THE NOISE AWARENESS AMONG HOSPITAL COMMUNITY DUE TO TRAFFIC AND CONSTRUCTION NOISE IN HOSPITAL RAJA PERMAISURI BAINUN

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DEDICATION

First of all, I would like to dedicate my dissertation work to Allah S.W.T for His guidance throughout the research.

I also dedicate for my beloved mother and father as well as a beloved family member who give support and assistance and many friends who have supported me throughout the process.

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ABSTRACT

The Hospital Raja Permasuri Bainun Ipoh is the third largest hospital in Malaysia with a capacity of 990 beds, 16 operating room, 16 bed adult intensive care unit, 8 bed coronary care units, 17 bed intensive care unit of a child (PICU) and 20 extra neonatal care unit. Due from that, the identification about surrounding of hospital is needed. This research investigates the traffic noise and construction noise and the perception it has on the community of Hospital Raja Permaisuri Bainun, Ipoh. The selected study area was delimited by traffic noise on the Raja Ashman Shah Road and construction on the hospital block. A sound level meter was used to measure the both noise at 3 different measuring points within the study area. Measurements were taken during the day (7am to 7pm) and at night (8pm-11.30pm) in order to establish the noise around the hospital. The data have been analyzed using the Microsoft Excel 2007 to get the average of noise produced. A 29-item noise-perception –related questionnaire was used to establish the perception of noise pollution on the respondents. A 150 randomly chosen participants within the hospital community were answers the through quantitative method. On the completion of this research, it was established that the noise surround the hospital are exceed the permissible noise level limits based on Department of Environment Malaysia. Based on the result, the majority of the participants are having bad perceptions with support from literature review about the noise pollution causing around the hospital that it affected them during current and after receive the noise. The finding contributes to increase the awareness among the stakeholders.

ABSTRAK

Hospital Raja Permasuri Bainun Ipoh merupakan hospital ketiga terbesar di Malaysia dengan kapasiti 990 katil, 16 bilik operasi, unit rawatan rapi dewasa 16 katil, 8 unit rawatan koronari katil, 17 unit rawatan rapi kanak-kanak (PICU) dan 20 unit penjagaan neonatal tambahan. Oleh itu, pengenalan tentang persekitaran hospital diperlukan. Penyelidikan ini menyiasat bunyi bising dan kebisingan pembinaan dan persepsi yang terdapat pada komuniti Hospital Raja Permaisuri Bainun, Ipoh. Kawasan kajian terpilih dibatasi oleh bunyi bising di Jalan Raja Ashman Shah dan pembinaan di blok hospital. Tahap meter bunyi digunakan untuk mengukur bunyi bising di 3 titik pengukur yang berbeza di dalam kawasan kajian. Pengukuran diambil pada siang hari (7 pagi hingga 7 malam) dan pada waktu malam (8 malam hingga 11.30 malam) untuk menimbulkan bunyi bising di sekitar hospital. Data telah dianalisis dengan menggunakan Microsoft Excel 2007 untuk mendapatkan purata bunyi yang dihasilkan. Soal selidik berkaitan persepsi kebisingan 29 item digunakan untuk membuktikan persepsi pencemaran bunyi pada responden. Sebanyak 150 peserta yang dipilih secara rawak dalam komuniti hospital adalah jawapan melalui kaedah kuantitatif. Setelah selesai kajian ini, telah ditetapkan bahawa bunyi bising di sekeliling hospital melebihi had paras bunyi bising yang dibenarkan berdasarkan Jabatan Alam Sekitar Malaysia. Berdasarkan hasilnya, majoriti peserta mengalami persepsi yang tidak baik dengan sokongan dari tinjauan literatur tentang pencemaran bunyi di sekitar rumah sakit yang mempengaruhi mereka semasa dan setelah menerima bunyi bising. Hasilnya menyumbang untuk meningkatkan kesedaran di kalangan pihak berkepentingan.

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LIST OF SYMBOLS AND ABBREVIATION

HRPB	Hospital Raja Permaisuri Bainun
DOE	Department of Environment
WHO	World Health Organization
L_{eq}	Equivalent continuous sound pressure level
L_{max}	Maximum sound level
L_{min}	Minimum sound level
dB	Decibel
SLM	Sound level meter
ISO	International Organization for Standardization
BS	British Standard

CHAPTER 1

INTRODUCTION

1.1 Introduction

Noise features different characteristics that make it different from every other "classic" pollutant. Noise is invisible; it does not smell; it disappears when the source is turned off and leaves no traces in the environment. Several definitions of "pollution" may be found. Lilia Albert definition has been chosen to guide this discussion: "Pollution refers to the presence or introduction of substances, organisms or forms of energy to substrates or media they do not belong to or exceeding their typical quantities, for enough time and under conditions that allow interfering with health and comfort of people, damaging natural resources or altering the ecological balance of an area." (Albert, L., 1997).

Community noise also called environmental noise, residential noise or domestic noise is defined as noise emitted from all sources noise at the industrial workplace. Main sources of community noise include road, rail and air traffic, industries, construction and public works; and neighbourhood. The main indoor noise sources are ventilation systems, office machines, home appliance and neighbours.

In the European Union (EU) about 40% of the population is exposed to road traffic noise with an equivalent sound pressure level exceeding 55 dB(A) daytime and 20% are exposed to levels exceeding 65 dB(A). When all transportation noise is considered, more than half of all European Union citizens is estimated to live in zone that do not ensure acoustical comfort to residents. At night, more than 30% are exposed to equivalent sound pressure level exceeding 55 dB(A), which are disturbing to sleep. Noise pollution is also severe in cities of developing countries. It is caused

mainly by traffic and alongside densely-travelled road equivalent sound pressure levels for 24 hours can reach 75-80 dB(A) (World Health Organisation – *Guidelines for Community Noise*).

In contrast to many environmental problems, noise pollution continues to grow and it is accompanied by an increasing number of complaints from people exposed to the noise. The growth in noise pollution is unsustainable because it involves direct as well as cumulative, adverse health effects. It also adversely affects future generations and has social-cultural, aesthetic and economic effects (Ch. Maschkle, H.N. (2004).

1.2 Background of Study

Communities are developing more rapidly today than at any time in our history. Land is becoming insufficient in demand, and developments more intense. As lot sizes have occupied, we are move much closer to our neighbours along with the sights and sounds they produced. Due to rapidly developments, a higher level of urban sounds has come to be known as 'noise pollution'. High sound levels impact our physical health, stress levels and quality of life (Sustainable Community Forestry Program of Georgia Forestry Commission, 2008 in *Green Buffers for Screening and Noise Reduction*). Nowadays, noise pollution has been identified as annoying and cause harm (Li et., al, 2010). Noise pollution can be classified as any sound that interferes and causes uncomfortable by the listener.

The noise pollution will result the discomfort or annoyance as a people have receive or seeing noise source directly (Bangjun et al., 2003). Besides that, noise pollution can contribute a bad effect on human physiology and psychology (Department of Environment, The Planning Guidelines for Noise Labelling and Emission Limits of Outdoor Source, Department of Environment, Ministry of Natural Resources and Environment, 2004). The impact of noise pollution to human is hidden and the causes harm can be seen in long term period (Selfe, 1982; Willett, 1991; Nassiri and Golbabai, 1993; Yildirim *et al.*, 2007; Keipert, 2008). Therefore, it ise very important that hospital environment should provide a quiet and peaceful environment for the patients since unwanted sound could have a negative impact on patient outcomes (D. F. Juang, H. Lee, Yang, & M. C. Chang,2010).

The use of natural product for example street trees provide many benefits such as energy savings, reduce storm water runoff, clean air, reduce levels of noise and increase levels of community involvement and interaction (Shukur et al., 2010). The trees will protect sun and wind and as source to stabilize the air temperature of surrounding surfaces. The effectiveness of these spaces depends on their density, shape, size and position (Boukhabla and Alkama, 2012). On the other hands, a positive evaluation of landscape tended to be resulted in lower annoyance rated for sounds capes (Maffiolo et al., 1999). People more likely to choose better accessibility to nearby green spaces could lead to reduce long-term noise annoyances and thus could improve individuals' well-being (Gidlöf- Gunnarsson & Öhrström, 2007). The premise that having parks and green spaces around it could lower dissatisfaction for traffic noise (Kastka & Noack, 1987).

1.3 Problem Statement

Some hospitals are located near a busy road or town. Traffic pollution spikes close to roads, a health hazard for nearby hospital and anyone who spends time in those areas. Exposure increases the risk of problems, ranging from asthma attacks to heart disease. Hospitals are noisy and they are getting noisier. Several studies performed by the WHO (World Health Organization) reveals that hospital noise levels have been increasing consistently since 1960 (Ryherd, et al, 2008). WHO have recommended that noise levels should not exceed 35 dB(A) in rooms where patients are treated or observed (Berglund et al. 1999 as cited in Richardson et al., 2009) and 30 dB(A) in ward rooms (Ryherd, Okcu ,Hsu, & Mahapatra, 2011).

Homes, schools, offices, hospitals, commercial business centers, and other community buildings were routinely built close to the main roads of the municipality without buffer zones or adequate sound proofing. Theproblem has been made up from increasing in traffic volumes (two wheelers, heavy motor vehicles, and other vehicles) far beyond the expectations of our early urban planners (P.Balashanmugam, et. al, 2013).

There was nowhere is free from any noise, at home, on the streets, or at work. It's also happen in hospitals, technological progress brings, as a consequence, potentially harmful noise levels (P. Srivastava, et al., 2016). In 1974, the United

States Environmental Protection Agency (EPA) suggested that the peek sound level of noise in a hospital should not be more than 45 decibels (dB) during the day and 35 dB at night. The noise level in hospitals is usually higher than these recommendations and even higher in intensive care units (Li et al., 2011).

Effect of noise annoyance would be different among others. The affect is related to positive feelings and pleasant emotions like joy, satisfaction, love and pride. By opposition, Negative Affect refers to negative feelings and unpleasant emotions such as guilt, shame, sadness, anger, worry, anxiety and depression (Diener, Suh & Oishi, 1997 as cited in Imaginário, 2011).

According to Breetvelt and Van Dam (1991), the perception of Health is more important, to explain subjective wellbeing variance, than objective Health. There are only little differences between the subjective wellbeing of a group of individuals with cancer and a control group (Galinha, 2010)

1.4 Research Questions

Finding on the extent of gap between expectations of respondent on a receiving the noise as a pollution with the reading of the noise recorded on site. This gap needs to be investigated and analyzed each of respondent and identify the noise measurement around hospital. These give practical thoughts toward forming part of research questions:

1. Does the reading level of noise measurement in hospital surrounding is within the suitable level dB (A)?
2. Does the measured noise levels are in the acceptable reading compare to Department of Environment guideline?
3. What types are sources of noise annoyance most according to respondents?

1.5 Objective of study

There were some objectives listed for the studies are:

1. To determine the noise level in hospital.
2. To compare the measured noise levels with the Department of Environment limit guidelines.
3. To determine the perceptions of noise pollution on reactions and annoyance response of medical care staff, patients and visitors in the hospitals.

1.6 Scope of work

This study is focus on the buffer zone for screening and sound reduction in Hospital Raja Permaisuri Bainun (HRPB). There are two methods which are used in this study. Firstly, quantitative method is used in this study to determine the perception of respondent to noise level. The collection of questionnaire will carried out. Secondly, by noise measurement technique method is to measure the noise level is by using sound level meter. However, the noise level meter will be located on main ward and maternity ward. The noise measure is limited only measure noise outside of the hospital. To achieve the goal of the study, we focus on one hospital and the respondent are among the medical staffs, patients and visitors.

1.7 Brief Methodology

This section describes the methods used to collect information for the study application of buffers zone for screening and noise reduction for Hospital Raja Permaisuri Bainun (HRPB). Apart from the sources of information obtained through secondary such as reference books, journals, articles, conference reports and report papers. The information is also obtained through primary research in which data are collected from questionnaire and on-site measurement sound level meter.

1.8 Research Area

This section describes areas used to carry out the study application of buffers zone for screening and noise reduction for Hospital Raja Permaisuri Bainun (HRPB). There are two area surround the hospital to be study which is the hospital ward which is located near to main road; to study the traffic noise, and maternity ward; to study the construction noise , which is located beside the on-going construction work for new building.

1.9 Significant Study

The levels of noise are produced surround the hospitals are from various sources. By identified the effectiveness of buffer zone and perceptions of respondent can helps authority to overcome for upcoming events. Hence, this study is conducted to serve several significances such as:

4. Determine the level of noise around the hospital.
5. Determine the effectiveness of the buffers zone in hospital.
6. Establish the perceptions of noise from respondents

1.10 Conclusion

In this chapter, it is necessary to explain the problem of the study so that the researcher can get the research questions in more detail. The question of study is also very important in determining the direction of this study. Furthermore, the scope of this study is also important for researchers and also respondents to be found so that this will not make it difficult for researchers to obtain data from respondents later.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In this chapter explains the process of expanding and understanding the subject of the study. The literature review in this chapter focuses on the disclosure of information relating to the research to be conducted through written sources such as books, journals, magazines, past theses and others. This chapter will discuss the chronology of noise pollution produce that effect the community, the types of buffer zones systems in Malaysia according to Department of Environment (DOE), and the guidelines of buffer zone use in residential areas or sensitive area.

2.2 Sound

In physics, sound is a vibration that typically propagates as an audible wave of pressure, through a transmission medium such as a gas, liquid or solid. It's a sensory perception that the pattern that depend of the sound to produce waves. It is recognized as music, speech or any of the environmental noises to which are continuously exposed (Pope, 2010).

2.3 Noise Pollution

Sound becomes noise when it defined as unwanted sound. Besides that, it also can be consider as an environmental pollutant, which can cause major effect to workplace

disruption and has implication for chronic mental and physical health (Choiniere, 2010). According to Bistrup (2010), the loudness of noise may becoming an undesired physiological or psychologicalbresponse in an individual and that may interfere the person activities (Gerhardsson & Nilsson, 2013). Numerous studies shown that hospital noise are gave impact to many bad physiological outcomes (Pope, 2010).

The person react to sound to noise are different from others, it is influenced by several factors. Acousticians estimate that about one in ten people are particularly noise sensitive (Hilmi, Narimah & Haryati, 2014). The level of annoyed by noise will become 10 per cent more by general population (John Steward, 2013). To measure the noise is by its loudness (decibels) and frequency (hertz). The measure for both loudness and frequency is for get the idea the disturbing particular noise. The loudness are depends how long the measurement are conducted and the frequency is about high and low pitch produce my loudness (John Steward, 2013).

2.4 Health Impact from Noise

Noise pollution is like a modern parasite. There is much evidence shown that noise pollution on human health. The sleep disturbances primarily from difficulty in falling asleep, frequent awakenings, waking too early and change in sleep stages and depth (Hui Xie, Jian Kang & Gary H Mills, 2009). Besides that, noise during sleep cause increased blood pressure, heart rate and changes in respiration because increased in body movement (Preeti Srivastava et. al, 2016).

In the experiments involving sleep disturbance, researchers have often focused on disturbances that occur within 3 seconds of a measurable increase in noise, eg, greater than 10 to 15 decibels (dBA). The effects measured the following day include fatigue and depressing. From that, it will decrease alertness and leading to accidents, injuries and disruption (Aurell J & Elmqvist D, 1985).

The words that are frequently to discuss and heard from the media and academic circles are “climate change and global warming”. These words are associated with studies based on carbon dioxide emissions and excessive heat. According to normal thinking, generally, humans do not believe that the noise can impacts to the total environment. They instead believe that fairly common atmospheric pollutants have more extreme consequences for the planet as opposed to

noise. (Fyhri & Klaeboe, 2006).

Noise control has been existing as a major challenge to mankind. As it is indeed a serious environmental problem. In ancient Rome, there were rules existed governing the noise emitted from the iron wheels of wagons, causing the inhabitants of the city to suffer disturbed sleep patterns and annoyance. In Medieval Europe, horse - drawn carriages and horseback riding were not allowed in certain cities at night to ensure that the city dwellers could enjoy a peaceful night's sleep. However, the noise problems that happened at the past are incomparable to those of modern society. A high number of motor cars are constantly travelling and producing through our cities and the countryside, while heavily- laden trucks with diesel engines, which have been ineffectually silenced for engine and exhaust noise, moulded in our cities day and night (Schwela & Zali, 1999).

In contrast to other pollution control measures, the control of environmental noise has been hampered by lack of knowledge in its effects on humans. The effects of noise on people in developing countries are just as extensive as those in developed countries, and the long-term effects are the same. Even though noise pollution control is perceived as excessiveness, with the result that it has not been placed on the priority list of developed countries, exposure to harmful noise levels is often greater in developing countries, on account of ineffective planning and the poor construction of buildings (Schmidt, 2005).

Hearing is very important for communication. It produces reflexes and emotions (Tripathi, 1994). Human behaviour is strongly influenced by receiving of sounds. Based on the experiments in sound-proofed rooms have proved that complete silence can lead to serious psychological effects on individuals. In short, the human race needs noise (Tripathi, 1994). But what is the optimum or best possible on noise level for humans? The type of sound is a very important factor and in addition it is important to know that the effect varies with individuals (Miyaya, 1997).

The most significant health problem caused related by noise pollution is hearing loss. Loud noise cane becomes deafens quickly—extremely loud sounds, such as gunshots at close range, can cause immediate hearing loss. But even sound

levels of only 85 decibels will cause some hearing loss after have been exposed in long exposure (Hart, 1977). Most hearing loss occurs in the work-place, where workers may be unable to avoid unhealthy noise, and where exposure may continue for years. Factory workers, construction workers, farmers, military personnel, police officers, fire-fighters, and musicians all have reason to be worried about their occupational exposure to noise (Hart, 1997).

Even at levels below those that can cause hearing loss, noise pollution also can produces problems. Noise makes conversation in verbal and interferes of hearing difficult, interferes with some types of work, and disturbs sleep. As a source of stress, it can promote high blood pressure and other cardio-vascular problems, as well as nervous disorders. According to the National Institute of Health, 65 million people are exposed to noise levels that can hamper their work or disrupt their sleep, and 25 million risk health problems due to noise (Holmes, 1995).

The general noise level increases in towns and cities increases, mainly due to traffic. If a job entails concentration, the effect of noise on the worker will make the work much more tiring than if the job demands little thought concentration. The effect of noise on the health of individuals, especially over a period of years, is an area of research that needs to be explored (Schmidt, 2005).

2.5 Measurement of Noise

The sound frequency (Hertz) and sound pressure (decibels) plays significant roles as response to the human ear. According to Berglund B, et. al (2010), the range of hearing by healthy young person is 20-20,000 Hz. The sensitivity of individual is different due to decrease with age and exposure to noise. To measure the noise exposure, it should consider the exposure at one time from various sources and the average sound pressure level over specific time period.

A widely scale to measure sound pressure levels is expressed as decibels in A-Scale (dBA). The method is simple and convenient, but it has limitations of poor predictability (Berglund B & Lindvall T, 2011). The measurement apparatus is done by noise level meters and to be located at the specific area to be measure. Noise dosimeter is worn by the person which capturing the average noise exposure even while moving.

To control of various noise and regulates the people to protect the environment, the government have comes with several standards of sound for different categories of areas (residential, commercial, industrial and silence zones), separately for day –time and at night. There are two examples of country standard which are table 2.1 shown Central Pollution Control Board, under the Ministry of Environment and Forests, Government of India and table 2.2 shows the maximum permissible sound level (LAeq) according to the receiving zones by DOE.

Table 2.1: Noise limitation by Ministry of Environment and Forests, Govt. of India, (2010).

Area code	Category of area/zone	Limits in dB(A) Leq*	
		Day time	Night time
(A)	Industrial area	75	70
(B)	Commercial area	65	55
(C)	Residential area	55	45
(D)	Silence zones	50	40

*dB(A) L_{eq} denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing. Source: Central Pollution Control Board, India.

Table 2.2: The Maximum Permissible Sound Level

(*L*aeq) According To the Receiving Zones (DOE, 2010)

Category	Noise level, Leq dBA	
	Daytime 7.00am-10.00am	Night time 10.00pm-7.00pm
Noise sensitive area, low density residential, institutional (school, hospital), worship areas	50	40
Suburban residential. Medium density areas, public areas, parks, recreational areas.	55	45
Urban residential, high density areas, designated mixed development areas (commercial)	60	50
Commercial business zones	65	55
Designated industrial zones	70	60

2.6 Types of Noise Pollution

2.6.1 Traffic Noise

There are studies have been conducted in many country to measure the ambient noise level. The founding shown that the majority of the total environmental noise is caused my motor vehicles (Central Pollution Control Board, 2011). Several studies to measure the day time noise levels along roads between campuses of University in Balasore, Orissa, ranged from 10.1 dB(A) to 120.4 dB(A) which shown that above the permissible limits standard for road traffic noise (70 dB[A]). Noises made from different vehicles are measured. Most of the vehicles generate within the permissible limits for road traffic noise (Goswami S et. al, 2011). The major contribution of high noise levels is from vehicle air horns and their misuse (Patel R, Tiwari TN & Patel T, 2006).

In a study which measured noise levels in the four zones as categorized by the Central Pollution Control Board, the highest average day- time noise level was detected in silence zones (73.53 dB[A]), i.e., not less than 100 m around hospitals, educational institutions, court, and religious places; and lowest in Residential areas (63.5 dB[A]). The highest average noise level for night time was in traffic intersection areas (71.18 dB[A]) and lowest in the industrial areas (Banerjee D et. al, 2008).

2.6.2 Construction Noise

Construction noise with an adverse impact on amenity is defined as an average noise of 45dB(A) or any singular noise event with a maximum noise level of 60dB(A) at a noise receiver (such as a domestic premise). In practical terms this means that normal construction activity (such as the use of power tools, machinery, hammering and sawing) is only permitted between the hours of 7 am and 7 pm Monday to Saturday where residential premises are nearby.

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