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# The Connection Between Noise Pollution and Mental Health: An Examination of Existing Research

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KEY W O R D S
Stress, Noise Pollution, Mental Health.

A B S T R A C T
Noise pollution is a condition where the environment is disturbed due to excessive noise, which can come from motor vehicle traffic, industry, construction, aviation, maritime traffic, urban noise, and other human activities, which in the long run can have an adverse impact on health and cause several disorders such as stress and mental health. Noise pollution is a condition where the environment is disturbed due to excessive noise, which can come from motor vehicle traffic, industry, construction, aviation, maritime traffic, urban noise, and other human activities, which in the long run can have an adverse impact on health and cause several disorders such as stress and mental health. The research involved a literature review of articles focusing on the effect of noise on mental health, sourced from Google Scholar, PubMed, and ScienceDirect. Out of 50 journals reviewed, 9 articles met the inclusion and exclusion criteria and were included in the analysis. The findings indicate that noise intensity significantly influences work-related stress, with most respondents reporting increased stress levels. Furthermore, individuals living in higher-quality environments tend to exhibit better psychological well-being. The research discovered a connection between noise exposure during both daytime and nighttime and the duration of headaches, implying that noise exposure might play a significant role in prolonged headaches in young individuals. The significance of headaches in public health is underscored by their widespread prevalence and considerable personal and social consequences.

## 1. INTRODUCTION

Noise pollution refers to a condition where the environment is disrupted by excessive or unnecessary sound, which can negatively effect comfort, health, and overall quality of life for humans and other living organisms (Hernati, 2018). Sources of noise pollution include motorized traffic, industry, construction, aviation, maritime activities, urban noise, and various other human activities. Individual tolerance to noise varies, but prolonged exposure to sound levels exceeding 80 dB can lead to adverse health effects. These effects include stress, sleep disturbances, hearing loss, concentration issues, reduced productivity, and potentially permanent hearing loss and mental health problems.

A mental health disorder is a condition that effects an individual's emotions, thought processes, and behavior. Common types of mental disorders include depression, bipolar disorder, anxiety, and stress-related disorders. These conditions can be triggered by various factors, both biological and psychological. For instance, genetics is a biological factor, while trauma represents a psychological factor.

Additionally, environmental factors, such as noise pollution, can also contribute to the development of mental health disorders.

In an environment that has high noise intensity such as airports and factories, a person is expected to experience stress that will have an impact on mental health disorders (Sahadewa & Durry, 2023). This is because noise can induce stress, which, if left unmanaged, may lead to serious physical, emotional, and behavioral issues. Potential complications include feelings of unhappiness, family conflicts, difficulties in forming connections, social isolation, suicidal thoughts, harmful behaviors, legal and financial troubles, involvement in social problems, and increased susceptibility to illnesses.

The aim of analyzing scientific articles is to determine the effect of noise pollution on mental health and to explore the connection between noise pollution intensity and mental well-being.

## 2. METHOD

The literature search focused on articles that discuss the effect of noise on mental health. The search was conducted using the keywords stress, noise pollution, and mental health. Literature sources were obtained from google scholar, pubmed, and science direct. The sources were searched using Indonesian and English. Based on the type of publication, we considered articles in scientific journals restricted from 2019-2024.

We employed a population, intervention, comparison, and outcome (PICO) strategy for our scientific research. By combining various search terms from each PICO category, we ensured the inclusion of relevant literature on the topic.

1. Population: workers, community;
2. Interventions: workplace, residence, noise;
3. Comparison: mental health and noise;
4. Outcome: mental health with workplace and residential noise

We used literature data that included titles, abstracts, and results. We obtained 50 journals and then filtered them based on the corresponding results. We used a total of 9 journals consisting of 4 Indonesian articles and 5 English articles that met the inclusion criteria from the 50 journals we screened.

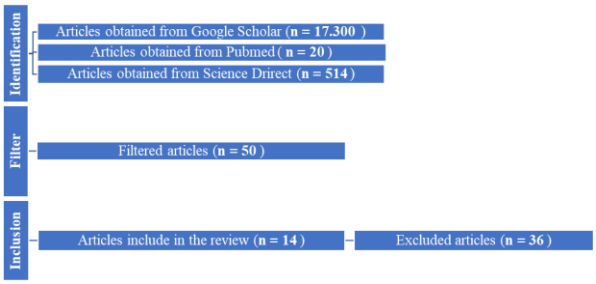


Figure 1. Flowchart of literature search strategy and screening process

## 3. RESULT AND DISCUSSION

| Title | Author and year | Research Subject | Methods | Results |
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| The Effect of Neighbourhood Quality on Psychological Wellbeing of Individuals in a Metropolitan City | Ferdinand Salomo L., Ramdan Yusuf, Eko Wahyudi, Nunung Suryana J. Year: 2023 Volume 2, Number 08 | 500 participants between the ages of 18 and 65, who have lived in various Jakarta metropolitan cities for at least 6 months. | Mixed methods by combining quantitative surveys and qualitative interviews. | A noteworthy positive correlation emerged between the quality of neighborhoods and psychological well-being. Those indicating favorable environmental conditions in their residential areas tended to exhibit higher levels of psychological well-being. Moreover, individuals with access to green spaces or perceiving their neighborhoods as cleaner tended to demonstrate elevated well-being scores. Conversely, respondents reporting lower levels of noise pollution also displayed better psychological well-being. |
| The Effects of Environmental Noise on Annoyance, Stress, and Urine Cortisol Levels Among Residents Living Near Industrial Sites in Bangkok, Thailand | Nutthajit Onmek, Narisa Kengtrong B., Supat Wangwongwatana Year: 2024 Volume 19, Number 1 | 200 residents in Khlong Luang District who live in the community close to industrial sites on the Bangkok border. | Descriptive research with a questionnaire adapted from a standardised stress evaluation questionnaire to fulfil the scope of this study. | This study revealed heightened irritation, stress, and elevated urinary cortisol levels among residents residing in close proximity to industrial sites in Bangkok, Thailand. It confirmed the detrimental effect of environmental noise on mental health and overall human well-being. |
| Noise and Work Stress of Employees of PT PLN (Persero) Kairatu | Eka Safitri S., Indriati Paskarini, Fatima Tatroman, Sahrir Sillehu Year: 2022 Volume 13, Number 4 | From the population of all employees of PT PLN, a research sample was taken which was 28 respondents | Analytical observational with *cross-sectional* research design. | The findings indicate a substantial effect of noise on work-related stress, with most participants reporting experiencing stress. This outcome aligns with prior studies demonstrating that workplace noise can induce stress among employees. |

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| The Association between environmental noise exposure and primary headache in paediatric population | Sunho Lee, Wanhyung Lee Year: 2023 | There were 125 participants with headache complaints, 53 of whom were male and 72 of whom were female. | Methods This study used the Study population and subgrouping method, to analyse each variable, and conducted the chi-square test and linear regression model was used to analyse the statistical correlation. | The findings indicated that males had a 54.2% higher likelihood of experiencing headaches before puberty, whereas females had a 68.2% likelihood of experiencing headaches before puberty. There was a statistically significant higher prevalence of migraine headaches among the pre-pubertal group and tension-type headaches (TTH) among the pubertal group. However, there were no significant differences in lateralization observed between each group, even within specific headache regions. |
| Neighbor noise irritation correlates with a range of mental and physical health manifestations: findings from a nationwide investigation involving individuals residing in multi-story residential buildings. | Heidi A. R. Jensen, Birgit Rasmussen, Ola Ekholm Year: 2019 Volume 19 Number 1508 | participants were randomly selected from a nationally representative sample of 25,000 adults. | Methods In this study the research method used cross-sectional data from the Danish health and morbidity survey. data were collected using questionnaires. this study also used statistical methods. | In 2017, findings revealed that 6.7% of participants residing in multi-story housing reported being highly annoyed, while 28.9% indicated slight annoyance. |
| Effects of noise on mental performance and distraction given task | Mohammad Javad Jafari, Marzieh Sadeghian, Ali Khavanin, | 60 men and women aged 20 to 30 years | method using questionnaires and quantitative surveys | The findings demonstrated how tonal noise influences distraction and cognitive performance, particularly across various levels of task difficulty. Additionally, the results illustrated the high accuracy and efficiency of the neural network model, suggesting |

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| difficulty and noise tone components | Soheila Khodakarim, Amir Salar Jafarpisheh Year: 2019 | | | its potential utility in predicting noise interference. |
| Environmental Noise Exposure and Mental Health: Evidence From a Population-Based Longitudinal Study | Ang Li, PhD, Erika Martino, MUP, Adelle Mansour, MPH, Rebecca Bentley, PhD Year: 2022 Volume 63, Issue 2 | 31,387 respondents | Analyses using instrumental variables, fixed effects models, and aggregate area-level measures of noise exposure. large-scale national datasets, socio-spatial distribution | This study presents compelling evidence regarding the adverse mental health effects associated with perceived residential noise, highlighting implications for the design of healthy homes and urban planning. Further research is warranted to corroborate these findings through assessments of noise intensity and housing standards. |
| Building Cities with Low Noise Pollution: Exploring Thresholds for Mental Health Effects of Spatio Temporal Environmental Noise Exposure and Urban Planning Solutions | Zhang, Xue & Zhou, Suhong. Year: 2023 | There were 142 volunteers with a complete data set. | This study uses real-time noise exposure data, and uses a quantitative survey method. | The findings indicate noticeable variations in residents' noise exposure during daily activities concerning time, location, and context. Noise exposure during various activities such as nighttime, work, personal affairs, travel, and sleep, both at home and at work, appears to have a discernible threshold effect on residents' mental health. |
| Assessing personal noise exposure | Jing Ma, Chungjiang Li, Mei-Po Kwon, | participation was attended by 117 residents | Methods Descriptive statistical methods and | This study shows that objective noise exposure at the individual level based on space-time behaviour measured over a 24-hour period (Leq,24h) is |

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| and its connection with mental health in Beijing based on individuals' space-time behaviour | Lirong Kou, Yanwei Chai Year: 2020 | aged 18-60 years | geo-visualisation methods were used to examine how personal noise exposure varies across different types of activities. | strongly associated with resident-reported mental health. Higher noise exposure was significantly associated with poorer mental health. |

**Mechanisms by which Noise Can Disrupt Mental Health**

Mental health disorders encompass a spectrum of psychological conditions characterized by intricate symptoms. However, anxiety, depression, and psychological distress are frequently linked to the functioning of specific nervous and endocrine system pathways. Stress induced by noise can trigger the activation of the hypothalamic-pituitary-adrenal (HPA) axis and the sympathetic nervous system (SNS), leading to the secretion of corticotropin hormone (CRH) and arginine vasopressin (AVP) towards the pituitary gland. This initiates the release of adrenocorticotropic hormone (ACTH) into the bloodstream. ACTH then prompts the adrenal cortex to release glucocorticoids, while the SNS prompts the adrenal medulla to release catecholamines.

Persistent stress and excessive glucocorticoid production can cause a decrease in immune cell receptor sensitivity, resulting in what is termed "cortisol resistance". This diminishes the effectiveness of glucocorticoids in inhibiting inflammatory pathways, leading to the secretion of pro-inflammatory cytokines regulated by factors like NF-κB. This process contributes to systemic inflammation and can potentially worsen neuroinflammation. Activated microglia and astrocytes further exacerbate neuroinflammation by releasing pro-inflammatory cytokines, disrupting the blood-brain barrier, and facilitating the passage of circulating pro-inflammatory cytokines into the brain.

Anxiety and depression affect the amygdala region. During conditions of external stress. The amygdala can become hyperactive and increase sensitivity to environmental stimuli. This hyperactivity may contribute to both neuroinflammation and susceptibility to systemic inflammation.

Noise-induced stress is also linked to oxidative stress, as Reactive oxygen species (ROS) are released as a defence mechanism by immune cells. Neural tissues, especially neurons, are vulnerable to oxidative stress due to lipid oxidation and auto-oxidation of neurotransmitters, as well as the lack of strong antioxidant defence mechanisms.

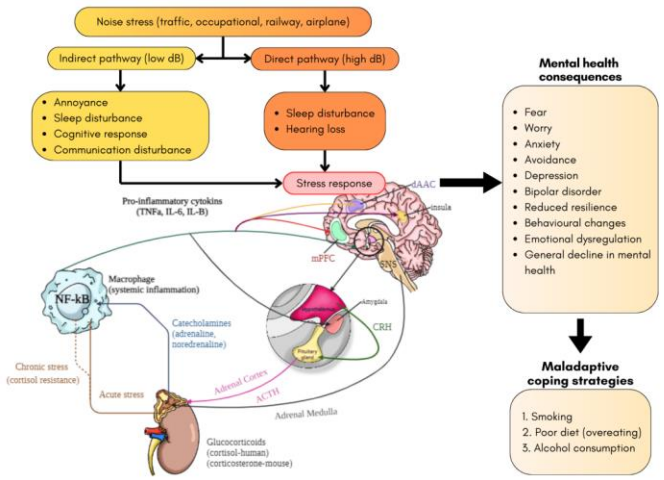


Figure 2. Pathophysiology of Noise with Mental Health

## Noise in Metropolitan Cities and Mental Health

Neighbourhood conditions in metropolitan cities can affect a person's mental health. Unequal mental health outcomes can be caused by differences in neighbourhood quality, with lower-income populations experiencing higher levels of stress and mental health difficulties.

Higher well-being scores were associated with access to green spaces, neighbourhood cleanliness, and lower perceived levels of noise pollution. It was shown that age influenced these connections, with older people showing stronger links between wellbeing and neighbourhood quality. The density of a person's perceived physical environment is also very likely to have an effect on their psychological well-being.

Research on the influence of neighbourhood quality on the psychological well-being of individuals in metropolitan cities can help authorities and urban planners to understand how economic, social, and cultural factors influence people's perceptions of their quality of life and mental health in cities.

## Noise on Mental Health of People Living Near Industrial Sites

A study titled "The Effects of Environmental Noise on Annoyance, Stress, and Urine Cortisol Levels Among Residents Living Near Industrial Sites in Bangkok, Thailand" found that:

1. Stress
   Exposure to community noise was linked to perceived stress, while environmental noise was connected to stress symptoms and the release of stress hormones.
2. Cortisol
   Cortisol levels are high at the end of the work shift when exposed to chronic noise, and almost as high as in the morning. This increased cortisol excretion was accompanied by high levels of fatigue and irritability after work.
3. Disruption
   Industrial and community noise affects physical and mental health and daily activities.

The study also discovered that annoyance and concern about the impacts of noise can negatively affect stress and health, indicating that sound levels alone are not the sole indicators of stress or health outcomes.. Bangkok, Thailand, suffers from pollution problems such as noise pollution, poor air quality, and improper garbage disposal. According to a review, sleep disturbances and cardiovascular problems are the effects of noise pollution that affect Thai people the most.

## Workplace Noise on Employees' Mental Health

Work-related stress is a prevalent concern among employees, with noise ranking among the primary physical hazards encountered in workplaces. Noise exposure can result in impaired psychomotor responses, diminished concentration, and reduced productivity. Additionally, occupational stress can manifest in interpersonal symptoms, including apathy,

distrust, and breached commitments, as well as cognitive symptoms such as forgetfulness, confusion, and difficulties in maintaining focus.

Research indicates a correlation between job stress and proximity to the workplace; individuals working closer to their workplaces are observed to have a lower risk of experiencing stress compared to those commuting from farther distances.

**Noise and Physical and Mental Health in Children**

In a study authored by Sunho Lee and Wanhyung Lee, it was revealed that environmental noise exposure correlates with primary headaches among children and adolescents. The research discovered a connection between noise exposure during both daytime and nighttime and the duration of headaches, implying that noise exposure might play a significant role in prolonged headaches in young individuals. The significance of headaches in public health is underscored by their widespread prevalence and considerable personal and social consequences. Evidence indicates that individuals suffering from headaches experience poor health-related quality of life and significant functional limitations due to the nature and unpredictability of their headaches.

**Noise Abatement Strategy**

The management of sound or noise is crucial for safeguarding safety and health through preemptive measures. Technical expertise or managerial intervention can be utilized, either independently or in tandem, to diminish noise levels. Moreover, personal protective equipment (PPE) can be employed as a means of noise control (Endrixs, 2023). Effective strategies for noise reduction encompass visual training, data acquisition, audiometric examinations, and assessment. Utilizing hearing protection gear such as earplugs can mitigate the risk of noise-induced injuries. Leveraging technology to identify areas characterized by elevated noise levels can foster the creation of a secure, healthy, and productive work environment. Safety officers and managers play pivotal roles in overseeing noise levels. The incorporation of safety protocols, the establishment of healthy work environments, and the deployment of additional protective gear also contribute to noise reduction and the enhancement of workplace safety.

## 4. CONCLUSION

Noise can be defined as a pollution or sound pollution that has a negative impact on health. This research highlights the negative impact of environmental noise on a person's mental health, including an increased risk of work-related stress, depression and anxiety. This emphasizes the importance of noise control in work and public environments to improve people's overall psychological well-being. Recent research has shown that exposure to environmental noise pollution can increase the risk of mental illness, therefore we must implement specific measures to address noise issues.

## 5. REFERENCES

Andersson, E. M., Ögren, M., Molnár, P., Segersson, D., Rosengren, A., & Stockfelt, L. (2020). Road traffic noise, air pollution and cardiovascular events in a Swedish cohort. Environmental Research, 185, 109446. https://doi.org/10.1016/j.envres.2020.109446

Endrianto, Endrixs. (2023). Upaya Pencegahan Kebisingan di Industri Petrokimia. Journal on Education. http://jonedu.org/index.php/joe

Fakhriyani, D. V. (2019). Kesehatan mental.

Pamekasan: duta media publishing, 11-13.
Guha, M. (2022). Noise pollution and mental health. Journal of Mental Health, 31(5), 605–606. https://doi.org/10.1080/09638237.2022.2118694
Hahad, O., Bayo Jimenez, M. T., Kuntic, M., Frenis, K., Steven, S., Daiber, A., & Münzel, T. (2022). Cerebral consequences of environmental noise exposure. Environment International, 165, 107306. https://doi.org/10.1016/j.envint.2022.107306
Hahad, O., Kuntic, M., Al-Kindi, S., Kuntic, I., Gilan, D., Petrowski, K., Daiber, A., & Münzel, T. (2024). Noise and mental health: evidence, mechanisms, and consequences. Journal of Exposure Science & Environmental Epidemiology. https://doi.org/10.1038/s41370-024-00642-5
Hegewald, J., Schubert, M., Freiberg, A., Romero Starke, K., Augustin, F., Riedel-Heller, S. G., Zeeb, H., & Seidler, A. (2020). Traffic Noise and Mental Health: A Systematic Review and Meta-Analysis. International Journal of Environmental Research and Public Health, 17(17), 6175. https://doi.org/10.3390/ijerph17176175
Jensen, H. A. R., Rasmussen, B., & Ekholm, O. (2019). Neighbour noise annoyance is associated with various mental and physical health symptoms: results from a nationwide study among individuals living in multi-storey housing. BMC Public Health, 19(1), 1508. https://doi.org/10.1186/s12889-019-7893-8
Lan, Y., Roberts, H., Kwan, M.-P., & Helbich, M. (2020). Transportation noise exposure and anxiety: A systematic review and meta-analysis. Environmental Research, 191, 110118. https://doi.org/10.1016/j.envres.2020.110118
Lee, S., & Lee, W. (2023). The Association between environmental noise exposure and primary headache in pediatric population. https://doi.org/10.21203/rs.3.rs-3158921/v1
Leuwol, F. S., Ramdan Yusuf, Eko Wahyudi, & Nunung Suryana Jamin. (2023). Pengaruh Kualitas Lingkungan Terhadap Kesejahteraan Psikologis Individu di Kota Metropolitan. Jurnal Multidisiplin West Science, 2(08). https://doi.org/10.58812/jmws.v2i08.592
Ma, J., Li, C., Kwan, M.-P., Kou, L., & Chai, Y. (2020). Assessing personal noise exposure and its relationship with mental health in Beijing based on individuals' space-time behavior. Environment International, 139, 105737. https://doi.org/10.1016/j.envint.2020.105737
Onmek, N., Bordeerat, N. K., & Wangwongwatana, S. (2024). The Effects of Environmental Noise on Annoyance, Stress, and Urine Cortisol Levels Among Residents Living Near Industrial Sites in Bangkok, Thailand. Kesmas, 19(1), 18–26. https://doi.org/10.21109/kesmas.v19i1.7521
Penelitian Kesehatan Suara Forikes Volume, J., Penelitian Kesehatan Suara Forikes, J., Safitri Sillehu, E., Paskarini, I., Tatroman STIKes Maluku Husada, F., & Sillehu STIKes Maluku Husada, S. (2022). Kebisingan dan Stres Kerja Karyawan PT PLN (Persero) Kairatu. https://doi.org/10.33846/sf13433
Wardhani, D. K., & Mukono, J. (2020). Sensorineural Hearing Loss Due to Exposure of Noisy Trains on Populations Around Turirejo Train Railroad Cross. Jurnal Kesehatan Lingkungan, 12(1), 59–

68. https://doi.org/10.20473/jkl.v12i1.2020.59-68

Welch, D., Shepherd, D., Dirks, K. N., & Reddy, R. (2023). Health effects of transport noise. Transport Reviews, 43(6), 1190–1210. https://doi.org/10.1080/01441647.2023.2206168

Zhang, X., & Zhou, S. (2023). Building a City with Low Noise Pollution: Exploring the Mental Health Effect Thresholds of Spatiotemporal Environmental Noise Exposure and Urban Planning Solution. International Journal of Environmental Research and Public Health, 20(5), 4222. https://doi.org/10.3390/ijerph20054222

Hernati (2018).Pengaruh Kebisingan (Pencemaran Suara) Terhadap Aktivitas Belajar IPA-Biologi Peserta Didik Kelas VIII SMP-IT As Salam Ambon. Skripsi .JURUSAN PENDIDIKAN BIOLOGI FAKULTAS ILMU TERBIYAH DAN KEGURUAN INSTITUT AGAMA ISLAM NEGERI (IAIN) AMBON 2018 http://repository.iainambon.ac.id/412/2/BAB%20I%2C%20III%2C%20V_91.

Sahadewa, S., Durry, F. D., Masyarakat, I. K., Kedokteran, F., Wijaya, U., Surabaya, K., Veteran, U., & Timur, J. (n.d.). KESEHATAN MENTAL DAN STRES KERJA DI TEMPAT KERJA: TINJAUAN PUSTAKA. http://journal.universitaspahlawan.ac.id/index.php/ners