Journal of Vocational Health Studies

www.e-journal.unair.ac.id/index.php/JVHS

NOISE LEVEL IDENTIFICATION ON DENTAL CLINIC

IDENTIFIKASI TINGKAT KEBISINGAN PADA KLINIK GIGI

Research Report
Penelitian

Izza Matsalul Kamila*, Vincentius Totok Noerwasito, Fx Teddy Badai Samodra

Department of Architecture, Institute of Technology Sepuluh Nopember, Indonesia

A B S T R A C T

Background: *Noise is a problem affecting toothache patients psychological and physical aspects. The dental clinic can be a source of noise because it contrasts with the function of the dental clinic as a place of healing. Noise can cause toothache to be more psychologically painful, which causes dryness of the oral cavity.* **Purpose:** *Therefore, it is necessary to know how much the noise level in the dental clinic is with the case study of the Benowo dental clinic and where it comes from.* **Method:** *The researchers used an explorative method and observations to realize this activity. This study begins by calculating the clinical noise level using a sound meter, and then the results are compared with a literature study.* **Result:** *The highest noise recorded in this clinic reaches 84 dB. This is very far from the sound level recommended by SNI 03-6386-2000, which is 45 dB for dental clinics. Outside noise comes from roads, trains, and parking areas. The nature of noise from outside is sporadic, but the intensity of the noise is very high. Sources of noise from inside come from activities in the medicine room, patient conversations, drills, scaling, and compressors. Noise from within is continuous but less intense.* **Conclusion:** *The design of the dental clinic must consider the acoustic aspect as the central aspect. Further research is needed to choose the right design concept to protect the dental clinic from noise.*

A B S T R A K

Latar belakang: Kebisingan merupakan masalah yang mempengaruhi aspek psikologis dan fisik pasien sakit gigi. Klinik gigi dapat menjadi sumber kebisingan karena kontras dengan fungsi klinik gigi sebagai tempat penyembuhan. Kebisingan dapat menyebabkan sakit gigi menjadi lebih menyakitkan secara psikologis, yang menyebabkan kekeringan pada rongga mulut. **Tujuan:** Oleh karena itu, perlu diketahui seberapa besar tingkat kebisingan di klinik gigi dengan studi kasus klinik gigi Benowo dan dari mana asalnya. **Metode:** Untuk mewujudkan kegiatan tersebut, penelitian ini menggunakan metode eksploratif dan observasi. Penelitian ini dimulai dengan menghitung tingkat kebisingan klinis menggunakan *sound* meter, kemudian hasilnya dibandingkan dengan studi literatur. **Hasil:** Kebisingan tertinggi yang tercatat di klinik ini mencapai 84 dB. Ini sangat jauh dari tingkat suara yang direkomendasikan oleh SNI 03-6386-2000, yaitu 45 dB untuk klinik gigi. Sumber kebisingan dari luar berasal dari jalan raya, kereta api, dan area parkir. Sifat kebisingan dari luar bersifat sporadis, namun intensitas kebisingannya sangat tinggi. Sumber kebisingan dari dalam berasal dari aktifitas di ruang obat, percakapan pasien, bor, scaling dan kompresor. Kebisingan dari dalam terus menerus tetapi kurang intens. **Kesimpulan:** Desain klinik gigi harus mempertimbangkan aspek akustik sebagai aspek utama. Diperlukan penelitian lebih lanjut untuk memilih konsep desain yang tepat untuk melindungi klinik gigi dari kebisingan.

INTRODUCTION

Noise is sounds that are unwanted and can cause harm to human health and environmental comfort. So far, noise has become a secondary problem in Indonesia and is not even considered a problem. Domestic architects often ignore the acoustic aspect of solving noise problems in buildings (Mediastika, 2005). This is caused by the acoustic solution clashing with the climate solution. Noise reduction measures are generally viewed as a source of additional costs that do not generate appropriate profits because they are not considered the primary feature sought in the device (Cox and D'Antonio, 2017), even though the destructive effects of noise are real. Therefore, this study aimed to determine how much noise impact the dental clinic received. In addition, it is also to find out where the noise is coming from so that it can be considered how to reduce it.

According to the Indonesian Ministry of Health, a dental clinic is a facility or place built to carry out dental care for the entire community, including prevention, treatment, and recovery efforts. The dental clinic has a specific problem. There are trauma effects because of dental handpiece noise. Sound sources from dental clinics can potentially harm the hearing system. It was analyzed that the clinic environment can directly affect the patient's level of fear and annoyance (Yousuf *et al*., 2014). 33% of women and 34% of adolescent respondents felt that the sound made by dental tools (some specifically mentioned drills) was the most unpleasant experience they encountered during their visit to the dentist. Nearly 60% of adults participating in the survey were "upset" to "very disturbed" by the sound of dental handpieces (Elmehdi, 2010). This statement is statistically significant and qualitative. But not substantial in the physical effect. Noise can also affect the dryness of the oral cavity. These symptoms in the medical realm are also called *Xerostomia* which causes toothache to become more painful when hearing noise (Lubis, 2003). However, the research was analyzed theoretically.

There is a relationship between noise and dental clinics from a psychological aspect. The noise generated in the dental clinic causes anxiety and contributes significantly to prospective patients avoiding dental treatment (Muppa *et al*., 2013) . Anxiety is a symptom that affects the psychological. In dental and oral health, this term is called dental fear. In addition to physical disturbances, noise also affects the listener's psychology.

There is an assumption that people with toothache will get angry when exposed to noise. Some journals examine the relationship between noise and blood pressure. Some journals concluded that there was no effect of noise on blood pressure, but several other journals concluded that there was an effect of noise on blood pressure. One of the journals examined the relationship between noise and the hormone cortisol associated with human stress. One journal concluded that stress could affect the level of saliva (saliva) in the oral cavity. The conclusion that can be drawn is that noise can increase the stress of toothache patients, which affects the dryness of the oral cavity, thereby increasing the pain in the teeth. In addition, noise can have a negative impact on the listener's physical state. This effect can be in the form of disruption of body homeostasis due to loss of sympathetic and parasympathetic balance, which clinically can be in the form of psychosomatic complaints due to autonomic nervous disorders and activation of adrenal gland hormones such as hypertension, cardiac dysrhythmias (Mashuri, 2009). However, there is the statement that there was no effect of noise on hypertension (H.C *et al*., 2012). In addition, there is research on noise affecting the Cortisol hormone. Cortisol hormone, which has been known to the general public, is a hormone that controls stress, blood pressure, and sugar levels and is helpful as an anti-inflammatory.

It is known that there is a significant effect of noise on clinic workers. The results showed that dentists who regularly used high-speed hand tools had worse hearing than other study group members (Theodoroff and Folmer, 2015). The researcher also suggested the application of protective strategies in dental clinics. 84 out of 304 tested ears (28%) showed a pattern of hearing loss, the audiometric analysis showed that 30 ears had a pattern indicating another pattern of hearing loss, influenced mainly by age (Dierickx *et al*., 2021). But this statement has no meaning in statistics.

To prove this, it is necessary to conduct research in dental clinics located in areas that have high noise. The right dental clinic for this research is the Benowo dental clinic in Surabaya City. This study was conducted during peak dental clinic hours to obtain optimal results.The most audible sounds in the environment are sounds directed straight from the source or various sources and direct reflections from surfaces or other objects (Cox and D'Antonio, 2017). It is very easy to find the sound source even if it is only tracked by ear. Based on this statement, it can be understood that sound can be predicted and analyzed even though it cannot be seen.

Sound waves will experience a decrease in intensity due to friction with the air on its way. Therefore, the farther the noise source is, the smaller the noise intensity will be. In an open space, the farther a person is from the sound source, the weaker the sound level that can be heard. But, the situation in the room is not always the case. Sometimes, listeners farther away from the sound source hear louder sounds than closer listeners. This is because it occurs due to the reflection of the surrounding furniture. The process of sound wave propagation in an enclosed space is not the same as in an open space. Areas that limit the room, such as walls, floors, and platforms, cause the process of sound wave propagation in all directions to be limited. The sound

that propagates in space will experience various events, such as reflection, diffusion, absorption, diffraction, and refraction, depending on the character of the surface. The type of surface that is textured will absorb sound. The smoother the surface, the stronger the reflected sound. This theory is the basic theory of the reflection of sound on a type of surface. In acoustics, diffusion (spreader) and absorption (damper) have different functions. Diffusion is often used for concerts, operas, speeches, and so on, while absorption is used for studios, ENT examinations, karaoke, etc.

Sound can pass through small gaps in the room, such as ventilation holes, window sides, and door gaps. This small gap can not be seen with the eye, but we can hear the effect. In addition, walls can propagate sound from one room to another. This is called the flanking effect. The direction of the flanking effect can come from anywhere, especially if the wall and floor materials are made of concrete. This is due to the hollow nature of the concrete, so sound propagation between the two rooms can occur. The most obvious effect of flanking transmission is when the flanking construction is so light and has no structural damage to the main partition (partitions with good sound insulation properties as stand-alone elements (Virgan, 2008). So, the flanking effect can occur even though the room has used sound insulation walls.

MATERIAL DAN METHOD

The method used in this research is observation. The observation's purpose was to determine how much noise level the Benowo dental clinic received. The scope of observation covers the whole building in general. This observation was carried out outside and inside the Benowo dental clinic building (Fig. 1). Observation time follows the operating hours of the clinic, which are 8.00 am to 4.00 pm. Observations are made at that hour to get accurate results as needed.

(a)   (b)

Figure 1. (a) Benowo dental clinic facade, (b) Operation room

The data that needs to be collected is the size and shape of the overall building, the source data, and the noise source's direction. The tools used to collect noise data received by the building are the sound meter application and recording the results by office stationery. A sound meter application is a noise intensity measurement application that can be used on a smartphone or laptop. Unlike the manual sound meter tool, this application can record sound, calculate the maximum noise, calculate the average noise in a certain period, and save the calculation data. The sound recording can be known from where the source. At this stage, seven-day noise data is calculated, especially during operations. The highest point of noise will be obtained by research within that period. These spaces include an outdoor terrace, lobby, operating room, toilet, and service room. At the measuring distance, its size does not affect the deterioration of the sound field (Long, 2006). Therefore, the research location point is in the middle of the room facing the sound source (Fig. 2). Calculations are held for two minutes at critical times each day in each room.
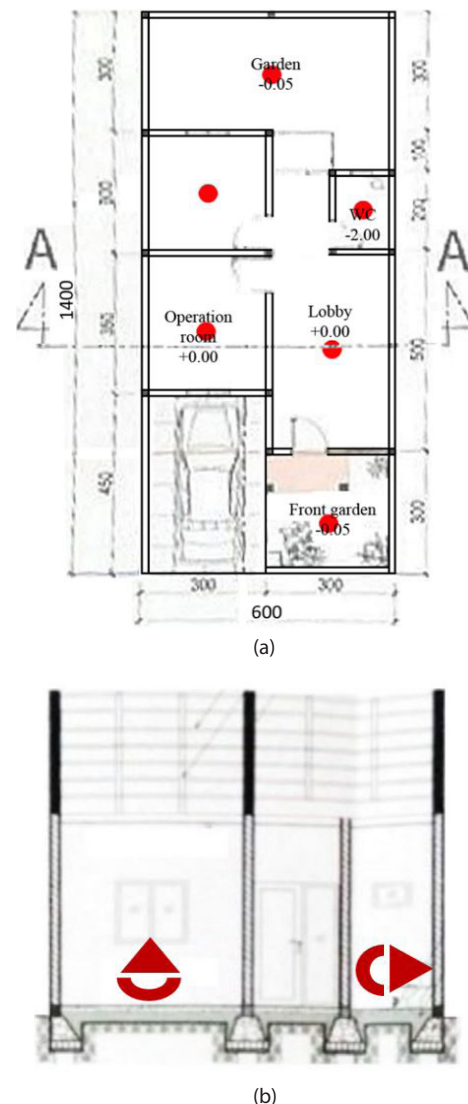

(a)

(b)

Figure 2. (a) Research location point, (b) Sound meter face direction

After observing, it is necessary to check the allocation map and satellite map to complete the data. The data to be collected is the state of the environment and the distance of the building from the sound source. The tools used are regional allocation maps and satellite maps. Regional allocation maps explain the division of functions in an area authorized by the government, while satellite maps are maps photographed by satellites. This map has complete data regarding the geography of the area and the surrounding atmosphere. This tool, the calculation of long distances becomes more accessible than the manual method.

The results recorded with sound meter need to be analyzed what kind of the highest level noise with *Audacity* software. *Audacity* software is a free sound editing software for laptops that can display sound wave graphics. This software, it can be analyzed what type of the highest noise and when the noise occurs. This software has been used by researchers in calculating the speed of sound propagation in the air and the speed of sound in the air at temperature variation. This software can record sound waves as signals or waves, which can later help to analyze validly and quickly (Astuti, 2016). The highest noise can be counted by looking at the wave's crest (Fig. 3).
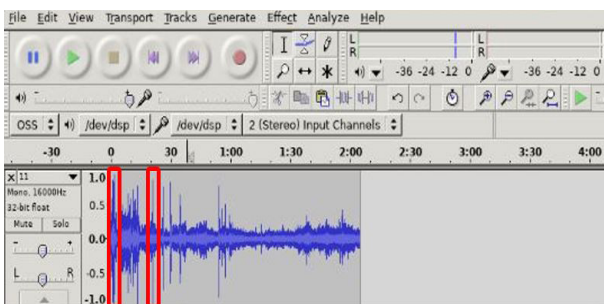

Figure 3. Counting the crest of the wave in *Audacity*

It is necessary to collect literature and related journals to find out the newness of technology in noise reduction in dental clinics. Literature collection contains aspects of spatial planning, building mass and acoustic elements in the interior. After that, the results of observations and literature must be compared and analyzed.

RESULT

The object of research is on Jalan Singgapur, Benowo District, Surabaya City. Although the area is still not too dense and close to the urban forest, this area still has some residential areas. Surabaya is the second-most populous city in Indonesia. This is because the port of Tanjung Perak in Surabaya is Indonesia's center of trade destinations. The arrival of traders from outside proves that Surabaya has long been a stopover and

was even discovered by foreign colonies with residents (Baskoro, 2017). The influence of this trade caused this city to have many factories for distribution efficiency and was called an industrial city. Therefore, this city unconsciously produces very high noise. As many as 28% of respondents felt disturbed because of the noise caused by the flow of motorized traffic.

In comparison, 26% of respondents were disturbed because of the increasing number of street vendors, and only 13% felt disturbed because many vehicles were parked irregularly even though there were parking attendants (Syafiul, 2005). In this study, 67% of respondents were disturbed by traffic noise. This study used a questionnaire method on the effect of city noise on residents. However, when compared to rural communities, the characteristics of urban communities tend to be careless in many ways. They can no longer properly digest what is captured by their senses because every day, they are forced to examine new impressions that are constantly changing, such as shop displays, cinema advertisements, various shows, headlines in newspapers, and traffic jams (Jamaludin, 2015). This makes urban people sometimes not realize the direct impact of noise. Noise has a significant effect physically on humans even without realizing it.

The city is the center of settlements and population activities with administrative boundaries regulated by laws and regulations, as well as settlements that have shown the character and characteristics of urban life. The city's center has the main characteristic of very high traffic density. Suppose it is roughly averaged by calculating the ratio of the number of vehicles and the population from the statistical center data, one vehicle for eight people, every day, and every time. In that case, there is always activity passing by vehicles, to go to work or shopping. The function of the city and the very busy activities carried out, we can conclude that the busyness of the city greatly affects the high noise level. Noise conditions in the city center tend to be high. Noise value (Ldn) in residential areas located around the train track in Kota Bandung and Yogyakarta has crossed the line of environmental noise quality standards, which is 55 dB(A) (Fachrul *et al*., 2014). This condition is very close to the condition of Surabaya. This is due to the heavy traffic in both the highway and residential areas.

Benowo sub-district is an area that is quite crowded but very busy at certain events (Fig. 4). There are railroad tracks in the southern area, so the noise level is very high. The object building faces south so that the highest humidity is in the area closest to the facade. The location of the design object is close to Benowo Station. This fact reinforces noise reduction because trains must signal when they are close to the station and when they are about to depart.

Source: petaperuntukan.cktr.web.id, 2020

Figure 4. Object's surrounding

Jalan Singgapur is close to several things that trigger noise. These include trains, roads, and activities to the stadium. The distance between the object and the train station is about 0.7 km, with the nearest rail gate about 0.06 km, the highway about 0.3 km, and the stadium about 2 km (Fig. 5).

Source: maps.google.com, 2021

Figure 5. Distance of the design object to the noise trigger

The distance between the object and the Benowo station is approximately 0.7 kilometers, and the distance between the object and the nearest railroad crossing is about 60 meters. On average, the train passes through Benowo station every 40 minutes. Train noise against things is very influential. It is known that the noise level of the train affects blood pressure (Suryani, 2015). The average continuous value (LAeq) obtained in the morning ranges from 69 dBA-73 dBA; during the day, it is around 66 dBA-77 dBA, and at night it is around 67 dBA-76 dBA. The value obtained has exceeded the environmental noise threshold set by the Minister of Environment Decree No. 48 of 1996 of 55 dBA (Ikhasari and Wibowo, 2019). There is a significant difference between the concentration of respondents before and after the noise from train activities (Andriani, 2020). According to the Regulation of the Minister of Transportation, the sound power of the train reaches 71 decibels, and the sound strength of the slogan is around 50-80 decibels.

The path to the object passes through the Benowo highway and then the Singgapur road. Even though the object is far from the highway, Jalan Singgapur is also a busy street. The Benowo highway is 7.5 meters wide, while the Singgapur road is 6.5 meters wide. According to the Government Regulation of the Republic of

Indonesia, the minimum width of the highway is 7.5 meters. Therefore, these roads have the potential to cause traffic jams. Highway congestion soars at 7 am and 5 pm. The vehicles that pass through the road include motorcycles, cars, city transportation, and class 5 trucks.

The distance between the object and the Gelora Bung Tomo Stadium is two kilometers, so the noise from the stadium does not affect the object. However, football fans heading to the stadium made a very high noise. That's because football fans have the characteristics of always being compact together and marching. The fans' path to reach the stadium passes through the object, so the object is directly impacted by the noise (Fig. 6). Previously, it was mentioned that the Singgapur road has a width of 6.5 meters, and supporters come from both directions of the Benowo highway. This caused the fans to increasingly crowded the Singgapur road, the traffic jam was very severe, and the noise was very high.

Source: maps.google.com, 2020

Figure 6. Soccer fans walkway to the stadium

Noise on this highway has a negative impact on human physical and psychological health. There is a study of city noise on presbycusis disease or lack of hearing function. Presbycusis is high-frequency sensory nerve deafness that occurs progressively, generally strongly influenced by age. Starting at the age of 65 years is symmetrical in the right and left ears. Most presbyacusis patients live in urban areas, and more non-presbyacusis patients live in rural areas. It can be assumed that urban residence is a risk factor for presbyacusis because they are more often exposed to noise. Thus they increase their hearing threshold more quickly than residents of rural areas, which are more minimally exposed to noise (Widuri and Kurniawati, 2011). It can be concluded that the urban community is more adversely affected by physical health from noise. Therefore, vehicles that pass through the designed object influence the noise received by dental clinic patients. However, humans can ignore background noises that are louder than they want to capture. The ear can detect individual sounds (e.g., known sounds) in a complex background of loud and unwanted sounds, such as in a noisy and crowded room, which is called the cocktail party effect (Egan, 2007). This explains that the human auditory perception does not respond

to sound in a simple way and on average decibels. Listeners will perceive the sounds represented by the spectrum as very different sounds: low-frequency noise caused by the turbulent "shock" of jets of water and pumping "humming" noise, and high-frequency noise caused by the "splash" impact of the flowing water filling tub (Egan, 2007). However, sound levels must be processed with care because human auditory perception does not respond to sound in a simple and average way. In addition to sound level, individual sensitivity to sound varies with frequency content, duration, and psychological factors (Egan, 2007). In conclusion, the sound of vehicles with average decibels in the background does not disturb the patient directly, except for loud and sudden sounds such as horns.

DISCUSSION

One solution to protect ear damage from noise is to use in-ear filters. However, there is research on the effect of EPA-certified stock ready-made In-Ear filters with a passive NRR rating of 12 dB. The concentration-related data gave us a p-value of more than p= 0.05, concluding that there's also no statistically significant difference in the effect of using the in-ear acoustic filters regarding operator concentration (Qifari, 2018). That earmuffs have not been able to solve the problem. Therefore, efforts to reduce noise by processing dental clinic architecture and interior design are needed.

The land area of the design object is 84 m², and the building area is 66 m², so the distance between the fence and the facade is only 3 meters. The general theory states that the farther the sound source is, the lower the received sound. However, the effectiveness of the barrier wall gets stronger the closer it is to the building. To achieve effective sound attenuation, the barrier provided will be most effective if it is as close as possible to the source (Mediastika, 2005). Natural stone or ordinary brick walls can be used for the fence wall material. The sound absorption coefficient of natural stone walls ($\Sigma\tau= 10^{-4}$) is greater than that of ordinary walls ($\Sigma\tau= 3.16 \times 10^{-5}$) (Imran, 2013). Imran's research (2013) shows that the TL (Transmission Loss) of ordinary walls is larger than natural stone. This is because, in that research, the surface area of the ordinary model wall is larger than the natural stone wall. Therefore, using natural stone is considered to significantly impact noise protection by expanding its use.

In addition, renovations were carried out on the outer space of the terrace. In the blueprint, there is a garden area on the terrace, but renovations were carried out, and it was closed with ceramics to make it more presentable (Fig. 7). These renovations serve to reduce

the chances of pests making their homes. It is common knowledge that pests make transport routes through soil holes. The ceramic cover limits the passage of pests. However, there is a shortage in noise because it has been known previously that the shade of plants can be a noise barrier. The use of ceramics on the walls follows clinical needs that must be hygienic. But it has a bad impact on the noise aspect. The advantages of this room with ceramics can increase comfort and positively divert the patient's attention. It has been explained that sound bounces on a slippery surface, which will disturb clinic users.
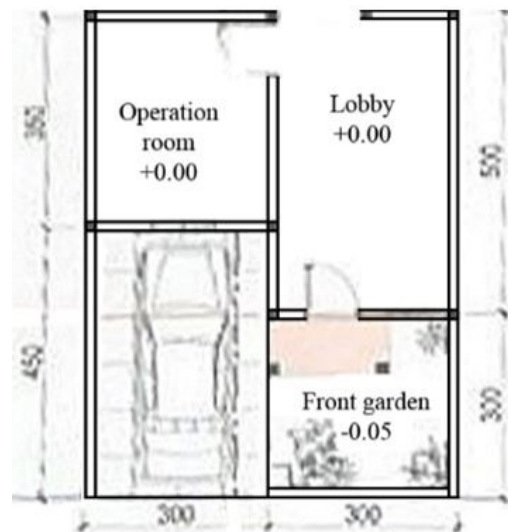
(a)

(b)

Figure 7. (a) Blueprint, (b) Benowo dental clinic terrace

The results of observations using a sound meter are shown in Figure 8. This tool records the history of sound capture received by each research object room. The picture only shows the results carried out for one day. More complete results are shown in Table 1. That table displays the critical results, the highest noise level, and the average noise level.
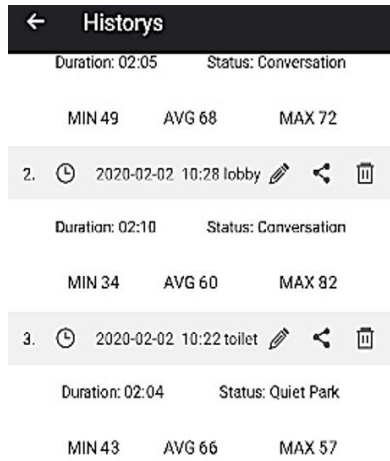
Figure 8. Example of the result in one day

Figure 9. Noise chart at Benowo Dental Clinic

Based on Table 1, it can be concluded that the difference in days does not determine the difference in noise. Still, the difference in noise is influenced by the equipment used and the occurrence of certain events that make the highway crowded. The results of this research table will be stored for comparison of results. The table meaning is converted to a two-line graph (Fig. 9).

The graph (Fig. 9) concludes that the highest noise can be captured in the waiting room with a value of 84 dB (Fig. 9). Meanwhile, the highest average noise is caught in the outdoor and operating rooms. There is a slight difference with the results studied by Elmehdi (2010). Measuring noise levels in dental clinics include 65dB for background noise without dental equipment, 72 dB - 85 dB for scaling tools, and 87 dB for compressors (Elmehdi, 2010). This is because the design object uses a new type of compressor. However, the noise from the new type of compressor is still not up to the standards of the Ministry of Health. It still affects health because even though the sound level is low, it will continuously affect hearing loss (Mediastika, 2005). No matter the noise, it will still harm users' health.
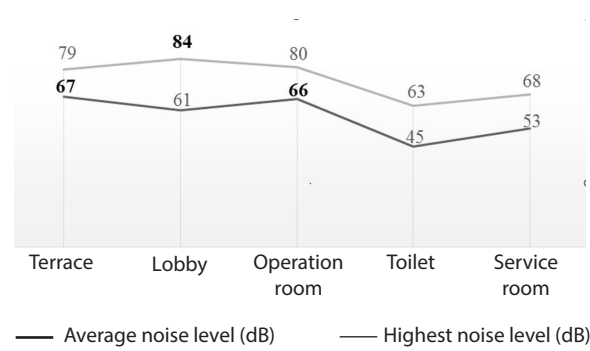
Based on the Figure 9, it can be concluded that the sound tends to come from the front of the clinic. In addition, the noise greatly affects the critical rooms, which are the lobby and operating room. Therefore, noise intensity analysis was carried out on the terrace, lobby, and operating room using *Audacity* software. The noise level is often different at different locations, and when a person moves around, the exposure varies, and it becomes difficult to estimate the total exposure during a workday (Moller, 2006). This analysis can still be explored even though, according to Moller (2006), the hearing received by the ear can be 6 dB different from the sound level meter because it depends on the direction of the sound to the ear canal. The results of the analysis are shown in Table 2 with the conclusion that noise from outside comes from the parking area, vehicles on the road, and level crossing. Meanwhile, from inside the dental clinic, conversations, drills, and furniture cause the highest noise. That table shows in the waiting room, noise is exposed sporadically, while it is exposed continuously in the outdoor room and operating room.

In addition, several things can increase the reverberation time of indoor noise. Previously, it was mentioned about the reverberation time by the space element material. However, it is necessary to analyze the potential for increasing the reverberation time of the geometry of the space element. The results of the analysis are shown in Table 3.

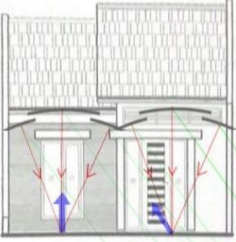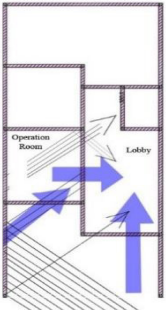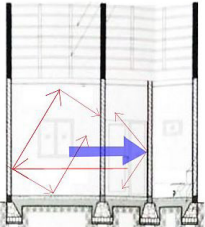**Table 1.** The result of the noise level of each room

Room	Noise Level (dB)														
	Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday		Meaning
Terrace	65[a]	**79**[b]	68	**75**	69	**78**	63	**67**	66	**69**	68	**72**	67	**79**	67	**79**
Lobby	61	**82**	59	**71**	58	**69**	62	**84**	64	**84**	61	**81**	60	**72**	61	**84**
Operation room	68	**77**	64	**79**	66	**75**	66	**80**	65	**79**	69	**80**	64	**78**	66	**80**
Toilet	46	**56**	43	**55**	43	**54**	48	**63**	46	**62**	45	**63**	46	**57**	45	**63**
Service room	53	**62**	52	**60**	52	**60**	55	**61**	53	**68**	51	**65**	55	**67**	53	**68**

[a] Average noise level; [b] **Highest noise level**

Table 2. The intensity of the noise

Day	Room	Duration	Highest noise level (dB)	Noise source	Possible source direction	Noise repetition
Monday	Terrace	02:05	79	Motorcycles	Street	7
	Lobby	02:00	82	Vehicles	Street	7
	Operation room	02:00	77	Conversation	Seat position	3
Tuesday	Terrace	02:10	75	Vehicles	Street	4
	Lobby	02:05	71	Motorcycles	Street	9
	Operation room	02:00	79	Conversation	Seat position	6
Wednesday	Terrace	02:10	78	Level crossing	Roadway	46
	Lobby	02:00	69	Motorcycles	Street	8
	Operation room	01:47	75	Level crossing	Roadway	51
Thursday	Terrace	02:02	67	Conversation	Seat position	2
	Lobby	02:10	84	Motorcycle	Parking area	3
	Operation room	02:10	80	Drill	Dental handpiece	3
Friday	Terrace	02:10	69	Conversation	Front door	3
	Lobby	02:10	84	Squeak fence	Parking area	2
	Operation room	01:40	79	Table	Dental handpiece	2
Saturday	Terrace	02:24	72	Motorcycles	Street	8
	Lobby	02:10	81	Conversation	Seat position	3
	Operation room	02:00	80	Drill	Dental handpiece	2
Sunday	Terrace	02:05	79	Motorcycles	Street	4
	Lobby	02:10	72	Level crossing	Roadway	49
	Operation room	02:20	78	Table	Dental handpiece	1

Table 3. Noise received by Benowo dental clinic

Aspect	Noise source and the impact
	Building mass Noise from highways and trains comes directly towards the facade in the southeast direction. The facade has a curved canopy (Fig. 4) that allows sound to bounce and collect in one direction. Sounds with this strong intensity can easily enter through the doors and windows. In the case of a saddle-backed roof, the presence of a green roof is essential, but flat roofs generally provide the best protection (Renterghem and Botteldooren, 2009). It means that in this clinic, roof management is still lacking.
	Spatial planning The noise source comes from the front of the building, dental care activities, and drug processing. There is no medicine room, so the drug compounding process is carried out in the operating room. This will disturb the patient in the operating room. This also affects the patient before and after surgery because, after surgery, the patients may be waiting for medicine from the receptionist. Noise not only enters through the gap but also the dense medium. In addition to the airborne sound transmission through the partition wall, energy will be transmitted through the flanking walls, through cracks, and crannies, by way of the windows, common ventilation or cable duct, etc. (Vigran, 2008). The blue arrow shows the flanking effect.
	Rooms elements Noise comes from both indoors and outdoors. Noise bounces off the floor, walls, or ceiling. The build-up of sound levels in a room is due to the repeated reflections of sound from its enclosing surface (Egan, 2007). Noise from inside the room appears from the dental handpieces and user chatter.

CONCLUSION

Dental clinics receive many harmful effects due to noise. The noise source is not only from outside and from some dental handpieces but also the shape and material of the dental clinic building elements can increase the time of noise reflection. The average noise received by the lobby of the Benowo dental clinic reaches 61 dB. This is very far from the sound level recommended by SNI 03-6386-2000, which is 45 dB for dental clinics. Although there are many innovations in dental drills and compressors directly, it is necessary to improve the building design in terms of acoustics. The purpose of that is to increase patient comfort in the waiting room. Further research is needed to choose the right design concept to protect the dental clinic from noise.

ACKNOWLEDGMENTS

REFERENCE

Andriani, E., 2020. Studi Keluhan Subyektif dan Intensitas Bising di Pemukiman Sepanjang Rel Kereta Api Kelurahan Pegirian Kota Surabaya. Poltekkes Kemenkes Surabaya.

Astuti, I.A.D., 2016. Pengembangan Alat Eksperimen Cepat Rambat Bunyi dalam Medium Udara dengan Menggunakan Metode Time of Flight (ToF) dan Berbantuan Software Audacity. UPEJ Unnes Phys. Educ. J. Vol.5(3), Pp. 18-24.

Baskoro, S., 2017. Surabaya sebagai Kota Kolonial Modern pada Akhir Abad ke-19: Industri, Transportasi, Permukiman, dan Kemajemukan Masyarakat. Mozaik Hum. Vol.17(1), Pp. 157-180.

Cox, T.J., D'Antonio, P., 2017. Acoustic Absorbers and Diffusers Theory, Design and Application, 3 rd. ed. CRC Press, New York.

Dierickx, M., Verschraegen, S., Wierinck, E., Willems, G., Wieringen, A. van, 2021. Noise Disturbance and Potential Hearing Loss Due to Exposure of Dental Equipment in Flemish Dentists. Int. J. Environ. Res. Public Health Vol.18(11), Pp. 5617.

Egan, M.D., 2007. Architectural Acoustics. J Ross Publishing Classics, New York.

Elmehdi, H.M., 2010. Assessing Acoustic Noise Levels in Dental Clinics and Its Link to Dental Anxiety and Fear among UAE Population. In: Proceedings of 20th International Congress on Acoustics. ICA 2010, Sydney, Australia, p. Pp. 1-4.

Fachrul, M.F., Yulyanto, W.E., Maulana, S., 2014. Kajian mengenai Tingkat Kebisingan Lingkungan dan Spektrum Frekuensi akibat Lalu Lintas Kereta Api (Studi kasus: permukiman di Kota Yogyakarta dan Kota Bandung). Universitas Trisakti.

H.C, D., Pangemanan, P., Engka, J.N.A., Sapulete, I.M., 2012. Pengaruh Pajanan Bising terhadap Pendengaran dan Tekanan Darah pada Pekerja Game Center di Kota Manado. J. Biomedik JBM Vol.4(3), Pp. S133-S140.

Ikhasari, A., Wibowo, E., 2019. Analisis Variansi Kebisingan di Pemukiman Sekitar Rel Kereta Api Jalan Rakata Bandung menggunakan Soundscape berdasarkan Perbedaan Waktu. eProceedings Eng. Vol.6(1), Pp. 1097-1104.

Imran, M., 2013. Studi Tingkat Kebisingan Lalu Lintas Jalan pada Area Sempadan Bangunan (Studi Kasus: Jalan Poros Maros - Makassar, km. 5 Maccopa). J. Perad. Sains, Rekayasa, dan Teknol. Vol.1(2), Pp. 160-185.

Jamaludin, A.N., 2015. Sosiologi Perkotaan: Memahami Masyarakat Kota dan Problematikanya, 1 st. ed. CV Pustaka Setia, Bandung.

Long, M., 2006. Architectural Acoustics, 1 st. ed. Elsevier, New York.

Lubis, W. hafny, 2003. Stres Akut karena Bising sebagai Penyebab Terjadinya Xerostomia. J. Dent. Indones. Vol.10(3), Pp. 821-825.

Mashuri, Y.A., 2009. Perbedaan Kadar Kortisol akibat Bising Pesawat Udara pada Masyarakat di Sekitar Bandara Adi Sumarmo Boyolali. Universitas Sebelas Maret.

Mediastika, C.E., 2005. Akustika Bangunan. Erlangga, Jakarta.

Moller, A., 2006. Hearing: Anatomy, Physiology, and Disorders of The Auditory System, 2 nd. ed. Academic Press.

Muppa, R., Bhupatiraju, P., Duddu, M., Penumatsa, N.V., Dandempally, A., Panthula, P., 2013. Comparison of Anxiety Levels Associated with Noise in The Dental Clinic among Children of Age Group 6-15 Years. Noise Heal. Vol.15(64), Pp. 190-193.

Qifari, A.F., 2018. The Effect of Acoustic Filters in Reducing Noise Levels in Different Dental Settings. EC Dent. Sci. Vol.17(11), Pp. 2031-2033.

Renterghem, T. Van, Botteldooren, D., 2009. Reducing the Acoustical Façade Load from Road Traffic with Green Roofs. Build. Environ. Vol.44(5), Pp. 1081-1087.

Suryani, N.D.I., 2015. Analisis Pengaruh Tingkat Kebisingan dan Getaran Kereta Api terhadap Tekanan Darah Ibu Rumah Tangga di Pemukiman Pinggiran Rel Kereta Api Jalan Ambengan Surabaya. Universitas Airlangga.

Syafiul, S., 2005. Analisis Kebisingan Arus Lalu Lintas dan Geometri Jalan di Kawasan Simpang Lima Kota Semarang. Universitas Diponegoro.

Theodoroff, S.M., Folmer, R.L., 2015. Hearing Loss Associated with Long-Term Exposure to High-Speed Dental Handpieces. Gen. Dent. Vol.63(3), Pp. 71-76.

Virgan, T.E., 2008. Building Acoustics. Taylor & Francis Group, London and New York.

Widuri, A., Kurniawati, D.K., 2011. Bising Lingkungan Tempat Tinggal Kita sebagai Faktor Risiko Presbiakusis. J. Mutiara Med. J. Kedokt. dan Kesehat. Vol.11(1), Pp. 62-66.

Yousuf, A., Ganta, S., Nagaraj, A., Pareek, S., Atri, M., Sing, K., Sidiq, M., 2014. Acoustic Noise Levels of Dental Equipments and Its Association with Fear and Annoyance Levels among Patients Attending Different Dental Clinic Setups in Jaipur, India. J. Clin. Diagnostic Res. Vol.8(4), Pp. ZC29-ZC34.