# Noise Level Assessment Near the Hospitals Located in Dhangadhi Sub-Metropolitan City

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**Abstract**

Undesirable sound is called noise. Excessive amounts of sound in the environment cause noise pollution. Noise pollution is one of the major environmental problems in recent times especially in urban regions. This study aims to examine the noise levels near hospitals located in Dhangadhi Sub-Metropolitan City. A total of nine hospitals were selected for this study which are located in Dhangadhi Sub-Metropolitan City. The noise level was recorded in those hospitals in morning (8:00-10:00), day (14:00-16:00), and evening (17:00-19:00) time. A digital sound level meter was used to measure noise levels in the month of February 2024. This study showed that noise levels ($L_{eq}$) at those hospitals were more than the prescribed noise level. In the selected hospitals higher noise level was observed in those hospitals which are near the roads or highways. Less noise level was measured in the hospitals which are inside the road. This study concluded that high traffic of vehicles on the road, bad condition of the road, human crowds, and unnecessary use of horns are the major causes of noise pollution in those hospitals.

***Keywords***: sound pollution, hospitals, noise level, environmental pollution

## Introduction

The word 'Noise' is derived from the Latin word *Nausea*, which means an unwanted and harmful sound (Darshana et al., 2013). Noise is an undesirable, disturbing, and harmful sound that causes different health problems. In the urban region, noise pollution is one of the major environmental pollutions. In urban regions, noise pollution

increases rapidly affecting human health as well as deteriorating the quality of the environment (Murthy et al., 2007; Neupane&Chauhan, 2024). On the basis of sources of noise, it has been broadly categorized as; Machinery noise, Transportation noise, Construction noise, Building service noise, domestic noise, and Noise from Leisure activities. Among them, noise due to transportation of the vehicles is a major one (Onder & Akay, 2015).

Several adverse effects on human health such as hearing and sleep disturbance can be caused due to high exposure to noise. Apart from that, it also leads to cause psycho-social effects like miscommunication and annoyance (Regmi et al., 2021). High exposure to noise may have a negative effect on memory leading to permanent loss of memory or psychiatric disorder (Chauhan&Pande, 2010). People working in factories or industrial premises who are regularly exposed to 85-90 dB have a high chance of hyperacusis (Astrauskas et al., 2021).

From physics perspective, noise is taken as a random, fluctuating, unharmonious waveform. Sound can be measured by analyzing its intensity, frequency, and temporal dimension of acoustic signal. However, the sound intensity level is generally expressed in dB. Frequency or pitch refers to the number of cycles per second. The audible range for human beings is 20 Hz- 20 KHz and in everyday practice most of the sounds fall in the range 60 Hz- 6 KHz. Temporal characteristics of sound refer to the duration, phase, and rate of repetition of the sound. High-frequency sounds are more harmful than low-frequency sounds (Kam et al., 1994). Actually sound can be considered as an auditory perception of wave motions in air or in any other media. Among the series of environmental stressors, noise pollution has been ranked second (Chhetri et al., 2019).

The intensity of sound waves can be defined as the rate of flow of sound energy through an area. The intensity of sound level can be defined as; $\beta = 10 \log_{10}\left(\frac{I}{I_0}\right)$

Where, I shows the intensity of sound and $I_0$ represents the threshold of hearing and $I_0 = 10^{-12} Wm^{-2}$.

This study assessed the noise level near hospitals located in Dhangadhi Sub-Metropolitan City. Along with presenting the current noise level near those hospitals, this study also mentions strategies to reduce noise pollution. This study was guided by a research question: What is the current noise level status in the hospital area located in Dhangadhi Sub-Metropolitan City?

## Literature Review

In the area of sound pollution analysis, there have been several studies in the past which were carried out to assess noise levels in different locations. These studies are widespread at national and international levels. In this section, some relevant literatures has been reviewed.

Ibrahim and Richard (2000) conducted a study to examine noise levels at school environment located in a residential area of Malaysia. They found noise pollution in schools negatively affects various teaching and learning activities. They found high noise levels in the school environment. They suggested to construct noise insulation buildings to reduce noise pollution. They pointed out that policy making of noise pollution should be formulated by taking into consideration of school context as well. Likewise, Singh and Davar (2004) conducted a study to explore sources of noise, its effects, reactions, and suggestions for controlling the noise level. They mentioned that automobiles and loudspeakers as major sources of noise pollution.

Datta et al. (2006) assessed noise levels in Burdwan city of Kolkata, India. They collected data from various places in the city using sound level meters. The sound level was found in the range of 64-85 dB and sometimes beyond in selected locations. They also mentioned the adverse effects caused by noise on human beings. Strict implementation of rules and regulations of the Environmental Protection Act must be followed to maintain the noise level at a safe limit.

Murthy et al. (2007) conducted a study to measure the noise levels in the semi-urban area Banepa of Nepal. They found that in most of the cases, noise levels exceeded prescribed levels. On an average minimum and maximum noise level for the main road are 60.1 dB and 110.2 dB respectively likewise, minimum and maximum noise levels near bus parks were 63.9 dB and 110.2 dB. They mentioned motor vehicles as the major cause of noise pollution. They recommended to formulate noise standards in the country to control noise pollution. They have suggested that improvement of road quality, banning hydraulic horns, planning on both sides of the road, and public awareness lead to reduce the noise level.

Chauhan and Pande (2010) conducted a study to monitor noise pollution in different zones of Dehradun City of Uttarakhand. They pointed out that poor maintenance of automobiles and music systems is the major cause of noise pollution. It results in

severe effects like improper communication, sleeplessness, and reduced efficiency. They found that in all locations noise level exceeds the value of standard noise level. Proper maintenance of vehicles and roads, timely checking of vehicles, and plantation of trees lead to a reduction in noise pollution. They also highlighted the importance of public awareness about noise pollution and its adverse effects to reduce the noise pollution levels.

Likewise, Darshana et al. (2013) carried out a study in Navsari city of south Gujarat to assess noise level. A portable sound level meter was used to measure the noise level. They found noise levels in the range of 107 dB to 32.1 dB. This value was more than the prescribed standard noise level. They emphasized on to enhance public awareness to control noise pollution levels.

Bhattarai (2014) conducted a study to assess noise levels at selected locations of silent, residential, and commercial zones of Siddharthanagar Municipality by using the sound level meter. They found that at each location noise levels were above the prescribed standard noise level. The maximum noise level was observed as 81.9 dB at the bus park and the minimum noise level was observed at 54.5 dB near the medical college. He pointed out that sound produced from vehicles is the main source of noise pollution. Also, bad condition of road and vehicles also increases the noise levels.

Rayamajhi (2017) conducted a study to measure the noise level at five different locations in Butwal Sub-Metropolitan city using a digital sound level meter. They observed the highest noise level of 79.8 dB on *hatbazar* day at Butwal and on non-*hatbazar* day highest noise level was found as 71.9 dB. They concluded that people's crowds, various commercial activities, unnecessary advertisement of goods, and blasting of horns increase the noise level in the *hatbazar* region.

Regmi et al. (2021) conducted a study to measure noise levels at different wards of Kathmandu Metropolitan City (KMC). A sound level meter (SLM) was used to measure noise level and they found the average equivalent noise level as 82.58 dB in KMC. This value was above the predefined noise level value. They mentioned that the bad condition of vehicles and roads was the major cause of noise pollution. Unnecessary use of pressure horns adds more noise. They suggested that using noise barriers and public awareness may help to reduce noise levels.

Singh et al. (2022) explored traffic noise levels in Kathmandu city of Nepal. They made direct observations for the vehicle flow status whereas secondary sources were used

to get a time series of noise. They have determined noise indicators like traffic noise level, noise pollution level, equivalent continuous sound level, and minimum and maximum sound level. They found in all the locations $L_{eq}$ value exceeds 70 dB(A) which is above the national and international noise standard. They indicate the chance of harmful effects on human beings due to noise pollution in coming future. Among various ways to reduce environmental noise pollution, using noise barriers is one of them. The geometrical shape of barriers is also significant in reducing noise pollution (Astrauskas et al., 2021).

Neupane and Chauhan (2024) conducted a survey to assess noise pollution in Gauradaha Municipality, Nepal. For this study, they have categorized the area into five zones viz. commercial, industrial, quiet, rural, and urban residential. They used the sound level meter to measure noise levels followed by a questionnaire survey to assess community perception regarding noise pollution. They measured the overall equivalent sound level as 65.19 dB which is above the national and WHO standard. They observed the highest noise level in industrial areas and the lowest in rural areas.

Likewise, Sodari et al. (2024) conducted a study that aimed to measure noise levels in the school area of Dhangadhi Sub-Metropolitan City. Their study also reflects that noise level was found higher than prescribed values. The noise was measured high in those schools which are near the roads and located in crowded places.

This discussion of the literatures also implies that among many challenges of modern urban society, noise pollution is also one of the serious issues for livelihood. Urbanization is peaking up in Nepal too because of this noise pollution is also increasing day by day.

## Materials and Method

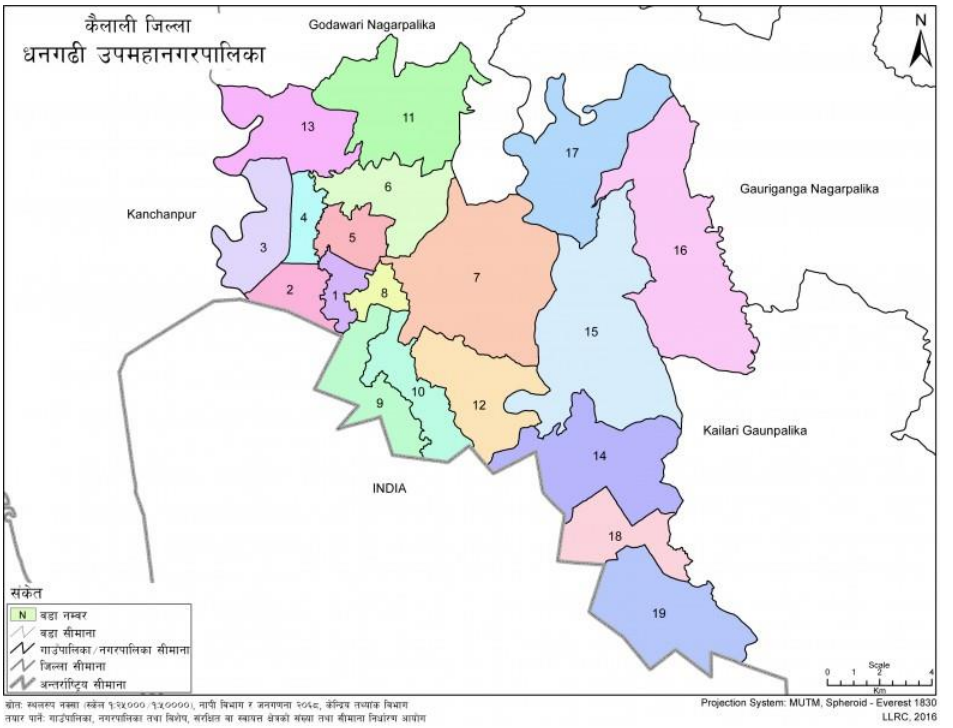
### Study Site

This study was carried out in Dhangadhi Sub-Metropolitan City located in the Kailali district of Nepal. It is one of the major urban cities in Far Western region of Nepal. Geographically Dhangadhi Sub-Metropolitan City lies at $28.6852^0\ N$ latitude and $80.6216^0\ E$ longitude and at an altitude of 109 m from sea level. This city has been spread over an area of 271.74 sq. km. This Metropolitan city is surrounded by Kailari Rural Municipality in the east, Mohana River in the west, Godawari and Gauriganga

Municipality in the north, and India in the South of the city. It consists of 19 wards in the city. It is plane Terai of Nepal.

**Figure 1**

*Geographical Map of Dhangadhi Sub-Metropolitan City*




## Data Collection

To carry out this work we selected hospitals located in Dhangadhi Sub-Metropolitan City. The selected hospitals were Navjeevan hospital, K.G. hospital, Swostik hospital, CP hospital, Maya Metro hospital, Saubhagya hospital, SetiZonal hospital, Nisarga hospital, and Kailali hospital. The noise levels were measured in decibels (dBA) using the digital sound level meter (SLM). This SLM works in the range of 30-130 dB with an accuracy of 1.5 dB. The readings were noted for 10 minutes at a specific location for the interval of 10 sec. The process was repeated thrice a day.

The measurements were done in the daytime from 8:00 to 20:00 in the month of February 2024. For the measurement purpose, time was categorized into three parts: 8:00- 10:00, 14:00- 16:00, and 17:00- 19:00. All the measurements were taken in normal atmospheric conditions. Raw data obtained from the field were organized and tabulated. For visualization purposes, bar diagrams were plotted which also helped in analysis purposes.

**Data Analysis**

Microsoft Excel was used for the quantitative analysis of the data. Noise levels for different hospitals are presented in bar charts for clear visualization.

## Results

Raw data obtained from the field are managed in tabulated form as shown below.

**Table 1**

*Noise Level in dB(A) at Different Hospitals of Dhangadhi*

| | Morning | | | Day | | | Evening | | |
|---|---|---|---|---|---|---|---|---|---|
| Location | Leq | Lmax | Lmin | Leq | Lmax | Lmin | Leq | Lmax | Lmin |
| Navjeevan Hospital | 61.87 ±3.02 | 65.74 ±1.59 | 45.88 ±2.84 | 62.64 ±1.98 | 63.31 ±2.04 | 51.95 ±1.80 | 59.08 ±2.16 | 67.03 ±1.45 | 41.41 ±3.53 |
| K.G. Hospital | 60.60 ±2.13 | 66.42 ±1.27 | 48.82 ±1.00 | 58.15 ±2.33 | 63.92 ±2.13 | 51.28 ±2.13 | 64.05 ±1.95 | 65.47 ±2.28 | 52.81 ±1.61 |
| Swostik Hospital | 55.69 ±2.20 | 65.66 ±2.53 | 48.18 ±2.34 | 54.47 ±1.82 | 62.08 ±1.57 | 48.06 ±0.68 | 47.48 ±2.11 | 56.37 ±2.81 | 43.01 ±1.62 |
| CP Hospital | 66.37 ±2.15 | 72.13 ±1.45 | 55.03 ±1.42 | 62.38 ±2.41 | 69.54 ±1.69 | 55.55 ±2.17 | 61.84 ±2.14 | 68.85 ±2.04 | 51.96 ±1.31 |
| Maya Metro Hospital | 62.69 ±2.09 | 71.07 ±0.89 | 51.24 ±2.28 | 66.2± 1.47 | 68.64 ±0.94 | 55.32 ±1.16 | 60.29 ±2.86 | 65.1± 1.89 | 48.68 ±1.99 |
| Saubhagya Hospital | 59.95 ±2.15 | 66.36 ±2.81 | 51.71 ±2.17 | 62.56 ±1.78 | 61.9± 2.33 | 51.61 ±1.77 | 55.42 ±2.21 | 63.02 ±1.88 | 47.05 ±1.91 |
| SetiZonal | 64.97 ±1.31 | 65.29 ±1.82 | 50.27 ±0.86 | 64.97 ±1.72 | 71.33 ±2.28 | 54.87 ±1.73 | 62.48 ±1.96 | 63.19 ±1.94 | 47.15 ±2.26 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nisarga | 61.57 ±1.98 | 68.9± 1.41 | 52.08 ±1.23 | 69.25 ±2.61 | 74.59 ±2.31 | 54.37 ±2.31 | 59.53 ±2.05 | 69.77 ±1.35 | 51.91 ±1.40 |
| Kailali Hospital | 64.97 ±1.31 | 65.19 ±1.81 | 50.27 ±0.86 | 64.97 ±1.72 | 71.33 ±2.28 | 54.87 ±1.73 | 62.48 ±1.96 | 64.19 ±2.05 | 47.15 ±2.26 |

Above Table 1 shows the noise level in dB(A) at different hospitals of DhangadhiSub-Metropolitan City. The data were collected three times a day viz. morning, day, and evening. In the morning the noise level was minimum (Leq=55.69 dB) at Swostik Hospital and maximum (Leq=66.37 dB) at CP Hospital. Likewise, in day daytime noise level was minimum (Leq=54.47 dB) at Swostik Hospital and maximum (Leq=69.25 dB) at Nisarga Hospital. Similarly, in the evening time, the noise level was minimum (Leq=47.48 dB) at Swostik Hospital and maximum (Leq=64.05 dB) at K.G.Hospital.

**Table 2**

*Noise Level Standard of Nepal (Bhattarai, 2014)*

| S.N. | Area | Noise level in dB (Day time) | Noise level in dB (Night time) |
|---|---|---|---|
| 1 | Silent Zone | 50 | 40 |
| 2 | Business Area | 65 | 55 |
| 3 | Urban Residential Area | 55 | 45 |

Table 2 represents the prescribed noise level published by the Nepalese government.

**Figure 2**

*Representation of Standard Noise Level*

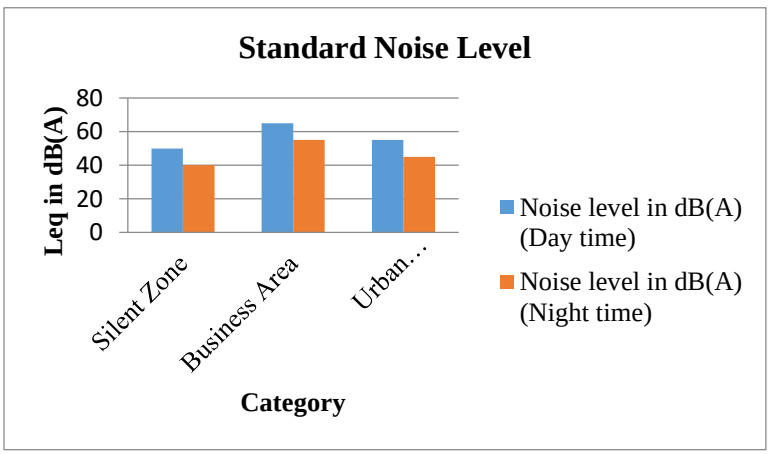


Figure 1 shows the standard noise at day and night time prescribed by the Nepal government.

**Figure 3**

*Representation of Noise Level (Leq) in dB(A) at Morning Time*

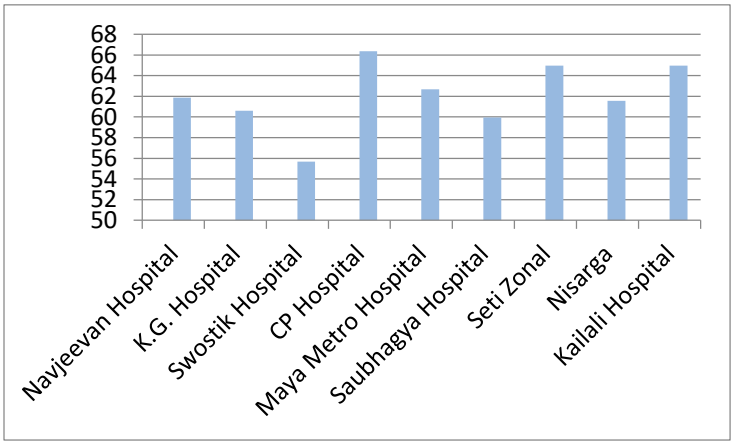



Figure 2 shows the noise level near different hospitals located in Dhangadhi Sub-Metropolitan City in the morning time (8 am – 10 am). It shows that the noise level was a maximum of 66.37 dB near CP hospital which is because of high traffic in the road and high crowd. Moreover, this hospital is located on Dhangadhi-Attariya six-lane road and lies close to Sahidgate Chowk. On the other hand minimum noise level was 55.69 dB near Swostik Hospital. It is because this hospital is a little away from Dhangadhi-Attariya six-lane road. Almost in all the hospitals noise level was beyond 60 dB.

**Figure 4**

*Representation of Noise Level (Leq) in dB at Daytime*

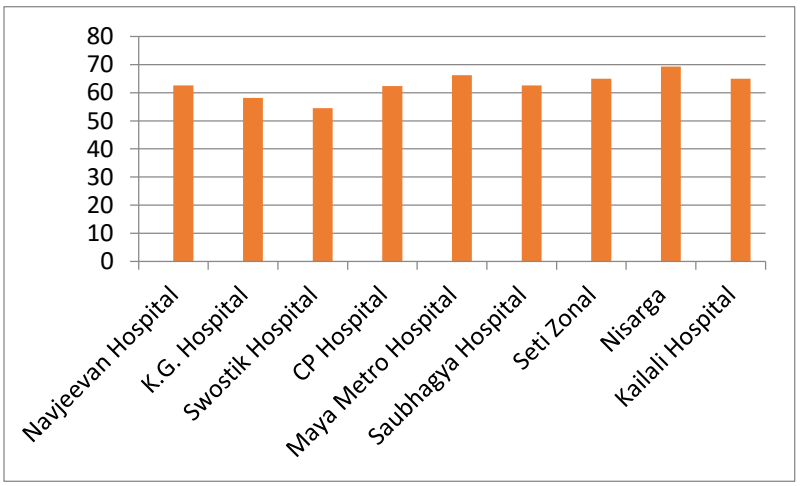


Figure 3 shows the noise level of the respective hospitals in the daytime (2 pm – 4 pm). It was found that the noise level was a maximum of 69.25 dB near Nisarga Hospital. This is because of the high traffic on the road and the high crowd of people. Moreover, this hospital lies very close to the main road and is located at a junction. On the other hand minimum sound level of 54.47 dB was found at Swostik Hospital which is because this hospital lies a little inside the highway road. At this time range too, the majority of the hospitals have sound levels beyond 60 dB.

**Figure 5**

*Representation of Noise Level (Leq) in dB at Evening Time*

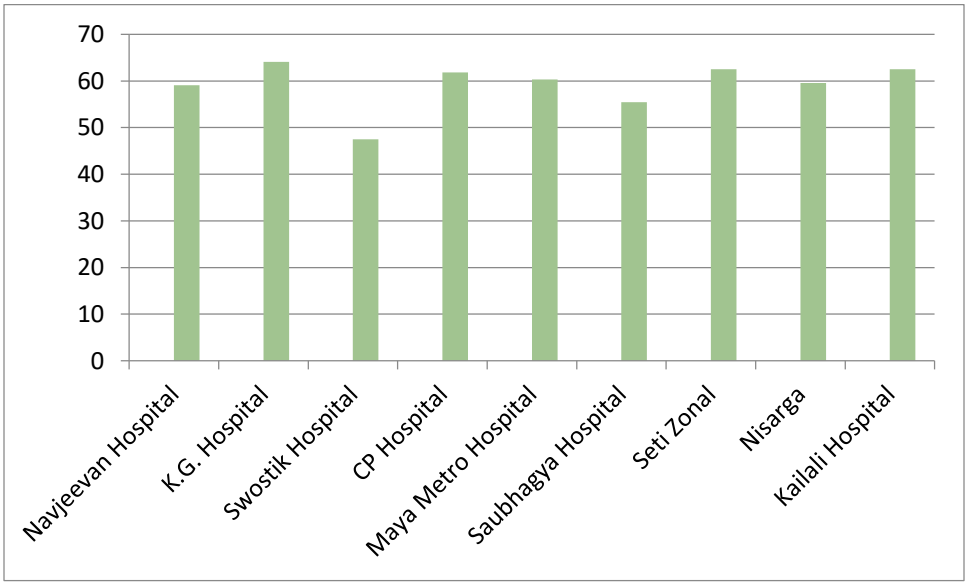



Figure 4 shows the noise level of the respective hospitals in the evening time (5 pm -7 pm). It was found that the noise level was a maximum of 64.05 dB near K.G. Hospital. This is because of the high traffic on the road and the high crowd of people. Moreover, this hospital is attached to the Dhangadhi-Attariya six-lane road. On the other hand minimum sound level of 47.48 dB was found at Swostik Hospital which is because this hospital lies a little inside the highway road. In the evening time too, the noise level was beyond 60 dB on average.

**Figure 6**

*Comparative Representation of Noise Levels of Different Hospitals*

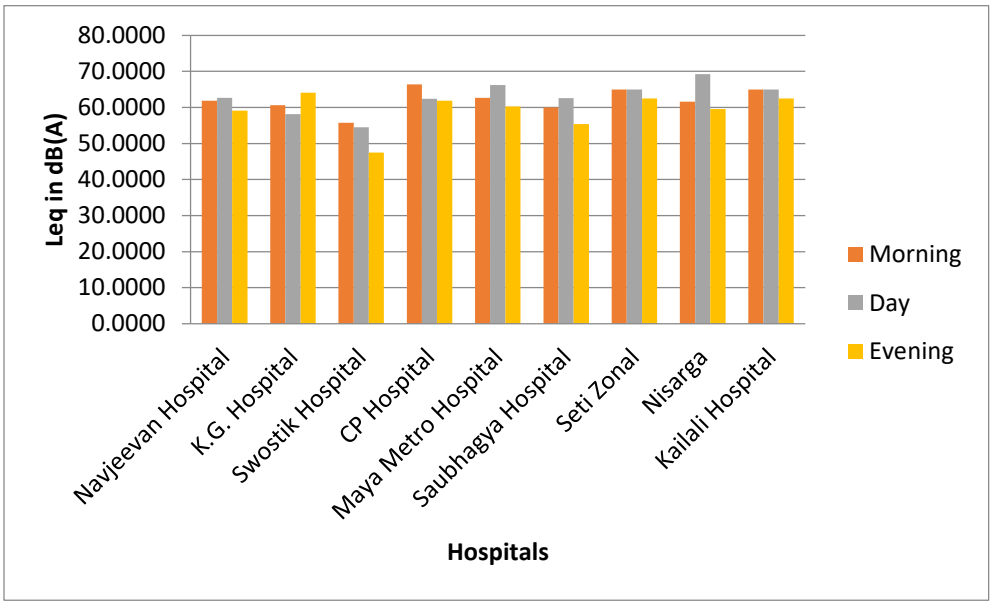



Figure 5 shows the comparative analysis of noise levels at different hospitals in all time ranges. For almost all cases the noise level was near 60 dB.

**Figure 7**

*Comparison of Noise Levels With Prescribed National Standard*

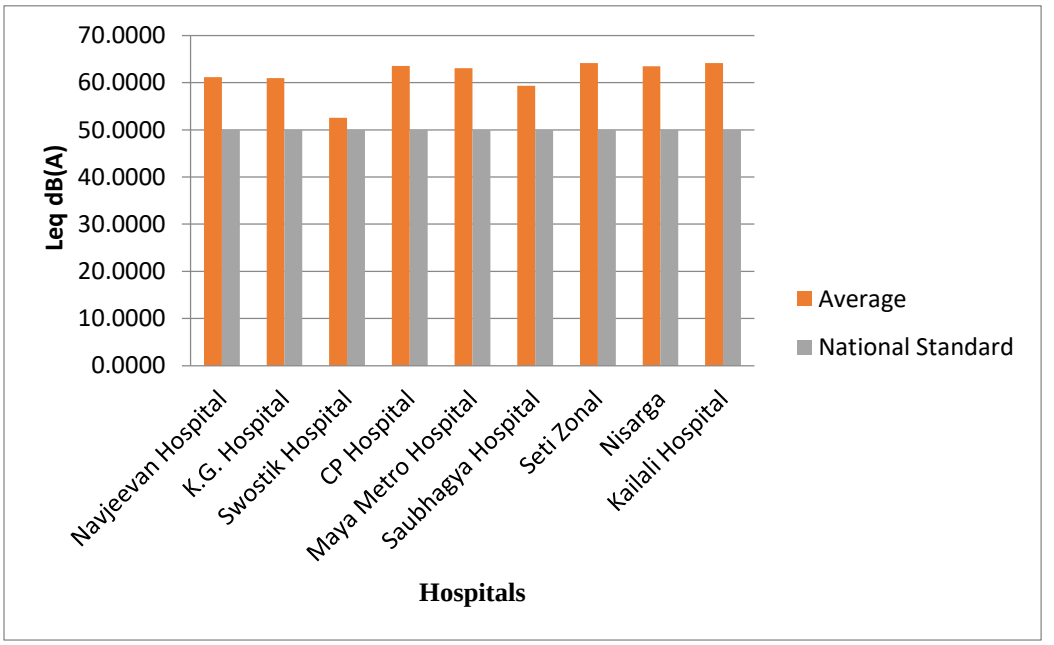


Figure 6 shows the comparison of noise levels at different hospitals with reference to national standard noise levels. We consider hospitals lie in Urban residential areas having an average noise level of 50 dB(A) (Bhattarai, 2014). As we can see, in all the hospitals value of noise level exceeds national standard. From the noise perspective, these hospitals do not lie in the safe zone.

## Discussion

This study has explored the noise level near a few selected hospitals located in Dhangadhi Sub-Metropolitan City. In all locations, the average noise level exceeds 60 dB which indicates that the region is noise polluted. Among the hospitals chosen, the majority of them lie close to the highway road so due to the sound produced by vehicles the high noise level was detected. Road traffic, bad condition of vehicles, and unnecessary use of pressure horns lead to increased noise pollution (Regmi et al., 2021). The condition of the road is not so good in the above-mentioned hospital regions due to which also noise pollution was high which is in agreement with (Bhattarai, 2014). Likewise, most of these hospitals were located in crowded regions, which also caused noise pollution. Rayamajhi (2017) also mentioned people's crowds as one of the factors for noise pollution. Another important aspect we observed was a lack of awareness among the citizens about the adverse effects of noise pollution. Mostly we had seen people using the horns unnecessarily leading to an increase in the noise level. Darshana et al. (2013) also suggested that public awareness helps in reducing noise pollution. In the hospitals, there was no use of acoustic barriers. The use of acoustic barriers also helps in reducing noise pollution. Also, policies related to sound should be implemented strictly to control noise pollution (Bhattarai, 2014).

## Conclusion

The purpose of this study was to examine the noise level status in the hospital area located in Dhangadhi Sub-Metropolitan City. It was found that in all the hospitals noise level was above the prescribed national noise standard. Almost at all times and at all chosen locations noise level recorded was beyond 60 dB(A). Noise from vehicles, bad condition of the road, crowd of people, and lack of awareness among the people were the

major causes of noise pollution in those selected hospitals. Public awareness and strict following of noise regulations lead to a reduction in noise pollution.

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