
Industrial Noise and Psychological Well-Being among Employees in Industrial Units

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Date of publication (dd/mm/yyyy): 28/02/2019

Abstract – This research studies Industrial Noise and Psychological Well-Being among Employees in Industrial Units. The objective of this research was to verify if significant difference exists in psychological well-being of employees as per the category of noise they are subjected to. Multiple industrial units in Chinchwad MIDC, Bhosari MIDC and Chakan industrial area were chosen for the research. The sample was 100 male employees for Low Intensity Noise category (0 to 75 Decibel) and 100 male employees for High Intensity Noise category (above 75Decibel). Decibel Meters developed to answer to the Indian standard for sound level measurement, issued by Bureau of Indian Standards, such as IS 15575 (Part 1):2005 and IS15575 (Part 2):2005, were used to measure noise levels in industrial units and select the sample according to the noise exposure. Data was collected in the form of data entry sheets of Ryff's Psychological Well-Being Scale (RPWB), 42-item version; to be filled by the employees. The results indicated that significant difference exists in all six domains of Ryff's Psychological Well-Being Scale, viz. Autonomy, Environmental Mastery, Personal Growth, Positive Relations, Purpose in Life and Self-Acceptance, among employees in industrial units with high intensity noise and in industries with low intensity noise.

Keywords –Noise, Industrial Noise, Psychological Well-Being, Environmental Mastery, Industries.

I. INTRODUCTION

Noise is an essential differentiation from the word “sound”. And that differentiation arises from a human necessity to provide linguistic support to express an entity along with the undesirable quality it possesses. From a simple physics standpoint, noise is indistinguishable from sound, as both are vibrations through a medium, such as air or water. The difference arises when the brain receives and perceives a sound. Environmental noise sources expose millions of people to noise pollution that creates not only annoyance, but also significant health consequences such as elevated incidence of hearing loss and cardiovascular disease. There are a variety of mitigation strategies and controls available to reduce sound levels including source intensity reduction, land use planning strategies, noise barriers and sound baffles, time of day use regimens, vehicle operational controls and architectural acoustics design measures.

Noise:

When sound reaches unwanted levels, it becomes noise. In other words, noise is unwanted sound judged to be unpleasant, loud or disruptive to hearing. And this lack of desirability arises from its possible adverse affects on many different aspects of human life, such as being a stark irritation in the way of carrying out intellectual (and sometimes physical) activities successfully, or being an obstacle in a conversation, or being a catalyst to neurochemical activities that may lead to anything from a mild migraine to severe psychological problems. In experimental sciences, noise can refer to any random fluctuations of data that hinders perception of an expected signal. Acoustic noise is any sound in the acoustic domain, either deliberate (e.g., music or speech) or unintended. In contrast, noise in electronics may not be audible to the human ear and may require instruments for detection. Environmental noise is the accumulation of all noise present in a specified environment. The principal sources of environmental noise are surface motor vehicles, aircraft, trains and industrial sources. Common examples of noise

are traffic noise, noise by crowded gatherings, noises generated by DJ systems in parties, shrill whistles, industrial operations, etc. Noise is measured in terms of “Decibels” (dBA). Decibel levels are observed to be comfortable up to 75 dBA; which is the decibel level of a household vacuum cleaner. An industrial arc welder operates at 90 dBA. A jet engine take-off showcases 140 dBA of noise. A rocket launch takes place at 180 dBA. Post 194 dBA, sound waves become shock waves.

Industrial Noise:

Industrial noise or occupational noise is the amount of acoustical energy (noise) received by an employee’s auditory system while they are working. The term “Industrial Noise” has a degree of specificity to it. It is a distinction of undesirable sounds from those arising out of the generic term of “environment”, to a more exact term of “industrial environment”. We are talking about noises such as those arising continuously due to mechanical activities of functioning heavy machinery, observed in production industries. It is linked to traditionally loud industries such as ship-building, mining, railroad work, Welding and Construction. Industrial noise, or occupational noise, is often a term used with contextual relationship with environmental health and safety. Noise is considered as something more than mere auditory nuisance. There is ample scientific research to support that sustained exposure can cause permanent hearing damage. When industrial noise or occupational noise is referred to as specificity among various kinds of noise, it is considered as the amount of acoustical energy (noise) received by an employee’s auditory system while they are working. Industrial noise, if experienced repeatedly, at a high intensity, for an extended period of time, can cause noise-induced hearing loss (NIHL). NIHL caused by industrial noise can be classified as occupational hearing loss.

Psychological Well-Being:

Psychological well-being is a state of equilibrium observed across all walks of cognitive domains, including ability to maintain rational thinking styles and capacity to maintain balanced emotional states that may aid an individual to have healthy and sound personal and societal life. A state of equilibrium defines the expression of personality, in ways such as how a person thinks, feels, communicates, acts, behaves with others; and it also has its reaches to social psychological ideas such as attitudes, perception, attribution etc. Psychological well-being is quantified as per six domains, viz. Autonomy, Environmental Mastery, Personal Growth, Positive Relations, Purpose in Life and Self-Acceptance. Psychological well-being can be measured by Carol Ryff’s Psychological Well-Being Scale.

Autonomy:

Autonomy is a sense of independence in thought and action. Civilization is essentially an eco-system in which social dynamic is construed out of interactive relations people maintain with each other. Individuals may have the capacity to manage these interactive relations out of healthy will for participation; or they may lack such capacity and tend to be swayed, helplessly in some cases, either by generic consensus or a specific individual’s or group’s persuasion. Autonomy is the degree of ability to deploy individual will and thought to make decisions if a certain set of actions should be led or not. Social persuasion is an issue to be considered in face of any study related to an individual’s autonomy. From psychological point-of-view, it is interesting to know if the individual “selects” a path or “follows” a path. Selection based on freewill is the virtue of the autonomous; following the herd is a characteristic of people with low scores for autonomy.

Environmental Mastery:

Environmental mastery is the ability to manage complex environments to suit personal needs and values. Environmental mastery is the antidote to feelings of helplessness. It is a state of mind rather than a behavior. Environmental mastery is the sense that we are able to have an influence on the events in our lives. What this means is that it is not necessary to actually be in control; it is simply necessary to have the sense that we are capable of acting on our own behalf.

Personal Growth:

Ryff's idea of growth brings with it a sense of development and evolution as a person, in all walks of life. Growth includes expansion; but it is not limited by mere stretch in boundaries. It is also supposed to showcase addition of new values, capacities, awareness, understanding, gain of strength which was previously absent, reach toward entirely new concepts and fields of life, ability to encompass more ideas, reach more people, connect with more interests, gain power to generate things autonomously whereas previously external help was needed, and always be ready to unlearn what is obsolete and learn what is new and necessary. Growth also relates with an individual's ability to be compatible with future, for future scarcely remains distant in modern times.

Positive Relations:

Relations are the ties one establishes and maintains with others; where boundaries of sharing can be healthy or rigid or diffused, depending on the relationship dynamic. Positive, productive relationships demand the best of us. For a friendship or marriage to allow both people to flourish, each person is an active participant in helping create the other one's positive future. Whether we are a friend, lover, daughter, or grandparent, each relationship gives us a chance to invest our energy in making another person's reality better. Each of us needs to fully show up, be present, listen, express ourselves, and care for the other, and that requires time and attention. When it all works out well, and we can see the happiness on the other's face, that creates the best feeling of satisfaction in the world. From psychological context, such a positive relationships can exist only if the individual has the capacity to cater to its nourishment, understanding why it is important and how it can be aided.

Purpose in Life:

The sense of a goal, an objective, a purpose in life is one of the important aspects that may cater to overall psychological well-being. An individual may have a singular purpose in life, a set goal for which whole of life and time can be dedicated; or there may be a variety of objectives to accomplish in various departments of life. It could relate to achievements in academics, personal wealth and financial advancement, work-related goals such as a dream post and authority, a specific standing and status in a business, relationships and love, social recognition and fame, general physical fitness or a very specific goal such as achieving an athlete's body-frame, a dream standing or ranking in sports, political achievements, a social service, spiritual enhancement etc. The question is not about the "quality" of the goal; for each individual's distinct idea of a goal is valid as it is and could be appreciated in a civilized society so long as it involves integrative ideas and lacks destructive ones. The question is, if the individual is aware of his or her purpose in life; and do people showcase their ability to reach those goals by actually walking the path.

Self-Acceptance:

Self-acceptance is considered an anchor to reality of one's personality and existence; with a degree of congruence among what the person expects out of oneself, in terms of virtues of personality; and what real life experiences appear to be. According to Shepard (1979), self-acceptance is an individual's satisfaction or happiness with oneself, and is thought to be necessary for good mental health. Self-acceptance involves self-understanding, a realistic, albeit subjective, awareness of one's strengths and weaknesses. It results in an individual's feeling about oneself that they are of "unique worth". In clinical psychology and positive psychology, self-acceptance is considered the prerequisite for change to occur. It can be achieved by stopping criticizing and solving the defects of one's self, and then accepting them to exist within one's self.

II. REVIEW OF LITERATURE

Pal D. et al (2012); examined the problems of reduction of individual's efficiency in his/her respective working places because of road traffic noise pollution in Agartala due to rapidly growing vehicular traffic. Disturbances caused due to vehicular road traffic, interrupted by traffic flow conditions on personal work performance have been monitored and models of such disturbances have been mapped. Total of 270 individuals from different road side Government Offices, Private Organizations and Commercial Business Centers on both sides of busy roads of the city were interviewed. The interviews focused on mapping attitudinal responses. As supplementary data, traffic volume count and noise indices data were collected simultaneously; and to encompass majority of areas of possibly affected populace to increase validation, the activities have been conducted at six selected sites of the city. The researchers have identified a relationship between different traffic noise parameters and its harmful impact on work competency of individuals using MATLAB.

Atmaca E. (2005), examined industrial noise issues in Sivas; and noise measurement and survey studies have been carried out at concrete traverse, cement, iron and steel and textile factories located in this region. The objective is to determine the physical, physiological, and psycho-social impacts of the noise on humans and to specify what kind of measurements have been taken both by the employers and workers for protection from the effects of noise. Specific purpose of the study was to learn whether hearing losses in workers originate from any factors other than noise (a hereditary illness, effect of medication, exposure to sudden non-professional sources of noise, etc.); to determine effects and complaints other than permanent hearing loss that may occur due to the noise; to determine rates of using ear protection equipment used to decrease the level of noise influencing workers at workplaces, and expressing the complaints and positive comments on using them; to determine the factors that are effective on workers exposed to noise; and to specify worker comments on protection from noise. A questionnaire was completed with a sample size of 256 workers during this study. The research reveals that in the concrete traverse factory, 28% of the workers in the production department are exposed to a noise level of 107 dBA while 74% of the workers in the whole factory also were exposed to a noise level much above the standards specified in the Noise Control Regulations. In the textile factory, 60% of the workers were exposed to a noise level of maximum 106 dBA and they are working at the mill department. At textile and cement factories, the majority of the workers are working in very noisy environments. The surveys reveal that the detected noise levels in all the industries are much above the 80 dBA that is specified in the regulations: 73.83% of the workers in these industries are disturbed from the noise in their workplaces, 60.96% of them have complaints about their nervous situations, 30.96% of these workers are suffering hearing problems which may be added in the observations as a separate auditory effect of noise on human health.

Stansfeld S. et al (2003) focused on non-auditory effects of noise on human health. Their search sample included 7 different laboratory experiments in which sample sizes varied such as 1046, 191, 1101, 7679, 8811, 2197, and 3105 respectively. These were all cross-sectional type of studies. The experiments spanned a time duration of 14 to 15 nights each. Symptoms reported among industrial workers regularly exposed to high noise levels in settings such as schools and factories include nausea, headaches, argumentativeness and changes in mood and anxiety. Many of these industrial studies are difficult to interpret, however, because workers were exposed to other stressors such as physical danger and heavy work demands, in addition to excessive noise. Community surveys have found that high percentages of people reported 'headaches', 'restless nights', and 'being tense and edgy' in high-noise areas. An explicit link between aircraft noise and symptoms emerging in such studies raised the possibility of a bias towards over-reporting of symptoms. Notably, a study around three Swiss airports, which did not mention that it was related to aircraft noise, did not find any association between the level of exposure to aircraft noise and symptoms.

Mehta. R. et al (2012) the objective of the research was to examine the underlying mechanism through which ambient noise affects creative cognition. A high level of noise, reduces the extent of information processing, thus impairing creativity. The researchers carried out a series of 5 experiments in which participants were expected to use cognitive skills. 65 undergraduate students from the University of British Columbia were taken as sample for "Restaurant Experiment Study" with high noise as a control factor. Creative performances were assessed by using Remote Associates Test. They found that a high level of noise impairs creativity by reducing the extent of information processing.

III. SIGNIFICANCE OF STUDY

We live in a world that functions on the complimentary relationships that profit-oriented businesses have with consumer-oriented lifestyles. For such a world, a continuous demand is placed on industries to generate useful products at a fast rate, which can answer to the rising demands of populace in continuous search of sources to fulfill their needs. It is observed in all walks of industrial life that competitions are fierce and the need to be ahead of everyone else is primary. In order to cater to that need, the industries need to be functional up to their optimum capacities. Such optimization of activities may at times take its toll on human health, both physical and psychological. Humans are a fundamental necessity at the centre of all production, as without the human presence in tandem with working machines, output generation cannot take place. Production industry, for example, being at the core of such consumer-orientation, observes a continuous stream of action on a daily basis, where machines and men operate in unison to generate output fast, and in big volumes. There exists a remarkable strain in physical and psychological terms, due to long working hours and the sheer presence of very physical ideas such as "continuous noise" generated by heavy machinery operating at its maximum maybe at the foremost of causal factors that affect human health. Noise pollution has adverse effects on mental health. Research has shown damage to psychological health due to noise pollution in traffic. Men and women who were placed as test samples displayed symptoms of psychological unrest such as heavy irritability, mood shifts, anger management issues, listlessness, low frustration tolerance (LFT), disorder in thinking, loss of vigor, loss of interest, impatience, etc. These researches have been leading governments all over the world to take matters seriously and implement measures to reduce noise pollution. Psychological well-being is a human right and should be maintained for growth and maintenance of healthy human life, both at individual and societal levels.

IV. METHODOLOGY

Objective:

To study industrial noise and psychological well-being among employees of industrial units.

Hypotheses:

1. There will be difference in Autonomy of employees in industrial units with high intensity noise and in industries with low intensity noise.
2. There will be difference in Environmental Mastery of employees in industrial units with high intensity noise and in industries with low intensity noise.
3. There will be difference in Personal Growth of employees in industrial units with high intensity noise and in industries with low intensity noise.
4. There will be difference in Positive Relations of employees in industrial units with high intensity noise and in industries with low intensity noise.
5. There will be difference in Purpose in Life of employees in industrial units with high intensity noise and in industries with low intensity noise.
6. There will be difference in Self-Acceptance of employees in industrial units with high intensity noise and in industries with low intensity noise.

Sample:

Purposive sampling method was used. 100 employees aged between 30 to 40years who had 9 hours of duties on a daily basis. 50 employees were selected from industrial unit which would have low intensity noise ranging from 0 to 75 dBA and 50 employees from industries having High Intensity Noise which would be above 75 dBA.

Tools:

1. Decibel Meters developed to answer to the Indian Standard for Sound Level Measurement, issued by Bureau of Indian Standards, such as IS 15575 (Part 1):2005 and IS15575 (Part 2):2005, were used.
2. The Ryff's Psychological Well-Being Scale (42-items version), developed by Dr. Carol D. Ryff, Ph.D. The structure includes a set of 42 statements to be replied by the test subject with his/her degree of agreement, ranging from 1 to 6; 1 representing "strong disagreement" and 6 representing "strong agreement". 6 domains are covered by RPWB Scale; namely: Autonomy, Environmental Mastery, Personal Growth, Positive Relations, Purpose in Life, Self Acceptance. The test-retest reliability coefficient of RPWBS is 0.82. The subscales of Self-acceptance, Positive Relation with Others, Autonomy, Environmental Mastery, Purpose in Life, and Personal Growth are found to be 0.71, 0.77, 0.78, 0.77, 0.70 and 0.78 respectively, which are statistically significant ($p < 0.001$).

V. ANALYSIS

Quantitative Analysis:

1. *Autonomy of Employees*

Table 1 shows the Autonomy of employees exposed to Low Intensity Noise, Mean is 28.36 and Standard Deviation is 2.67; and for employees exposed to High Intensity Noise, Mean is 27.10 and Standard Deviation is 3.2. The obtained value for t is 3.02; which is significant at 0.05 level of confidence. Hence the hypothesis, there is significant difference in Autonomy of employees in industrial units with high intensity noise and in industries with low intensity noise, is *accepted*.

	N	Mean	SD	t
Low Intensity Noise	100	28.36	2.67	3.02
High Intensity Noise	100	27.10	3.2	

Significant at .05 level of confidence

2. Environmental Mastery of Employees

Table 2 shows Environmental Mastery of employees exposed to Low Intensity Noise, Mean is 29.19 and Standard Deviation is 3.2; and for employees exposed to High Intensity Noise, Mean is 28.58 and Standard Deviation is 3.39. The obtained value for t is 1.309; which is not significant. Hence the hypothesis that there is significant difference in Environmental Mastery of employees in industrial units with high intensity noise and in industries with low intensity noise, is *rejected*.

	N	Mean	SD	t
Low Intensity Noise	100	29.19	3.2	1.309
High Intensity Noise	100	28.58	3.39	

Significant at .05 level of confidence

3. Personal Growth of Employees

Table 3 shows that, for Personal Growth of employees exposed to Low Intensity Noise, Mean is 32.85 and Standard Deviation is 3.98; and for employees exposed to High Intensity Noise, Mean is 31.13 and Standard Deviation is 3.65. The obtained value for t is 3.185; which is significant at 0.05 level of confidence. Hence the hypothesis, there is significant difference in Personal Growth of employees in industrial units with high intensity noise and in industries with low intensity noise, is *accepted*.

	N	Mean	SD	t
Low Intensity Noise	100	32.85	3.98	3.185
High Intensity Noise	100	31.13	3.65	

Significant at .05 level of confidence

4. Positive Relations of Employees

Table 4 shows that, for Positive Relations of employees exposed to Low Intensity Noise, Mean is 32.25 and Standard Deviation is 3.84; and for employees exposed to High Intensity Noise, Mean is 31.08 and Standard

Deviation is 4.2. The obtained value for t is 2.056; which is significant at 0.05 level of confidence. Hence the hypothesis, there is significant difference in Positive Relations of employees in industrial units with high intensity noise and in industries with low intensity noise, is *accepted*.

	N	Mean	SD	t
Low Intensity Noise	100	32.25	3.84	2.056
High Intensity Noise	100	31.08	4.2	

Significant at .05 level of confidence

5. Purpose in Life of Employees

Table 5 shows the Purpose in Life for employees exposed to Low Intensity Noise, Mean is 33.13 and Standard Deviation is 3.9; and for employees exposed to High Intensity Noise, Mean is 31.21 and Standard Deviation is 4.02. The obtained value for t is 3.428; which is significant at 0.05 level of confidence. Hence the hypothesis, there is significant difference in Purpose in Life of employees in industrial units with high intensity noise and in industries with low intensity noise, is *accepted*.

	N	Mean	SD	t
Low Intensity Noise	100	33.13	3.9	3.428
High Intensity Noise	100	31.21	4.02	

Significant at .05 level of confidence

6. Self Acceptance of Employees

Table 6 shows that, Self-Acceptance of employees exposed to Low Intensity Noise, Mean is 30.32 and Standard Deviation is 4; and for employees exposed to High Intensity Noise, Mean is 28.45 and Standard Deviation is 3.24. The obtained value for t is 3.633; which is significant at 0.05 level of confidence. Hence the hypothesis, there is significant difference in Self-Acceptance of employees in industrial units with high intensity noise and in industries with low intensity noise, is *accepted*.

	N	Mean	SD	t
Low Intensity Noise	100	30.32	4	3.633
High Intensity Noise	100	28.45	3.24	

Significant at .05 level of confidence

VI. QUALITATIVE ANALYSIS

- Employees experienced occasional outbursts of anger, frequent shifts in mood, loss of interest in work and communication; and in some cases an urge to take a break.
- Some individuals reported shifts in mood, negative thoughts during the afternoon session.

- Regular indulgence in nicotine to keep calm.
- An industrial unit conducted research on 100 employees. They were introduced to techniques in yoga and mindfulness to help them maintain their peace of mind.
- Individuals reported that apart from physical and psychological strain due to noise levels and physical fatigue due to load of work, issues such as miscommunication, misunderstanding and lack of synchronicity among the managerial level and operations department lead to certain conflict situations.
- Many employees reported that it was not possible to continue working in the same setup for long due to the increased noise levels.

VII. CONCLUSIONS

1. There is difference in Autonomy of employees in industrial units with high intensity noise and in industries with low intensity noise.
2. There is no difference in Environmental Mastery of employees in industrial units with high intensity noise and in industries with low intensity noise.
3. There is difference in Personal Growth of employees in industrial units with high intensity noise and in industries with low intensity noise.
4. There is difference in Positive Relations of employees in industrial units with high intensity noise and in industries with low intensity noise.
5. There is difference in Purpose in Life of employees in industrial units with high intensity noise and in industries with low intensity noise.
6. There is difference in Self Acceptance of employees in industrial units with high intensity noise and in industries with low intensity noise.

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