in many countries, is the biggest compensatable occupational hazard. In developing countries, occupational noise and urban, environmental noise are increasing risk factors for hearing impairment. As populations live longer and industrialization spreads, NIHL will add substantially to the global burden of disability, and hence has a high public health priority. Hearing losses from different causes are additive and interaction can occur between noise exposure and chemicals. Exposure to excessive noise is also of concern because it is associated with distressing conditions such as tinnitus. In the elderly, NIHL may add to the hearing loss of presbyacusis to produce a hearing handicap sooner and worse than would occur from age alone.

High levels of occupational noise remain a problem in all regions of the world. Although noise is associated with almost every work activity, some activities are associated with particularly high levels of noise, the most important of which are working with impact processes, handling certain types of materials, and flying commercial jets. Occupations at highest risk for NIHL include those in manufacturing, transportation, mining, construction, agriculture and the military.

In India only a few reports give statistical data regarding the incidence and etiology of hearing impairment. These are generally on a state or district rather than national basis. However, Indian Council of Medical Research (ICMR) [1983] report the proportion of hearing impairment to be 10.7%. A study by Kryter (1970) [17] found hearing impairment to range from 13.5% to 18.5%. A 10-year study of noise-induced hearing loss in coalfield, steel plant, textile and pharmaceutical industry workers and natural oil and gas plants found that the amount of noise trauma depended on intensity and also on characteristics of noise, duration of exposure, dimensions of the workplace, age, sex, temperament, susceptibility and personality. Another study of 430 patients conducted by Srivastava at Bokaro Steel Plant found a 37% incidence of mild to severe sensor neural hearing loss. A noise-induced disability is defined as the difference in the disability estimated from the overall hearing thresholds of the noise exposed individual (taking into account any constitutional hearing disability), and the disability estimated from the thresholds of hearing in a median person of the same age and sex who has not been exposed to noise. Hence, the hearing impairment which can occur by any cause as explained earlier affects functioning at different levels. The effects depend on the type and degree of hearing loss in both ears. The consequences and impact of hearing loss acquired in adulthood depend on the type of routine that the individual follows the work environment and the relevance or importance of verbal communication in his or her specific work situation. Thus, two individuals might have the same degree of loss, but the handicap resulting from it might be very different in both cases. Hearing impairment and deafness are serious disabilities that can impose a heavy social and economic burden on individuals, families, communities and countries. In adults, hearing impairment and deafness often make it difficult to obtain, perform, and keep employment, which results in social stigmatization and isolation.

The effects of hearing loss on hearing-impaired subjects are compounded by poor listening conditions often present in normal social settings. Such conditions include simultaneous conversation, environmental background noise (such as music, television or general noise) and interrupted speech. Employment is an integral part of adult life and most jobs have some kind of communication requirement. The impact of hearing loss on one's vocational life depends on the nature of the work, on the extent of communication required, on the need to use the telephone and to converse with people. Instructions may hard to follow and sociable relations with workmates are commonly disturbed. As hearing loss progresses up the scale and communication breakdown becomes more frequent the affected individual runs the very real of having his services terminated. Considerable anxiety and depression is not surprising in such instances.

Review of literature

Hogan, O'Loughlin, Davis, Kendig (2009) [21] in their study found that hearing loss was associated with an increased rate of non-participation in employment of between 11.3% and 16.6%. Advancing age and the existence of co-morbidities contribute significantly to reduced participation in employment. A disproportionate impact is evident for women and for those having low education and communication difficulties. Controlling for co-morbidities, hearing loss was associated with a 2.1% increase of non-participation in employment, a proportional difference of 1.4 times the population. People with hearing loss were less likely to be found in highly skilled jobs and were over-represented among low income earners.

In a Symposium on the Rehabilitation of adult deaf, held at Royal Society of Medicine in London in 1975, Wendy Galbraith said this psychologically an acquired hearing loss brings an inevitable deterioration in the individual's security and self-esteem. He loses touch with his environment from which, as a normal hearing person, he gained much information. Where hearing is essential for the continuation of job, a deafened person may have to take an alternative occupation and this is likely to be of an inferior nature to that held previously; this may well produce a sense of failure. The impact of hearing loss is not simply measured in decibels. Hearing loss is an individual experience, and how the individual copes will depend on a great many factors, including early versus late onset, the progressive nature of the loss (gradual vs. sudden), the severity of the loss, communication demands, and personality (Kaland & Salvatore, 2002) [23]. Regardless of the combination of these presenting factors, hearing loss has been linked to feelings of depression, anxiety, frustration, social isolation, and fatigue. Several studies have documented the impact of untreated hearing loss. An often cited survey was commissioned by the National Council on Aging in 1999 (Kochkin & Rogin, 2000) [24]. This nationwide survey of nearly 4,000 adults with hearing loss and their significant others showed significantly higher rates of depression,

anxiety, and other psychosocial disorders in individuals with hearing loss who were not wearing hearing aids. This survey looked at the positive benefits of amplification and showed that hearing aid use positively affected quality of life for both the hearing aid wearer and his or her significant other. These findings were consistent with the findings of a large randomized controlled study which found that hearing loss was associated with decreased social/emotional, communication, and cognitive function in addition to increased depression for subjects who were unaided as compared to those who received hearing aids. These conditions were improved after hearing aids were fit (Mulrow et al., 1990) [25].

More recently, Dr. Frank Lin and his colleagues at Johns Hopkins University found a strong link between degree of hearing loss and risk of developing dementia. Individuals with mild hearing loss were twice as likely to develop dementia as those with normal hearing, those with moderate hearing loss were three times more likely, and those with severe hearing loss had five times the risk. While this study could not definitively conclude that early treatment with hearing aids would reduce the risk of dementia, there was a positive correlation between degree of hearing loss and risk of dementia (Lin et al., 2011) [26].

Hearing loss is an invisible handicap. Although it is increasingly prevalent with age, hearing loss is often ignored during the diagnosis and treatment of cognitive and memory disorders in elderly patients (Chartrand, 2005) [27]. The comorbidity of hearing loss and cognitive disorders makes it even more important to determine hearing status prior to any diagnostic protocol. This would undoubtedly lead to more appropriate diagnosis and treatment as well as significantly better outcomes for individuals with cognitive impairments. Vision impairment is another common comorbidity affecting between 9% and 22% of adults over 70 (Saunders & Echt, 2011) [28]. Researchers using longitudinal data from the National Center for Health Statistics and the National Institute on Aging analyzed the relationship between visionimpairment and hearing loss on quality of life in older adults, and they concluded that both hearing loss and vision impairment have a negative impact on health, social participation, and daily activities, and those individuals with a combination of both hearing loss and vision impairment (i.e., dual sensory impairment) experience the greatest difficulty (Crews & Campbell, 2004) [29]. The implication is that when both sensory systems are impaired, the individual is less able to compensate.

Objective

The purpose of the present study is to investigate and compare the activities and participation of industrial and non-industrial worker with hearing impairment.

Methodology

The current research is a descriptive research using a purposive sample of 300 males in the age range of 30-45 years.

Sample

The total sample comprised of 300 male subjects with acquired hearing loss falling in the following two groups:

- **Group A:** 150 Industrial workers
- **Group B:** 150 Non-industrial workers.

Group A: For Group A sample will be selected from following various factories in Madhya Pradesh State of India:

- Diamond cement factory located at Narsinghad, District Damoha.
- Birla Corporation Ltd. Satna.
- KJS Cement Ltd. Maihar, Satna.
- Mahir Cement at Sarlangar, District Satna.
- Jaypee Rewa Plant, Rewa.

Group B: For Group B sample was from Audiology clinic at different Centres, Hospitals and Institutes across Maharashtra like Ali Yavar Jung National Institute For the Hearing Handicapped Mumbai, Ninad Speech and Hearing Clinic Jalgaon, Swanim Speech and Hearing Clinic Nanded, Dinanath Mangeshkar Hospital, Poona Hospital, Pune.

Sample selection criteria

The samples were drawn on the basis of the following criteria:-

- Employed workers with a minimum of 5-10 years of experience in the industry
- Age range between 30 to 45 years.
- Bilateral sensor neural hearing loss in the range from moderate to severe degree (pure tone average threshold greater than 40 dBHL but less than or equal to 90 dBHL).
- No associated medical conditions including ear discharge or any congenital malformation of ear.
- No associated disability.
- Ability to read and understand Marathi, Hindi or English language.

Tool

Self-made Questioners were papered by the researcher and validated by the expert of Rehibition field.

Data analysis

Data were analysed through calculated percentile bases.

Limitation of study

It is restricted to persons with bilateral moderate to severe sensor neural hearing loss.

Results and Statistical Analysis

The statistical analysis, scrutiny of the protocols of both groups of workers highlights some additional problems. These are enumerated below:

- Out of 150 industrial workers approximately 65% workers reported that they suffer from sleep disturbances, 55% workers reported fatigue, irritation, tinnitus. Almost 70% of the workers complained of headache. Similar findings are also reported in a study conducted by Hollander et al. (2004) [30], Anthrop (1970) [31], Lipscomb and Roettger (1976) [32].
- It was also found that 75% of workers have high frequency hearing loss (more at 2 kHz, 4 kHz and 8 kHz). This finding shows that exposure to excess noise typically affects threshold of hearing (threshold shift).Evidence to this effect has also come from NIOSH (1998) [18].
- Among non-industrial workers, 70% reported depression, frustration, loneliness and social isolation.

Almost 60% of these workers experienced greater difficulty in communication. A similar pattern was observed by Wood and Kyle (1983) [33], Knutson and Lansing (1990) [34], Sitka (1997) [35] and Max Stanley (2007) [16] they highlighted the predominance of communication and psychological problems among persons with acquired hearing loss.

Conclusion

One the bases of result it was concluded that hearing impairment negatively influences daily life in terms of limitations in activities and restrictions in participation. The degree of limitations and restrictions also depends on the nature of job or employment and by default, the place of employment too. Needless to say, the degree of impairment would also exert an impact on the extent of limitations.

Suggestion and Recommendation

- This study suggests that industrial workers experience more somatic difficulties, while non-industrial workers appear to be more concerned about the personal-social impact of their impairment.
- These findings stress the need for audiologists to consider how non-audio logical factors such as nature and place of employment affect activities and participation so that more holistic aural rehabilitative programs can be designed and implemented.

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