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Impacts of traffic noise in residential area of Permatang Pauh, Pulau Pinang

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ABSTRACT. Traffic noise has become an alarming issue in this era of urbanization where transportation and road traffic are the major sources of noise pollution in the environment. Frequent, intensifying noise pollution has become a potential health hazard to the community, causing sleep disturbances, noise-induced hearing loss and mental health problems. The aim of this study is to determine the current state of traffic noise levels at residential college located in Permatang Pauh, Pulau Pinang and to examine the perceptions of noise pollution in relation to health hazards among college students. Traffic noise levels were measured during peak hours and evaluated based on the permissible noise level by the DOE Malaysia. A questionnaire was distributed to assess the impacts of frequent noise exposure of traffic noise on the neighbouring residents. The on-site measurements show that the traffic noise levels more than 60 dBA, and the maximum recorded noise level is 86 dBA which exceeds the permissible limits specified by DOE Malaysia. The students agreed that the constant traffic noise presents health risks including headache (67.5%), sleep disturbances (69.8%) and nuisances to hearing system (53.5%). 79.1% of the respondents concurred that noise emitted by vehicle exhausts is the primary contributor to noise pollution. Hence, the findings of this study emphasize the relevance of setting rules for traffic noise levels and measures in reducing the health hazards of urban residents.

Key words: Traffic noise level, Noise pollution, Health risk

INTRODUCTION

In general, noise arises as a result of human activities, the growth of urban and industrial areas, and the expansion of transportation line. Even in industrialized nations, noise is becoming an increasingly invisible source of pollution (Hamad et al., 2017). Environmental noise, including traffic noise, is a global rising public health issue that is one of the most severe forms of pollution for humans, significantly impacting human health. Nevertheless, in Malaysia, environmental noise pollution tends to be commonly overlooked compared to water and air pollution, which are widely recognised as significant factors affecting human well-being. This is due to the common perception that noise pollution primarily just constitutes a source of discomfort towards individuals (Halim et al., 2019b). The primary source of the noise pollution in Malaysia is predominantly attributed to the transportation network systems including traffic where the substantial volume of road users and traffic congestion has led to increased noise levels (Nayan et al., 2021). Poor urban road planning also another factor contributes to a significant traffic noise problems, as residential properties and public facilities like schools, hospitals, religious places, and other community structures are frequently situated in close vicinity to major roads without sufficient soundproofing or buffer zones (Sakieh et al., 2017).

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The noise limit, on the other hand, varies depending on the sensitivity of the area, the type of venue, and various country-specific legislation. To date, several research investigating on the noise pollution caused by traffic noise in Malaysia have been conducted and highlighted severe traffic noise pollution, but it is always limited to spotted popular cities and urban residential areas such as Kuala Lumpur (Lim & Lee, 2023), Shah Alam (Isa et al., 2018), Pulau Pinang (Halim et al., 2019a; Halim et al., 2019b; Aziz et al., 2012) and Johor Bahru (Balasbaneh et al., 2020). Findings from these studies reported the monitored noise levels in day and night are exceeding the permissible noise limit based on the receiving land use. Additionally, noise level assessment also has been conducted to several sensitive areas in Malaysia including schools (Abdullah et al., 2021; Kedri et al., 2023; Murally & Daud, 2022; Segaran et al., 2019), institutional area (Abdullah et al., 2019; Badruddin et al., 2020; Nayan et al., 2021) and hospital (Helmi et al., 2021; Segaran et al., 2019) concerning on the persistent traffic noise level in vicinity. Unexpectedly, this area experiences high noise level more than 50 dBA with lack thereof buffer zone for the receptors from traffic noise emanating the nearby major road. According to the environmental control standards for suburban and residential areas by Department of Environment Malaysia (DOE, 2019), the maximum allowable noise level suburban and urban residential zones should not exceed 65 decibels (dBA) to protect the neighbourhood from environmental noise pollution. Table 1 below shows the recommended permissible sound level (L_{Aeq}) at receptor locations in context of an existing developed area as prescribed in Guidelines for Environmental Noise Limits and Control, Department of Environmental Malaysia (DOE, 2019). It is observed that the allowable limit during nighttime is lower in comparison to daytime. According to Wrótny & Bohatkiewicz (2021), because the central nervous system is activated subconsciously during sleep, the rest of the sleep patterns is particularly essential. After considering the above, all rules and guidelines advocate for lowering the sound intensity specifically at night compared to daylight.

Table 1. Permissible sound level for existing developed area

Receiving Land Use Category	L_{Aeq} Day 7.00 am – 10.00 pm	L_{Aeq} Night 10.00 pm – 7.00 am
Low Density Residential, Noise Sensitive Receptors, Institutional (School, Hospital, Worship).	60 dBA	55 dBA
Suburban and Urban Residential, Mixed Development	65 dBA	60 dBA
Commercial Business Zones	70 dBA	65 dBA
Industrial Zones	75 dBA	75 dBA

*Source: Department of Environmental Malaysia (DOE, 2019)

Furthermore, road traffic noise is consistently become source of irritation and a potential threat to the hearing among the urban communities (Stansfeld et al., 1997). It is possible to assess environmental noise with respect to community annoyance, considering human perception of sound levels and whether the sound is deemed intrusive. Typically, individuals within the vicinity of noise exposure perceive it based on their personal judgment, comparing it to the existing ambient sound in the absence of any intrusive noise (DOE, 2019). The effects of road traffic noise in urban areas have been extensively studied, not only due to the increasing volume of motor vehicles on the roads but also

because of the significant levels of annoyance and disturbance it can cause. This annoyance response from road traffic noise can lead to a decline in the overall quality of life in urban area (Babisch et al., 2009; Jones, 2010; Lekaviciute & Sobotova, 2013). Concerning the environmental impact of the noise on human perception and community annoyance, Department of Environment (DOE, 2019) Malaysia outlines the guidelines on the noise severity and impact assessment towards the community based on the increment range of sound level. In the range of 3 to 5 dBA the increase in sound levels has minimal impact on both humans and the environment. Conversely, an increase in sound level within the range of 15 to 20 dBA strongly influences noise annoyance within the neighbouring community. Table 2 below tabulates the typical human subjective perception of loudness change in sound level and its likelihood of environmental impact.

Table 2. Human perception of sound and likely environmental impact*

Increase in sound level (dB)	Subjective change in perceived loudness	Environmental Impact
3	Just perceptible	None
5	Noticeable difference	Little
10	Twice as loud	Medium
15	Large change	Strong
20	Four times as loud	Very strong

*Source: Department of Environmental Malaysia (DOE, 2019)

While commonly perceived as a nuisance, noise pollution holds significant importance in terms of monitoring because prolonged exposure of road traffic noise has been linked to various adverse health effects. Prolonged exposure to excessive noise can impact the psychological and physiological well-being of the surrounding community. Noise annoyance, cardiovascular health, hypertension and sleep deprivation are among the contributing traffic noise-induced health effects occurred (Singh et al., 2018; NIDCD, 2017). According to Nijland and Wee (2005), individuals may experience health issues, disruption, and discomfort because of noise exposure in certain cases, it may also influence job efficiency and the quality of life. Moreover, it also can significantly impact the learning process of a person by influencing understanding and behaviour (Badruddin et al., 2020). Over the past 20 years, numerous researchers have conducted considerable studies to examine the relationship between exposure to road traffic noise and human health, including sleep disruption, decreased task performance, hypertension, high blood pressure, and cardiovascular issues (Kumar, 2019). Most studies describe using social survey questionnaires to examine the detrimental impact of traffic noise on social communities in addition to monitoring, modelling, and sleep disturbance investigations in lab and field settings (Kumar, 2019).

Jadaan et al., (2021) conducted a study in Jordan to measure the level of public awareness regarding road traffic noise and impact of noise disturbance towards their daily activities. The research highlighted primary effects of road traffic noise on community health, encompassing fatigue (64%), anxiety (75%), nervousness (87%), reduced focus (89%), and overall discomfort (90%) (Jadaan et al., 2021). Wrótny & Bohatkiewicz (2021) conducted a comprehensive sociological study in twelve European capitals, specifically examined the effects of traffic noise from railways and

roads on the health of the residents. Research has shown that road traffic noise has a greater negative impact than train noise, particularly in terms of causing discomfort and disrupting sleep. The majority of residents in urban areas experience the highest level of noise annoyance and sleep disruption at sound levels ranging from 65 to 70 dB and over 70 dB (Wrótny & Bohatkiewicz, 2021).The study conducted by Shi et al. (2023), acquiring data from the FAMILY cohort in 18 districts of Hong Kong, has found a significant correlation between residential traffic noise and likely depression as well as lower mental wellness in a densely populated urban environment. Exposure to road traffic noise levels exceeding 40 dBA during nighttime has a detrimental effect on the mental well-being of urban residents. An increase of 10 dBA in residential road traffic noise during the day and night was found to be correlated to decreased mental wellness. Additionally, a 10 dBA increase in noise exposure in residential areas during both day and night is connected with a 15% higher likelihood of experiencing depression among the inhabitant (Shi et al., 2023).

In Malaysia, over the last decade, Aziz et al., (2012) conducted a study in Bukit Mertajam, Pulau Pinang focusing on the relationships between noise pollution with traffic volume. The results disclose an elevated range of traffic noise, with one of the locations approaching an almost hazardous noise level of 76 dBA. The high range of traffic noise not only causes annoyance among residents but also may pose a significant risk to the hearing health of the broader community. In 2018, 40% of Shah Alam residents reported experiencing annoyance as a result of exposure to traffic noise from nearby roadways. Additionally, 50% of the respondents suffered headaches and acknowledged that it can lead to stress (Isa et al., 2018). Abdullah et al. (2021) administered a questionnaire-based survey to explore the noise perceptions of primary school students and teachers. The findings revealed that 26% of the students acknowledged that the noise originating from nearby traffic does indeed impact their concentration during the learning process in the classroom. Nevertheless, it is observed that there is a dearth of assessment study on the traffic noise level associated with health risk in Malaysia.

Aligned with Sustainable Development Goal (SDG 11) focusing on creating safe and sustainable cities and communities, it is critical to investigate traffic noise pollution in Malaysia and its potential in triggering noise induced-health risk to the urban communities. Hence, this research paper is focusing on; (1) assessing the traffic noise levels at study area in comparison with the permissible noise limit, and (2) evaluating the perception, awareness and experience of the local residents concerning the potential health effects due to continuous traffic noise exposure. Eventually, this research can provide valuable insights for policymakers and town planners, who can utilise the findings for future town planning efforts, particularly in developing sustainable cities. Furthermore, suitable mitigation measures shall be taken to quantify the problem and reduce the potential of noise-associated health effect towards the urban residents in the long-term period.

METHODOLOGY

Study Area

This research was conducted in a local residential college namely Kolej Mutiara, located in Permatang Pauh, Pulau Pinang, Malaysia. Physically, Kolej Mutiara is situated at the geographical coordinates of 5.36 degrees latitude and 100.42 degrees longitude. The study area is located within residential suburban areas with a medium density of population. Kolej Mutiara is consists of two blocks and occupied by 43 students of Universiti Teknologi Mara (UiTM) Pulau Pinang. Figure 1 shows the location of study area (circled in red), located in front of Jalan Baru which is one of the busy roads in Permatang Pauh, Pulau Pinang. The study area often encounters traffic congestion and high noise levels, particularly during morning and evening. From the urban development shown in Figure 1, it is observed that Kolej Mutiara is encircled by a busy roadway of Jalan Baru consist of roundabout and flyover. Within 200 m radius, there are presence of KTM railway, Bukit Tengah train station and a transportation company namely Central Kargo Sdn Bhd, which provides transportation services of heavy vehicles. It is expected that the heavy vehicles also contribute to the traffic volume of Jalan Baru. However, traffic volume of the study area and noise measurements generated from nearby railway are excluded in this research.

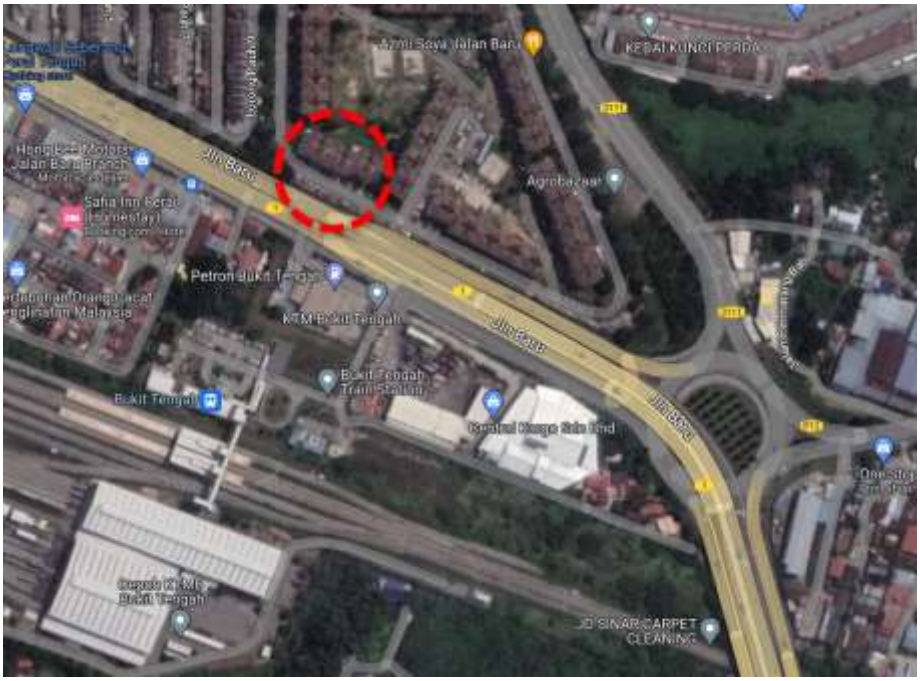

Figure 1. Location of study area
(Source: Google Map)

Traffic Noise Level Measurement

The study was conducted using a portable Sound Level Meter (SLM MODEL quest 1700/0 B-100). Noise is measured using SLM in A-weighted sound pressure. The SLM delivers linear readings in the 50 dbA to 100 dbA range, with a weighted scale A and C, and slow and fast time constants. The operational temperature range for SLM is 5°C to 35°C. The noise level was received by the microphone and displayed measurement values in decibels on SLM. The

microphone has a 1700 output impedance, a sensitivity of 50 dbA, and a frequency response of 20 dB. The frequency range is 30Hz to 1600Hz. The SLM is placed on a tripod, located 1.5 m above the ground level and at least 3.5 m away from any reflecting surfaces (DOE, 2019). Short term sampling was employed in this study where the noise measurements were taken over 7 days, with 30 minutes monitoring period during peak times (0700 to 0730, 1700 to 1730, and 2200 to 2230). The selection of monitoring period is based on the heavy traffic condition during morning, evening and night. With three sets of measurements, these measures were taken for each sampling location. Monitoring of the noise level is conducted for 15 minutes interval where minimum and maximum noise level were also recorded.

Data Analysis

Equivalent noise level (L_{Aeq}) was calculated using Eqn. (1) which is expressed in dB(A) unit.

$$L_{Aeq} = 10 \log \sum_{(i=t)}^{(i=n)} 10^{L_i/10} (t_i) \quad (1)$$

where,

n = total number of samples taken

L_i = noise level of the sample in dB(A)

t_i = fraction of total sample time

The recorded noise level is analysed for maximum and minimum levels and compared with the permissible sound level for existing developed area for urban residential as shown in Table 2.

Questionnaire Survey

The information on noise perspectives and awareness level on traffic noise health related impacts were acquired from the students of Kolej Mutiara via questionnaire survey. All 43 students who occupies the Kolej Mutiara are the respondents. The locals from neighbouring residential area were excluded in the selection of respondent as this research is focusing on the noise-induced health effects on student. This is aligned with previous studies highlighted the concerns of reduced performance and health risks among students due to high noise levels (Abdullah et al., 2021; Wen et al., 2019; Shield & Dockrell, 2003). Information regarding demographic attributes such as age, gender, duration of residency, and educational background was acquired. Data regarding any pre-existing medical conditions was also gathered. A Likert scale of five-point scale is used in the questionnaire where scale 1 strongly disagree, scale 2 disagree, scale 3 neutral, scale 4 agree and scale 5 strongly agree. The questionnaire was designed to determine the perspective and awareness of the college students on noise-related health risk due to constant exposure of traffic noise from the nearby surrounding area. The questionnaire survey is divided into four sections which are (1) demographic (2) perception of students towards the environmental noise level and (3) awareness of students on the effects of traffic noise towards health and (4) impacts of traffic noise on student health. The questionnaire was distributed to the students occupying Kolej Mutiara via google forms and a total of 43 responses were positively acquired. In the next

section, the discussion on the responses will be grouped into three, (1) strongly agree and agree (2) neutral and (3) disagree and strongly disagree.

RESULTS AND DISCUSSION

Traffic Noise Level

The traffic noise level was measured at three different time which are at 7am morning, 5pm evening and 11pm evening. The selection of sound level monitoring is based on the heavy traffic especially during 7am in the morning and 5pm in the evening. Figure 2 represent the maximum noise level (L_{max}) monitoring results recorded during the monitoring period. These results clearly indicates that the study area experienced high noise levels all the time including nighttime. The Malaysian Department of Environment (DOE) Malaysia prescribes that the permissible equivalent noise level (L_{Aeq}) for sub-urban dan urban development regions should not exceed 65 dBA during the day (7.00 am to 10.00 pm) and 60 dB(A) at night (10.00 pm to 7.00 am). During the morning period, the highest recorded noise level is 86 dBA, 82 dBA during evening session and 83.2 dBA during night session. All the recorded noise level during morning and evening sessions are exceeding the permissible limit of 65 dBA and the noise level during night session also exceed the permissible limit of 60 dBA. Previous study on road traffic noise level conducted in 2019 in residential areas of Nibong Tebal, Penang shown that the sound level (LAeq) was exceeded the maximum allowable limit for medium density residential areas during daytime from 7.00 am to 10.00 pm is 55 dBA while at nighttime from 10.00 pm to 7.00 am is 45 dBA (Halim et al., 2019a).

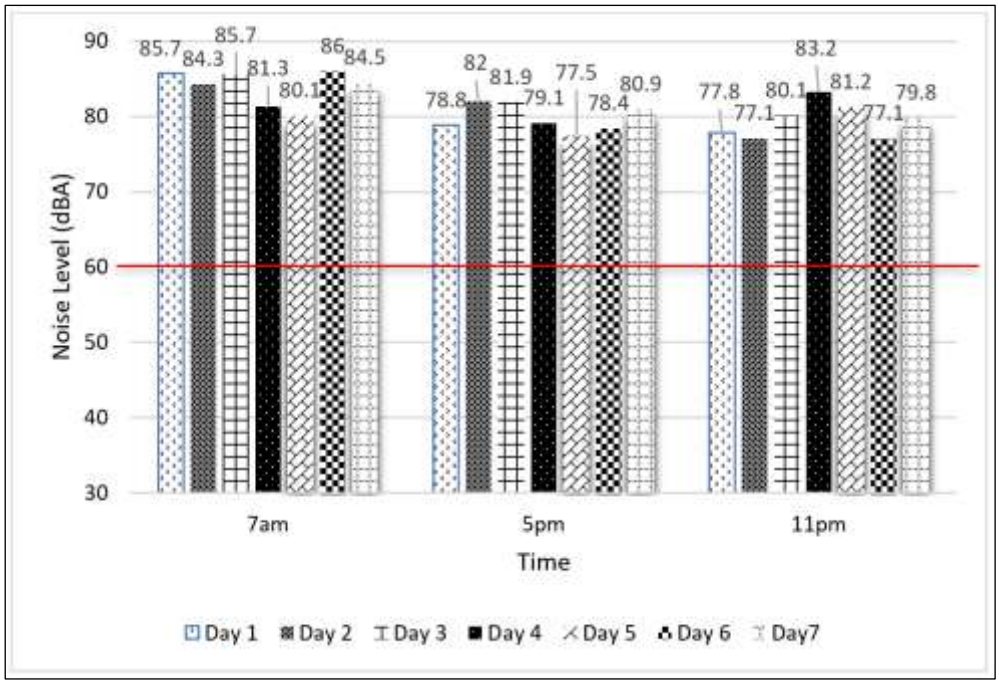

Figure 2. Maximum noise level
*Red line represents the maximum permissible sound level for sub-urban and urban development at night

The primary contributors to road traffic noise includes vehicular sources, traffic volume, traffic speed, traffic composition, road gradient, and pavement condition (Haron et al., 2019). Kumar (2019) identified automotive sources

as the leading contributors, comprising 80% of noise pollution, followed by electrical and industrial machines. The noise generated by automotive sources includes the engine, exhaust, tire-pavement interaction, and other factors (Haron et al., 2019). Furthermore, the study area is encircled by a busy roadway of Jalan Baru consist of roundabout and flyover which leads to Seberang Perai and Bukit Minyak industrial regions. The increment of traffic volume especially during morning and evening leads to high level of traffic noise. The noise level was higher particularly during peak hours (7.00 am and 5.00 pm), as there were increased in traffic volumes and a higher percentage of heavy vehicles. This condition is in-line with previous studies on traffic noise in Nibong Tebal by (Halim et al., 2019a) and (Aziz et al., 2012) in Bukit Mertajam where the increasing number of traffic volume and high number of heavy vehicles passing the road contributed to the high noise levels.

In addition, one of the possible reasons for high noise levels recorded in study area because of the existence of roundabout which can increase the traffic capacity up to 67% (Demir & Demir, 2020). Moreover, there are the heavy transportation cargo station and railway station located within 200 m of the study area which does contribute to high number of heavy vehicles especially during daytime. Heavy vehicles like lorries, trucks, buses, and trailers are also significantly contribute to the overall ambient noise level (Halim, et al., 2019b; Aziz et al., 2012). The noise emitting from the nearby Bukit Tengah train station could also be a contributing factor to the elevation of noise levels in the study area. This is attributed to the fact that the noise generated during the arrival of trains may escalate to a maximum level ranging between 90 to 100 dBA (Selamat & Abdul Rahim, 2018). Kalansuriya et al. (2015) recommends that a 50% reduction in traffic volume results in a 3 dBA decrease in traffic noise. Similarly, a reduction in traffic speed by 50 to 75% leads to a corresponding reduction in traffic noise ranging from 3 to 6 dBA (Boer & Schroten, 2007).

Students Perceptions Towards the Environmental Noise Level

The survey findings shed light on the students' perceptions, awareness and impacts of environmental noise level acquired from a total of 43 respondents. Figure 3 implies the proportion of responses regarding student perceptions towards the traffic noise level within their residence at Kolej Mutiara. From the findings, a notable 62.8% of participants described their living environment as noisy, while a contrasting 9.3% held the opposite point of view. Similarly, in city of Shah Alam, Malaysia, 18.4% of respondents affirmed that their surroundings are free from noise pollution, experiencing no sounds that cause annoyance (Isa et al., 2018). Moreover, 74.4% of the students acknowledged being significantly bothered by daytime traffic noise, while 65.2% of them are bothered during the nighttime. Interestingly, these responses correspond with the recorded noise levels which exceeding 80 dBA particularly during the day. Furthermore, the study identified that vehicle exhaust noise does contributes significantly, influencing the ambient noise level in the study area by 79.1%. Examining the impact on daily routines, 65.1% of students concurred that constant exposure to traffic noise shall affect their work efficiency. These insights underline the dynamics of noise perception among the students and its tangible effects on their daily lives.

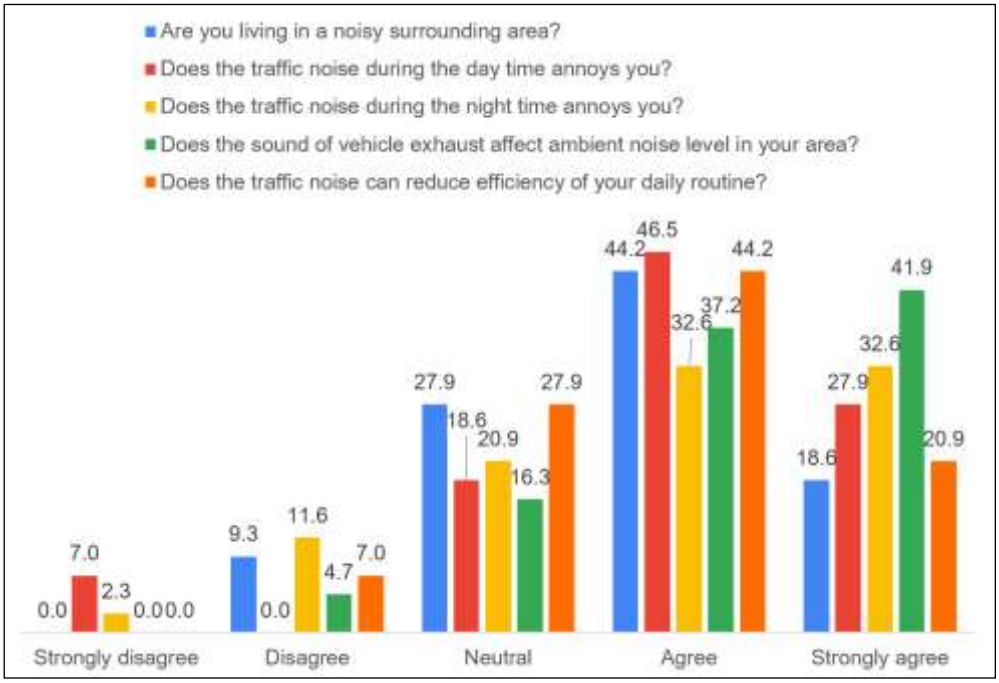

Figure 3. Proportion of responses regarding student perceptions towards the environmental noise level

In previous study, (Jadaan et al., 2021) compared the effects of traffic noise on urban residents during both daytime and nighttime, revealing that the impact of traffic noise is notably more significant during daytime, particularly during leisure activities such as reading and studying. Undoubtedly, communication noise, involving railway and road noise, is one of the environmental variables that disrupt human activity. Nevertheless, the characteristics of these sounds are quite distinct where road noise poses a higher risk to the environment compared to railway noise (Wrótny & Bohatkiewicz, 2021; Fields & Walker, 1982).The high road traffic noise levels are mostly originating from the vehicle engines. The noise generated by motor vehicles, such as cars, motorcycles, buses, and trains, arises from the interaction of the vehicle's traction systems, particularly the engine, with the wheel. This interaction tends to become more significant specifically at high speeds (Bhatiar, 2014). According to a study conducted by Kumar (2019), approximately 70% of respondents expressed the view that noise pollution primarily originates from vehicular road traffic, leading to annoyance among individuals. Industrial and electrical machines were identified as subsequent contributors to noise pollution.

Moreover, based on the monitoring noise level of study area, the increase in sound level during morning, evening and night session is in the range of 4.5 to 6.1 dB. Within this range of increment as in Table 2, it is considered as minor significance in the context of sound levels (DOE, 2019). 62.8% of the students may perceives a 5 dB noise difference as slightly louder, but it unlikely to cause significant annoyance or disruption. Meanwhile, the remaining 37.2% consider it as insignificantly noticeable and normal to everyday situations. Previous study conducted by (Lim & Lee, 2023) in city zone of Cheras, Kuala Lumpur observed an increase of 5 dB to 10 dB in four different monitoring stations, located near to mass-rapid transit (MRT) line. The results suggest that certain individuals near the source of the MRT noise may be aware of its presence, but it is improbable to induce considerable annoyance or disruption. Nevertheless, it is crucial to acknowledge that the impact of noise may varies depending on other factors such as the

time of day, the duration of the noise, and the sensitivity of the individuals who are affected (Lim & Lee, 2023).

Students Awareness on The Effects of Traffic Noise Towards Health

According to the World Health Organization (WHO, 2021), traffic noise may lead to annoyance and health effects, for instance, communication problems, headaches, sleep disturbance, stress, high blood pressure, an increased risk of heart disease and hormonal effects. From the questionnaire survey, the respondents were assessed in term of their awareness on the potential incident health problem such as cardiovascular disease, loss of hearing, stress and loss of focus especially during learning time. The survey results disclose varying levels of awareness among students regarding the health hazards associated with noise exposure. Figure 4 shows the distribution of responses regarding student awareness on the traffic noise health related. It is observed that only 44.2% of the respondent demonstrated awareness of the potential risks caused by traffic noise. Interestingly, 58.1% recognized the relationship between constant exposure to traffic noise and the development of cardiovascular diseases, indicating a higher awareness in this aspect. Furthermore, 55.9% acknowledged the possibility of damage to the hearing system due to traffic noise. A significant 72.1% of the students agreed that traffic noise could be a trigger for anxiety or tension, underlining the perceived psychological impact of environmental noise. Additionally, a substantial majority of 81.4% agreed that traffic noise adversely affects their focus during study sessions, highlighting the potential interference of noise with their academic activities. These findings underscore the importance of enhancing awareness and understanding of the diverse health implications associated with exposure to traffic noise.

From the findings, it indicates that a considerable number of students demonstrate limited awareness or lack thereof concerning the health hazards related to traffic noise exposure. A majority of more than 50% of the student acquire only minimal understanding of the effects of traffic noise. Notably, only 32.6% of students demonstrate awareness of the damaging impacts of traffic noise on their health. Similar to the study conducted by Gilani & Mir (2021) as most of their respondents are classified as lack of awareness about the serious health risk posed by traffic noise. This emphasizes the need for increased education and awareness campaigns to enhance students' understanding of the potential health risks associated with prolonged exposure to traffic noise. Regarding the awareness on harmful effects of traffic noise exposure, Kumar (2019) concluded that there is a lack of understanding among both poor and highly educated individuals in Delhi regarding the detrimental effects of traffic noise on their health. Furthermore, they are largely unaware about the issue of noise pollution.

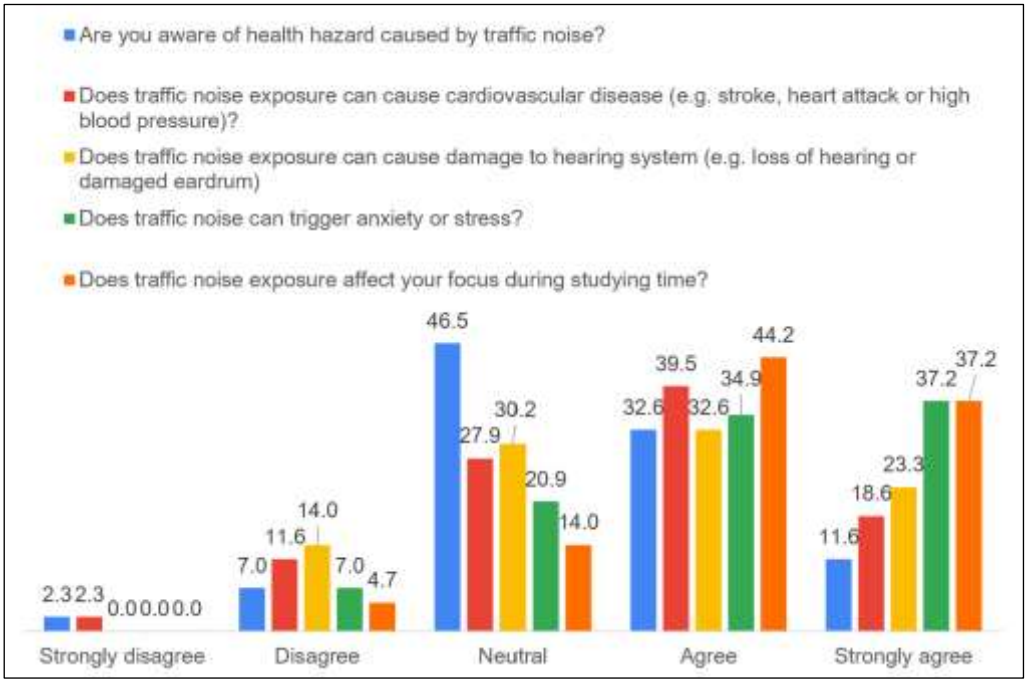

Figure 4. Proportion of responses regarding student awareness on the traffic noise health related

In addition, 81.4% of the students acknowledged that traffic noise has a negative impact on their concentration while studying. This finding aligns with a study conducted by Jadaan et al. (2021), where 75% of their respondents reported feeling annoyed by traffic noise while studying during the day, and 60% experienced annoyance from traffic noise while studying at night. Besides, Gilani & Mir (2021) evaluated the awareness level using mean awareness index score (MAIS) among urban residents on impacts of traffic noise towards their health including cardiovascular diseases and work efficiency. The study revealed that stress is the most severe health impacts can occur due to traffic noise with MAIS score of three. However, the personal experience of the students in impacts of traffic noise towards their personal health is further discussed in the next sub-section.

Impacts of Traffic Noise on Student Health

Figure 5 illustrates the distribution of responses regarding the impact of traffic noise exposure on students of Kolej Mutiara. Examining the data shows that 53.5% of the students acknowledged that traffic noise originating from the nearby road poses a nuisance to their hearing, while 69.8% agreed that the traffic noise from the nearby roadway disrupts the quality of their sleep. These responses are aligning with the high range of noise levels, 77.1 to 83.2 dBA recorded during the noise level monitoring in night session. Urban residents who experiencing poor quality of sleep have four times higher risk to be highly annoyed due to traffic noise (Gilani & Mir, 2021). This underlines a substantial correlation between exposure to high traffic noise levels with community annoyance and a lack of quality sleep. Furthermore, a substantial 67.4% of students reported a reduced ability to focus on their studies due to traffic noise. Abdullah et al. (2021) emphasized in their research that traffic noise significantly contributes to disturbances experienced by school students during the learning process. In contrast, only 48.8% of students admitted to feeling anxiety attacks due to sudden loud traffic noise, and 67.5% claimed to suffer headaches due to the increased volume

of traffic noise throughout the day and night. This aligns with the results presented by Kumar (2019), indicating that noise disturbance is the primary health problem due to persistent exposure of higher noise levels encountered by the urban residents followed by irritation and headaches.

The World Health Organization (WHO) reports an annual loss of over 1.6 million healthy life-years in Western Europe due to traffic-related noise (Münzel et al. 2018). This issue is particularly noteworthy in Malaysia, where there seems to be insufficient attention given to these noise levels. Continuous exposure to high environmental noise levels in the country shall lead to adverse health effects such as nausea, headaches, and changes in mood and anxiety among urban citizens (Lim & Lee 2023) Additionally, Jadaan et al. (2021) concurred, noting that 80% of urban residents experienced a reduction in focus, discomfort, and nervousness during the daytime as a result of exposure to traffic noise. These findings collectively underscore the multifaceted impacts of traffic noise on various aspects of students' well-being and daily activities. In brief, residential road traffic noise remained associated with the risk of depression and reduced mental well-being. Nevertheless, the correlation between traffic noise and the occurrence of depression and mental wellness shall be categorized as moderate level of significance (Shi et al., 2023). Nevertheless, by reducing the degree of traffic noise exposure, there is a potential to significantly enhance the mental well-being of the community, considering the considerable number of individuals affected by traffic noise (Rose et al., 2008; VanderWeele et al., 2019).

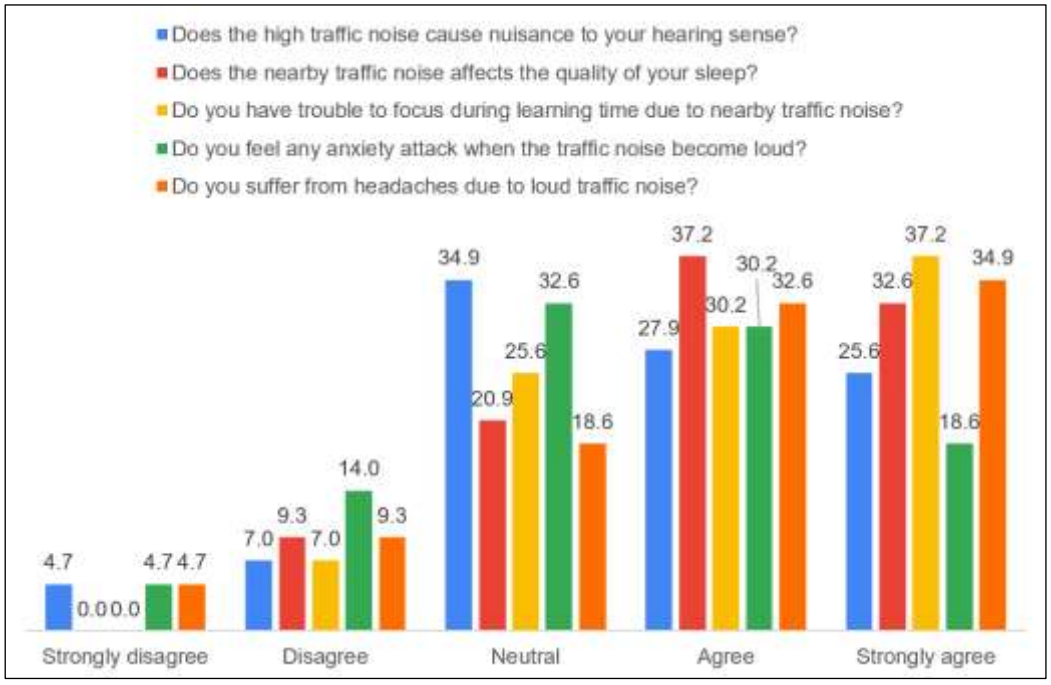

Figure 5. Proportion of responses regarding impacts of traffic noise exposure towards the students

CONCLUSION

The aim of this study is to evaluate the environmental noise level and the health risk associated traffic noise. Traffic noise perception at urban residences was revealed to be a major predictor of the irritation caused by traffic noise.

Using a Sound Level Meter (SLM), the traffic noise level was determined to acquire the maximum equivalent noise level during peak hour. Based on the noise level data, the study area consistently encountered high noise levels, even during nighttime. The maximum recorded L_{Aeq} exceeded the permissible limit set by the Malaysian Department of Environment, 65 dBA during daytime and 60 dBA during nighttime. However, it is important to note that the traffic volume study is excluded in this research, but strongly recommended to be included in future research to determine the number of movements from several classification of vehicle at particular area.

In term of student perception towards the health problem related to traffic noise, 74.4% agreed that the traffic noise in daytime does cause annoyance to them while 32.6% claimed that traffic noise causes less distraction during nighttime. In the other hand, most of the respondents have minimum/less awareness on the bad impacts of traffic noise exposure towards their health. Furthermore, due to high noise level from the nearby traffic road, more than 60% of the students experienced poor quality of sleep, less focus during learning time and headaches which could result in a diminished quality of life and overall well-being. However, the influence of noise can vary based on several aspects, such as the time of day, the duration of the noise, and the sensitivity of the individuals impacted. It is vital to consider these factors when assessing the impact of noise towards the environment. Several mitigation measures can be employed to minimise noise exposure and alleviate the health hazards linked to traffic noise. Possible solutions to address the issue include implementing noise barriers and planting trees to mitigate noise, enhancing traffic management by modifying speed limits, and adopting noise-reduction technologies. Furthermore, individuals can lessen their exposure to traffic noise by using earplugs, closing windows, or seeking out quieter environments for work or rest. Nevertheless, this study does have a number of limitations. The measurement of traffic noise pollution provides short-term noise pollution assessment, as it is just focusing on the permissible noise level by within a seven-day monitoring period. Moreover, the awareness and perception of the health consequences resulting from road traffic noise are restricted solely to college students residing in urban setting.

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AUTHOR CONTRIBUTIONS

Nurakmal Hamzah: Main conceptualization, methodology, data analysis, writing-original draft, writing-review and editing. M**uhammad Syarafuddin Mohd Salehudin**: Methodology, data collection, data analysis, writing-original draft, **Amalina Amirah Abu Bakar:** Data curation, **Adhilla Ainun Musir:** Data curation and analysis, **Nor Azliza Akbar:** Conceptualization.

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DATA AVAILABILITY

Not applicable.

COMPETING INTEREST

The authors declare that there are no competing interests.

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