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EFFECTS OF CHANGE IN ACOUSTIC ENVIRONMENT ON RESIDENTS LIVING AROUND AIRPORTS IN VIETNAM

「ベトナムの空港周辺の住民に対する音環境の変化の影響」

DOCTORAL THESIS

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CHAPTER 1: INTRODUCTION

1. HEALTH EFFECTS OF AIRCRAFT NOISE

In general, sound becomes unwanted because of its effects on normal life activities as well as other socioeconomic development processes (Schreckenberg et al., 2010). The exposure-response relationships for noise annoyance were proposed based on data of socio-acoustic surveys as a basement for noise framework policy [1-4]. An exposure to high levels of aircraft noise will cause not only annoyance and sleep disturbance but also adverse effects on cardiovascular health [5,6]. Recent investigations based on meta-analysis found that step-change in traffic noise caused an excess response [7-9]. The development of air transport infrastructure which is being actively promoted in developing countries is driving the negative environmental changes in areas around the airports including noise problems. Therefore, it is essential to understand the impact of environmental change on humans for appropriately managing aircraft noise and increasing number of flights in harmony with the health and quality of life for residents in the surrounding vicinities [14].

Noise has been considered one of the most severe environmental pollutions that affect people's quality of life and health. In the context in which many airports are being expanded or newly constructed in developing countries, the residents in the surrounding area will be exposed to aircraft noise for an extended period, which will harm their health. A review of studies on the effect of environmental noise reported that the change in sound environment by various interventions could cause a change effect on people severer than on those living in the stable one. The impact of noise change is becoming severe for residents living in areas close to expanded and new facilities. However, there are no specific measures to minimize the effects of the changing sound environment – only some regulations and standards on the general, stable sound environment [14].

Aircraft noise is typically the most significant environmental concern for societies adversely effected by aviation operations, whether from major international airports, night-time flight operations, business aviation facilities, helicopters, airfields with repetitive activities such as circuits or aerobatic practice, or flightpath changes. Noise from aircraft is a public health concern. It can have an effect on children's memory and learning, disrupt sleep, and cause serious long-term health problems such as cardiovascular disease. There is also emerging evidence of mental health consequences linked to increases in stress and anxiety. The AEF's 2016 report Aircraft Noise and Public Health: The Evidence is Loud and Clear examines a large body of health evidence [15].

Aircraft noise and health effects is a rapidly growing area of research worldwide, and there have been many important findings published in recent years. Of particular importance has been the European Network of Noise and Health (ENNAH), which has connected researchers in the field throughout Europe to critically assess the current

evidence base and identify gaps in the knowledge as well as suggesting directions for future research. The World Health Organization (WHO) published their Burden of Disease from Environmental Noise report, which has enabled the calculation of healthy life years lost due to environmental noise which is very important for decisions on policy making. The European Environment Agency published their good practice guide on noise exposure and potential health effects which included important exposure-response relationships and thresholds for health endpoints and the Health and Safety Laboratory, through a Defra contract, produced their work on quantifying the links between environmental noise related hypertension and health effects [16]. The European Network of Noise and Health (ENNAH) was set up in 2009 and is the largest network ever established in this research area, comprising academic researchers and health workers throughout Europe. The outcomes of this project serve to identify gaps in the current research on noise and health and provide suggestions for the prioritization of future directions in this field. An example of these is the inclusion of air pollution confounding variables in noise and health research, in particular for environmental noise and transportation noise studies where there is inevitably a level of air pollution as a result of the noise sources themselves, as well as supplementary sources [17].

Numerous studies have shown that high aircraft noise exposure affects the quality of life and health of people living in the area around the airport. However, most of the surveys assumed a steady state where the noise exposure level does not suddenly change throughout the year. Very few studies considered step-change of noise exposure levels due to changes in airport operation conditions [10]. Moreover, while most studies on intervention effects have been conducted in developed countries, there is no study on specific health effects of aircraft noise on residents of developing countries [2,11]. Though several Asian studies including research by Nguyen et al. [3,11] have been reflected in recent WHO noise guidelines [12], most studies were on general annoyance. No research on health effects have been found for residents outside Europe. It is necessary to clarify this in Asia in preparation to increase aviation demand.

2. RESEARCH ON CHANGE EFFECTS OF ACOUSTIC ENVIRONMENT AROUND VIETNAM'S AIRPORTS

Discomfort caused by aircraft noise is becoming an increasingly important issue in areas close to airports as air traffic spreads and environmental awareness increases, Nguyen et al. conducted social surveys of the community response to aircraft noise around Tan Son Nhat International Airport in 2008, around Noi Bai International Airport in 2009, and around Da Nang Airport in 2011 to formulate Vietnamese and global noise policies, and found that the Vietnamese living around airports were more disturbed by aircraft noise than European, especially those living in Da Nang city [13].

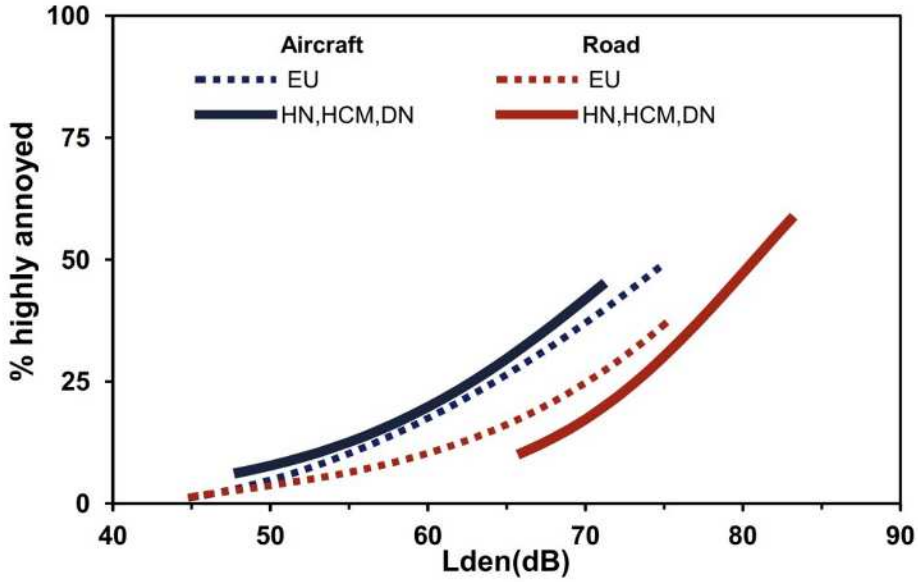

Figure 1. The dose-response relationships for aircraft noise and road traffic noise synthesized from Hanoi, Ho Chi Minh, and Da Nang to the European Union's corresponding curves [13]

The operation status of HNBIA was considered to be stable in 2009 survey. Since then, the number of operations of the aircraft has gradually increased, especially after the opening of the new terminal building in December 2014. To assess effects of a step change of noise exposure levels around HNBIA, step-change surveys were conducted once before and twice after the operation change happened. As a result, an excess response due to the step-change were found [11].

Against this background, the research project is about the effects of a significant change in aircraft noise exposure on community reaction and public health in major airports of Vietnam. In my study, two case studies on health impacts of aircraft noise were conducted around two largest airports in Vietnam: Noi Bai International Airport (HNBIA) in Hanoi and Tan Son Nhat International Airport (TSN) in Ho Chi Minh City.

2.1. Hanoi Noi Bai International Airport (HNBIA)

HNBIA in Hanoi, Vietnam's capital, has the largest capacity of any airport in the country. Aside from Tan Son Nhat International Airport, it is the second busiest airport in Vietnam. The airport replaces Gia Lam Airport as the main airport serving Hanoi. Two passenger terminals are available at the airport. International flights into and out of Hanoi are operated from Terminal 2 (inaugurated on 4 January 2015), while domestic flights are handled from Terminal 1.

Terminal 1, completed in 2001, had one main section for international flights with a new terminal extension (denoted Lobby E) for domestic flights, which was completed in late 2013. Together with the extension, terminal 1 is capable of handling

9 million passengers per annum. Following the inauguration of Terminal 2 in January 2015, Terminal 1 is solely used for domestic flights. The terminal is currently being upgraded to handle 15 million passengers annually upon completion in March 2018.

Figure 2. Noi Bai International Airport, Hanoi, Vietnam

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The construction of the new terminal (Terminal 2) next to the existing one with a designed capacity of 10 million passengers per annum started in March 2012. The 996-meter-long new terminal building, funded by a Japan International Cooperation Agency ODA loan, was designed by Japan Airport Consultants and was built by Taisei Corporation. The total investment for the project was ¥75.5 billion (US$645.35 million). Japan's official development assistance accounted for ¥59 billion ($504.27 million) of the investment, while the remaining amount was covered by local funds [1]. The new international terminal was inaugurated on 4 January 2015 together with a new freeway connecting the airport to downtown Hanoi via the Nhat Tan Bridge [18].

The airport has a 3,800-meter paved runway (CAT II – 11R/29L) which opened in August 2006 and an older 3,200-meter paved runway (CAT I – 11L/29R). The older runway was closed for upgrades for 4 months from August to December 2014. The distance between the two runways is only 250 meters, so the airport currently restricts the maximum passenger capacity in accordance with International Civil Aviation Organization safety regulations [18].

The airport is located in Phu Minh Commune in Sóc Sơn District, about 35 kilometers (21 miles) northeast of downtown Hanoi. The airport served a total of 13 million passengers in 2013, despite having a capacity of only 9 million at the time. The new international terminal, which had its first commercial flight on 25 December 2014 and went into full operation on 31 December 2014, has boosted the airport's total capacity to 20 million passengers per year. In 2018, the airport served 28 million passengers. Of the routes the airport offers, the Hanoi – Ho Chi Minh City route is the busiest in Southeast Asia and the sixth busiest in the world, serving 6,867,114 customers in 2018 [18].

This led to health consequences caused by increasing aircraft noise levels for residents living around HNBIA. In the previous surveys on step change effects of

aircraft noise conducted in HNBIA, the exposure changes due to increase in flight operation and the community response to such a change were investigated.

2.2. Tan Son Nhat International Airport (TIA)

Locating inside a very dense residential area of Ho Chi Minh City, the most active metropolitan area in Vietnam, Tan Son Nhat Airport (TIA) is the largest airport in Vietnam with over 250,000 movements, serving almost 40 million passengers in 2018. Tan Son Nhat International Airport handled 64,000 aircraft movements and about 8.5 million passengers in 2006 (up from 7 million in 2005). Nearly two-thirds of recent arrivals and departures at Vietnam's international gateway airports were attributed to it.

Figure 3. Tan Son Nhat International Airport, Ho Chi Minh, Vietnam

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Tan Son Nhat Domestic Terminal reached its maximum capacity of 8 million passengers in 2010. In 2013, two years earlier than anticipated, the airport handled all 20 million passengers it could handle. To accommodate the rising demand, domestic and international terminals are being expanded. The domestic terminal's expansion was completed in December 2014, increasing the terminal's annual passenger capacity to 13 million. The People's Army of Vietnam gave the Airports Corporation of Vietnam a 21-hectare military parcel of land in the area of the airport in September 2017 for use in civil purposes. Ho Chi Minh City - Hanoi is the busiest route the airport offers, carrying 6,769,823 passengers in 2017, making it the busiest in Southeast Asia and the seventh busiest in the world.

A new international terminal with an initial capacity of 10 million passengers a year, which was built by a consortium of four Japanese contractors with funding from the Japanese government's official development assistance program, opened in September 2007. The terminal handled more than 9 million international passengers in 2014, and an expansion of the terminal was anticipated. Two new jet bridges and other facilities were added as part of an urgent terminal expansion that was completed in its first phase in December 2016. The terminal can accommodate 13 million passengers yearly once phase two is finished.

Tan Son Nhat now has two main terminal buildings with distinct sections for international and domestic flights after the opening of its new international terminal in September 2007.

By Decision 1646/TTg-NN, the Prime Minister of Vietnam approved the expansion of the apron by 40 hectares (99 acres) and the construction of a cargo terminal to accommodate the airport's rapidly rising passenger and cargo volumes (estimated to reach 17 million in 2010 compared to 7 million and 8.5 million in 2005 and 2006, respectively).

The effects of aircraft noise on the health of the urban population continue to grow. In 2015, the Vietnamese government decided to build a new airport, Long Thanh Airport (LT), in the east of Ho Chi Minh City, which is expected to handle 100 million passengers per year and reduce the current congestion at TIA [9]. The new airport was scheduled to open in 2023, and possibly help minimize the noise impact around TIA.

On the other hand, residents in the surrounding area of LT will be affected by long-term exposure to noise from a new airport. This transfer provides an excellent opportunity to carry out both step-change studies and cohort studies on aircraft noise impacts, simultaneously. A step-change or cross-sectional study was planned to examine the effects of gradual changes in noise exposure in areas around TIA.

3. TERMS AND DEFINITIONS

Glossary of terms used to describe sound [19]:

- *Sound pressure level* is a logarithmic measure of the effective pressure of a sound relative to a reference value. It is measured in decibels (dB) higher than a reference level. The reference sound pressure in air is 20μPa (2×10^{-5}Pa), which is thought to be the human hearing threshold at a sound frequency of 1000Hz.
- *dB scale* is a logarithmic scale to measure sound pressure level. A two-fold increase in sound energy will cause the sound pressure level to increase by 3dB. A ten-fold increase in sound energy will cause the sound pressure level to increase by 10dB, which is perceived as about twice as loud.
- L_{max} is the highest sound pressure level in a given time period

- L_{eq} is average level of sound pressure within a certain time period. If the A-filter is used for frequency-weighting, the average level is referred to as L_{Aeq}. The filter and time period used for averaging are often indicated in subscript.
- L_{den} (Day-Evening-Night level), also referred to as DENL, is the A-filtered average sound pressure level, measured over a 24h period, with a 10dB penalty added to the night (23:00-7:00 or 22:00-6:00), and a 5dB penalty added to the evening period (19:00-23:00 or 18:00-22:00), and no penalty added to the average level in the daytime (7:00-19:00 or 6:00-18:00). The L_{dn} measure is similar to the L_{den}, but omits the 5dB penalty during the evening period. The penalties are introduced to indicate people's extra sensitivity to noise during the night and evening. Both L_{den} and L_{dn} are based on A-weighted sound pressure levels.

WHO definitions of health effects of different average night noise levels [19]

- Below 30dB $L_{Aeq,night,outside}$: Although individual sensitivities and circumstances may differ, it appears that up to this level no substantial biological effects are observed.
- 30-40dB $L_{Aeq,night,outside}$: A number of effects on sleep are observed from this range (body movements, awakening, self-reported sleep disturbance, arousals). The intensity of the effect depends on the nature of the source and the number of events. Vulnerable groups (children, chronically ill, elderly people...) are more susceptible. However, even in the worst cases the effects seem modest.
- 40-45dB $L_{Aeq,night,outside}$: Adverse health effects are observed among the exposed population. Many people have to adapt their lives to cope with the noise at night. Vulnerable groups are more severely affected.
- Above 55dB $L_{Aeq,night,outside}$: The situation is considered increasingly dangerous for public health. Adverse health effects occur frequently, a sizable proportion of the population is highly annoyed and sleep disturbed. There is evidence that the risk of cardiovascular disease increases.

4. SCOPE OF STUDY

During the past years, the number of flights at the two largest airports in Vietnam has changed significantly. This study aims to assess the change in residents responses when the noise level from aircraft around Noi Bai airport changes gradually over the years. In addition, a socio-acoustic study and assessment of people's health was carried out at Tan Son Nhat airport 11 years after Nguyen et al. last survey in 2008, and immediately followed by a study on the response of people when the number of flights suddenly decreased due to the impact of the Corona pandemic.

5. THESIS STRUCTURE

Chapter 1: Introduction

This chapter provides an overview of the background study and the content of this doctoral thesis.

Chapter 2: General research methods

This chapter describes the general data collection methods used throughout the surveys carried out around the airport area and how to analyze the data.

Chapter 3: Follow-up surveys on public health around Hanoi Noi Bai International airport

In this chapter, the results of residents' responses to aircraft noise around Noi Bai airport in five surveys from 2014 to 2018 are compared.

Chapter 4: Socio-Acoustic and Health Surveys on Residents around Tan Son Nhat International Airport

Unlike Chapter 3, Chapter 4 shows the change in noise levels and people's reactions around Tan Son Nhat airport - the busiest airport in Vietnam after a long time, and immediately after the effects of the sudden decrease in the number of flights due to the impact of the global epidemic.

Chapter 5: Summary

This chapter summarizes the results obtained from chapters 3 and 4.

Chapter 6: Further works

To reduce the load on Tan Son Nhat airport in the future, the project on Long Thanh airport is underway. The research project on the obvious change before and after the construction of a new airport is going to be a breakthrough in the future

References

1. Schultz, T.J. (1978). Synthesis of social surveys on noise annoyance. J.Acoust. Soc. Am. 1978, 64, 377–405.
2. Fidell, S., Silvati, L., Haboly, E. (2002). Social survey of community response to a step change in aircraft noise exposure. J.Acoust. Soc. Am. 111, 200–209.
3. Nguyen, T.L., Yano, T., Nguyen, H. Q., Nishimura, T., Fukushima, H., Sato, T., Morihara, T., and Hashimoto, Y. (2011). Community response to aircraft noise in Ho Chi Minh City and Hanoi. Appl. Acoust. 72, 814–822.
4. Yano T, Gjestland T, Lee S. (2012). Community response to noise. Noise Health, 14:303-306.
5. Muzet, A. (2007). Environmental noise, sleep, and health. Sleep Medicine Reviews, 11, 135-142.
6. Brown A.L. and van Kamp I. (2017). WHO Environmental Noise Guidelines for the European Region: A Systematic Review of Transport Noise Interventions and Their Impacts on Health. Int. J. Environ. Res. Public Health 2017, 14, 873.
7. Brown, A. L. (1987). Responses to an increase in road traffic noise. J. Sound Vib. 117, 69–80.

8. Brown, A. L. and van Kamp, I. (2009a). Response to a change in transport noise exposure: A review of evidence of a change effect. J. Acoust. Soc. Am. 125(5), 3018–3029.
9. Brown, A.L. and van Kamp, I. (2009b). Response to a change in transport noise exposure: Competing explanations of change effects. J. Acoust. Soc. Am. 125(2), 905–914.
10. Brink, M., Wirth, K.E., Schierz, C., Thomann, G., Bauer, G. (2008). Annoyance responses to stable and changing aircraft noise exposure. J. Acoust. Soc. Am. 124(5), 2930–2941.
11. Nguyen T.L., Nguyen T.L., Morinaga M., Yokoshima S., Yano T., Sato T., Yamada I. (2018). Community response to a step change in the aircraft noise exposure around Hanoi Noi Bai International Airport. J Acoust Soc Am. 143(5):2901.
12. WHO (2018) Environmental Noise Guidelines for the European Region - WHO Regional Office for Europe, Denmark.
13. Nguyen T.L., Yano T., Nguyen H.Q., Nishimura T., Sato T., and Morihara T. (2012). Community response to aircraft noise around three airports in Vietnam. Proceedings of Meetings on Acoustics, Vol. 15, 040003
14. Growth and Mansell (eds.) (2021). Negotiating Noise. Across Places, Spaces and Disciplines. Lund: Sound Environment Centre, Lund University
15. Aircraft noise: a long standing problem https://www.aef.org.uk/what-we-do/noise/
16. Environmental Research and Consultancy Department, Civil Aviation Authority (2016). Aircraft noise and health effects: Recent findings, CAP 1278
17. Environmental Research and Consultancy Department, Civil Aviation Authority (2014). Aircraft noise, sleep disturbance and health effects, CAP 1164
18. https://en.wikipedia.org/wiki/Noi_Bai_International_Airport
19. Basner M, Babisch W, Davis A, Brink M, Clark C, Janssen S, Stansfeld S. (2014). Auditory and non-auditory effects of noise on health, Lancet. 12;383(9925):1325-1332

CHAPTER 2: GENERAL RESEARCH METHODS

1. NOISE LEVELS MEASUREMENT AND ESTIMATION

1.1. Sound Pressure Level Measurement

Day-evening-night noise level (L_{den}) and nighttime equivalent noise level ($L_{night\ (22:00\text{-}6:00)}$) were estimated from the field measurement of noise levels. Sound level meters (RION NL-42, NL-21, NL-22) were set up on the roof of houses selected at each surveyed site. A-weighted and S-weighted sound pressure levels ($L_{A,S}$) sampled at 1 s were recorded continuously through 7 days. Noise level meters were placed on the roofs of 13 previously selected households. Within 1 week, batteries needed to be replaced to maintain the continuity of the measurement method. The noise data of each day for each site was compared with flight logs to identify the aircraft events and then calculate the L_{den}. Since the day, evening and night periods are different between countries, depending on the activity pattern of daily life, in this study, they are defined as the periods from 06:00 to 18:00, from 18:00 to 22:00, and from 22:00 to 06:00, respectively [5].

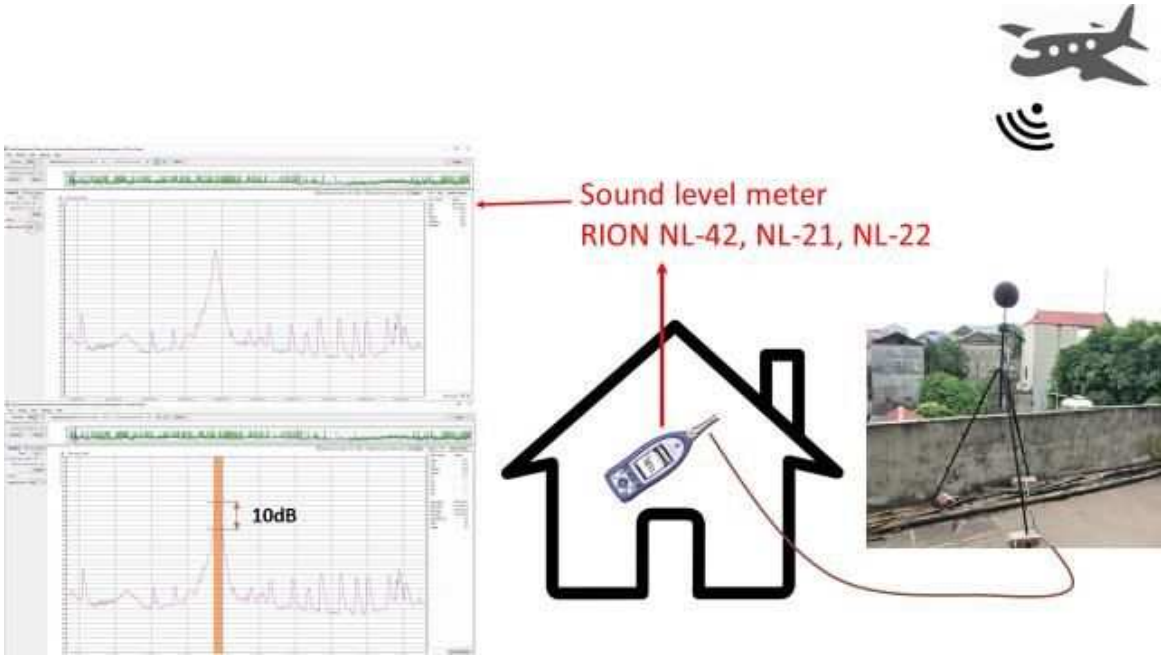


Figure 4. Field measurement of noise levels

1.2. Sound Pressure Level Estimation

L_{den} and L_{night} were estimated from noise contours maps calculated by using Integrated Noise Model (INM) instead of field measurements. The necessary data for calculating the noise contours maps such as airport operation data including flight logs and weather conditions during the surveys were provided by the airport managers. The flight operation at HNBIA is categorized into winter (late October to late March) and

summer (in the remaining period) schedules. Due to the prevailing wind direction, almost all takeoffs and landings at HNBIA are to the east. ADS-B (Automatic Dependent Surveillance-Broadcast) receiver was installed to collect the flight route information.

Figure 5. ADS-B system

The estimation was made based on the flight data logged for the whole survey period in one week. The flight data log obtained from the airport office and compared with the seasonal average traffic to ascertain that the estimated period was representative of the noise situation. The validity of estimated noise levels was confirmed by comparing those with the measured noise data of the same period. According to the flight logs, the average arrivals and departures in a day at HNBIA were counted and classified into day, evening and night periods defined as the periods from 06:00 to 18:00, from 18:00 to 22:00, and from 22:00 to 06:00, respectively. These data were then used to calculate the Day-evening-night noise levels (L_{den}) and the night-time noise levels ($L_{night\ (22:00\text{-}6:00)}$) [6].

2. ANALYSIS METHODS

2.1. Noise Levels

2.1.1. Noise measurement

After the field measurement by RION NL-42, use specialized software (RION AS-60 Data Management software for Environmental measurement) to analyze collected noise. The AS-60 software graphically displays measurement data, performs calculation processing and excluded sound processing, creates reports, output files and plays real sounds.

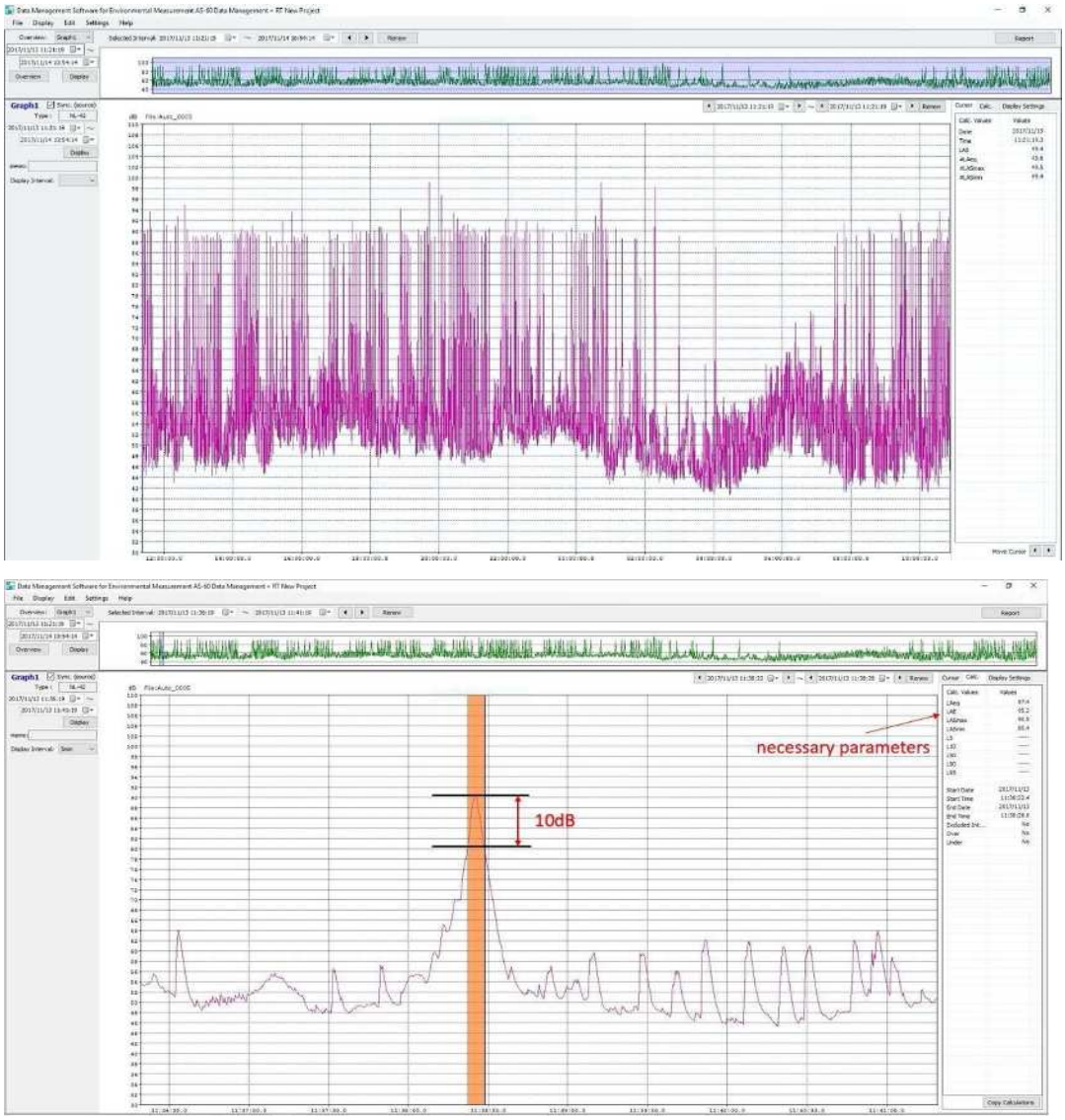


Figure 6. Measurement data displayed by the AS-60

To eliminate background noise and focus on aircraft noise, select data that corresponds to aircraft noise by comparing peak of each event with take-off or landing time according to flight log data provided by the Civil Aviation Authority of Vietnam (CAAV). The number of flight events was also counted based on this flight log data.

Some noise metrics such as L_{Aeq}, L_{dn}, L_{den} were calculated to analyze noise exposure level.

$$L_{Aeq} = 10\log_{10}\frac{1}{T}\sum 10^{L_{AE}/10}$$

Where L_{AE} is the measured dB level of a single noise event over a period of one second.

- Daytime Average Noise Level ($L_{\text{Aeq,d1}}$ or L_{d1})

$$L_{\text{d1}} = 10\log_{10}\frac{1}{57600}\sum 10^{L_{AE}/10}$$

L_{AE} is L_{Aeq}'s during the period from 6:00 to 22:00

- Daytime Average Noise Level ($L_{\text{Aeq,d2}}$ or L_{d2})

$$L_{\text{d2}} = 10\log_{10}\frac{1}{43200}\sum 10^{L_{AE}/10}$$

L_{AE} is L_{Aeq}'s during the period from 76:00 to 18:00

- Evening Average Noise Level ($L_{\text{Aeq,e}}$ or L_{e})

$$L_{\text{e}} = 10\log_{10}\frac{1}{14400}\sum 10^{L_{AE}/10}$$

L_{AE} is L_{Aeq}'s during the period from 18:00 to 22:00

- Nighttime Average Noise Level ($L_{\text{Aeq,n}}$ or L_{n})

$$L_{\text{n}} = 10\log_{10}\frac{1}{28800}\sum 10^{L_{AE}/10}$$

L_{AE} is L_{Aeq}'s during the period from 22:00 to 6:00

- 24-hour Average Noise Level ($L_{\text{Aeq,24h}}$ or L_{24h}) is defined in term of average noise level during 24-hour period of a day.

$$L_{\text{24h}} = 10\log_{10}\frac{1}{86400}\sum 10^{L_{AE}/10}$$

L_{AE} is L_{Aeq}'s during the period from 0:00 to 23:59

- Day-night Average Noise Level (L_{dn}) is applied a 10dB penalty to nighttime noise level.

$$L_{dn} = 10\log_{10}\frac{1}{86400}\left(57600 \times 10^{\frac{L_{d1}}{10}} + 28800 \times 10^{\frac{L_n+10}{10}}\right)$$

- Day-Evening-Night Average Noise Level (L_{den}) is applied a 5dB penalty to the evening noise level and a 10dB penalty to nighttime noise level.

$$L_{den} = 10\log_{10}\frac{1}{86400}\left(43200 \times 10^{\frac{L_{d2}}{10}} + 14400 \times 10^{\frac{L_e+5}{10}} + 28800 \times 10^{\frac{L_n+10}{10}}\right)$$

2.1.2. Noise estimation

In this study, the noise contour map calculation was performed using the Integrated Noise Model (INM) [4], which is designed to evaluate long-term average noise exposure contours using average annual input conditions. The INM was a computer model that evaluated aircraft noise impacts in the vicinity of airports. It was developed based on the algorithm and framework from the SAE AIR 1845 standard, which used noise-power-distance (NPD) data to estimate noise accounting for specific operation mode, thrust setting, and source-receiver geometry, acoustic directivity, and other environmental factors. The INM could output either noise contours for an area or noise level at pre-selected locations. The noise output could be exposure-based, maximum-level-based, or time-based.

The information relating to airport activities and aircraft operations, runway use, the flight track geometry and dispersion, and the number of aircraft movements per flight track were required for the prediction. As such data were not available due to technical and security reasons, field measurements were performed to collect supplemental data. Flight track data was collected by using a receiver of Automatic Dependent Surveillance–Broadcast (ADS-B). The ADS-B data receiver was placed at the observation deck located near the runway end 11L runway in a week corresponding to the period of the field measurement described in 1.1.

ADS-B was useful in obtaining flight path data of civil aircraft, but it was not possible to get such data of military aircraft using this device, because military aircraft are not equipped with ADS-B. Addressing this lack of military data, field measurement was performed to observe flight operations of civil and military aircraft including the operation time, flight position and altitude at several points along the straight flight path near the runway ends of HNBIA. Noise-Power-Distance (NPD) data of many aircraft types, the relationship between the noise level at the receiving point and the slant distance from that point to the aircraft, are included in INM database. However, there are several aircraft types operated in HNBIA which are not available in INM database, including military aircrafts. In addition, a question is raised whether the meteorological condition in Vietnam affects the NPD relationships included in INM, which was originally created for the use of the airports in the United States. In order to improve the accuracy of the noise prediction, NPD data was created based on data obtained through the field measurement. The measurement was carried out during the daytime in two days within the implementation period of field noise measurement. In addition, observation of touch-down points before landing and lift-off points after take-off was carried out by manual inspection.

According to the flight logs, the average arrivals and departures in a day at HNBIA were counted and classified into day, evening and night periods defined as the periods from 06:00 to 18:00, from 18:00 to 22:00, and from 22:00 to 06:00, respectively.

Then proceed to classify each type of aircraft named in INM into flight route (from R1 to R5, or from L1 to L4 for departure or arrival event, respectively) and flight time (day, evening and night periods). Enter the calculated data into the INM and export noise contours of each day, thereby resulting in day-evening-night noise levels and night-time noise levels.

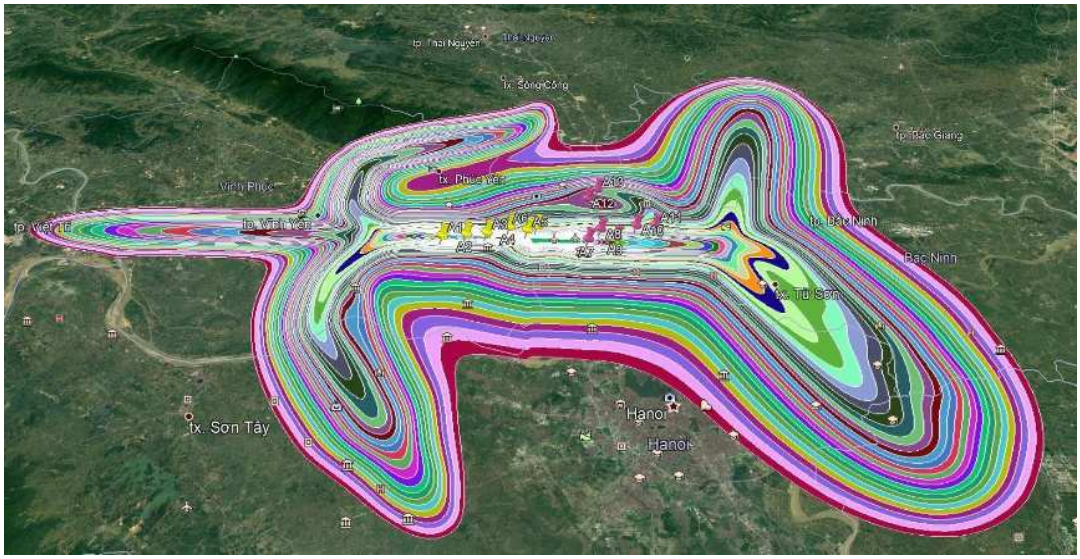


Figure 7. An example of noise contour map

2.2. Health Indexes

Data are analyzed and arranged in binary form 1 and 0 to input into statistical analysis software. Then use multiple logistic regression models to analyze the relationship between noise levels and these data.

2.2.1. Annoyance

Annoyance was evaluated with an 11-point numerical scale (extremes labeled "not at all" and "extremely") proposed by the International Commission on Biological Effects of Noise (ICBEN). The question wordings were almost the same as those in ISO15666, except the period of evaluation was "the last one month" instead of the general use "the last 12 months" [7].

Thinking about the last 1 month (a month) or so, what number from 0 to 10 best shows how much you are bothered, disturbed, or annoyed by aircraft noise? 0 1 2 3 4 5 6 7 8 9 10 Not at all Extremely

The percentage of highly annoyed respondents (%HA) was taken as an annoyance measure in the noise exposure range corresponding to the rate of people who responded to the 11-point numerical scale with 8, 9 or 10 [7].

2.2.2. Insomnia

According to the International Institute of Sleep (Kuwano et al., 2014), the frequency of sleep was obtained using the complete set of questions below.

Do you have any trouble with your sleep?

1) No ☐

2) Yes ☐

If you answered "Yes" to the above question, please choose appropriate numbers for each item.

	1 Occasionally	2 Once or twice a week	3 More than 3 time a week
1) Difficult to fall asleep			
2) When awakened during the night, it is difficult to sleep again.			
3) Awakened early in the morning			
4) Do not feel as having slept well the next morning			
5) Sleepy during daytime and cannot work well			
6) Others _____			

The sleep effects are defined as follows:

- Difficulty initiating sleep: "Difficult with sleep", "Difficult to fall asleep more than three times a week", and "Sleepy during daytime and cannot work well more than three times a week".
- Difficult maintaining sleep: "Difficult with sleep", "Difficult to sleep again when awakened during the night more than three times a week", and "Sleepy during daytime and cannot work well more than three times a week".
- Premature waking: "Difficult with sleep", "Woke up early in the morning more than three times a week", and "Sleepy during daytime and cannot work well more than three times a week".
- A feeling of light overnight sleep: "Difficult with sleep", "Do not feel as having slept well the next morning more than three times a week", and "Sleepy during daytime and cannot work well more than three times a week".
- Insomnia: Any of the symptoms above.

The percentage of insomnia (%ISM) was used as the sleep effect measure. [1-3]

2.3. Other Factors

2.3.1. Demographic factors

Demographics is defined as statistical data about the characteristics of a population, such as the age, gender, and income of the people within the population. Researchers routinely collect demographic data to describe the sample of people or organizations in their studies. These data are reported in narrative or table format, with frequencies used for qualitative and quantitative studies. Readers of research should not skip these data to get to the results of the report. The demographic data are an important part of the study and should be examined carefully [8].

1. Gender:

1) Male ☐

2) Female ☐

2. How old are you?

1) From 20 – 29 ☐

2) From 30 – 39 ☐

3) From 40 – 49 ☐

4) From 50 – 59 ☐

5) From 60 – 69 ☐

6) More than 70 ☐

3. What is your present job?

1) Employed -> (Occupation)_____ ☐

2) Farmer ☐

3) Student ☐

4) Housewife ☐

5) Retired ☐

6) Unemployed ☐

The response data of each factor, except the noise level, was categorized into "positive" and "negative". While those with female gender or above 50 years old or unemployed are classified as "negative", those who are male or under 50 years old or employed are classified as "positive".

In the question of factors that respondents felt were sensitive such as coldness, hotness, noise, vibration, chemicals, odors and dust, pollen, polluted air, this study only focused on analyzing noise sensitivity factor. This is a 5-point verbal scale question with "not at all", "slightly", "moderately", "very" and "extremely" respectively.

Respondents who feel "very" or "extremely" sensitive to noise are in the "negative" group.

In daily life, climatic factors as well as environmental conditions affect us much, then how much are you sensitive to the following factors?

3) Noise

1	2	3	4	5
Not at all	Slightly	Moderately	Very	Extremely

2.3.2. Residential factors

The length of residence is also an important factor to assess the change in the way of thinking about the impact of noise on the lives of local people due to familiarity with the conditions and living environment. People who are living in those surveyed areas more than 5 years are in "positive" group.

How long have you been living in your present house? _____ years

Housing factors such as bedroom doors or windows whether facing to the main road and installation of air-conditioner were considered.

1. Do your bedroom windows/doors face the main road?

No ( )

Yes ( )

2. Are air-conditioners installed in the house?

No ( )

Yes ( )

2.4. Statistical Analysis

Statistical analyses are performed using the JMP software. The multiple logistic regression model is used to analyze the community responses, the health data of respondents and noise levels in HNBIA.

Logistic regression is a statistical model that in its basic form uses a logistic function to model a binary dependent variable, although many more complex extensions exist. In regression analysis, logistic regression (or logit regression) is estimating the parameters of a logistic model (a form of binary regression). Mathematically, a binary logistic model has a dependent variable with two possible values, such as pass/fail which is represented by an indicator variable, where the two values are labeled "0" and "1". In the logistic model, the log-odds (the logarithm of the odds) for the value labeled "1" is a linear combination of one

or more independent variables ("predictors"); the independent variables can each be a binary variable (two classes, coded by an indicator variable) or a continuous variable (any real value). The corresponding probability of the value labeled "1" can vary between 0 (certainly the value "0") and 1 (certainly the value "1"), hence the labeling; the function that converts log-odds to probability is the logistic function, hence the name. The unit of measurement for the log-odds scale is called a *logit*, from *logistic unit*, hence the alternative names. Analogous models with a different sigmoid function instead of the logistic function can also be used, such as the profit model; the defining characteristic of the logistic model is that increasing one of the independent variables multiplicatively scales the odds of the given outcome at a *constant* rate, with each independent variable having its own parameter; for a binary dependent variable this generalizes the odds ratio [9].

Odds ratio (OR) is the odds of disease among exposed individuals divided by the odds of disease among unexposed individuals. In other words, OR measure association between exposure (i.e. vibration, noise) and outcomes (i.e. highly annoyance). [1]

The ratio of the odds of an event occurring in one group to the odds of it occurring in another group is counted by the equation below.

$$OR = \frac{a.d}{b.c}$$

Where a is number of people that had a disease outcome

b is number of people that did not have a disease outcome

c is number of people unexposed to the risk

d is number of people that had disease outcome (among those unexposed to the risk)

If OR=1, there is no association between exposure and outcome

OR>1, there is a positive relationship between exposure and outcome

OR<1, there is a negative relationship between exposure and outcome

2.4.1. JMP

JMP is a suite of computer programs for statistical analysis developed by the JMP business unit of SAS Institute. It was launched in 1989 to take advantage of the graphical user interface introduced by the Macintosh. It has since been significantly rewritten and made available for the Windows operating system. JMP is used in applications such as Six Sigma, quality control, and engineering, design of experiments, as well as for research in science, engineering, and social sciences [10].

JMP can be automated with its proprietary scripting language, JSL. The software is focused on exploratory visual analytics, where users investigate and explore data. These explorations can also be verified by hypothesis testing, data mining, or

other analytic methods. In addition, discoveries made through graphical exploration can lead to a designed experiment that can be both designed and analyzed with JMP [10].

2.4.2. Fit Model [11]

When your response variable has discrete values, you can use the Fit Model platform to fit a logistic regression model. The Fit Model platform provides two personalities for fitting logistic regression models. The personality that you use depends on the modeling type (Nominal or Ordinal) of your response column.

For nominal response variables, the Nominal Logistic personality fits a linear model to a multi-level logistic response function.

For ordinal response variables, the Ordinal Logistic personality fits the cumulative response probabilities to the logistic distribution function of a linear model.

Both personalities provide likelihood ratio tests for the model, a confusion matrix, and ROC and lift curves. When the response is binary, the Nominal Logistic personality also provides odds ratios (with corresponding confidence intervals).

2.4.3. Determine and classify data

In order to import the collected data into statistical analysis software, these data must be converted to binary 0 and 1 format to be compatible with the analysis program. The classification and conversion are shown in Table 1.

Table 1. Data classification to input into JMP

	Items	Type of answer	Positive – 0	Negative – 1
1	Gender		Male	Female
2	Age		Under 60 years old	Above 60 years old
3	Occupation		Employed	Unemployed
4	Noise sensitivity	5-point verbal scale	Choose 1, 2, 3	Choose 4, 5
5	Length of residence		Above 5 years	Under 5 years
6	Annoyance	11-point numeric scale	Choose 1 to 7	Choose 8, 9 or 10
7	Insomnia		Not insomnia	Insomnia
8	Blood pressure	Y/N	Upper ≥ 140mmHg or Lower ≥ 90mmHg	Upper < 140mmHg or Lower <90mmHg

9	Bedroom direction	Y/N	Not face to the mainroad	Face to the mainroad
10	Air conditioner	Y/N	Installed	Uninstalled
11	Health status	5-point verbal scale	Choose 1, 2, 3	Choose 4, 5
12	Stress	5-point verbal scale	Choose 1, 2, 3	Choose 4, 5
13	Medical problems	Open	No problem related to cardiovascular disease	Having problems related to causes of high blood pressure
14	Smoking	Y/N	No smoking	Smoking
15	Drinking alcohol	Y/N	No drinking	Drinking
16	Body Mass Index	Open	BMI <30	BMI ≥30 (Overweight)

References

1. Buysse DJ, Ancoli-Israel S, Edinger JD, Lichstein KL, Morin CM. Recommendations for a standard research assessment of insomnia. Sleep 2006;29:1155-73.
2. Michele L. Okun, Howard M. Kravitz, Mary Fran Sowers, Douglas E. Moul, Daniel J. Buysse, and Martica Hall, Psychometric Evaluation of the Insomnia Symptom Questionnaire: a Self-report Measure to Identify Chronic Insomnia, J Clin Sleep Med. 2009 Feb 15; 5(1): 41–51.
3. Lichstein KL, Durrence HH, Taylor DJ, Bush AJ, Riedel BW. Quantitative criteria for insomnia. Behav Res Ther. 2003;41:427–45.
4. Integrated Noise Model (INM) Version 7.0 Technical Manual, Office of Environment and Energy, Federal Aviation Administration, Washington DC, USA (2008).
5. Thulan Nguyen, Bachlien Trieu, Takashi Yano, Takashi Morihara, Yasuhiro Hiraguri, Makoto Morinaga. Effects of changes in operational and residential factors on public health and reactions at the vicinity of Noi Bai International Airport, ICA 2019, Aachen, Germany
6. Nguyen, Thu Lan, Bach Lien Trieu, Yasuhiro Hiraguri, Makoto Morinaga, Takashi Morihara, and Takashi Yano. 2020. “Effects of Changes in Acoustic and Non-Acoustic Factors on Public Health and Reactions: Follow-Up Surveys in the Vicinity of the Hanoi Noi Bai International Airport” International Journal of Environmental Research and Public Health 17, no. 7: 2597
7. Nguyen T.L., Nguyen T.L., Morinaga M., Yokoshima S., Yano T., Sato T., and Yamada I., “Community response to a step change in the aircraft noise exposure around Hanoi Noi Bai International Airport”, J. Acoust. Soc. Am. 143(5), 2901-2912, (2018).
8. The Free Library. S.v. Demographic data in research studies..” Retrieved Feb 21 2023 from https://www.thefreelibrary.com/Demographic+data+in+research+studies.-a0341687270
9. http://data2businessinsights.in/2019/11/04/logistic-regression-interview-questions/

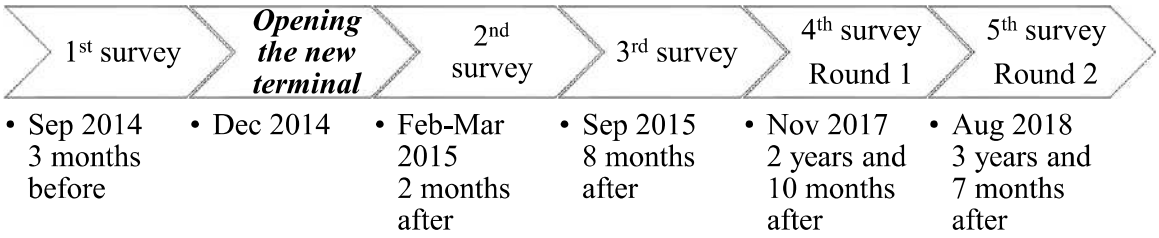
10. https://en.wikipedia.org/wiki/JMP_(statistical_software)
11. JMP Statistical Discovery From SAS. (Ver 13.1) Fitting Linear Models, Chapter 11. Logistic Regression Model

CHAPTER 3: FOLLOW-UP SURVEYS ON PUBLIC HEALTH AROUND HANOI NOI BAI INTERNATIONAL AIRPORT

***This chapter has been reconstructed and written based on references [15] and [16].*

1. INTRODUCTION

An increase of flight operation to meet the growing air travel demand have various negative environmental impacts, particularly noise and air pollution, that affects quality of life and health of communities living near the airport [1]. However, the number of studies on this issue is very limited in developing countries where the aviation transport has the fastest growth rate [2]. A socio-acoustic survey on community response to aircraft noise around Hanoi Noi Bai International Airport (HNBIA), Vietnam, was conducted in 2009 [3]. The operation status of HNBIA was considered to be stable around the survey period. Since then, the number of operations of the aircraft has gradually increased, especially after the opening of the new terminal building in December 2014. To assess effects of a step change of noise exposure levels around HNBIA, step-change surveys were conducted once before and twice after the operation change happened. As a result, an excess response due to the step-change were found [4]. To clarify whether this excessive reaction decreases over time or continues afterwards, two follow-up surveys were conducted in 2017 and 2018, which are about 3 years and 4 years after the step-change.



In parallel with the change in air transport, the period from 2014 up to now has witnessed a dramatic change in Vietnam's economy and urbanization. As a result, the housing conditions of the Vietnamese people in general as well as the people living around HNBIA also changed. Since noise annoyance was found to vary through factors other than noise exposure such as housing, neighborhood environment, socio-demographic variables, and personal and environmental contexts [6, 7]. Effect of noise change should be investigated using effects of both acoustic and such of non-acoustic variables. In this chapter, the results of socio-acoustic surveys in four years around HNBIA will be summarized with aims to assess effects of changes in operational and residential factors on public health and reactions at the vicinity of HNBIA. The outcomes from this study are expected to contribute to appropriate noise policy for improving the living environment around the airports in developing countries.

2. STUDY PURPOSES

There are three previous surveys conducted before and after the opening of the new terminal to investigate the impacts of aircraft noise exposure on residents by the same questionnaire including the items about living conditions, annoyance, and sleep disturbance.

By conducting two surveys in November 2017 and August 2018, in addition to researching the community responses, the impacts of noise on residents' health were assessed. This study aims to (1) investigate the relationship between aircraft noise exposure levels and general health; and (2) assess change effect due to change in aircraft noise levels on residents living near the airport.

The comparison between the community reaction and health conditions is expected to provide practical data and knowledge about the impact of noise on human health, especially those living around the airport areas. The result will have implications for policy decisions regarding increasing airport capacity as it will provide evidence on both associations of aircraft noise with annoyance, activity disturbance and health to populations living near airports. The findings of this study will contribute to technical guidelines, standards, regulation of aircraft noise impact assessment and noise control policies not only in Vietnam but also in other developing countries which have the same conditions as Vietnam.

3. RESEARCH METHODS

3.1 Survey sites

Figure 8. Map of survey sites (Copyright by Google Earth)

This study was conducted at thirteen survey sites which were selected by Nguyen et al. (2011) from the surveys in 2014 and 2015 (Figure 8). Sites A1-A11 were located under the major flight routes of the aircrafts and affected by noise from the

noisiest level to almost unconceivable levels. Sites A1-A6 were on the arrival side, while Sites A8-A11 were on the take-off side. Two reference sites A12 and A13 were assumed to be unaffected by aircraft noise but have the same living conditions as the other sites.

3.2. Sound pressure level measurement

In the surveys until 2015, day-evening-night noise level (L_{den}) and nighttime equivalent noise level (L_{night}) were estimated from the field measurement of noise levels. Measurement equipment were installed on the roof of a house selected in each survey site (Figure 9). Time-averaged sound pressure level was achieved by field measurement for 7 days using sound level meters (RION NL-42, NL-21, NL-22). In the surveys of 2017 and 2018, Lden and Lnight were estimated from noise contour maps calculated by using Integrated Noise Model (INM) [12] instead of field measurements. The number of flight events during the two surveys were counted based on flight log data provided by the Civil Aviation Authority of Vietnam (CAAV). The validity of estimated noise levels was confirmed by comparing those with the measured noise data of the same period. According to the flight logs, the average arrivals and departures in a day at HNBIA were counted and classified into day, evening and night periods defined as the periods from 06:00 to 18:00, from 18:00 to 22:00, and from 22:00 to 06:00, respectively. These data were then used to calculate the Day-evening-night noise levels (L_{den}) and the night-time noise levels ($L_{night\ (22:00\text{-}6:00)}$).

3.3. Questionnaire survey

In the series of surveys, Vietnamese questionnaires including two standardized annoyance questions recommended by ICBEN [9-11] were prepared. Community responses in the vicinity of HNBIA were collected by the face-to-face interview method. In addition to general annoyance and sleep impacts, exposure to high levels of aircraft noise may adversely affect cardiovascular disease and other health categories [1]. Since studies of health effect of aircraft noise has not so far been conducted for residents living near airports in developing countries, in the survey of 2017, data on the health status of residents such as body mass index (BMI) and blood pressure based on self-report were collected to evaluate the health effects of aircraft noise around NBIA. The respondents in the 2018 survey were selected from the same residential areas as those of the respondents in the 2017 survey randomly but with a smaller sampling size. Furthermore, in the survey in 2018, the blood pressure was measured with a blood pressure meter (OMRON HEM-6324T) for all respondents. Instead of questions about living conditions and the surrounding environment, questions about current health status such as BMI, blood pressure and heart rate were added.

Table 2. Questionnaire items in five surveys

Survey items	Three previous surveys	Round 1 November 2017	Round 2 August 2018
Demographic variables	◯	◯	◯
Housing factors	◯	◯	X
Living environment	◯	◯	◯
Living habits	◯	◯	◯
Sensitivities	◯	◯	◯
Annoyance	◯	◯	◯
Insomnia	◯	◯	◯
Body Mass Index (BMI)	X	◯	◯
Blood pressure	X	◯ Self-reported	◯ Self- reported +Measurement
Health status, medical issues	X	X	◯

3.4. Analysis methods

Data are analyzed and arranged in binary form 1 and 0 to input into statistical analysis software. Then use multiple logistic regression models to analyze the relationship between noise levels and this data.

3.4.1. Prevalence of annoyance

Annoyance was evaluated with an 11-point numerical scale (extremes labeled “not at all” and “extremely”). The percentage of highly annoyed respondents (%HA) was taken as an annoyance measure in the noise exposure range corresponding to the rate of people who responded to the 11-point numerical scale with 8, 9 or 10. [13]

3.4.2. Prevalence of insomnia

According to the International Institute of Sleep (Kuwano et al., 2014), the frequency of sleep was obtained using the complete set of questions. The percentage of insomnia (%ISM) was used as the sleep effect measure. [3,4]

3.4.3. Multiple logistic regression analysis

In order to import the collected data into statistical analysis software, these data must be converted to binary 0 and 1 format to be compatible with the analysis program. The response data of each factor, except the noise level, was categorized into "positive" and "negative". For example, in demographic factors, while respondents who are female or above 50 years old or unemployed are classified as "negative", those who are male or under 50 years old or employed are classified as "positive".

4. RESULTS

4.1. Demographic data

A demographic data of the respondents of all the surveys since 2014 was summarized in Table 3. A high response rate was achieved in all the surveys. There is no significant difference in demographic data between the follow-up surveys and the previous surveys.

Table 3. Demographic data in five surveys

		Surveys					Vietnamese Census (2018)
		1st	2nd	3rd	4th	5th	
Number of respondents		890	1109	1286	623	132	
Response rate (%)		68.5	85.3	98.8	95.8	83.3	
Gender	Male	54.1	52.4	49.4	47.7	40.9	49.5
	Female	45.9	47.6	50.6	52.3	59.1	50.5
Age	20s-50s	82.2	84.3	84.7	75.5	71.2	88.6
	≥60s	17.8	15.7	15.3	24.5	28.8	11.4
Length of residence	Under 5 years	27.1	19.4	22.3	6.9	2.4	
	5 years or more	72.9	80.6	77.7	93.1	97.6	
Occupation	Employment	53.5	60.3	60.4	51.4	75.0	56.5
	Student, housewife, retired, unemployed	46.5	39.7	39.6	48.6	25.0	43.5

4.2. Number of flight events

Table 4 shows the average number of daily flights operated by HNBIA during each survey period. It can be seen that the number of flights observed in 2018 is about 1.7 times more than that of 2014. It could be seen that the number of flights increased sharply after the new terminal building was put into operation and has gradually increased since then. It is worth noting that the most recent number of nighttime flights in the 2018 survey increased by 6 times and 4 times, compared to the September 2014

"before the new terminal building opened" survey and the latest "after the opening" survey for September 2015, respectively. Especially, the recent number of flight events at night increased sharply and occupied about two-fifths of the total number of flights.

Table 4. Average numbers of aircraft noise events

Time period		Surveys				
	Operation modes	1st	2nd	3rd	4th	5th
Day (6:00-18:00)	Arrival	84	104	100	120	141
	Departure	90	109	107	135	123
	Total	174	213	207	255	264
Evening (18:00-22:00)	Arrival	32	43	39	47	12
	Departure	16	27	22	35	13
	Total	48	70	61	82	25
Night (22:00-6:00)	Arrival	9	16	14	38	77
	Departure	21	26	25	36	94
	Total	30	42	39	74	171
All day	Arrival	125	163	153	205	230
	Departure	127	162	154	206	230
	Total	252	325	307	411	460

4.3. Change of noise exposure levels

The noise levels estimated by using INM were compared with noise levels data derived from the field measurement of the 2017 survey to clarify the consistency with the measured noise level of the estimated noise level used for the surveys conducted in 2017 and 2018.

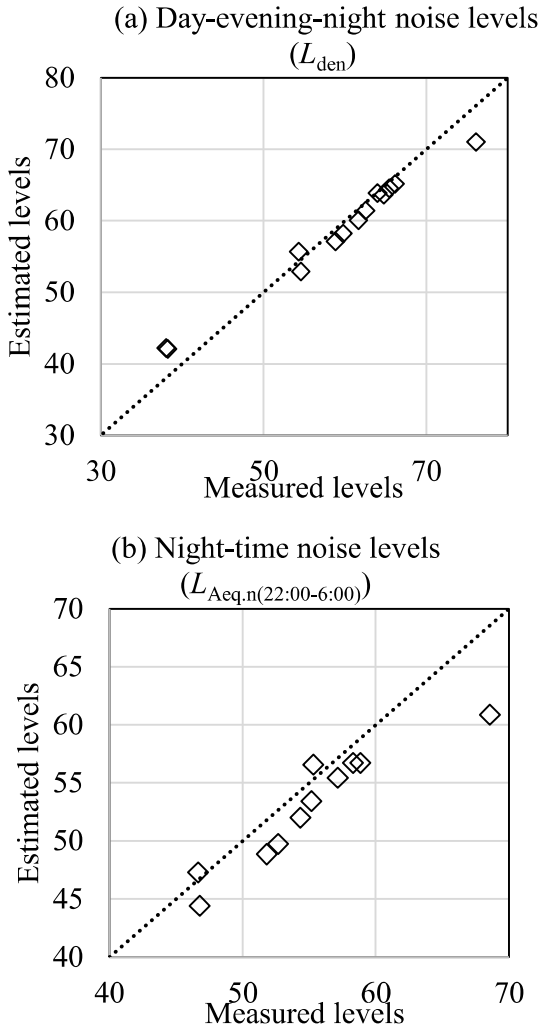


Figure 9. The comparison of estimated and measured noise levels in 2017 survey

It could be seen that the estimated noise levels are almost corresponding to the measured levels for both L_{den} and $L_{Aeq.n(22:00-6:00)}$.

The location of the setting point for noise measurement at Site 5 was at the edge of the residential area, right below the center of the aircraft landing track at the closest distance to the airport among other houses at the same site. Meanwhile, Sites A12 and A13 are located far from the airport to the north without a flight path above and almost unexposed to aircraft noise. These features can cause a significant difference between the actual measurement value at such a special point and the overall calculated value for the area on a noise contour. Table 5 shows the noise levels obtained during each survey period. Especially, L_{night} was found to increase more than 10 dB from 2014 to 2018 at Sites A4 and A5 This result is consistent with the sharp increase in the flight operations during the night-time at HNBIA.

Table 5. Changes of noise exposure levels: Day-evening-night noise levels (L_{den}) and Night-time noise levels (L_{night})

Site	L_{den}					L_{night}				
	1st	2nd	3rd	4th	5th	1st	2nd	3rd	4th	5th
A1	55	55	53	53	55	45	46	45	44	48
A2	55	56	54	56	58	45	48	46	47	51
A3	62	64	62	60	62	53	56	55	51	56
A4	54	56	57	61	63	46	48	48	52	56
A5	61	61	68	71	73	51	53	59	61	69
A6	65	64	64	64	65	50	57	56	56	58
A7	66	62	62	64	67	55	56	55	54	60
A8	66	66	65	65	67	58	58	58	55	60
A9	63	60	63	65	66	55	53	56	56	60
A10	60	58	59	58	60	52	52	53	48	53
A11	60	57	59	57	59	52	50	52	48	52
A12	45	45	49	42	44	36	38	39	34	36
A13	47	44	51	42	44	36	38	44	34	36

4.4. Change of residential factors

In this study, residential factors such as length of residence, total floor area of the house, evaluation on sound insulation, location of the bedroom, air-conditioner installation are considered to be factors related to respondents' reactions to noise. The percentage of the length of residence that is less than 5 years has decreased in the recent surveys.

Table 6. The percentage of residential factors

Residential factors (%)	1st	2nd	3rd	4th	5th
Length of residence <=5 years	14.8	10.3	11.0	8.8	6.2
Floor area <=100m^2	40.6	71.4	67.7	51.1	-
Bad sound insulation	33.0	31.0	38.9	32.4	-
Bedroom facing road	-	35.3	31.0	44.2	-
Air-conditioner uninstalled	-	71.5	71.2	50.1	-

4.5. Changes of annoyance and insomnia ratios

Table 7 shows that despite a slight increase in L_{den} between 2015 and 2017, %HA decreased at Sites A7 and A8 which are located under the take-off path of

aircraft. Among the sites under the landing path, %HA increased remarkably at Site A3 from 65% in 2017 to 96% in the 2017 survey, then decreased to 60% in the 2018 survey. The highest %HA in the survey 2018 was found at the two sites having the highest L_{den}, Sites A5 (90%) and A8 (80%).

Table 7. Percentage of highly annoyed (%HA) and percentage of insomnia (%ISM)

	%HA					%ISM				
	1st	2nd	3rd	4th	5th	1st	2nd	3rd	4th	5th
A1	8	6	2	0	20	1	1	0	0	20
A2	9	36	29	14	20	0	7	3	4	20
A3	59	71	65	96	60	17	20	22	2	22
A4	48	83	92	78	60	18	27	22	19	20
A5	48	74	96	92	90	9	34	17	44	40
A6	71	64	84	83	60	5	8	20	17	10
A7	44	12	61	10	20	5	18	9	0	10
A8	58	55	69	33	80	33	1	7	8	10
A9	28	38	56	53	10	7	6	24	11	10
A10	10	10	28	34	0	6	5	12	10	10
A11	9	6	11	12	40	0	4	5	0	30
A12	0	0	2	0	9	0	0	1	0	0
A13	0	0	3	0	0	6	1	1	0	0

Figure 10 shows a comparison of (a) L_{den} - %HA and (b) L_{night} - %ISM relationships established by using data obtained from all the surveys. The L_{den} - %HA relationships of the follow-up survey in 2017 and 2018, which were conducted about 3 and 4 years after the step change, are lower than those of the 2015 surveys which were carried out 3 and 8 months after the change occurred. The exposure-response relationship established in the follow-up study in 2018 is located closer to the relationship established in the survey before the change but significantly higher than that in the EU position paper [14]. In other words, though the change effect due to the step change seems to decline over time but still stays higher than that of the steady state at the same noise levels.

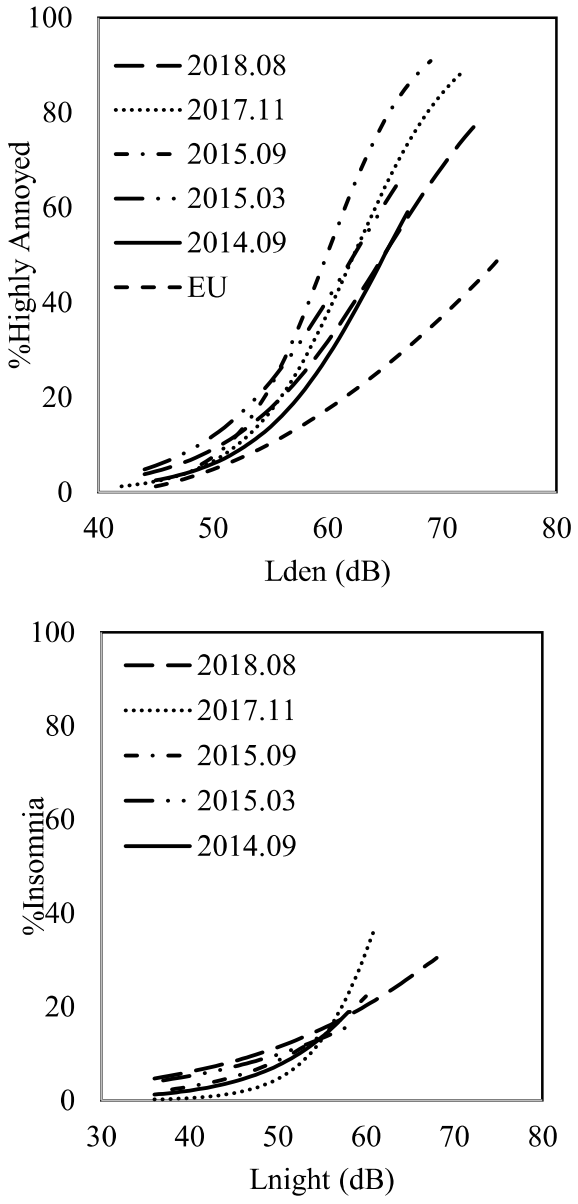


Figure 10. The relationship between noise exposure levels and (a) %HA, (b) %ISM

A multiple logistic regression analysis was done to determine the change in the relationships between noise exposure and community response, represented by the correlations between the percentage of highly annoyed respondents and L_{den}, and between ISM and L_{night}, moderated by the effect of the noise exposure change, residential factors which listed in Table 8, and personal traits such as sex, age, and sensitivity to noise. The noise exposure change was represented by the difference in noise levels between the after-change surveys and those measured in the first survey (before the change) ΔL_{den} and ΔL_{night} categories in form of dummy variables.

Table 8. Multiple logistic regression of annoyance and insomnia among five surveys

Item	Category	Estimate	Std Error	p-value	Odds ratio	Lower 95%	Upper 95%
Annoyance							
Intercept		-14.863	0.840	<.0001*			
L_{den}		0.208	0.013	<.0001*	1.231	1.264	0.812
ΔL_{den}	1st Survey						
	ΔL_{den} <=0, 2nd&3rd Surveys	0.579	0.143	<.0001*	1.785	1.349	2.360
	ΔL_{den} >0, 2nd&3rd Surveys	2.199	0.189	<.0001*	9.013	6.217	13.065
	ΔL_{den} <=0, 4th&5th Surveys	0.289	0.229	0.2070	1.334	0.852	2.089
	ΔL_{den} >0, 4th&5th Surveys	1.305	0.307	<.0001*	3.686	2.020	6.727
Sex	Male						
	Female	0.139	0.100	0.1649	1.149	0.944	1.399
Age	<=60s						
	>60s	-0.064	0.137	0.6387	0.938	0.717	1.226
Noise sensitivity	Not sensitive						
	Sensitive	1.885	0.108	<.0001*	6.589	5.335	8.136
Length of residence	>5 years						
	<=years	-0.417	0.168	0.0133*	0.659	0.474	0.917
Floor area	>100m2						
	<=100m2	-0.043	0.108	0.6911	0.958	0.775	1.184
Sound insulation	Good						
	Not good	0.361	0.105	0.0006*	1.435	1.169	1.762
Insomnia							
Intercept		-6.205	0.694	<.0001*	1.045	1.018	1.073

L_{night}		0.044	0.014	0.0012*	3.282	1.614	6.822
ΔL_{night}	1st Survey						
	ΔL_{night} <=0, 2nd&3rd Surveys	0.279	0.334	0.4039	1.322	0.687	2.543
	ΔL_{night} >0, 2nd&3rd Surveys	0.923	0.223	<.0001*	2.518	1.627	3.895
	ΔL_{night} <=0, 4th&5th Surveys	0.125	0.423	0.7680	1.133	0.494	2.597
	ΔL_{night} >0, 4th&5th Surveys	1.075	0.301	0.0004*	2.930	1.624	5.287
Sex	Male						
	Female	0.410	0.129	0.0015*	1.507	1.170	1.940
Age	<=60s						
	>60s	0.120	0.166	0.4711	1.127	0.814	1.561
Noise sensitivity	Not sensitive						
	Sensitive	1.182	0.167	<.0001*	3.261	2.351	4.525
Length of residence	>5 years						
	<=years	-0.139	0.231	0.5483	0.870	0.553	1.370
Floor area	>100m2						
	<=100m2	-0.146	0.139	0.2931	0.864	0.659	1.134
Sound insulation	Good						
	Not good	0.342	0.132	0.0097*	1.408	1.086	1.826

According to the results of logistic regression analysis shown in Table 19, the noise change and survey factor represented by the four dummy variables significantly affected the prevalence of annoyance and ISM except the category of "ΔL_{den} <=0, 4th&5th Surveys" in the estimation for annoyance and "ΔL_{night}<=0 of 2nd&3rd Surveys" and "ΔL_{night}<=0 of 4th&5th Surveys" in the estimation for ISM. The significant associations were found between L_{den} and annoyance and between L_{night} and ISM. The personal and residential factors such as noise sensitivity, length of residence, and the evaluation of sound insulation had a significant effect on the prevalence of annoyance. Meanwhile, respondents' sex, noise sensitivity and the evaluation of sound insulation had a significant effect on the prevalence of ISM. Similar to high blood pressure, the prevalence of annoyance and ISM were significantly affected by the noise sensitivity factor.

5. CONCLUSION

The number of flights operated and the living conditions in residential areas around Noi Bai International Airport (NBIA) have changed significantly in the past years due to the rapid development of air transport and the economy in Vietnam. In this study, the responses obtained in the follow-up surveys are higher than those obtained before the opening of the new terminal at the end of 2014 at the same noise level. Exposure-response relationships established in the follow-up studies were found to be lower than the relationships established in the surveys in 2015 after the step-change and locate closer to the relationship established in the survey before the step change occurred but significantly higher than that in the EU position paper. In other words, though the change effect due to the step change seems to decline over time but still stays higher than that of the steady state at the same noise exposure levels. Comparisons of respondents with insomnia ratios at different noise level ranges showed that there is a significant exposure-response relationship was found between insomnia and night-time noise levels. Non-acoustical factors such as noise sensitivity, sound insulation ability of the house, and length of residence were found to moderate the respondents' annoyance, insomnia. These suggest that improvement of residence quality and a restriction on nighttime flight operation should be considered to protect the health of the residents living around airports in Vietnam.

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References

1. Hansell AL, Blangiardo M, Fortunato L, Floud S, de Hoogh K, Fecht D, Ghosh RE, Laszlo HE, Pearson C, Beale L, Beevers S, Gulliver J, Best N, Richardson S, Elliott P et al., Aircraft noise and cardiovascular disease near Heathrow airport in London: small area study, British Medical Journal, Vol: 347, 2013.
2. Airports Council International (2018), World Airport Traffic Forecasts 2018–2040.
3. Nguyen T.L., Yano T., Nguyen H.Q., Nishimura T., Fukushima H., Sato T., Morihara T., and Hashimoto Y., Community response to aircraft noise in Ho Chi Minh City and Hanoi. Applied Acoustics, 72, pp.814-822, 2011.
4. Nguyen T.L., Nguyen T.L., Morinaga M., Yokoshima S., Yano T., Sato T., and Yamada I., "Community response to a step change in the aircraft noise exposure around Hanoi Noi Bai International Airport", J. Acoust. Soc. Am. 143(5), 2901-2912, (2018).

5. Thu Lan Nguyen, Bach Lien Trieu, Thanh Loc Bui, Takashi Yano, Yasuhiro Hiraguri, Makoto Morinaga, Takashi Morihara, and Thao Linh Nguyen, Long term follow-up study of community response to step-change in aircraft noise exposure around Noi Bai International Airport, in Proc. Inter–Noise 2018, Chicago.
6. H. M. E. Miedema, H. Vos, "Demographic and attitudinal factors that modify annoyance from transportation noise," J. Acoust. Soc. Am. 105, 3336-3344 (1999).
7. R. Guski, "Community response to environmental noise", Chap. 4 in Environmental Urban Noise edited by A. Garcia, WIT Press, Southampton UK, (2001).
8. European Commission (2002). "Position paper on dose response relationships between transportation noise and annoyance," EU's Future Noise Policy WG2–Dose/Effect
9. ISO/TS 15666 (2003). "Acoustics—assessment of noise annoyance by means of social and socio-acoustic surveys".
10. Fields, J. M.; de Jong, R. G.; Gjestland, T.; Flindell, I. H.; Job, R. F. S.; Kurra, S.; Lercher, P.; Vallet, M.; Yano, T.; Guski, R.; Felscher-Suhr, U.; Schumer, R.; Standardized general-purpose noise reaction questions for community noise surveys: research and a recommendation. J. Sound Vibr., 242, 2001, pp. 641-679.
11. Yano, T & Ma, H 2004, 'Standardized noise annoyance scales in Chinese, Korean and Vietnamese' Journal of Sound and Vibration, vol 277, no. 3, pp. 583-588
12. Integrated Noise Model (INM) Version 7.0 Technical Manual, Office of Environment and Energy, Federal Aviation Administration, Washington DC, USA (2008).
13. Lan T. Nguyen; Yano, T.; Huy Q. Nguyen; Community response to aircraft noise around three airports in Vietnam, Proc. Mtgs. Acoust. 15, 040003 (2012)
14. European Commission (2002). "Position paper on dose response relationships between transportation noise and annoyance," EU's Future Noise Policy WG2–Dose/Effect
15. Nguyen, T., Trieu, B. L., Yano, T., Morihara, T., Hiraguri, Y., & Morinaga, M. (2019). Effects of changes in operational and residential factors on public health and reactions at the vicinity of Noi Bai International Airport, ICA 2019,, Aachen, Germany.
16. Nguyen, T. L., Trieu, B. L., Hiraguri, Y., Morinaga, M., Morihara, T., & Yano, T. (2020). Effects of changes in acoustic and non-acoustic factors on public health and reactions: follow-up surveys in the vicinity of the Hanoi Noi Bai international airport. International Journal of Environmental Research and Public Health, 17(7), 2597.

CHAPTER 4: SOCIO-ACOUSTIC AND HEALTH SURVEYS ON RESIDENTS AROUND TAN SON NHAT INTERNATIONAL AIRPORT

**This chapter has been reconstructed and written based on references [13] and [29].*

1. INTRODUCTION

The European Ministerial Conference on Environment and Health was held in Parma in 2010 and decided to develop new guidelines on noise. In response, the World Health Organization (WHO) has conducted a systematic review [1-4] of the effects of environmental noise and announced the results in the Environmental Noise Guidelines for the European Region (2018) [5]. It is strongly recommended to reduce the aircraft noise level to 45 dB L_{den} (Day-evening-night-weighted sound pressure level) or less and 40 dB L_{night} (Nighttime equivalent continuous sound pressure level) or less to protect the health of the residents. However, although the recommended values were derived using data from around the world, most of them are from Europe and North America. Besides, European and American studies have reported that people's reaction to aircraft noise has become severer year by year [6], and Brown et al. conducted a systematic review of transport noise interventions and their impacts on health (2017). The review has shown that there is an overreaction to noise [4]. Most of these are also based on the results of research conducted in developed countries [4]. The recent research on the change due to the opening of a new terminal building at Noi Bai Airport at the end of 2014, shows that the responses obtained several years later are higher than those obtained before the change took place under the same noise level. However, it seems that the change effect due to the operational change is observed to decrease in the follow-up study with regard to annoyance and remains the same with regard to insomnia [7,8]. Further studies in developing countries are needed to determine these findings.

This paper presents an investigation conducted around TIA in August 2019. By surveying the same areas as the 2008 study [10], this research acts as a follow-up examination of the community response to noise after 11 years. The number of flights at present has tripled compared to that of 2008. This study is also an investigation of the situation before the change due to the new airport takes place. Since the number of flights and noise exposure around TIA will gradually decrease after LT came into operation in 2023, this survey will provide the primary data for continuous research on change effects for decades to come. This research project aims at answering the following questions: (1) Is there a secular change in the community reaction due to increase/decrease in exposure to aircraft noise; (2) Is the WHO's guidelines obtained based on the data of developed countries applicable to developing countries.

In December 2019, the corona pandemic first appeared, and the peak period of the Corona pandemic was between March and early May, making the aviation industry

seriously affected. As the number of new infections is increasing exponentially across the globe, the number of flights also decreases in the opposite direction. This chapter also compares the community response from three surveys conducted in 2019 (before the Corona pandemic) and 2020 surveys (after the corona pandemic). The 2020 study acts as a follow-up test of the community's response to post-Corona epidemic noise by surveying areas similar to the 2019 study 2.4 times that of 2019. This research project aims to answer the following questions: (1) Is there been a secular change in the community's response to aircraft noise exposure being reduced? (2) Investigating the relationship between aircraft noise exposure and general health.

2. RESEARCH METHODS

2.1. Socio-acoustic survey on community response to aircraft noise in Ho Chi Minh City in 2008

Survey sites: Ten residential areas were selected around Tan Son Nhat Airport, including eight sites under the landing and takeoff paths of aircraft and two other sites lying to the north and south of the runway (see Figure 11). The site selection was intended to reflect the aircraft noise exposure covering locations at various distances from and in directions relative to the airport. Because this study was intended to investigate aircraft noise both as a single and as a combined source, all the sites except Sites 9 and 10 were selected from residential areas that had roads passing through them. The houses facing the roads were selected for the combined noise survey, and those set back from the road were selected for single aircraft noise surveys. Only the data from the single aircraft noise surveys was used for analysis in this paper.

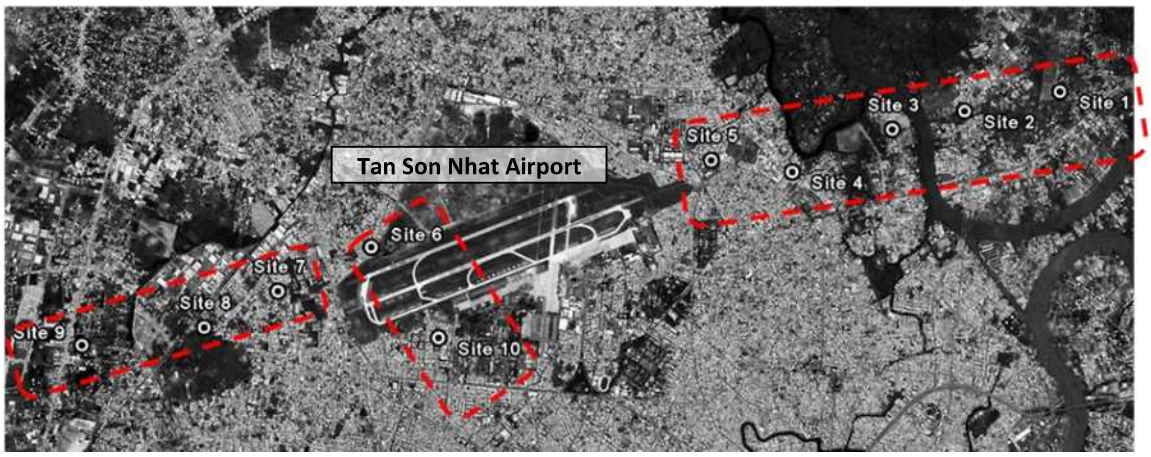


Figure 11: Map of survey sites in 2008 (Copyright by Google Earth)

Questionnaire surveys: Community response to aircraft noise were investigated around Tan Son Nhat Airport in Ho Chi Minh City from August to September 2008.

The surveys were conducted by face-to-face interviews during the daytime on weekends. To guarantee a balance of males and females and generations, fathers, mothers, and others whose age was over 18 were selected. The design of the questionnaire followed Technical Specification ISO/TS 15666, in which an internationally standardized interview method for the assessment of noise annoyance by socio-acoustic surveys is described [11]. That is, the questionnaire is labeled as "Survey on Living Environment." The questionnaire was not only on noise but also various components of the living environment. The content of the questionnaire contained queries on housing, neighborhood environment, noise annoyance, interference with daily activities, sensitivity, attitude towards transportation, and socio-demographic items. In the questionnaire, two scales—5-point verbal and 11-point numeric—constructed according to the ICBEN (International Commission on Biological Effects of Noise) method were used to evaluate the respondents' noise annoyance [12].

Noise measurements: Since there was a lack of available noise data in Vietnam, all noise databases for this study were compiled using field measurements. Noise measurements were performed in Ho Chi Minh City from September 22 to 29, 2008. Aircraft noise exposure was measured every 1 s for seven successive days by using sound level meters (RION NL-21 and NL-22) in the areas of the single noise surveys. Microphones covered with omni–weather wind screens were positioned on the rooftops of the highest houses in the areas—1.5 m above the roofs and at least 1 m away from any other reflecting surface. Flight numbers and conditions were obtained from the Airport Office.

2.2. A follow-up investigation on the impact of aircraft noise around Tan Son Nhat Airport in 2019

Survey sites: In the follow-up survey, a total of twelve sites, including ten sites in the 2008 Survey and two newly selected sites north of the airport as control areas to compare with the noise-affected areas, were investigated.

Questionnaire surveys: Face-to-face interviews were performed in August 2019, using a questionnaire that includes the 2008 Survey's items, which are mainly about general annoyance and impacts on sleep. In addition, data on the health status of residents were collected to evaluate the effects of aircraft noise around TIA. This paper will focus on analyzing and comparing similar data between the two surveys.

Noise measurements and estimation: Noise measurement and flight route data collection for estimation noise contours around the airport were conducted at the same time. The noise measurement was conducted for one week, from August 4 to August 11, applying the same method with the 2008 survey. Flight route data were collected in the period from August 12 to August 16, 2019, with an ADS-B receiver installed in the airport office building at the location having good visibility to obtain flight route information in every one-second interval. The relationship between the obtained noise

exposure and the residents' reaction was clarified for the data of the 2019 survey, and the change in the residents' reaction in the 11-year span was examined by comparing with the exposure-response relationship obtained in 2008.

Figure 12: Map of survey sites in 2019 (Copyright by Google Earth)

2.3. Self-reported health status of residents associated with the reduced aircraft noise around Tan Son Nhat Airport after the epidemic outbreak survey

Survey sites: Same as survey conducted in August 2019

Questionnaire surveys: Survey 2 was conducted by re-visiting residents who participated in Survey 2019. Furthermore, residents' health status data were collected to assess the effects of aircraft noise around TSN airport; therefore, some duplicate questions were excluded. In Survey 2020.09, the interviews were conducted with other residents who lived in the same area as participants of Surveys 2019 and 2020.06. The main noise effect considered in this study is residents' self-reported health status under the reduction in the number of flights during the Corona pandemic. Stress, morbidity, salt and alcohol intake, smoking habits, and exercise routine are considered variables that moderate the health outcomes.

Noise estimation: The noise levels were estimated by updating the noise contour map of Survey 2019 using the TSN airport's operation data in corresponding periods in 2020 updated on website FlightRadar24.com.

2.4. Health survey

Face-to-face interviews were conducted to obtain data on community responses and health indicators. The questionnaire items were composed referring Technical Specification ISO/TS 15666, the Total Health Index or Todai Health Index (THI), Komo-Ise Study health and lifestyle questionnaire, The Center for Epidemiologic Studies Depression Scale Revised's questionnaire, Kadena Study insomnia and

hypertension questionnaire, and questionnaires to identify insomnia and hearing loss [13]. The investigation focused on not only noise-effect responses but also the status of residents' health, including both mental and physical health indicators.

Table 9: Questionnaire items

Question number	**Items**	
	1. Personal factors	
Q12~Q14	Coping and attitudes	Airplane flying through; opening windows in seasons; personal sensitivity to weather and environmental factors
Q15	Occupation	
Q34~36	Income and education	Number of vehicles; monthly income; educational background
Q1~Q5, Q16, F1~F9	2. Residential factor	Type of house; length of residence; ground floor area; area preference; self-assessed housing quality; duration staying at home; housing structure
Q6, Q7	3. Annoyance	Annoyed factors: airplane, traffic, factories, neighbours, vibration, exhausted fumes, smoke discharged from factories, odors
Q8~Q11	4. Effects on sleep	Sleep trouble; sleep duration; self-rated sleep quality; insomnia
	5. Health indexes	
Q17	Self-reported health status	
Q18	Life satisfaction	
Q19	Stress	
Q20	Health examination's frequency	
Q22, Q23	Morbidity	Heart trouble, high blood pressure or hypertension, hyperlipaemia, stroke, asthma, diabetes, cancer, depression or neurosis; health conditions of biological father and mother
Q24~Q26	Salt intake	Frequency of salt intake; salty food: pickles, fish sauce, soy sauce, braised fish

Q27~Q30	Nutrition, alcohol, smoke, exercise routine	
Q31	Hearing ability	Difficulty in hearing conversation; deafness, tinnitus; hearing ability of left ear and right ear
Q32	Depression	
Q33	Malaise	Questions related with malaise was only asked out of all 130 questions in THI.
Q37, Q38	Height, weight, blood pressure	

In the questionnaire, two scales—5-point verbal and 11-point numeric—constructed according to the ICBEN (International Commission on Biological Effects of Noise) method were used to evaluate the respondents' noise annoyance [14,15]. Respondents with insomnia are defined as who have trouble with their sleep and "sleepy during daytime and cannot work well more than three times a week" and have at least one of the other items more than three times a week.

Stress, health check's frequency, morbidity, salt intake, drinking alcohol and smoking habits, and exercise routine are considered as confounding factors of high blood pressure.

THI encompasses 130 questions about lifestyle, personal preference, physical symptoms, and mental-condition-related complaints [16]. For example, the answer for the question "Do you have headaches?" is one of the three response alternatives: (1) often; (2) sometimes; or (3) hardly ever or never, to which Score of 1, 2, or 3 point(s) is assigned, respectively. In this study, 20 questions related with malaise were selected from a total of 130 items. A weak correlation between aircraft noise and malaise was suggested in a previous study [17]. The scores obtained from all the questions are summed to form a total score, ranging from 20 to 60 points.

An inquiry on depression was referred from the Center for Epidemiologic Studies Depression Scale (CESD) created in 1977 [18]. The 20 items in the CESD-R scale measure symptoms of depression in nine different groups, as defined by the American Psychiatric Association Diagnostic and Statistical Manual (DSM-5).

Figure 13 shows the question format used to investigate hearing problems, including screening questions and self-rating scales [19]

How much difficulty do you have hearing and understanding words in a normal conversation (even with a hearing aid)?

1. A great deal 2. Some 3. A little 4. None

1	Do you have deafness in one or both ears?	Yes	Sometimes	No
2	Do you now have any other trouble hearing with one or both ears?	( )	( )	( )
3	Do you now have tinnitus or ringing in one or both ears?	( )	( )	( )
4	Do you now use a hearing aid?	( )	( )	( )

5. Which statements best describe your hearing in your LEFT ear (without hearing aid)?

1. Good 2. Little trouble 3. A lot of trouble 4. Deaf

6. Which statements best describe your hearing in your RIGHT ear (without hearing aid)?

1. Good 2. Little trouble 3. A lot of trouble 4. Deaf

Figure 13: Question format asking the symptoms of hearing loss

In addition to the question of self-reported blood pressure, blood pressures of respondents in the questionnaire survey were measured with the blood pressure meter (OMRON HEM-6324T). The OMRON wrist monitor uses the oscillometric method of blood pressure measurement.

3. RESULTS

3.1 Demographic data of the surveys' respondents

Table 10: Demographic data of the respondents in all the surveys

		2008	**2019 Aug**	**2020 Jun**	**2020 Sep**	**Vietnam Census* (2019)**
Number of respondents		880	502	145	519	
Response rate (%)		88.0	60.3	28.9	68.6	
Gender	Male	47	46.2	46.5	49.2	49.9
	Female	53	53.8	53.5	50.8	50.1
Age	<60 years old	89	81.9	70.6	89.9	88.1
	≥60 years old	11	18.1	29.4	10.1	11.9
Length of residence	0-5 years		51.1	27.7	40.0	
	Above 5 years		48.9	72.3	60.0	
Occupation	Employment	45	53.6	37.4	40.0	55.5
	Student, housewife, retired, unemployed	55	46.4	62.6	60.0	44.5

(*): General Statistics Office in Vietnam, "Statistical Date" http://www.gso.gov.vn/default_en.aspx?tabid=491

A total of 880 502 and 145 and 519 responses were obtained in the 2008, August 2019, June 2020, and September 2020 surveys, respectively. Demographic data of the respondents of the surveys summarized in Table 10. A higher response rate was achieved in the 2008 survey. Among surveys, the proportions of female respondents are slightly higher than those of males. The respondents aged over 60 years accounted for 11% and 18% of the total number of respondents in the 2008 and 2019 surveys, respectively. These proportions are consistent with Vietnam's young population structure. The proportion of employed respondents in the follow-up survey is higher than that in the 2008 survey.

3.2 Increase in number of flights and noise levels

The numbers of flights operated and passengers at TIA have increased significantly over the past eleven years. Table 11 shows the average number of daily flights operated by TIA in the two survey periods. The number of flights observed in 2019 was about 3.3 times more than that in 2008. It is worth noting that the number of nighttime flights in the 2019 survey increased 4.3 times compared to the 2008 survey. Especially, the number of flight events at night occupied about 18.3% of the total number of flights in 2019, while this number is 13.7% in 2008 survey. The increase of nighttime flights is due to the rapid growth of low-cost carriers which prefer operation at nighttime (22:00–6:00) for a cost-saving benefit. This trend seems to reduce the components of flight in the day and evening. The same trend was observed in Hanoi Noi Bai Airport. Compared to 2019 survey, the number of flights operated at TSN Airport in a day have decreased by 43% in 2020 Jun and 59% in 2020 Sep due to the pandemic. There is no difference in number of events in nighttime period between two surveys conducted in 2020 while in daytime, 2020.06 survey has 1.5 times as many as 2020.09 survey.

Table 11: Average number of aircraft noise events

Time Period	**Operation Modes**	**2008**	**2019 Aug**	**2020 Jun**	**2020 Sep**
Day (6:00–18:00)	Arrival	67	214	140	86
	Departure	82	244	166	121
	Total	149	458	306	207
Evening (18:00–22:00)	Arrival	28	73	45	35
	Departure	16	64	23	20
	Total	44	137	68	55
Night (22:00–6:00)	Arrival	17	77	20	19
	Departure	14	56	19	18
	Total	31	133	39	37
All day	Arrival	112	364	205	140
	Departure	112	364	208	159
	Total	224	728	413	299

Table 12 shows the noise levels obtained during each survey period. In Table 3, the noise levels in the 2008 survey are measured values, and that in the 2019 survey are predicted values. L_{den} obtained at the ten sites (Sites 1-10) investigated in both surveys ranged from 53 to 71 dB in 2008 and from 63 to 81 dB in 2019. These ranges are from 45 to 62 dB in 2008 and from 55 to 74 in 2019 with noise exposure at night, L_{night}. Notably, among investigated 10 sites, L_{den} and L_{night} were found to increase10 dB and more at four sites, Sites 2, 3, 5, and 6. Out of which, three sites are on the landing side, only one on the takeoff side.

Table 12: L_{den}[a], L_{night}[b], and their changes from the 2008 survey to 2019 survey

Site	L_{den}[a]				L_{night}[b]			
	2008	2019 Aug	2020 Jun	2020 Sep	2008	2019 Aug	2020 Jun	2020 Sep
1	59	65.5	60.7	59.8	52	57.9	51.5	52.0
2	53	64.3	61.1	60.9	45	56.5	51.9	53.1
3	55	63.6	60.0	59.0	48	55.9	50.8	51.2
4	57	62.2	57.3	56.5	49	54.5	48.1	48.7
5	71	80.7	76.0	73.4	62	73.4	66.9	65.8
6	64	74.5	70.5	69.0	56	67.0	61.4	60.7
7	66	69.0	64.8	64.2	58	61.1	55.7	55.9
8	62	66.0	61.7	61.7	55	58.2	52.7	53.7
9	62	63.8	58.9	59.6	54	56.8	49.8	51.6
10	60	66.8	62.1	65.0	53	59.2	53.5	57.2
11		47.3	42.8	43.1		39.7	34.1	35.5
12		45.3	41.2	41.2		37.7	32.5	33.6

[a] Day-evening-night-weighted sound pressure level

[b] Nighttime equivalent continuous sound pressure level

3.3. Investigated factors in survey 2019

3.3.1 Confounding factors

In addition to noise levels (main considered factor), the confounding factors were assumed to have influence on annoyance, sleep disturbance, blood pressure, hearing ability, physical and mental health.

The multiple logistic regression model was analysed to examine the correlation among the community responses, the health status of respondents, and aircraft noise exposure around TIA, as shown in Table 13. The corresponding evaluation of these factors (except noise levels) were categorized into "positive" and "negative" and were given value of "0" and "1", respectively. For example, age≥60, length of residence≤5 years, floor area≤50m^2, BMI>29 (obesity) were assigned as "1".

In Table 13, the chi-squared test was applied to determine whether the difference distribution among noise level ranges (L_{den}) was significantly affected by these confounding factors. The significant difference was found with models of residents' life satisfaction (p<.0001), morbidity, and exercise routine (p<.01).

Table 13: The response rate of the factors at different noise level ranges

Noise range L_{den} [dB]	**<55**	**55-60**	**60-65**	**65-70**	**>70**	**p-value**
Number of responses	68	10	160	200	64	
Gender (Female) [%]	45.6	40.0	58.1	49.5	62.5	0.1129
Age≥60 [%]	17.6	20.0	19.4	17.5	15.6	0.9015
Length of residence≤5 years [%]	33.8	40.0	36.9	46.0	40.6	0.0827
Floor area≤50 m^2 [%]	70.6	70.0	38.8	54.0	68.8	0.8366
Area preference (Dislike) [%]	1.5	0.0	0.0	0.0	3.1	0.6959
Life satisfaction (Dissatisfied) [%]	8.8	10.0	16.3	10.5	32.8	<0.0001*
Noise sensitivity (Sensitive) [%]	10.3	20.0	6.3	11.5	56.3	0.4370
Self-rated health (Fair, Poor) [%]	30.9	30.0	25.0	16.5	28.1	0.7294
Stress (Quite a bit, extremely stressful) [%]	7.4	0.0	10.6	6.0	7.8	0.1039
Morbidity [%]	5.9	40.0	24.4	17.5	25.0	0.0032*
BMI>29 (Obesity) [%]	4.4	0.0	3.1	0.5	3.1	0.1770
Salt intake (every meals) [%]	19.1	30.0	54.4	34.5	26.6	0.5487
Drinking alcohol (At least 1 day a week) [%]	4.4	10.0	10.0	10.0	4.7	0.2857
Smoking (everyday) [%]	14.7	0.0	16.3	13.5	6.3	0.3532
Doing exercises (less than 2 times a week) [%]	57.4	80.0	56.3	67.5	59.4	0.0032*
Income<10 millions VND [%]	32.4	60.0	35.0	36.5	42.2	0.2496

3.3.2 Annoyance

Figure 13 shows the relationship between noise levels, L_{den}, and the percentage of highly annoyed respondents, %HA, derived from the results of the logistic regression analysis considering only L_{den} as an independent variable. The flat trend of the curve indicates that the weak correlation between L_{den} and %HA. When considering the

confounding factors, there is still a positive correlation between aircraft noise levels and percent highly annoyance, as shown in Table 14.

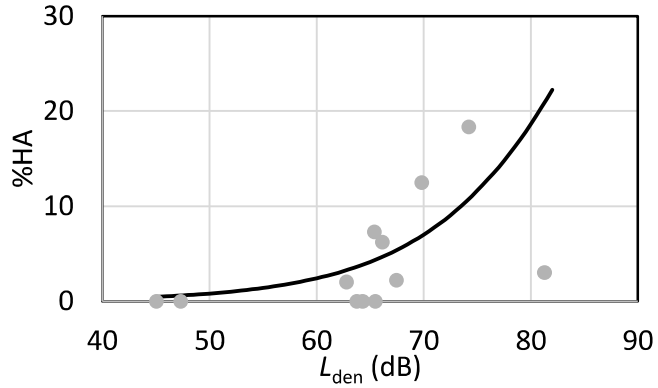


Figure 13: The relationship between noise levels and the percentage of high annoyance (R^2=0.0698, AICc=177.661, OR=0.730)

Table 14: The multiple logistic regression for annoyance (R^2=0.1340, AICc=164.979 AUC=0.729)

Term	**Estimate**	**Std Error**	**p-value**	**Odds ratio**	**Lower 95%**	**Upper 95%**
Intercept	-8.589	2.437	0.0004*			
L_{den}	0.079	0.036	0.0267*	1.082	1.009	1.161
Gender	0.247	0.483	0.6089	1.280	0.497	3.301
Age	0.953	0.493	0.0534	2.592	0.986	6.815
Length of residence	0.108	0.481	0.8230	1.114	0.434	2.859
Floor area	-0.704	0.657	0.2840	0.495	0.137	1.793
Noise sensitivity	0.882	0.486	0.0695	2.415	0.932	6.259

3.3.3 Sleep effects

There were 128 out of 471 respondents answering the question about sleep effects showed to have sleeping problems. Approximately 29% of respondents answered that the aircraft noise affected their sleep quality. However, there were only 11 responses categorized as insomnia. Figure 14 shows the relationship between L_{night} and the percentage of insomnia (%ISM) derived from the results of the logistic regression analysis considering only L_{night} as an independent variable. The low relationship curve, as shown in Figure 7, indicates that sleep effects due to aircraft noise around TIA was found to be moderate despite the high levels of noise exposure at the night time. The result of multiple logistic regression for insomnia in Table 15 shows that there is no significant association between aircraft noise levels and the percentage

of insomnia. Among analysed confounding factors, noise sensitivity, and sleep disturbance were found to be significantly correlated.

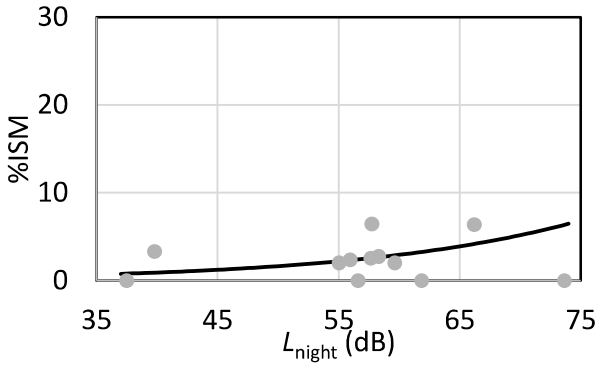


Figure 14: The insomnia rate and the correlation with noise levels (R^2=0.0195, AICc=113.855, AUC=0.653)

Table 15: The multiple logistic regression for insomnia (R^2=0.2064, AICc=89.496 AUC=0.816)

Term	**Estimate**	**Std Error**	**p-value**	**Odds ratio**	**Lower 95%**	**Upper 95%**
Intercept	-6.689	2.793	0.0166*			
L_{night}	0.039	0.046	0.3938	1.040	0.950	1.139
Gender	-0.121	0.707	0.8639	0.886	0.221	3.545
Age	0.811	0.702	0.2479	2.250	0.569	8.897
Length of residence	-0.173	0.703	0.8052	0.841	0.212	3.336
Floor area	-1.006	1.111	0.3650	0.366	0.041	3.225
Noise sensitivity	2.319	0.730	0.0015*	10.162	2.429	42.524

3.3.4 High blood pressure

Approximately 26.2% of respondents have an average blood pressure index reaching the index of hypertension stage 2. High blood pressure stage 2 is the second high blood pressure category in which the systolic number is 140mmHg or higher, or the diastolic number is 90mmHg or more. Figure 8 shows the relationship between L_{den} and the prevalence of high blood pressure (%HBP) derived from the results of the logistic regression analysis considering only L_{den} as an independent variable. Also, Table 7 shows the result of the multiple logistic regression analysis with the other factors. The result shown in Figure 15 and Table 16 indicates that the aircraft noise level L_{den} has no significant effect on %HBP. However, non-acoustical factors such as obesity and drinking alcohol habits significantly affect high blood pressure. This result

is consistent with the findings of previous medical studies of blood pressure and hypertension [16,17].

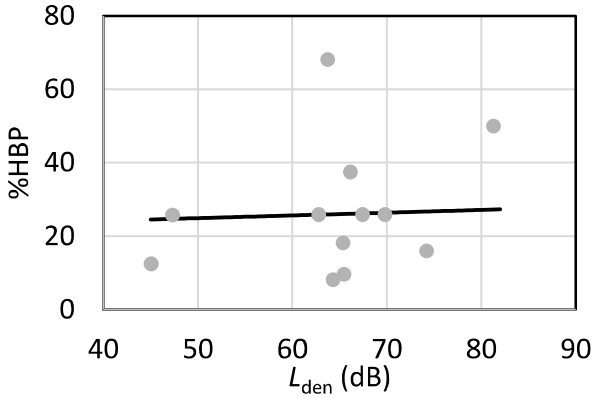


Figure 15: The association between noise levels and the high blood pressure rate (R^2=0.0002, AICc=524.203, AUC=0.495)

Table 16: The multiple logistic regression for high blood pressure (R^2=0.3586, AICc=123.727 AUC=0.822)

Term	**Estimate**	**Std Error**	**p-value**	**Odds ratio**	**Lower 95%**	**Upper 95%**
Intercept	0.733	3.863	0.8495			
L_{den}	-0.075	0.061	0.2134	0.927	0.824	1.044
Age	1.311	1.025	0.2010	3.709	0.497	27.656
Self-rated health	1.003	0.738	0.1743	2.726	0.642	11.584
Stress	0.946	0.646	0.1429	2.575	0.727	9.127
Morbidity	-0.703	0.600	0.2417	0.495	0.153	1.606
BMI (Obesity)	2.721	0.792	0.0006*	15.202	3.221	71.752
Salt intake	1.154	0.746	0.1216	3.171	0.735	13.674
Drinking alcohol	2.248	0.920	0.0146*	9.466	1.559	57.478
Smoking	-0.166	0.550	0.7631	0.847	0.288	2.491
Doing exercises	0.288	0.568	0.6117	1.334	0.438	4.065

3.3.5 Depression

In this study, the respondents who have symtoms of depression were defined by the Total CESD-R Score. The Score was rated based on their responses to all 20 questions, according to CESD-R score rating method [18]. The response values for each

question are: (1) Not at all or less than one day: 0 score; (2) 1-2 days: 1 score; (3) 3-4 days: 2 scores; (4) 5-7 days: 3 scores; (5) Nearly every day for 2 weeks: 4 scores.

Approximately 40% of respondents who have a total CESD-style score less than 16 across all 20 questions were identified as those who had no clinical significance.

In a group of confounding factors including residents' age, income, self-rated health, stress, and morbidity, the correlation between mental health and self-rated health, and stress were found while no association between aircraft noise exposure and self-reported depression were found (Table 17).

Table 17: The multiple logistic regression for depression

(R^2=0.0500, AICc=458.703, AUC=0.604)

Term	**Estimate**	**Std Error**	**p-value**	**Odds ratio**	**Lower 95%**	**Upper 95%**
Intercept	-0.914	1.331	0.4920			
L_{den}	0.002	0.020	0.9018	1.002	0.964	1.042
Age	0.192	0.321	0.5502	1.211	0.646	2.271
Income	0.367	0.233	0.1147	1.443	0.915	2.277
Self-rated health	0.801	0.393	0.0415*	2.229	1.031	4.816
Stress	0.703	0.288	0.0147*	2.019	1.148	3.550
Morbidity	-0.085	0.273	0.7561	0.919	0.539	1.568

3.3.6 Malaise

In this study, the respondents who have malaise were defined by the Total Health Index of an individual respondent which was rated according to a cumulative percentile distribution of the scored rated by the surveyed population. The dummy variables were obtained from the following five quintiles of the scale: D1=1 if the scale score was between the 80th and 100th percentile and D1=0 otherwise, and so on (D2, D3, D4, and D5 corresponded to 60-79, 40-59, 20-39, and 0-19 percentile classes, respectively) [16]. Then, D1=1 and D2=1 were grouped into negative responses and assigned as "1". According to the analysis of the multiple logistic regression, which accounts for confounding factors related to health, the significant correlation between aircraft noise and malaise was not found ($p>0.05$).

Table 18: The multiple logistic regression for malaise

(R^2=0.0919, AICc=208.119, AUC=0.664)

Term	**Estimate**	**Std Error**	**p-value**	**Odds ratio**	**Lower 95%**	**Upper 95%**
Intercept	-2.711	2.628	0.3022			
L_{den}	0.031	0.039	0.4187	1.032	0.956	1.114
Age	0.776	0.752	0.3021	2.172	0.498	9.475
Self-rated health	0.316	0.518	0.5413	1.372	0.497	3.786
Stress	0.679	0.466	0.1450	1.972	0.791	4.913
Morbidity	0.481	0.391	0.2181	1.618	0.752	3.482
BMI (Obesity)	0.412	0.366	0.2592	1.511	0.738	3.093
Salt intake	0.223	0.579	0.6996	1.250	0.402	3.885
Drinking alcohol	-0.888	0.640	0.1653	0.412	0.117	1.443
Smoking	0.150	0.378	0.6916	1.162	0.554	2.436
Doing exercises	0.107	0.396	0.7881	1.112	0.512	2.418

3.3.7 Hearing problems

In a total of 487 responses about hearing, there were 69 respondents confirmed to have difficulty in hearing and understanding words in normal conversation (even with a hearing aid). The number of respondents who have severe problems with the left ear, right ear, and both ears is 8, 6, and 5, respectively.

Table 19: The multiple logistic regression for hearing loss

(R^2=0.0997, AICc=252.036 AUC=0.708)

Term	**Estimate**	**Std Error**	**p-value**	**Odds ratio**	**Lower 95%**	**Upper 95%**
Intercept	-2.556	1.379	0.0639			
L_{den}	-0.009	0.021	0.6716	0.991	0.951	1.033
Age	1.142	0.367	0.0019*	3.133	1.525	6.437
Noise sensitivity	1.120	0.366	0.0022*	3.066	1.496	6.283
Income	0.272	0.351	0.4380	1.313	0.660	2.612

Some confounding factors, such as socioeconomic status or working conditions in the subgroup living closer to the noise source, could affect the results [20]. Rates of presbycusis or age-related hearing loss increase gradually as a person gets older.

Therefore, age and noise sensitivity are the variables correlated to hearing problems of the respondents. The analysis result in Table 19 shows that there is no significant association between aircraft noise levels and hearing loss.

3.4. Change effects after 11 years (2008-2019)

3.4.1. Annoyance and sleep effects

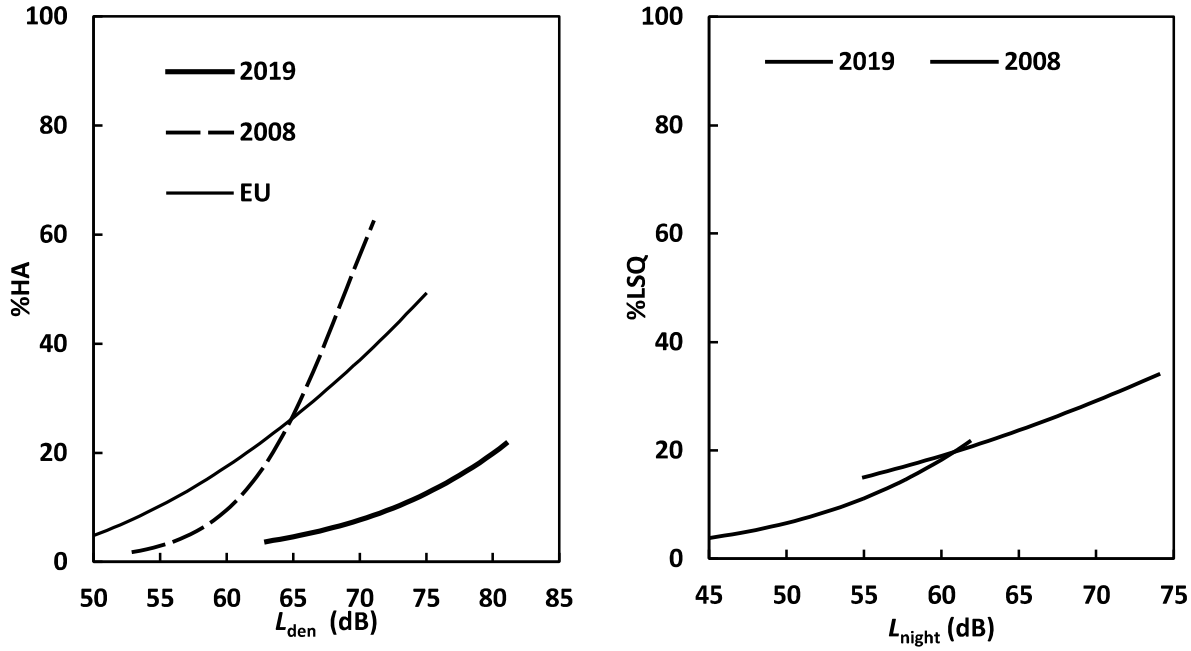
Annoyance and sleep effects are the most widely used measure of human response to noise. In both surveys, the aircraft noise-induced annoyance was represented by the percentage of respondents who were highly annoyed (% HA) defined by the percentage of respondents who chose 8, 9, or 10 out of the 11-point numerical scale (0–10) in the standardized annoyance question recommended by ICBEN [21]. In the 2019 survey, the percentage of insomnia was considered as the frequency of effects on sleep as proposed in previous studies [22-24] and was used as an indicator of the impact that flight operation during the nighttime had on sleep. However, the questionnaire on the insomnia symptom has not been used in the 2008 survey. Therefore, to compare the effect on sleep between the two studies, we used the data relating to sleep quality measured by two similar-content questions used in the two surveys.

In the 2008 study, sleep quality was assessed by a question termed "How is the status of your daily sleep?".The respondents were asked to respond to each item on a five-point scale 1: Extremely good; 2: Good; 3: Neutral; 4:Bad; 5:Extremely bad. In the 2019 survey, the wordings of the questions is: "During the past 4 weeks, how would you rate the quality of your sleep overall?" There are four alternatives for an answer: 1: Very good; 2: Fairly good; 3: Fairly bad; 4: Very bad. **Sleep effect**s of noise was represented by the percentage of respondents who had low sleep quality (% LSQ) defined by the percentage of respondents who chose "4:Bad" and "5:Extremely bad" categories in the 2008 survey and those chose "3:Fairly bad and "4:Very bad" categories in the 2019 study.

As shown in Table 20, The percentage of highly annoyed respondents at Site 5, an area of 71 dB (L_{den}) was 52% in the 2008 survey, while this number only 12% in the 2019 survey. The decrease in %HA was observed at all the sites except Sites 2 and 10. Despite having to live in a noisier environment than before, the residents around TIA seem to be more tolerant of noise. The difference trend was found for reported sleep quality. There is an increase in % LSQ at all surveyed sites except Sites 5 and 7. There is a dramatic increase in % LSQ at Sites 3 and 6, which increased from 3% and 11% in 2008 to 27% and 35% in 2019. This result was consistent with a 10 dB increase in L_{night} measured at Sites 3 and 6. However, the same trend was not observed with Sites 2 and 5, despite that L_{night} at these two sites increased 13 dB and 12 dB, respectively.

Table 20: Percentage of highly annoyed (% HA) and percentage of low sleep quality (% LSQ).

Site	*%HA*		*%LSQ*		Changes	
	2008	**2019**	**2008**	**2019**	**Δ*%HA***	**Δ*%LSQ***
Site 1	5	0	7	14	-5	7
Site 2	0	7	8	12	7	4
Site 3	7	0	3	27	-7	24
Site 4	9	2	8	18	-7	10
Site 5	52	3	27	15	-49	-12
Site 6	49	18	11	35	-31	24
Site 7	34	13	12	10	-21	-2
Site 8	11	6	9	12	-5	3
Site 9	3	0	13	22	-3	9
Site 10	1	2	2	4	1	2



(**a**) (**b**)

*Figure 16: Comparison of (**a**) L_{den}–% HA and (**b**) L_{nigh}–% LSQ relationships between the 2008 and 2019 surveys*

Logistic regression analysis was applied to establish an exposure-response relationship for each study. Figure 16 shows a comparison of (a) L_{den}–% HA and (b) L_{night}–% LSQ relationships of the two studies. The L_{den}–% HA relationship of the 2019

survey is lower than that of the 2008 survey. The exposure-response relationship established in 2008 located closer to the relationship established in the European Union Position paper [27]. The L_{night}–% LSQ relationships of the 2019 survey almost coincided with the curve drawn for the 2008 survey. The curve for the 2019 study can be considered as an extension of the 2008 curve.

3.4.2. Effects of non-acoustical factors

Non-acoustic factors were considered to influence reported aircraft noise annoyance and activity disturbance as significantly as the noise exposure level [25,26]. In this section, personal and residential factors such as noise sensitivity, length of residence, total floor area of the house, the frequency of opening windows, the area preference, and evaluation of the surrounding quietness are assumed to modify the respondents' reactions to noise. Sensitivity has been recognized as a moderator of the response to environmental noise exposure in many studies. In this study, noise sensitivity was among one of the seven items enquiring about sensitivity by a question that was termed "In daily life, climatic factors, as well as environmental conditions, affect us much, then how much are you sensitive to the following factors?" The respondents were asked to respond to each item on a five-point scale 1: Not at all; 2: Slightly; 3: Moderately; 4: Very; 5: Extremely.

The short length of residence was assumed to increase the respondents' negative reaction to aircraft noise due to insufficient time to adapt to the living environment near the airport. The respondents living in larger houses with the bedroom windows closed frequently were assumed to be less affected by noise. The average data of these factors obtained from the two surveys are summarized in Table 21.

The survey result shows the percentage of noise-sensitive respondents decreased from 26% in 2008 to 16% in the 2019 study. The rate of the length of residence that is less than five years has reduced in the 2018 survey. The respondents living in houses having floor areas less than 50m2 increased compared to the 2008 data. With the positive change in the economy, the living amenities of the residents around TIA has been improved, including the increased use of air conditioners. This improvement was indicated by the percentage of the windows opened decreased.

Table 21: Personal and residential factors in 2008 and 2019 Surveys.

Factors (%)		**2008**	**2019**
Noise sensitive	Not sensitive	73.9	83.9
	Sensitive	26.1	16.1
Length of residence ≤ 5 years	>5 years	44.8	58.3
	≤ 5years	55.2	41.7
Floor area ≤ 50 m^2	> 50 m^2	46.8	40.9
	≤ 50 m^2	53.2	59.1
Bedroom windows opened (dry season)	Rarely/Sometimes	65.2	68.8
	Often/Always	34.8	31.2
The area preference	Like/Neutral	94.3	99.5
	Dislike	5.7	0.5
The surrounding quietness	Good/neutral	84.9	90.6
	Bad	15.1	9.4

Multiple logistic regression analysis was applied to investigate the relationship between noise exposure and community response, represented by the correlations between L_{den} and the percentage of highly annoyed respondents, %HA (Table 22), and between L_{night} and %LSQ (Table 6). In this analysis, demographic factors such as sex and age, personal and residential factors listed in Table 4, and survey factor were applied to the model as influencing factors. The possible difference in community response to noise between the 2008 and 2019 study was represented by the survey factor in the form of dummy variables (2019 survey:1 and 2008 survey:0).

Significant associations were found between L_{den} and annoyance; and between L_{night} and LSQ. Survey factor and noise sensitivity had a significant effect on the prevalence of annoyance. Meanwhile, survey factor, respondents' age, noise sensitivity, and the area preference had a significant effect on the prevalence of LSQ. The difference in reaction to noise of the residents between 2008 and 2019 study represented by the survey factor significantly affected the prevalence of annoyance and LSQ. It is worth noting that the coefficient of the survey factor is positive in the model of annoyance but negative in the models of LSQ. The rate of negative response to noise around TIA increased in terms of general annoyance but decreased in term of low sleep quality in 2019 compared to 2008.

Table 22: Multiple logistic regression for annoyance (HA)

Item	Category	Estimate	Std Error	*p*-Value	Odds Ratio	Lower 95%	Upper 95%
Annoyance							
Intercept		-13.776	1.580	<.0001			
L_{den} [a]		0.187	0.023	<.0001	1.206	1.153	1.262
Survey	2008 Survey				1		
	2019 Survey	0.997	0.157	<.0001	7.349	3.966	13.615
Sex	Male				1		
	Female	-0.026	0.101	0.7975	0.950	0.639	1.410
Age	≤ 60 years				1		
	> 60 years	-0.291	0.156	0.0616	0.559	0.303	1.029
Noise sensitivity	Not sensitive				1		
	Sensitive	-0.752	0.105	<.0001	0.222	0.147	0.336
Length of residence	>5 years				1		
	≤ 5years	-0.166	0.106	0.1152	0.717	0.474	1.085
Floor area	> 50 m^2				1		
	≤ 50 m^2	-0.020	0.103	0.8503	0.962	0.641	1.443
Frequency of open windows	Rarely/Sometimes				1		
	Often/Always	-0.012	0.112	0.9123	0.976	0.629	1.514
Area preference	Like				1		
	Dislike	-0.243	0.186	0.1923	0.615	0.297	1.277
Quietness	Good				1		
	Bad	0.094	0.129	0.4659	1.207	0.728	2.004

* Odds ratio in 1 dB change.

[a] Day-evening-night-weighted sound pressure level

Table 23: Multiple logistic regression for low sleep quality (LSQ)

Item	Category	Estimate	Std Error	*p*-Value	Odds Ratio	Lower 95%	Upper 95%
Low sleep quality							
Intercept		-3.931	1.199	0.001			
L_{night} [a]		0.058	0.020	0.0044	1.060	1.018	1.103
Survey	2008 Survey				1		
	2019 Survey	-0.393	0.116	0.0007	0.455	0.289	0.717
Sex	Male				1		
	Female	-0.089	0.098	0.3638	0.838	0.571	1.228
Age	≤ 60 years				1		
	> 60 years	-0.514	0.127	<.0001	0.358	0.217	0.590
Noise sensitivity	Not sensitive				1		
	Sensitive	-0.518	0.111	<.0001	0.355	0.230	0.547
Length of residence	>5 years				1		
	≤ 5years	0.026	0.100	0.7937	1.054	0.711	1.562
Floor area	> 50 m^2				1		
	≤ 50 m^2	-0.131	0.100	0.1923	0.770	0.520	1.141
Frequency of open windows	Rarely/Sometimes				1		
	Often/Always	-0.173	0.107	0.1073	0.708	0.465	1.078
Area preference	Like/Neutral				1		
	Dislike	-0.423	0.191	0.0264	0.429	0.203	0.905
Quietness	Good/Neutral				1		

Bad	-0.228	0.126	0.0711	0.634	0.386	1.040

* Odds ratio in 1 dB change.

[a] Nighttime equivalent continuous sound pressure level

The exposure-response relationships found in Tables 23 and 24 are presented in the form of graphs in Figure 17. Figure 17a compares the L_{den}–% HA relationships and Figure 17b compares the L_{night}–% LSQ relationships in the 2008 and 2019 surveys, adjusted by the moderators listed in Tables 23 and 24. The adjusted curve of 2019 survey become higher than the curve drawn for the 2008 survey in the case of annoyance. On the other hand, in the case of low sleep quality, the adjusted curve of 2019 study located lower than the curve drawn for the 2008 survey.

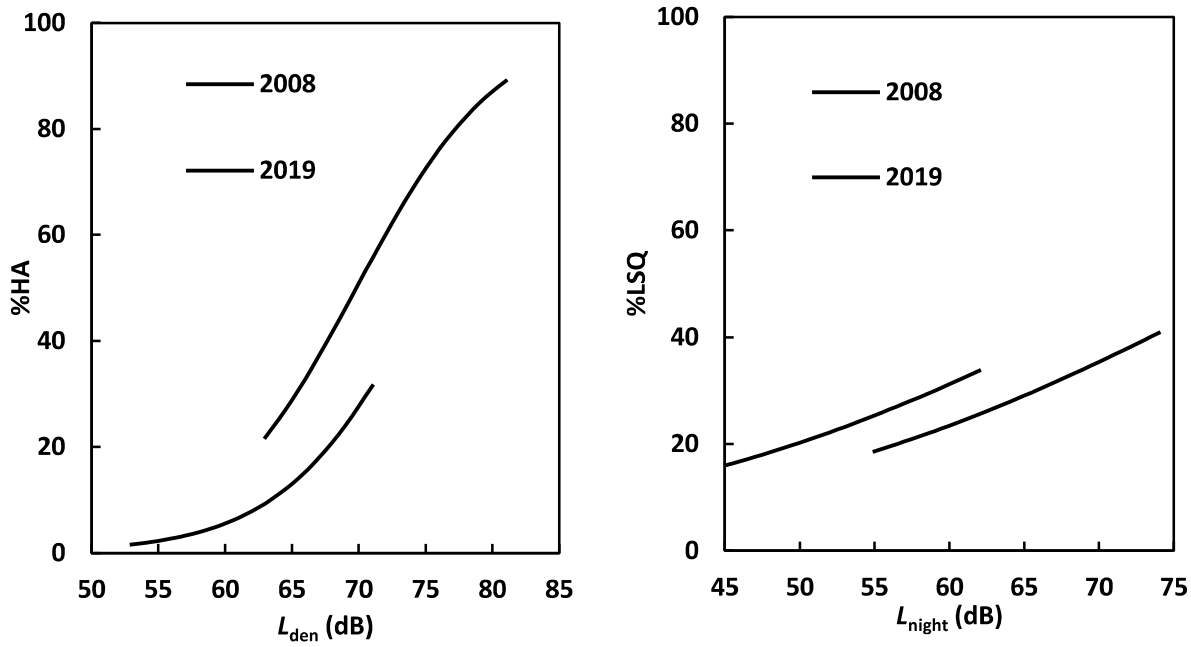


*Figure 17: Comparison of **(a)** L_{den}–% HA and **(b)** L_{nigh}–% LSQ relationships between the 2008 and 2019 surveys adjusted by non-acoustic variables including sex, age, noise sensitivity, length of residence, floor area, area preference, and quietness evaluation*

It could be found that the exposure-response relationships when considering them independently (Figure 3) are significantly different from those considered in relation to other factors (Figure 4). In other words, the change of response to aircraft noise of the residents in Ho Chi Minh City in the past 11 year is more influenced by non-acoustical factors than the change of aircraft noise level itself.

3.5. Change in the self-reported health status of residents associated with the reduced aircraft noise around Tân Sơn Nhất Airport after the epidemic outbreak

3.5.1 Residents' health status

Table 24 shows the percentage of respondents who had depressive symptoms, malaise, and hearing difficulty in three surveys. The percentage of respondents with depression, malaise, and hearing difficulties was 39.7%, 29.0%, and 40.4% in Survey 1. These numbers are 37.9%, 34.3%, and 33.1% in Survey 2, and 8.4%, 9.2%, and 5.3% in Survey 3. Multiple logistic regression analysis was conducted to determine the change in these health outcomes associated with noise exposure under the moderating effects of nonacoustic factors listed in Table 5. Each health outcome's model was firstly constructed by including L_{den}, survey, sex, and age factors as independent variables. Then, other nonacoustic factors that had a significant relationship with one of the health outcomes when analyzed in the logistic function with the corresponding outcome were included.

Table 24: Percentages of Depression, Malaise and Difficult in Hearing

Site	**%Depression**			**%Malaise**			**%Difficulty in hearing**		
	Survey 1	Survey 2	Survey 3	Survey 1	Survey 2	Survey 3	Survey 1	Survey 2	Survey 3
1	42.9	60.0	57.1	57.1	60.0	20.0	8.2	0.0	2.0
2	34.2	0.0	11.4	58.1	0.0	8.6	2.3	0.0	2.9
3	80.6	50.0	19.2	58.1	75.0	37.0	22.6	20.0	24.4
4	32.0	50.0	75.0	42.9	42.9	55.8	4.0	20.0	0.0
5	22.6	40.0	76.3	6.5	30.0	55.3	6.1	33.3	2.6
6	50.0	0.0	12.2	40.0	15.4	42.9	12.0	0.0	2.4
7	24.0	26.1	0.0	14.3	39.1	30.0	6.4	0.0	0.0
8	14.3	28.6	55.1	11.1	28.6	28.0	5.7	0.0	4.1
9	58.1	57.1	54.0	39.5	57.1	46.0	4.4	28.6	14.0
10	63.9	0.0	19.4	53.8	16.7	12.1	12.8	0.0	3.0
11	25.0	0.0	17.9	34.5	13.3	40.0	7.1	0.0	0.0
12	25.9	0.0	56.3	28.6	50.0	18.8	14.3	0.0	4.2
Total	39.7	29.0	40.4	37.9	34.3	33.1	8.4	9.2	5.3

3.5.2 Nonacoustic variables

Table 25 shows nonacoustic factors, including residential, personal and attitudinal, and health factors investigated in the questionnaire surveys. Factors related

to living conditions such as education, income, or housing were investigated and considered adjustment factors of the health outcomes. The distribution frequencies in each category of these factors were counted. **t-Test** was performed to test whether or not there is a statistically significant difference in the means of these factors between the two surveys (between Survey 1 and Survey 2, between Survey 1 and Survey 3). A significant difference was observed with housing type, housing structure, type of frame of living room windows and doors, type of frame of bedroom windows and doors, age, residential area preference and quality, the opening of bedrooms' windows, number of hours of staying at home, stress, morbidity, alcohol intake, doing exercise frequency.

Table 25: Comparisons of nonacoustic factors obtained in the three surveys.

Nonacoustic factors	**Categories**	**Survey 1**	**Survey 2**	***p*-Value**	**Survey 3**	***p*-Value**
Residential factors						
Housing type	Self-owning	64.9 (321/495)	76.9 (110/143)	0.0015**	78.4 (407/519)	<.0001**
Floor Area/Width of the house	≤50 m^2	59.1 (269/455)	65.9 (89/135)	0.7515	66.2 (129/195)	0.0467*
Housing structure	1. Wooden	2.1 (7/337)	0 (0/92)	0.0467*	0.8 (4/495)	0.4363
	2. Bricks	14.5 (49/337)	7.6 (7/92)		25.1 (124/495)	
	3. Prefabricated	0.3 (1/337)	0 (0/92)		0.6 (3/495)	
	4. Reinforced concrete	44.8 (151/337)	52.2 (48/92)		20.4 (101/495)	
	5. Reinforced concrete with brick wall	34.4 (116/337)	37 (34/92)		53.1 (263/495)	
	6. Others	3.9 (13/337)	3.3 (3/92)		0.0 (0/495)	
Number of living room's glass layers windows and doors	1. More than 3 layers	2.7 (13/490)	1.4 (2/140)	0.6218	3.3 (16/489)	0.7029
	2. 2 layers	18.2 (89/490)	19.3 (27/140)		18.6 (91/489)	
	3. 1 layer	75.3 (369/490)	74.3 (104/140)		71.8 (351/489)	
	4. Others (the window has no glass)	3.9 (19/490)	5 (7/140)		6.1 (30/489)	

Type of frame of living room windows and doors	1. Aluminum frame	31.7 (156/492)	24.8 (35/141)	0.0050**	42.2 (213/505)	<.0001**
	2. Wooden frame	14.2 (70/492)	7.1 (10/141)		16 (81/505)	
	3. Plastic frame	1.4 (7/492)	0 (0/141)		1.4 (7/505)	
	4. Others	52.6 (259/492)	68.1 (96/141)		40.4 (204/505)	
Number of glass layers of bedroom windows and doors	1. More than 3 layers	1.2 (6/488)	37 (51/138)	0.2147	57.2 (214/374)	<.0001**
	2. 2 layers	13.5 (66/488)	6.5 (9/138)		16.6 (62/374)	
	3. 1 layer	77.7 (379/488)	0 (0/138)		1.9 (7/374)	
	4. Others (the window has no glass)	7.6 (37/488)	56.5 (78/138)		24.3 (91/374)	
Type of frame of bedroom windows and doors	1. Aluminum frame	37.3 (181/485)	0 (0/139)	<.0001**	2.2 (8/363)	<.0001**
	2. Wooden frame	20.0 (97/485)	12.9 (18/139)		25.1 (91/363)	
	3. Plastic frame	2.7 (13/485)	77.7 (108/139)		64.2 (233/363)	
	4. Others	40.0 (194/485)	9.4 (13/139)		8.5 (31/363)	
Personal and attitudinal factors						
Sex	Male	46.2 (229/496)	46.5 (66/142)	0.9301	49.2 (255/518)	0.2994

Age	≥60 years old	18.1 (90/498)	29.4 (30/102)	0.0022**	10.1 (52/517)	<.0001**
Residence length	≤5 years	41.7 (204/489)	27.7 (39/141)	0.0057**	40.0 (204/510)	0.8851
Residential area preference and quality (% Bad and Extremely bad)	1 Green	12.3 (60/487)	4.9 (7/143)	0.0174*	21.4 (110/515)	0.0105*
	2 Street Sceneries	7.9 (38/483)	3.5 (5/143)	0.0213*	16.7 (83/498)	0.0005**
	3 View	8.0 (39/485)	7 (10/143)	0.4603	16.1 (80/498)	0.0346
	4 Quietness	9.0 (43/478)	21.1 (30/142)	0.0144*	9.0 (45/502)	<.0001**
	5 Work convenience	3.8 (18/475)	1.4 (2/142)	0.8063	2.0 (10/495)	0.0342
	6 Education convenience	1.9 (9/478)	2.8 (4/143)	0.4020	2.0 (10/500)	<.0001**
	7 Health care convenience	3.4 (16/477)	1.4 (2/143)	0.3665	2.8 (14/501)	0.0006**
	8 Daily life service convenience	1.3 (6/477)	0.7 (1/143)	0.1331	2.0 (10/498)	<.0001**
	9 Transport convenience	4.4 (21/478)	10.5 (15/143)	0.0044**	6.6 (33/501)	<.0001**
Opening of bedrooms' windows (%Often and Always)	1. Dry season	31.2 (140/449)	15.9 (20/126)	<.0001**	45.1 (233/517)	<.0001**
	2. Rainy season	17.9 (81/452)			32.5 (166/510)	<.0001**
Sensitivity (%Very and Extremely)	1. Cold	2.9 (14/480)	1.6 (2/124)	0.4278	2.2 (11/491)	0.0005**
	2. Heat	15.6 (75/482)	17.5 (22/126)	0.6934	36.7 (177/482)	<.0001**
	3. Noise	16.1 (78/483)	14.3 (20/140)	0.3094	13.7 (67/488)	<.0001**
	4. Vibration		10.9 (15/138)	0.5248	6.6 (31/472)	0.4345
	5. Chemicals		0.8 (1/122)	0.9849	3.4 (16/475)	0.0013**

	6. Odors	8.5 (41/482)	8.9 (11/123)	0.2981	12.9 (62/479)	<.0001**
	7. Dust, pollen, polluted air	5.4 (26/480)	5 (8/161)	0.9758	2.6 (12/467)	0.0062**
		8.8 (42/480)				
		6.7 (32/481)				
Job	1. Employed	53.6 (266/496)	37.4 (52/139)	<.0001*	40.0 (207/517)	<.0001**
	2. Student	9.3 (46/496)	0 (0/139)		4.3 (22/517)	
	3. Homemaker	13.1 (65/496)	4.3 (6/139)		16.2 (84/517)	
	4. Retired	9.7 (48/496)	15.8 (22/139)		6.8 (35/517)	
	5. Unemployed	14.3 (71/496)	13.7 (19/139)		32.7 (169/517)	
Number of hours of staying at home	1. Under 8 h	30.6 (149/487)	7.7 (11/143)	<.0001**	14.2 (72/507)	0.0497*
	2. From 8 to 15 h	36.6 (178/487)	41.3 (59/143)		60.6 (307/507)	
	3. Above 15 h	32.6 (159/487)	50.3 (72/143		24.9 (126/507)	
Life satisfaction	Very dissatisfied	1.0 (5/492)	4.2 (6/142)	0.3765	0.8 (4/513)	<.0001**
Health factors						
Self-rated health status	Fair or Poor	23.6 (115/488)	25.9 (37/143)	0.4229	9.3 (47/506)	<.0001**

Stress	Quite a bit or Extremely stressful	0.2 (1/488)	3.5 (5/142)	0.0005**	5.6 (28/500)	<.0001**
Morbidity	1. Heart trouble	5.5 (24/439)	7.0 (9/129)	0.0195**	1.4 (7/504)	<.0001**
	2. High blood pressure or Hypertension	8.4 (37/439)	20.1 (27/134)		9.7 (49/506)	
	3. Hyperlipidemia	4.3 (19/439)	3.0 (4/133)		0.4 (2/505)	
	4. Stroke, small stroke or TIA	0.2 (1/439)	1.5 (2/134)		0.0 (0/506)	
	5. Asthma	0.7 (3/439)	0.0 (0/134)		0.6 (3/506)	
	6. Diabetes	3.9 (17/439)	7.5 (10/134)		3.0 (15/506)	
	7. Cancer	0.2 (1/439)	0.0 (0/134)		0.0 (0/505)	
	8. Depression or Neurosis	0.5 (2/439)	0.7 (1/134)		0.0 (0/506)	
	9. Others	8.7 (38/439)	8.2 (11/134)		0.8 (4/506)	
Salt intake	Very much	4.6 (22/474)	5.0 (7/139)	0.0671	3.1 (13/417)	0.1631
Awareness of nutrition balance	Do not think	12.7 (61/482)	16.4 (23/140)	0.8462	10.3 (51/497)	0.3759
Alcohol intake	Almost everyday	1.6 (8/494)	1.4 (2/144)	0.0316*	1.6 (8/503)	<.0001**
Smoking habit	Smoking	13.6 (67/491)	15.3 (22/144)	0.4340	18.6 (93/499)	0.0060**
Exercise frequency	Above 4 times a week	37.0 (182/492)	56.0 (79/141)	0.0004**	32.1 (161/501)	0.0090**
Body Mass Index	Obesity (BMI>29)	2.3 (11/485)	3.5 (3/86)		1.0 (5/504)	

* $p<0.05$, ** $p<0.01$

3.5.3 Depression

In this study, respondents are identified to have no significant clinical signs of depression (clinical significance) when having a total CESD-R score under 16 across all 20 questions, referring the instruction in Reference 11. The scores for each response in one question are: "Not at all or less than one day" =0; "1-2 days"=1; "3-4 days"=2; "5-7 days"=3; and "Nearly every day for two weeks"=4. There are five categories of possible depressive symptom determined as below:

- Meets criteria for Major depressive episode: Anhedonia or dysphoria nearly every day for the past two weeks, plus symptoms in an additional 4 DSM symptom groups noted as occurring nearly every day for the past two weeks;
- Probable major depressive episode: Anhedonia or dysphoria nearly every day for the past two weeks, plus symptoms in an additional 3 DSM symptom groups reported as occurring either nearly every day for the past two weeks or 5-7 days in the past week;
- Possible major depressive episode: Anhedonia or dysphoria nearly every day for the past two weeks, plus symptoms in an additional two other DSM symptom groups reported as occurring either nearly every day for the past two weeks or 5-7 days in the past week;
- Subthreshold depression symptoms: People who have a CESD-style score of at least 16 but do not meet the above criteria;
- No clinical significance: People who have a total CESD-style score less than 16 across all 20 questions.

Table 26 show the multiple logistic regression model constructed for the depression adjusted by L_{den} and nonacoustic factors. No significant associations were found between L_{den} and depression. The percentages of residents who had no clinical significance in three surveys are 60.3%, 71.0%, and 59.6%. A significant correlation of depression with heat sensitivity and "morbidity" was found.

3.5.4. Malaise

The response values for each question are: "Yes"=1, "Sometimes"=2, and "No"=3. The percentage of malaise was calculated by percentile distribution of the score rated by the surveyed population. The dummy variables were obtained from the following five quintiles of the scale: D1, D2, D3, D4, and D5 corresponded to 80-100, 60-79, 40-59, 20-39, and 0-19 percentile classes, respectively [8]. Then, D1 and D2 were identified as those who have malaise condition. Table 7 shows the multiple logistic regression analysis with the malaise as health outcomes accounting for nonacoustic factors related to health. A significant correlation of malaise with "self-rated health" (p=0.0006) and "morbidity" (p=0.0005) was found.

Table 26: The multiple logistic regression for Depression

(Nagelkerke R^2=0.1282, AIC=1107.01, AUC=0.663)

Term		**Estimate**	**Std Error**	***p*-Value**	**Odds ratio**	**Lower 95%**	**Upper 95%**
Intercept		-1.164	0.568	0.0405*			
L_{den}		0.002	0.008	0.8474	1.002	0.985	1.018
Survey	Survey 1				1		
	Survey 2	-0.265	0.293	0.3668	0.768	0.432	1.364
	Survey 3			0.7222	1.063	0.759	1.487
Sex	Male				1		
	Female	0.219	0.147	0.1369	1.245	0.933	1.662
Age	<60 years old				1		
	≥60 years old	0.190	0.220	0.3874	1.209	0.786	1.860
Quietness around the house	Good				1		
	Bad	0.305	0.252	0.2269	1.357	0.827	2.225
Heat	Insensitive				1		
	Sensitive	0.982	0.172	<.0001*	2.670	1.905	3.743
Noise	Insensitive				1		
	Sensitive	0.085	0.269	0.7524	1.088	0.643	1.843
Vibration	Insensitive				1		
	Sensitive	0.725	0.388	0.0613	1.695	0.851	3.377
Dust	Insensitive				1		
	Sensitive	0.528	0.352	0.1333	1.395	0.676	2.880
Self-rated health	Good				1		
	Bad	0.287	0.224	0.2003	1.332	0.859	2.065
Morbidity	Positive				1		
	Negative	0.747	0.200	0.0002*	2.111	1.426	3.125

Table 27: The multiple logistic regression for Malaise

(Nagelkerke R^2=0.0912, AIC=1104.41, AUC=0.638)

Term		**Estimate**	**Std Error**	***p*-Value**	**Odds ratio**	**Lower 95%**	**Upper 95%**
Intercept		-1.281	0.573	0.0255*			
L_{den}		0.005	0.008	0.5388	1.005	0.988	1.022
Survey	Survey 1				1		
	Survey 2	-0.153	0.292	0.5994	0.858	0.484	1.520
	Survey 3			0.5881	0.911	0.650	1.276
Sex	Male				1		
	Female	-0.026	0.148	0.8591	0.974	0.729	1.302
Age	<60 years old				1		
	≥60 years old	0.057	0.220	0.7942	1.059	0.688	1.628
Quietness around the house	Good				1		
	Bad	0.142	0.253	0.5742	1.152	0.703	1.890
Heat	Insensitive				1		
	Sensitive	0.324	0.174	0.0622	1.382	0.984	1.943
Noise	Insensitive				1		
	Sensitive	0.307	0.267	0.2505	1.360	0.805	2.296
Vibration	Insensitive				1		
	Sensitive	0.052	0.344	0.8808	1.053	0.537	2.064
Dust	Insensitive				1		
	Sensitive	0.514	0.359	0.1522	1.672	0.827	3.377
Self-rated health	Good				1		
	Bad	0.738	0.215	0.0006*	2.091	1.372	3.189
Morbidity	Positive				1		
	Negative	0.677	0.195	0.0005*	1.969	1.342	2.887

3.5.5. Hearing ability

Table 28: The multiple logistic regression for Hearing Difficulty

(Nagelkerke R^2=0.2627, AIC=234.13, AUC=0.841)

Term		**Estimate**	**Std Error**	***p*-Value**	**Odds ratio**	**Lower 95%**	**Upper 95%**
Intercept		-6.091	1.629	0.0002*			
L_{den}		-0.002	0.022	0.9268	0.998	0.955	1.043
Survey	Survey 1				1		
	Survey 2	2.366	0.629	0.0002*	10.651	3.105	36.533
	Survey 3			0.0156*	4.641	1.337	16.104
Sex	Male				1		
	Female	1.263	0.444	0.0044*	3.535	1.482	8.434
Age	<60 years old				1		
	≥60 years old	0.965	0.462	0.0368*	2.624	1.061	6.491
Quietness around the house	Good				1		
	Bad	0.688	0.511	0.1784	1.990	0.730	5.422
Heat	Insensitive				1		
	Sensitive	0.015	0.445	0.9738	1.015	0.425	2.425
Noise	Insensitive				1		
	Sensitive	-0.047	0.764	0.9508	0.954	0.214	4.261
Vibration	Insensitive				1		
	Sensitive	0.124	0.871	0.8865	1.132	0.205	6.246
Dust	Insensitive				1		
	Sensitive	0.817	0.852	0.3375	2.264	0.426	12.020
Self-rated health	Good				1		
	Bad	1.429	0.482	0.0030*	4.173	1.622	10.731
Morbidity	Positive				1		
	Negative	0.685	0.474	0.1482	1.984	0.784	5.023

Table 28 shows the multiple logistic regression analysis for hearing ability as one of the health outcomes. The outcome of hearing ability was defined as the percentage of respondents who confirmed to "have difficulty in hearing and understanding words in normal conversation (even with a hearing aid)."

A statistically significant relationship between hearing ability with nonacoustic factors such as survey, sex, age, and self-rated health was found. Noise levels were not significantly associated with hearing ability in the models accounting for nonacoustic factors.

4. CONCLUSIONS

We analyzed the data of 2008 and 2019 aircraft noise surveys in Ho Chi Minh City and compared changes in noise annoyance and sleep quality based on the results of both surveys. Annoyance was significantly reduced in 2019 compared to that in 2008; however, changes in sleep quality were relatively small. This study demonstrates a contradictory tendency compared to that presented in recent studies, which report that aircraft noise annoyance increases over time. The decline in annoyance in the 2019 survey was found to be related to increased satisfaction with the convenience of accessing the workplace. The other cause is attributed to the increased number of households equipped with air conditioners, which indirectly reduced indoor noise exposure because the residents could close windows more frequently. Satisfaction with the green environment of living areas was found to lower the rate of low sleep quality. The positive air-transport attitudes of the residents were also found to be an important factor that contributed to minimizing air-craft noise annoyance in Ho Chi Minh City. These findings can help policymakers, aviation authorities, and environmental managers to design effective measures for mitigating noise impacts on residents in the vicinity of busy airports.

We also investigated the change effect of aircraft noise on the self-reported health status of the residents who lived around TSN Airport in the period from August 2019 to September 2020. The noise levels around TSN decreased considerably when the flight operation was cut down during the coronavirus pandemic. However, the trend of the health situation of the residents near TSN was various. An improvement in health due to the reduction of noise could not be observed. Although aircraft noise was found to be an essential predictor of annoyance reaction of the residents living near TSN, it was not significantly associated with all three self-reported health outcomes investigated in this study. Nonacoustic factors such as heat sensitivity and morbidity were found to moderate the prevalence of depression. Self-rated health and morbidity significantly affected the prevalence of malaise. Sex, age, and self-rated health were associated with hearing ability. A similar study on the health effect of road traffic noise in Bulgaria concluded that higher noise exposure was associated with worse mental health only indirectly and indicated independent indirect paths through noise annoyance, social cohesion, and physical activity [28]. In the further step of this study, we would like to determine the structure of the impact of aircraft noise on the residents' physical and mental health concerning nonacoustic factors. In this study, the data of three aircraft noise surveys were compared considering the changes in noise annoyance and sleep effects before and after the aircraft noise emission decreased due to the travel restriction at twelve residential areas around TSN. Annoyance and insomnia were not reduced but significantly increased in the survey conducted

three months after the change and returned closer to the state before the change. In other words, an "under response" occurred with the decrease in aircraft noise exposure around TSN shortly after the change but eased in 6 months later. This result demonstrates that noise limits recommended based on the exposure-response relationship derived from the studies conducted in steady-state conditions may not be applicable in the scenario of decreased exposure around TSN. View from home, residence length, floor area, and stress are nonacoustic factors found to moderate annoyance response, whereas heat sensitivity and number of hours staying at home were found to moderate the sleep.

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References

1. Guski, R.; Schreckenberg, D.; Schuemer, R. WHO Environmental Noise Guidelines for the European Region: A Systematic Review on Environmental Noise and Annoyance. Int. J. Environ. Res. Public Health 2017, 14, 1539.
2. Basner, M.; McGuire, S. WHO Environmental Noise Guidelines for the European Region: A Systematic Review on Environ-mental Noise and effects on sleep. Int. J. Environ. Res. Public Health 2018, 15, 519.
3. Kempen, E.V.; Casas, M.; Pershagen, G.; Foraster, M. WHO Environmental Noise Guidelines for the European Region: A Sys-tematic Review on Environmental Noise and Cardiovascular and Metabolic Effects: A Summary. Int. J. Environ. Res. Public Health 2018, 15, 379.
4. Brown, L.A.; Van Kamp, I. WHO Environmental Noise Guidelines for the European Region. A systematic review of transport noise interventions and their impacts on health. Int. J. Environ. Res. Public Health 2017, 14, 873, doi:10.3390/ijerph14080873.
5. World Health Organization. Environmental Noise Guidelines for the European Region; World Health Organization Regional Office for Europe: Copenhagen, Denmark, 2018.
6. Guski, R. How to forecast community annoyance in planning noisy facilities. Noise Health 2004, 6, 59–64.
7. Nguyen, T.L.; Nguyen, T.L.; Morinaga, M.; Yokoshima, S.; Yano, T.; Sato, T.; Yamada, I. Community response to a step change in the aircraft noise exposure around Hanoi Noi Bai International Airport. J. Acoust. Soc. Am. 2018, 143, 2901–2912.
8. Nguyen, T.L.; Trieu, B.L.; Hiraguri, Y.; Morinaga, M.; Morihara, T.; Yano, T. Effects of Changes in Acoustic and Non-Acoustic Factors on Public Health and Reactions: Follow-Up Surveys in the Vicinity of the Hanoi Noi Bai International Airport. Int. J. Environ. Res. Public Health 2020, 17, 2597.
9. Civil aviation authority of Vietnam, Delay in flight operations at Tan Son Nhat-Causes and Solutions. 2019. Available online: https://caa.gov.vn/hoat-dong-nganh/cham-tre-

hoat-dong-bay-tai-tan-son-nhat-nguyen-nhan-va-giai-phap-20190820095050690.htm (accessed on 22 February 2021).
10. Nguyen, T.L.; Yano, T.; Nguyen, H.Q.; Nishimura, T.; Fukushima, H.; Sato, T.; Morihara, T.; Hashimoto, Y. Community response to aircraft noise in Ho Chi Minh City and Hanoi. Appl. Acoust. 2011, 72, 814–822, doi:10.1016/j.apacoust.2011.05.002.
11. International Organization for Standardization. ISO/TS 15666, Acoustics—Assessment of Noise Annoyance by Means of Social and Socio–Acoustic Surveys; International Organization for Standardization: London, UK, 2003.
12. Fields, J.M.; de Jong, R.G.; Gjestland, T.; Flindell, I.H.; Job, R.F.S.; Kurra, S.; Lercher, P.; Vallet, M.; Yano, T.; Guski, R. Standardized general–purpose noise reaction questions for community noise surveys: Research and a recommendation. J. Sound Vibr. 2001, 242, 641–679.
13. Trieu, B.L; Nguyen, T.T.H.N; Nguyen, T.L; Morinaga, M.; Hiraguri, Y.; Yano, T.; Morihara, T.; Sasazawa, Y. Change in the self-reported health status of residents associated with the reduced aircraft noise around Tan Son Nhat Airport after the epidemic outbreak. Proceedings of the 50th International Congress and Exposition on Noise Control Engineering (internoise 2021), Washington DC, 1-5 August 2021, 49
14. ISO/TS 15666:2003, Acoustics — Assessment of noise annoyance by means of social and socio-acoustic surveys.
15. Yano T.; Ma H. (2004). Standardized noise annoyance scales in Chinese, Korean and Vietnamese. *Journal of Sound and Vibration*, vol 277, no.3, pp. 582-588.
16. Asano, H.; Takeuchi, K; Sasazawa, Y.; Otani, T.; Koyama, H; Suzuki, S. Predictive Validity of the Total Health Index for All-Cause Mortality Assessed in the Komo-Ise Cohort. *J Epidemiol* **2008**, *18(2)*, 68-76.
17. Hiroe M.; Makino K.; Ogata S.; Suzuki S. A questionnaire survey on health effects of aircraft noise for residents living in the vicinity of Narita International Airport: The results of physical and mental health effects, ICBEN 2017.
18. CESD-R explanation: https://cesd-r.com
19. Marjorie C. McCullagh. Validation of a questionnaire to identify hearing loss among farm operators. Noise and Health, January 2012; 14(56):32-8.
20. Sliwinska-Kowalska,M.; Zaborowski, K. (2017). WHO environmental noise guidelines for the European Region: A systematic review on environmental noise and permanent hearing loss and tinnitus. Int. J. Environ. Res. Public Health, 14, 1139.
21. Fields, JM; de Jong, R.G.; Gjestland, T.; Flindell, I.H.; Job, RFS; Kurra, S.; Lercher, P.; Vallet, M.; Yano, T.; Guski, R.; et al. Standardized general–purpose noise reaction questions for community noise surveys: Research and a recommendation. J. Sound Vibr. 2001, 242, 641–679.
22. Buysse, D.J.; Ancoli–Israel, S.; Edinger, J.D.; Lichstein, KL; Morin, C.M. Recommendations for a standard research assessment of insomnia. Sleep 2006, 29, 1155–1173.
23. Michele, L.; Okun, H.; Kravitz, M.; Sowers, M.F.; Douglas, E.; Moul, D.; Buysse, J.; Hall, M. Psychometric Evaluation of the Insomnia Symptom Questionnaire: A Self–Report Measure to Identify Chronic Insomnia. J. Clin. Sleep Med. 2009, 5, 41–51.

24. Lichstein, KL; Durrence, H.H.; Taylor, D.J.; Bush, A.J.; Riedel, B.W. Quantitative criteria for insomnia. Behav. Res. Ther. 2003, 41, 427–445.
25. Miedema, H.M.E.; Vos, H. Demographic and attitudinal factors that modify annoyance from transportation noise. J. Acoust. Soc. Am. 1999, 105, 3336–3344.
26. Guski, R. Community response to environmental noise. In Environmental Urban Noise; Garcia, A.; Ed.; WIT Press: Southampton, UK, 2001; Chapter 4.
27. European Commission. Position Paper on Dose Response Relationships between Transportation Noise and Annoyance, EU's Future Noise Policy WG2–Dose/Effect; European Commission: Brussels, Belgium, 2002. Available online: http://www.noiseineu.eu/en/2928-a/homeindex/file?objectid=2705&objecttypeid=0/ (accessed on 27 March 2020)
28. Dzhambov, A.; Tilov, B.; Markevych, I.; Dimitrova, D. Residential road traffic noise and general mental health in youth: The role of noise annoyance, neighborhood restorative quality, physical activity, and social cohesion as potential mediators, *Environment International*, 109, 2017, 1-9.
29. Trieu, B. L., Nguyen, T. L., Hiraguri, Y., Morinaga, M., & Morihara, T. (2021). How does a community respond to changes in aircraft noise? A comparison of two surveys conducted 11 years apart in Ho Chi Minh City. International Journal of Environmental Research and Public Health, 18(8), 4307.

CHAPTER 5: SUMMARY

The number of flights operated and the living conditions in residential areas around Noi Bai International Airport have changed significantly in the past years due to the rapid development of air transport and the economy in Vietnam. Exposure-response relationships established in the follow-up studies were found to be lower than the relationships established in the surveys in 2015 after the step-change and locate closer to the relationship established in the survey before the step change occurred but significantly higher than that in the EU position paper. In other words, though the change effect due to the step change seems to decline over time but still stays higher than that of the steady-state at the same noise exposure levels. Comparisons of respondents with insomnia ratios at different noise level ranges showed that a significant exposure-response relationship was found between insomnia and night-time noise levels. Non-acoustical factors such as noise sensitivity, sound insulation ability of the house, and length of residence were found to moderate the respondents' annoyance and insomnia. These suggest that improvement of residence quality and a restriction on nighttime flight operation should be considered to protect the health of the residents living around airports in Vietnam.

We analyzed data from aircraft noise surveys in Ho Chi Minh City in 2008 and 2019 and compared changes in noise pollution and sleep quality based on the results of both surveys. Harassment decreased significantly in 2019 compared to 2008. However, the change in sleep quality was relatively small. This study shows a trend that contrasts with recent studies that report an increase in aircraft noise annoyance over time. Residents' positive attitude towards air travel was also found to be a key factor in minimizing the annoyance of aircraft noise in Ho Chi Minh City. We also examined the impact of changes in aircraft noise on self-reported health status of residents living near TSN airport during the period August 2019 to September 2020. Although aircraft noise was found to be a significant predictor of airport nuisance reactions among residents living near TSN, all three of these self-reported health outcomes examined in this study was not significantly associated with Self-reported health status and prevalence had a significant impact on the prevalence of fatigue. A similar study on the health effects of road traffic noise in Bulgaria concluded that increased noise exposure was only indirectly associated with poorer mental health, including noise pollution, social cohesion, and independent indirect pathways by physical activity were revealed. In the next step of this research, we would like to clarify the structure of non-acoustic factors in the effects of aircraft noise on the physical and mental health of residents. This study compared data from three aircraft noise studies, considering changes in noise annoyance and sleep benefits before and after reductions in aircraft noise emissions due to movement restrictions in 12 residential areas around the TSN. View from home, length of stay, floor space, and stress are non-acoustic factors that moderate responses to discomfort, while sensitivity to heat and amount of time spent at home moderate sleep.

There are other possible reasons for the decrease in annoyance despite the increase in noise exposure around TSN Airport. For example, noise exposures increased significantly around TSN airports, whereas in Europe noise exposures remained stable or decreased over

time, which may be influenced by residents' expectations of aircraft noise. Gjestland and Gelderblom [1] used data from 32 aircraft noise surveys to calculate community tolerance levels (CTL). Around airports, such as European airports, where the rate of change in exposure is small, the rate of very noisy responses increases as the number of flights increases, but the same trend is not seen at airports, such as TSN airport, where the rate of change is high. At airports with large changes in operational patterns, the annoyance rating is likely to be dominated by non-acoustic factors, and it seems that the number of flights is not affected or is masked. This conclusion partly supports the findings of this study.

Among the occupancy factors that influenced responses to noise at NB airport, the assessment of sound insulation and duration of occupancy significantly affected annoyance. The 2017 and 2018 surveys found that more homes had improved sound insulation and the proportion of residences of less than five years decreased. Changes in these residential factors reduce the adverse effects of increased exposure and reduce overreaction. This result differs from Fields' findings [2], which stated that adaptation to resident noise does not occur with increasing years of residence.

Otherwise, differences in responses among residents are also influenced by differences in cultural environments. The Picture-Frustration Test was conducted by Nguyen et al. to see how people feel about different aspects of the airport, aircraft noise, living environment, and their awareness of the environmental protection of communities around the Hanoi Noi Bai International Airport. It was found that people living in different areas around the airport have different attitudes toward the airport and the environment. Urban residents are more likely to prefer natural environments, while those living in rural and mixed areas want the environment to harmonize with their life convenience. People who complained the most about the effects of aircraft noise on sleep were those living in rural and mixed areas [3].

References

1. Gjestland, T.; Gelderblom (2017), Prevalence of noise induced annoyance and its dependency on number of aircraft movements
2. Fields, J.M. (1993), Effect of personal and situational variables on noise annoyance in residential areas. J. Acoust. Soc. Am. 93
3. Nguyen, T.; Kuwano, S.; Yamada, I.; Yano, T.; Morinaga, M. Picture-Frustration Test to Assess Environmental Attitudes of Residents Exposed to Aircraft Noise from Hanoi Noi Bai International Airport. Sustainability 2021, 13, 2016.

CHAPTER 6: FURTHER WORKS

1. STUDY ON EFFECTS OF THE STEP-CHANGE IN SOUND ENVIRONMENT DUE TO THE OPENING OF LONG THANH INTERNATIONAL AIRPORT

During the rapid economic development process, aviation has become the most rapidly developed transport mode in developing countries. Tan Son Nhat (TSN) International Airport, the largest airport in Vietnam, is located 6 km north of the center of Ho Chi Minh City. Average flight numbers have also increased from about 500 flights per day in 2015 up to more than 600 flights per day in 2016 (ICAOAAPO, 2017). According to TSN's report, there were about 700 flights every day in 2018 and up to over 800 flights per day during the holidays. Comparing with data of 2008 shown by Nguyen et al. [1], the current total number of flights has increased more than four times. According to TSN's statistical data, TSN received around 32 million passengers in 2016, 36 million passengers in 2017, exceeding its capacity of 25 million passengers. Residents living near the airport are increasingly suffering from serious noise pollution. As a result, the high noise levels due to increasing number of flights around the airport is greatly concerned by the residents and the local government. As a national most important project, Vietnamese government is planning a new airport, LT Airport, located 30 km east of HCMC, which is expected to open in 2023 and decrease the burden of TSN. This intervention is also predicted to have a significant impact on the health of residents who are living in vicinities of the two airports.

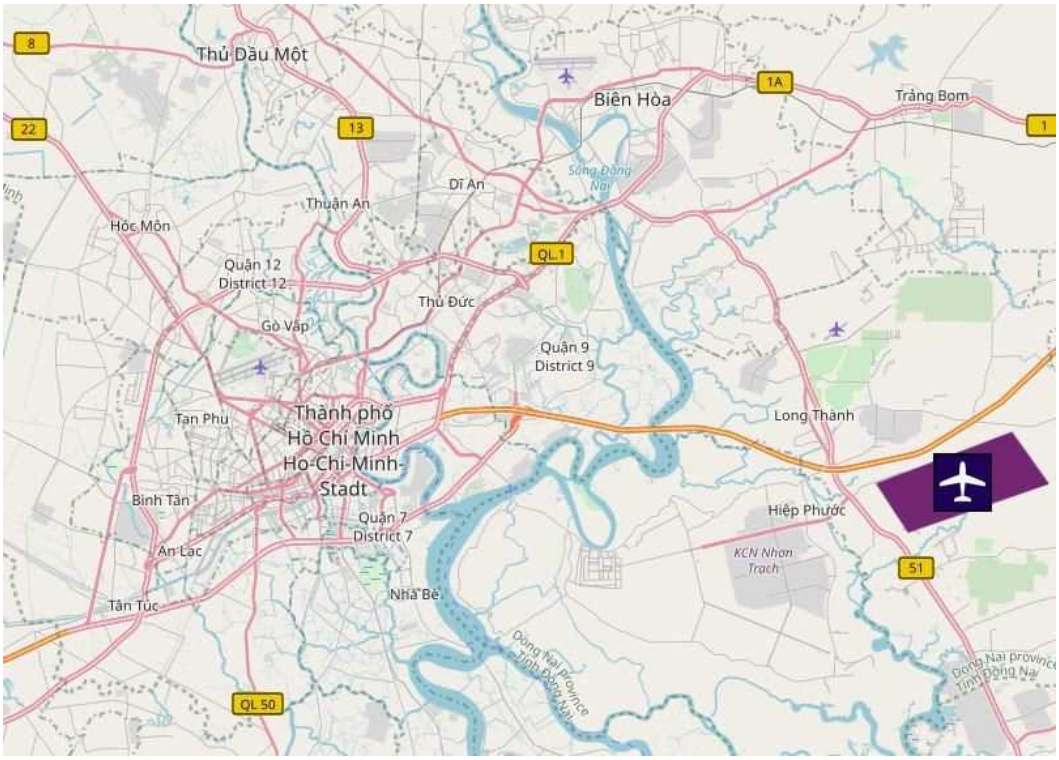

Figure 18. Long Thanh International Airport location

Tan Son Nhat (TSN) International Airport is the largest one in Vietnam whose traffic volume is over its capacity. To resolve the problem, Vietnamese Government decided to construct a new airport, Long Thanh (LT) International Airport in the east of Ho Chi Minh City. When LT Airport is operated, the number of flights suddenly decreased at TSN Airport and increased at LT Airport. This study is conducted in the context of a sudden increase in noise exposure around LT Airport, and reduction of noise exposure around TSN Airport due to the opening of the new airport. The opening of LT Airport is a great opportunity to examine the effect of a sudden change with increase and to decrease of aircraft noise exposure at the same time. Cohort study is a primary type of observational study that aids in evaluating associations between aircraft noise and exposures. In this study, the goal of analytic studies of cross-sectional studies is to identify and evaluate causes or risk factors of noise annoyance on health issues. In which, 10 groups (10 residents each group) will be selected and examined at each site around Tan Son Nhat and Long Thanh Airports by noise exposure status. A personal noise monitoring equipment is worn by volunteer respondent within successive 24 hours. Besides, the study will also directly measure the health data such as Body Mass Index, blood pressure, blood glucose, hearing ability, etc.

Objectives

- Investigate residents' responses and health situation under step-change before and after the opening of the LT airport and reaction to long-term change from the 2008 survey of residents living around TSN airport.
- Conduct before-survey to provide a basis data for the cohort study around the LT airport.
- To provide scientific basis and propose appropriate environmental control policies for the sustainable development in developing countries.
- Expected results
- Update current status and aircraft noise exposure levels around TSN and LT airports.
- Understand the step-change of community response in urban and residential areas around TSN and LT airports.
- Provide basis for establishment of aircraft noise policies in Vietnam.
- Publish the study outcome on 02 ISI index international journals and present at international conferences.

Research Impact

The findings from this study will provide scientific evidence as the basis of effective noise control policies and sustainable development in Vietnam. This will be also a reference for studying effects of step-change related to construction of new infrastructures in developing countries.

Reference

1. Nguyen, T.L., Yano, T., Nguyen, H. Q., Nishimura, T., Fukushima, H., Sato, T., Morihara, T., and Hashimoto, Y. (2011). Community response to aircraft noise in Ho Chi Minh City and Hanoi. Appl. Acoust. 72, 814–822.

2. DEVELOPMENT OF DESIGN SOUNDPROOF VENTILATION STRUCTURE FOR HOUSE DWELLINGS

Methods to improve air quality naturally have been applied since ancient times and are still being applied effectively in Vietnam today. With this method, the most basic thing is to design a system of ventilation doors and windows to catch the wind and push the air out. The principle of natural ventilation is to design window and door systems properly to ensure easy air exchange and to make living space clean and safe. Therefore, in the design process, it is necessary to calculate to arrange the doors and windows system in a reasonable way. For the climate in Vietnam, on hot days (in the summer in the North and throughout the year in the South), the house needs maximum ventilation to reduce the feeling of tightness and discomfort, so window opening is required.

However, according to the traditional design in Vietnam, the window only has the effect of ventilation, the protective frame behind the window has the effect of preventing intrusion from the outside, therefore when opening the window, the noise from outside will direct entry into the house. With such windows characteristics, we wanted to design a soundproof structure that could be installed on part of the protective frame while still ensuring ventilation for the house to minimize the impact of aircraft noise on health and improve the quality of life for people living in noisy areas, especially around airports.

Buildings in tropical regions are often designed with many openings for enhancing natural lighting and ventilation, therefore, have poor soundproofing performance. Besides, in rapid urbanization, many new transport facilities have been built in urban areas where residences and public buildings had existed earlier. This context raised the high-level outdoor noise released from the vehicles. Moreover, the outdoor noise attenuates through the openings and negatively affects the indoor acoustic quality. Recently, HVAC systems that provide indoor environmental comfort have become increasingly popular in new residential and commercial buildings. This process promotes the use and installation of aluminum-framed glass windows in place of traditional vent parts and the design of enclosed structures. This change improves the insulation performance of the building [1].

However, the residents in tropical countries often open windows during the dry season and close them during the wet season to use natural ventilation and save energy for active air conditioning. The inability to open windows due to high-level outside noise also increases negative responses in people living in noisy areas. This diverse building design and lifestyle makes it difficult to predict the effects of noise on people from noise data obtained for the outdoor environment. It is necessary to investigate the building envelope design regarding the sound insulation performance and the possibility of natural ventilation in tropical countries [2].

In reference [3], multi-objective optimization was performed to generate a model that satisfies both sound absorption and ventilation requirements in a cylindrical shape. Then, the impedance tube experiment was conducted in an anechoic chamber to investigate the sound absorption performance of all the specimens.

The growth of mobility has enriched people's lives by connecting people and places and led to more exposure to noise. There will be new roads, new airports, and infrastructure expansion projects. The impact of environmental noise change on human must be appropriately managed, the air transport needs to be promoted in harmony with maintaining health and quality of life for residents in the surrounding vicinities. My doctor research will enhance the application of the findings from the scientific research on environmental policy and practical measures regarding noise intervention in different cultures and economies, then contribute to the implementation of the future sustainable society.

References

1. Kaito Shoda. Actual Survey of the Air Environment in Live Music Club. Graduation thesis at Shibaura Institute of Technology, 2015 (Japanese)

2. Yang WeiDong, Li Yan. Sound absorption performance of natural fibers and their composites. Science China Technological Sciences, 55, 2278–2283 (2012)

3. Bach Lien Trieu, Keigo Kajitani, Kiichiro Sawada, Thu Lan Nguyen, Development of ventilation and sound-absorbing materials using specimens generated by the multi-objective optimization method, Proc. of the 51st International Congress and Exposition on Noise Control Engineering (internoise 2022), hybrid congress, Glasgow, 21-24 August 2022

APPENDIX

1. Questionnaire 2017 HNBIA (English version)
2. Questionnaire 2017 HNBIA (Vietnamese version)
3. Questionnaire 2018 HNBIA (English version)
4. Questionnaire 2018 HNBIA (Vietnamese version)
5. Questionnaire 2019 TIA (English version)
6. Questionnaire 2019 TIA (Vietnamese version)
7. Questionnaire 2020.06 TIA (Vietnamese version)
8. Questionnaire 2020.09 TIA (English version)
9. Questionnaire 2020.09 TIA (Vietnamese version)

QUESTIONNAIRE 2017 (English version)

used for follow-up survey on residents' responses around Noi Bai International Airport

Please answer the following questions by choosing and checking the corresponding answer:

1. What type is your house ownership?

1 Self-owning ( )
2 Renting ( )
3 Others_____ ( )

2. How long have you been living in your present house?

_____years

3. How big is your floor area?

About_____m^2

4. Please evaluate your present house according to the following categories

	1 Extremely good	2 Good	3 Neither good nor bad	4 Bad	5 Extremely bad
(1) Area of the house	( )	( )	( )	( )	( )
(2) Area of the yard and garden	( )	( )	( )	( )	( )
(3) Comfort in dry season	( )	( )	( )	( )	( )
(4) Comfort in rainy season	( )	( )	( )	( )	( )
(5) Thermal insulation	( )	( )	( )	( )	( )
(6) Ventilation	( )	( )	( )	( )	( )
(7) Sun lighting	( )	( )	( )	( )	( )
(8) Sound insulation	( )	( )	( )	( )	( )

5. How much do you like your residential area?

1 Like very much ( )
2 Like ( )
3 Neither like nor dislike ( )
4 Dislike ( )
5 Dislike very much ( )

6. Please evaluate your living area according to the following items:

	1 Extremely good	2 Good	3 Neither good nor bad	4 Bad	5 Extremely bad
(1) Surrounding environment and natural green	( )	( )	( )	( )	( )
(2) Surrounding street sceneries and buildings	( )	( )	( )	( )	( )

10. During the day, is there any specific time period are you bothered, disturbed or annoyed by aircraft noise? Select all that apply.

No ( )
Yes ( ) ⟶
1 Early morning 6:00-8:00 ( )
2 Morning 8:00-12:00 ( )
3 Noon to afternoon 12:00-16:00 ( )
4 Afternoon to evening 16:00-19:00 ( )
5 Evening 19:00-22:00 ( )
6 Night 22:00-6:00 ( )

11. Is there any specific season in a year are you bothered, disturbed or annoyed by aircraft no ise? Select all that apply.

No ( )
Yes ( ) ⟶
1 Dry season ( )
2 Rainy season ( )

12. Are you bothered, disturbed or annoyed by vibration caused by flying aircraft?

1 Several times in a year ( )
2 Once or twice in a month ( )
3 Once or twice in a week ( )
4 Almost everyday ( )
5 Not at all ( )

13. During the day, is there any specific time period do you feel annoyed/disturbed by vibratio n caused by flying aircraft? Check more than one or all period if applicable?

No ( )
Yes ( ) ⟶
1 Early morning 6:00-8:00 ( )
2 Morning 8:00-12:00 ( )
3 Noon to afternoon 12:00-16:00 ( )
4 Afternoon to evening 16:00-19:00 ( )
5 Evening 19:00-22:00 ( )
6 Night 22:00-6:00 ( )

14. In daily life, how disturbed are you by aircraft flyovers in the following cases?

	1 Not at all	2 Slightly	3 Moderately	4 Very	5 Extremely
(1) When you have conversation indoor	( )	( )	( )	( )	( )
(2) When you communicate with the phone	( )	( )	( )	( )	( )
(3) When you listen to TV/radio indoor	( )	( )	( )	( )	( )
(4) When you concentrate or read books indoor	( )	( )	( )	( )	( )

18. Please answer this question concerning your sleep.

(1) Do you have any trouble with your sleep?

No ( )

Yes ( )

If you answered "Yes" to the above question, please choose appropriate numbers for each item.

	1 Occasionally	2 Once or twice a week	3 More than 3 times a week
(1) Difficult to fall asleep	( )	( )	( )
(2) When awakened during the night, it is difficult to sleep again.	( )	( )	( )
(3) Awakened early in the morning	( )	( )	( )
(4) Do not feel as having slept well the next morning.	( )	( )	( )
(5) Sleepy during daytime and cannot work well	( )	( )	( )
(6) Others ( )	( )	( )	( )

(2) If you have trouble with your sleep, do you think that it is due to the aircraft noise?

No ( )
Yes ( )

19. Is your living room window(s) opened in the following season?

	1 Rarely	2 Sometimes	3 Often	4 Always
(1) Dry season	( )	( )	( )	( )
(2) Rainy season	( )	( )	( )	( )

20. In daily life, climatic factors as well as environmental conditions affect us much, then how much are you sensitive to the following factors?

	1 Not at all	2 Slightly	3 Moderately	4 Very	5 Extremely
(1) Coldness	( )	( )	( )	( )	( )
(2) Hotness	( )	( )	( )	( )	( )
(3) Noise	( )	( )	( )	( )	( )
(4) Vibration	( )	( )	( )	( )	( )
(5) Chemicals	( )	( )	( )	( )	( )
(6) Odors	( )	( )	( )	( )	( )
(7) Dust, pollen, polluted air	( )	( )	( )	( )	( )

25. Are you currently living in this house?

No ( )
Yes ( )

26. How long in a day do you stay at home? In what period of the day do you stay at home?

About_____hours
1 All day ( )
2 Morning ( )
3 Afternoon ( )
4 Evening ( )
5 Night ( )

27. How many family members do you have?

_____people

28. How old are you?

1 From 20 – 29 ( )
2 From 30 – 39 ( )
3 From 40 – 49 ( )
4 From 50 – 59 ( )
5 From 60 – 69 ( )
6 More than 70 ( )

29. Did you participate in the following interviews?

	No	Yes
(1) September 2014	( )	( )
(2) February and March 2015	( )	( )
(3) August and September 2015	( )	( )

30. Please tell us the information below concerning your health condition:

(1) Height _____cm
(2) Weight _____kg
(3) Maximum blood pressure _____mmHg
(4) Minimum blood pressure _____mmHg

31. As you wish, please provide your own comments on the living environment:

_____

_____

_____

_____

THANK YOU FOR YOUR COOPERATION!

QUESTIONNAIRE 2017 (Vietnamese version)

used for follow-up survey on residents' responses around Noi Bai International Airport

Xin vui lòng trả các câu hỏi sau bằng cách chọn đánh dấu câu trả lời thích hợp:

1. Nhà của anh(chị) thuộc loại nào trong số các loại dưới đây?

1 Nhà riêng ( )

2 Nhà thuê ( )

3 Ngoài ra_____( )

2. Anh(chị) đã ở ngôi nhà hiện tại bao nhiêu năm?

_____năm

3. Tổng diện tích sàn (tất cả các tầng của nhà nếu là nhà nhiều tầng) của nhà anh(chị) ước tính là bao nhiêu?

Khoảng_____m^2

4. Xin hãy đánh giá ngôi nhà anh(chị) đang ở theo các mục dưới đây:

	1 Cực tốt	2 Tốt	3 Bình thường	4 Kém	5 Cực kém
(1) Độ rộng của nhà	( )	( )	( )	( )	( )
(2) Độ rộng của sân	( )	( )	( )	( )	( )
(3) Độ dễ chịu vào mùa khô	( )	( )	( )	( )	( )
(4) Độ dễ chịu vào mùa mưa	( )	( )	( )	( )	( )
(5) Độ cách nhiệt	( )	( )	( )	( )	( )
(6) Độ thông gió	( )	( )	( )	( )	( )
(7) Độ sáng tự nhiên	( )	( )	( )	( )	( )
(8) Độ cách âm	( )	( )	( )	( )	( )

5. Anh(chị) thích khu vực mình đang sinh sống ở mức độ nào?

1 Cực kỳ thích ( )

2 Thích ( )

3 Bình thường ( )

4 Ghét ( )

5 Cực ghét ( )

6. Xin hãy đánh giá nơi ở của anh(chị) theo 9 mục dưới đây:

	1 Cực tốt	2 Tốt	3 Bình thường	4 Kém	5 Cực kém
Môi trường thiên nhiên, cây xanh xung quanh	( )	( )	( )	( )	( )
(2) Quang cảnh đường phố, nhà cửa xung quanh	( )	( )	( )	( )	( )
(3) Tầm nhìn từ nhà	( )	( )	( )	( )	( )
(4) Độ yên tĩnh xung quanh nhà	( )	( )	( )	( )	( )
(5) Thuận tiện cho việc đi làm	( )	( )	( )	( )	( )

11. Trong năm, có mùa nào anh(chị) thấy ồn ào khó chịu hay cảm thấy bị làm phiền bởi tiếng ồn từ máy bay không? Xin hãy chọn tất cả những mùa đó nếu có?

Không ( )

Có ( ) ⟶ 1 Mùa khô ( )

2 Mùa mưa ( )

12. Anh(chị) có bị làm khó chịu vì rung do máy bay gây ra không?

1 Không bị ( )
2 Vài lần trong năm ( )
3 Một hoặc hai lần trong tháng ( )
4 Một hoặc hai lần trong tuần ( )
5 Gần như hàng ngày ( )

13. Trong ngày, có khoảng thời gian nào anh(chị) thấy khó chịu hay bị làm phiền vì rung do máy bay gây ra (như là cửa sổ bị rung lên) hay không? Xin hãy chọn tất cả những khoảng thời gian đó nếu có?

Không ( )

Có ( ) — 1 Sáng sớm khoảng 6 giờ đến 8 giờ ( )
2 Trong buổi sáng khoảng 8 giờ đến 12 giờ ( )
3 Trưa chiều khoảng 12 giờ đến 16 giờ ( )
4 Chiều tối khoảng 16 giờ đến 19 giờ ( )
5 Tối khoảng 19 giờ đến 22 giờ ( )
6 Đêm khoảng 22 giờ đến 6 giờ ( )

14. Trong cuộc sống hàng ngày, khi máy bay bay qua, anh(chị) cảm thấy bị làm phiền ở mức độ nào trong các trường hợp dưới đây?

	1 Hoàn toàn không	2 Một phần nào	3 Không quá mức	4 Nhiều	5 Cực kỳ
(1) Làm phiền anh(chị) khi đang nói chuyện trong nhà?	( )	( )	( )	( )	( )
(2) Làm phiền anh(chị) khi nghe điện thoại trong nhà?	( )	( )	( )	( )	( )
(3) Làm phiền anh(chị) khi nghe đài, vô tuyến trong nhà?	( )	( )	( )	( )	( )
(4) Làm phiền anh(chị) khi anh(chị) đang tập trung suy nghĩ, hay đọc sách trong nhà?	( )	( )	( )	( )	( )
(5) Làm phiền khi anh(chị) nghỉ ngơi trong nhà?	( )	( )	( )	( )	( )
(6) Làm anh(chị) khó khăn khi bắt đầu vào giấc ngủ?	( )	( )	( )	( )	( )
(7) Làm anh(chị) bị thức giấc khi đang ngủ say?	( )	( )	( )	( )	( )
(8) Làm anh(chị) không thể mở cửa sổ bởi quá ồn trong khi anh(chị) muốn mở cửa?	( )	( )	( )	( )	( )
(9) Làm anh(chị) khó chịu vì rung do máy bay bay qua?	( )	( )	( )	( )	( )

) Không cảm thấy đã được ngủ ngon vào sáng hôm sau	( )	( )	( )
) Cảm thấy buồn ngủ vào ban ngày và không thể làm việc tốt	( )	( )	( )
) Ngoài ra ( )	( )	( )	( )

(2) Nếu anh (chị) có rắc rối với giấc ngủ, anh (chị) có nghĩ nguyên nhân là do tiếng ồn máy bay không?
Không ( )
Có ( )

19. Cửa sổ phòng khách nhà anh(chị) có để mở trong các mùa dưới đây không?

	1 Hiếm khi/ Hoàn toàn không	2 Thỉnh thoảng	3 Thường hay	4 Luôn luôn
(1) Mùa khô	( )	( )	( )	( )
(2) Mùa mưa	( )	( )	( )	( )

20. Trong cuộc sống hàng ngày các yếu tố thời tiết cũng như điều kiện môi trường tác động đến chúng ta rất nhiều, anh(chị) nhậy cảm ở mức độ nào đối với các yếu tố dưới đây?

	1 Hoàn toàn không	2 Một phần nào	3 Không quá mức	4 Nhiều	5 Cực kỳ
(1) Lạnh	( )	( )	( )	( )	( )
(2) Nóng	( )	( )	( )	( )	( )
(3) Tiếng ồn	( )	( )	( )	( )	( )
(4) Độ rung	( )	( )	( )	( )	( )
(5) Chất hóa học	( )	( )	( )	( )	( )
(6) Mùi hôi	( )	( )	( )	( )	( )
(7) Bụi, phấn hoa, không khí bẩn	( )	( )	( )	( )	( )

21. Anh(chị) sử dụng các phương tiện giao thông dưới đây ở mức độ nào?

	1 Sử dụng tích cực	2 Có sử dụng	3 Sử dụng cũng được, không cũng được	4 Đôi khi sử dụng	5 Hoàn toàn không sử dụng
(1) Xe hơi	( )	( )	( )	( )	( )
(2) Tàu	( )	( )	( )	( )	( )
(3) Xe gắn	( )	( )	( )	( )	( )
(4) Xe buýt	( )	( )	( )	( )	( )
(5) Máy bay	( )	( )	( )	( )	( )
(6) Xe đạp	( )	( )	( )	( )	( )
(7) Đi bộ	( )	( )	( )	( )	( )

22. Xin anh(chị) đánh giá cho về việc sử dụng các phương tiện giao thông dưới đây như thế nào thì tốt cho xã hội?

29. Anh (chị) có tham gia trả lời phỏng vấn các đợt điều tra trước đây không?

		Không	Có
1	Tháng 9 năm 2014	( )	( )
2	Tháng 2 và tháng 3 năm 2015	( )	( )
3	Tháng 8 và tháng 9 năm 2015	( )	( )

30. Xin anh (chị) cho biết các thông tin liên quan đến sức khỏe của anh (chị) như dưới đây:

1 Chiều cao _____cm

2 Cân nặng _____kg

3 Huyết áp cao nhất_____mmHg

4 Huyết áp thấp nhất _____mmHg

31. Ngoài các câu hỏi trên, nếu anh(chị) có ý kiến gì về môi trường sống hiện nay, xin cho biết:

_____

_____

_____

_____

XIN CHÂN THÀNH CẢM ƠN SỰ HỢP TÁC CỦA QUÝ VỊ

*** Phần này sinh viên thực hiện phỏng vấn xin hãy quan sát và tự điền câu trả lời (nếu không rõ, xin hỏi lại người trả lời phỏng vấn để có câu trả lời đúng)**

F1. Giới tính của người trả lời phỏng vấn?

Nam ( )

Nữ ( )

F2. Cấu tạo ngôi nhà thuộc loại nào trong các cấu tạo dưới đây?

1 Làm từ gỗ ( )

2 Xây từ gạch ( )

3 Nhà lắp ghép ( )

4 Nhà bê tông cốt thép ( )

5 Tường gạch và khung bê tông cốt thép ( )

6 Ngoài ra_____ ( )

F3. Kính các loại cửa hướng ra bên ngoài của phòng khách của ngôi nhà (cửa sổ, cửa ra vào) là loại kính bao nhiêu lớp? nếu là kính đôi nhiều lớp, xin xếp vào loại kính hai lớp.

1 Kính trên ba lớp ( )

2 Kính hai lớp ( )

3 Kính một lớp ( )

4 Ngoài ra_____ ( )

F4. Khung các loại cửa phòng khách của ngôi nhà thuộc loại nào trong số các loại khung dưới đây? Xin chọn đánh giá câu trả lời thích hợp:

1 Khung nhôm ( )

2 Khung gỗ ( )

3 Khung nhựa ( )

4 Ngoài ra_____( )

F5. Các cửa của phòng khách (cửa sổ, cửa ra vào) của ngôi nhà có hướng ra mặt đường hay không?

Không ( )

Có ( )

QUESTIONNAIRE 2018 (English version)

used for follow-up and health survey around Noi Bai International Airport

Thank you for taking the time to complete this questionnaire. Your answers are important and will help us to meet your health care needs. The questionnaire will take about 15 minutes to finish.

A. Personal information

1. Gender:

1) Male ☐
2) Female ☐

2. How old are you?

1) From 20 – 29 ☐
2) From 30 – 39 ☐
3) From 40 – 49 ☐
4) From 50 – 59. ☐
5) From 60 – 69 ☐
6) More than 70 ☐

3. What is your present job?

1) Employed -> (Occupation)_____ ☐
2) Farmer ☐
3) Student ☐
4) Housewife ☐
5) Retired ☐
6) Unemployed ☐

4. How long have you been living in your present house? _____ years

5. How many floors does your house have? _____ floors

At which floor are you usually sleeping?

6. How much do you like your residential area?

1) Like very much ☐
2) Like ☐
3) Neither like nor dislike ☐
4) Dislike ☐
5) Dislike very much ☐

11. Thinking about the amount of stress in your life, would you say that most days are?

1) Not at all stressful ☐
2) Not very stressful ☐
3) A bit stressful ☐
4) Quite a bit stressful ☐
5) Extremely stressful ☐

12. (1) Height: _____cm

(2) Weight: _____kg

13. Do you usually have periodic health examination?

1) No ☐
2) Yes ☐

14. What health facility do you usually visit? _____

15. Are there any medical problems you are being treated for?

1) No ☐
2) Yes ☐

If yes, what are medical problems? _____

The beginning of treatment: _____

16. Do you take any prescription medications?

1) No ☐
2) Yes ☐

If yes, please list:

_____

_____

17. Do you take non-prescription medications or supplements (for example, aspirin, vitamins, etc.)

1) No ☐
2) Yes ☐

If yes, please list:

_____

_____

18. Blood pressure: (1) Upper _____ mmHg (2) Lower _____mmHg

(3) Heart rate: _____

If you answered "Yes" to the above question, please choose appropriate numbers for each item.

	1 Occasionally	2 Once or twice a week	3 More than 3 times a week
1) Difficult to fall asleep			
2) When awakened during the night, it is difficult to sleep again.			
3) Awakened early in the morning			
4) Do not feel as having slept well the next morning			
5) Sleepy during daytime and cannot work well			
6) Others _____			

27. If you have trouble with your sleep, do you think that it is due to the aircraft noise?

1) No ☐

2) Yes ☐

28. (1) Do you see the airplane flying through your house?

1) No ☐

2) Yes ☐

(2) If yes, how many times a day? _____ times

29. Thinking about the last 1 months (a month) or so, how much does each of the following factors bothers, disturbs or annoys you when you are here at home?

	1 Not at all	2 Slightly	3 Moderately	4 Very	5 Extremely
1) Aircraft noise					
2) Road traffic noise					
3) Exhausted gas					
4) Factory noise					
5) Odors					
6) Smoke discharged from factories					
7) Noise from the neighbors					

30. Thinking about the last 1 month (a month) or so, what number from 0 to 10 best shows how much you are bothered, disturbed, or annoyed by aircraft noise?

0 1 2 3 4 5 6 7 8 9 10

Not at all Extremely

SHIMANE University

PHIẾU ĐIỀU TRA XÃ HỘI HỌC VỀ SỨC KHỎE CỘNG ĐỒNG

PHIẾU ĐIỀU TRA SỐ: .....
NGÀY PHỎNG VẤN: .....
HỌ TÊN NGƯỜI ĐƯỢC PHỎNG VẤN: .....
ĐỊA CHỈ: .....
SỐ ĐIỆN THOẠI: .....

TÊN PHỎNG VẤN VIÊN: .....

MỌI Ý KIẾN XIN GỬI VỀ:
NGUYỄN THU LAN
EMAIL: lan@riko.shimane-u.ac.jp
Hoặc
TRIỆU BẠCH LIÊN
EMAIL: trieulien0903@gmail.com

KHOA KIẾN TRÚC
ĐẠI HỌC SHIMANE – NHẬT BẢN

XIN CHÂN THÀNH CẢM ƠN
HÀ NỘI - 2018

9. Sử dụng thang đo từ 0 đến 10, trong đó 0 là "Rất không hài lòng" và 10 là "Rất hài lòng", anh (chị) cảm thấy thế nào về cuộc sống của mình hiện tại?

0 1 2 3 4 5 6 7 8 9 10

↓ ↓

Rất không hài lòng Rất hài lòng

10. Trong cuộc sống hàng ngày, các yếu tố thời tiết cũng như điều kiện môi trường tác động đến chúng ta rất nhiều, anh (chị) nhạy cảm ở mức độ nào đối với các yếu tố dưới đây?

	1 Hoàn toàn không	2 Một phần nào	3 Không quá mức	4 Nhiều	5 Cực kỳ
1) Lạnh					
2) Nóng					
3) Tiếng ồn					
4) Độ rung					
5) Chất hoá học					
6) Mùi hôi thối					
7) Bụi, phấn hoa, không khí bẩn					

11. Nghĩ về những căng thẳng trong cuộc sống, anh (chị) nói thế nào về mức độ căng thẳng trong hầu hết các ngày

1) Không căng thẳng chút nào ☐
2) Không căng thẳng lắm ☐
3) Căng thẳng một chút ☐
4) Khá căng thẳng ☐
5) Cực kỳ căng thẳng ☐

12. (1) Chiều cao: _____cm

(2) Cân nặng: _____kg

13. Anh (chị) có thường xuyên kiểm tra sức khỏe định kỳ không?

1) Không ☐
2) Có ☐

14. Anh (chị) thường xuyên đến cơ sở y tế nào? _____

_____

15. Anh (chị) có đang điều trị căn bệnh nào không?

1) Không ☐
2) Có ☐

Nếu có, đó là căn bệnh gì? _____

Thời gian bắt đầu điều trị: _____

16. Anh (chị) có đang sử dụng loại thuốc nào theo chỉ định của bác sĩ không?

1) Không ☐
2) Có ☐

Nếu có, xin hãy liệt kê:

_____

_____

26. Anh (chị) có gặp rắc rối với giấc ngủ không?

1) Không ☐
2) Có ☐

Nếu có, xin hãy chọn câu trả lời cho các mục sau đây:

	1 Hiếm khi/ Hoàn toàn không	2 Một hoặc hai lần một tuần	3 Từ 3 lần trở lên một tuần
1) Khó đi vào giấc ngủ			
2) Khó ngủ trở lại sau khi bị thức giấc vào buổi đêm			
3) Bị thức giấc sớm vào buổi sáng			
4) Không cảm thấy đã được ngủ ngon vào sang hôm sau			
5) Cảm thấy buồn ngủ vào ban ngày và không thể làm việc tốt			
6) Ngoài ra _____			

27. Nếu anh (chị) có rắc rối với giấc ngủ, anh (chị) có nghĩ nguyên nhân là do tiếng ồn máy bay không?

1) Không ☐
2) Có ☐

28. (1) Anh (chị) có nhìn thấy máy bay bay qua nhà mình không?

1) Không ☐
2) Có ☐

(2) Nếu có, khoảng bao nhiêu lần 1 ngày? _____ lần

29. Trong vòng 1 tháng qua, những yếu tố dưới đây làm phiền hoặc gây khó chịu cho anh (chị) ở mức độ nào khi anh (chị) ở nhà?

	1 Hoàn toàn không	2 Một phần nào	3 Không quá mức	4 Nhiều	5 Cực kỳ
1) Tiếng ồn từ máy bay					
2) Tiếng ồn từ các phương tiện giao thông trên đường					
3) Khí thải và khói từ nhà máy					
4) Tiếng ồn từ nhà máy					
5) Mùi hôi thối					
6) Khói từ nhà máy					
7) Tiếng ồn từ hàng xóm					

30. Trong vòng 1 tháng qua, con số nào từ 0 đến 10 thể hiện mức độ tiếng ồn từ máy bay đã làm phiền và gây khó chịu cho anh (chị)?

0 1 2 3 4 5 6 7 8 9 10

↓ ↓

Hoàn toàn không Cực kỳ

XIN CHÂN THÀNH CẢM ƠN SỰ HỢP TÁC CỦA QUÝ VỊ

QUESTIONNAIRE 2019 (English version)
used for socio-acoustic and health survey on residents around Tan Son Nhat Airport

QUESTIONNAIRE ON LIVING ENVIRONMENT AND HEALTH

ID: 2019-00x
Date: August xx, 2019
Interviewee:
Address:
GPS:
Contact:

Interviewer:

(5) Vibration by aircraft flyover	( )	( )	( )	( )	( )
(6) Exhausted gas actories	( )	( )	( )	( )	( )
(7) Smoke discharged from factories	( )	( )	( )	( )	( )
(8) Odors					

7. Thinking about the last 12 months or so, what number from 0 to 10 best shows how much you are bothered, disturbed, or annoyed by aircraft noise?

0 1 2 3 4 5 6 7 8 9 10

Not at all Extremely

8. How often do you have any trouble getting to sleep or staying asleep?

1. Often 2. Somtimes 3. Almost never

9. How many hours of sleep do you usually get at night?

1. 6 hours or less 2. 7 hours 3. 8 hours 4. 9 hours or more

10. During the past 4 weeks, how would you rate the quality of your sleep overall?

1. Very good 2. Fairly good 3. Fairly bad 4. Very bad

11. Please answer this question concerning your sleep:

(1) Do you have any trouble with your sleep?

1) No ☐
2) Yes ☐

If you answered "Yes" to the above question, please choose appropriate numbers for each item.

	1 Occasionally	2 Once or twice a week	3 More than 3 times a week
(1) Difficult to fall asleep	( )	( )	( )
(2) When awakened during the night, it is difficult to sleep again.	( )	( )	( )
(3) Awakened early in the morning	( )	( )	( )
(4) Do not feel as having slept well the next morning.	( )	( )	( )
(5) Sleepy during daytime and cannot work well	( )	( )	( )
(6) Others ( )	( )	( )	( )

(2) If you have trouble with your sleep, do you think that it is due to the aircraft noise?

1) No ☐
2) Yes ☐

12. Do you see the airplane flying through your house?

1) No ☐
2) Yes ☐

If yes, how many times a day? _____ times

13. Is your bedroom windows opened in the following season?

	1 Rarely	2 Sometimes	3 Often	4 Always

2) Not very stressful ( )

3) A bit stressful ( )

4) Quite a bit stressful ( )

5) Extremely stressful ( )

20. Do you usually have periodic health examination?

1) No ( )

2) Yes ( )

21. Which health facility do you usually visit? _____

22. Here is a list of medical conditions that usually last for some time. Have you ever had any of these conditions? In the first column, check "yes" or "no" for each condition, then, for each "yes", please answer every question across the page.

Have you ever had...? 1. No 2. Yes	What year did it start?	Did you ever see a doctor about it? 1. No 2. Yes	Have you ever been hospitalized for it? 1. No 2. Yes	Have you ever taken medicines prescribed for it? 1. No 2. Yes	Have you had it in the last 12 months? 1. No 2. Yes
Heart trouble		( )	( )	( )	( )
High blood pressure or Hypertension		( )	( )	( )	( )
Hyperlipidemia		( )	( )	( )	( )
Stroke, Small stroke or TIA		( )	( )	( )	( )
Asthma		( )	( )	( )	( )
Diabetes		( )	( )	( )	( )
Cancer Type of cancer: _____ _____ _____		( ) ( ) ( ) ( )	( ) ( ) ( ) ( )	( ) ( ) ( ) ( )	( ) ( ) ( ) ( )
Depression or neurosis		( )	( )	( )	( )
Others: _____ _____ _____ _____		( ) ( ) ( ) ( )	( ) ( ) ( ) ( )	( ) ( ) ( ) ( )	( ) ( ) ( ) ( )

6) Almost everyday ( )

31. Below is a list of the way you might have felt or behaved. Please check the boxes to tell me how often you have felt this way in the past week or so.

		Last week				Nearly every day for 2 weeks
		Not at all or less than 1 day	1-2 days	3-4 days	5-7 days	
1	My appetite was poor	( )	( )	( )	( )	( )
2	I could not shake off the blues	( )	( )	( )	( )	( )
3	I had trouble keeping my mind on what I was doing	( )	( )	( )	( )	( )
4	I felt depressed	( )	( )	( )	( )	( )
5	My sleep was restless	( )	( )	( )	( )	( )
6	I felt sad	( )	( )	( )	( )	( )
7	I could not get going	( )	( )	( )	( )	( )
8	Nothing made me happy	( )	( )	( )	( )	( )
9	I felt like a bad person	( )	( )	( )	( )	( )
10	I lost interest in my usual activities	( )	( )	( )	( )	( )
11	I slept much more than usual	( )	( )	( )	( )	( )
12	I felt like I was moving too slowly	( )	( )	( )	( )	( )
13	I felt fidgety	( )	( )	( )	( )	( )
14	I wished I were dead	( )	( )	( )	( )	( )
15	I wanted to hurt myself	( )	( )	( )	( )	( )
16	I was tired all the time	( )	( )	( )	( )	( )
17	I did not like myself	( )	( )	( )	( )	( )
18	I lost a lot of weight without any effort	( )	( )	( )	( )	( )
19	I had a lot of trouble getting to sleep	( )	( )	( )	( )	( )
20	I could not focus on the important things	( )	( )	( )	( )	( )

32. Below is a list of the way you might have felt or behaved. Please check the boxes to tell me how often you have felt this way.

		Yes	Sometimes	No
1	Do you have headaches?	( )	( )	( )
2	Do you experience feelings of dizziness?	( )	( )	( )
3	Have you experienced a sense of dullness or a heavy feeling in your head?	( )	( )	( )
4	Have you experienced a sense of dullness or a heavy sensation in your hands or legs?	( )	( )	( )
5	Do you have pains in various parts of your body?	( )	( )	( )
6	Does your head feel "heavy" or "dull"?	( )	( )	( )
7	Does your mouth "water" a lot ; that is, produce a lot of saliva?	( )	( )	( )
8	Do you have any stiffness or pain in your neck or shoulders?	( )	( )	( )
9	Do you have blurred vision?	( )	( )	( )

37. Please tell us the information below concerning your health condition:

(1) Height _____cm

(2) Weight _____kg

(3) Maximum blood pressure _____mmHg

(4) Minimum blood pressure _____mmHg

(5)Age_____ years old

38. Blood pressure measurement:

1st time measurement	**2nd time**	**3rd time**
Upper _____mmHg Lower _____mmHg Heart rate _____	Upper _____mmHg Lower _____mmHg Heart rate _____	Upper _____mmHg Lower _____mmHg Heart rate _____

39. As you wish, please provide your own comments on the living environment:

_____

_____

_____

_____

_____

_____

THANK YOU FOR YOUR COOPERATION!

F1. Gender of respondent

1.Male ( )
2.Female ( )

F2. How many floors does your house have? _____ floors
Which floor are you usually sleeping at? _____

F3. Structure of the house

1 Wooden ( )
2 Bricks ( )
3 Prefabricated ( )
4 Reinforced concrete ( )
5 Reinforced concrete with brick wall ( )
6 Others _____( )

F4. How many glass layers do your living room windows and doors have? If they are doubled-pane windows/doors, please specify as 2 layers.

1 More than 3 layers ( )
2 2 layers ( )
3 1 layer ( )

Dự án hợp tác nghiên cứu khoa học giữa

Đại học Nông Lâm Thành phố Hồ Chí Minh và Đại học Shimane

PHIẾU KHẢO SÁT VỀ TIỆN NGHI MÔI TRƯỜNG SỐNG VÀ SỨC KHỎE

ID: 2019-A...- _____

Ngày: ...../08/2019

Họ tên người trả lời phỏng vấn: .....

Địa chỉ: .....

GPS: .....

Liên hệ: .....

Người phỏng vấn: .....

MỌI Ý KIẾN XIN GỬI VỀ:

NGUYỄN THU LAN

Email: lan@riko.shimane-u.ac.jp

Hoặc

TRIỆU BẠCH LIÊN

Email: trieulien0903@gmail.com

KHOA KIẾN TRÚC

ĐẠI HỌC SHIMANE – NHẬT BẢN

Hồ Chí Minh - 2019

7. Trong khoảng 12 tháng qua, tiếng ồn từ máy bay đã làm phiền anh(chị), gây khó chịu cho anh(chị) ở mức độ nào?

0 1 2 3 4 5 6 7 8 9 10

Hoàn toàn không Cực kỳ

8. Anh(chị) có thường gặp vấn đề về giấc ngủ không?

1. Thường xuyên 2. Thỉnh thoảng 3. Hầu như không

9. Anh(chị) thường ngủ khoảng bao nhiêu tiếng vào buổi đêm?

1. 6 tiếng hoặc ít hơn 2. 7 tiếng 3. 8 tiếng 4. 9 tiếng hoặc hơn

10. Trong khoảng 4 tuần qua, anh(chị) đánh giá thế nào chất lượng giấc ngủ của mình?

1. Rất tốt 2. Tốt 3. Không tốt 4. Rất không tốt

11. Anh(chị) có gặp rắc rối với giấc ngủ không?

1. Không 2. Có

(1) Nếu "có", xin hãy chọn câu trả lời cho các mục sau đây:

	Hiếm khi/ Hoàn toàn không	1-2 lần/ tuần	3 lần/ tuần trở lên
(1) Khó đi vào giấc ngủ	( )	( )	( )
(2) Khó ngủ trở lại sau khi bị thức giấc vào buổi đêm	( )	( )	( )
(3) Bị thức giấc sớm vào buổi sáng	( )	( )	( )
(4) Không cảm thấy đã được ngủ ngon vào sáng hôm sau	( )	( )	( )
(5) Cảm thấy buồn ngủ vào ban ngày và không thể làm việc tốt	( )	( )	( )
(6) Ngoài ra _____	( )	( )	( )

(2) Nếu anh(chị) có rắc rối với giấc ngủ, anh(chị) có nghĩ nguyên nhân là do tiếng ồn máy bay không? 1. Không 2. Có

12. Anh(chị) có thấy máy bay bay qua nhà mình không? 1. Không 2. Có

Nếu "có" thì khoảng bao nhiêu lần 1 ngày? _____

13. Phòng ngủ của anh(chị) có thường mở cửa sổ không?

	Hiếm khi	Thỉnh thoảng	Thường xuyên	Luôn luôn
(1) Mùa mưa	( )	( )	( )	( )
(2) Mùa khô	( )	( )	( )	( )

22. Dưới đây là danh sách các bệnh lý thường kéo dài trong một thời gian. Anh(Chị) đã từng mắc bệnh nào trong danh chưa?

1 - Không 2 - Có

Đối với mỗi bệnh ở cột này, nếu "có" xin anh(chị) vui lòng trả lời những câu hỏi ở các cột tiếp theo.	Năm bắt đầu	Gặp bác sĩ chưa? (1/2)	Nhập viện vì nó? (1/2)	Uống thuốc theo đơn chỉ định của bác sĩ? (1/2)(Thuốc gì?)	Mắc trong vòng 12 tháng qua? (1/2)
(1) Bệnh tim mạch					
(2) Huyết áp cao hoặc Bệnh tăng huyết áp					
(3) Tăng lipid máu					
(4) Đột quỵ , Đột quỵ nhẹ hay Cơn thiếu máu não thoáng qua (TIA)					
(5) Hen suyễn					
(6) Tiểu đường					
(7) Ung thư					
(8) Trầm cảm, rối loạn thần kinh					
(9) Khác:					

23. Anh(Chị) vui lòng cho biết cha mẹ đẻ của anh(chị) có từng mắc các bệnh dưới đây?

1 - Không ; 2 - Có ; 3 - Không biết

	Cha đẻ	Mẹ đẻ
(1) Bệnh tim mạch		
(2) Huyết áp cao		
(3) Đột quỵ hoặc TIA		
(4) Tiểu đường		

24. Lượng muối anh(chị) sử dụng trong mỗi bữa ăn có nhiều không?

1. Rất nhiều 2. Một chút 3. Không nhiều lắm 4. Không

25. Anh(Chị) có hay ăn những món dưới đây không?

	Không nhiều lắm	1 lần/ ngày	Mọi bữa ăn
(1) Dưa muối	( )	( )	( )

32. Dưới đây là danh sách những điều anh(chị) cảm thấy và hành xử. Anh(Chị) có thường xuyên cảm thấy như vậy không?

		Tuần trước				Hầu như mọi ngày trong 2 tuần qua
		Hoàn toàn không hoặc ít hơn 1 lần 2 ngày	1-2 ngày trong tuần	3-4 ngày trong tuần	5-7 ngày trong tuần	
1	Tôi cảm thấy ăn không ngon miệng	( )	( )	( )	( )	( )
2	Tôi không thể rũ bỏ sự buồn chán	( )	( )	( )	( )	( )
3	Tôi gặp vấn đề trong việc tập trung vào những việc tôi đang làm	( )	( )	( )	( )	( )
4	Tôi cảm thấy rất chán nản	( )	( )	( )	( )	( )
5	Ngủ không yên	( )	( )	( )	( )	( )
6	Tôi cảm thấy buồn	( )	( )	( )	( )	( )
7	Tôi không thể bắt đầu một việc gì	( )	( )	( )	( )	( )
8	Không gì khiến tôi cảm thấy vui	( )	( )	( )	( )	( )
9	Tôi thấy mình như 1 người xấu vậy	( )	( )	( )	( )	( )
10	Tôi mất hứng thú với các hoạt động thường làm trước đây	( )	( )	( )	( )	( )
11	Tôi ngủ nhiều hơn bình thường	( )	( )	( )	( )	( )
12	Tôi cảm giác tôi đang di chuyển quá chậm	( )	( )	( )	( )	( )
13	Tôi cảm thấy bồn chồn	( )	( )	( )	( )	( )
14	Tôi đã ước tôi có thể chết đi	( )	( )	( )	( )	( )
15	Tôi muốn tổn thương bản thân mình	( )	( )	( )	( )	( )
16	Tôi thấy mệt mỏi mọi lúc	( )	( )	( )	( )	( )
17	Tôi không thích chính mình	( )	( )	( )	( )	( )
18	Tôi giảm cân rất nhiều mà không cần nỗ lực gì cả	( )	( )	( )	( )	( )
19	Tôi gặp nhiều vấn đề về giấc ngủ	( )	( )	( )	( )	( )
20	Tôi không thể tập trung vào những điều quan trọng	( )	( )	( )	( )	( )

37. Xin anh(chị) cho biết một số thông tin liên quan đến tình trạng sức khỏe.

(1) Chiều cao _____cm (2) Cân nặng _____kg

(3) Huyết áp trên _____mmHg (4) Huyết áp dưới _____mmHg

(5) Tuổi _____

38. Đo huyết áp

Lần 1	**Lần 2**	**Lần 3**
Upper _____mmHg Lower _____mmHg Nhịp tim_____	Upper _____mmHg Lower _____mmHg Nhịp tim _____	Upper _____mmHg Lower _____mmHg Nhịp tim_____

39. Ngoài các câu hỏi trên, nếu anh(chị) có ý kiến gì về môi trường sống hiện nay, xin cho biết:

_____

_____

_____

*** Phần này sinh viên thực hiện phỏng vấn xin hãy quan sát và tự điền câu trả lời (nếu không rõ, xin hỏi lại người trả lời phỏng vấn để có câu trả lời đúng)**

F1. Giới tính của người trả lời phỏng vấn? 1. Nam 2. Nữ

F2. Cấu tạo ngôi nhà thuộc loại nào trong các cấu tạo dưới đây?

1 Làm từ gỗ ( )

2 Xây từ gạch ( )

3 Nhà lắp ghép ( )

4 Nhà bê tông cốt thép ( )

5 Tường gạch và khung bê tông cốt thép ( )

6 Ngoài ra_____ ( )

F3. Kính các loại cửa hướng ra bên ngoài của <u>phòng khách</u> cửa ngôi nhà (cửa sổ, cửa ra vào) là loại kính bao nhiêu lớp? nếu là kính đôi nhiều lớp, xin xếp vào loại kính hai lớp.

1. Trên 3 lớp 2. Hai lớp 3. Một lớp 4. Ngoài ra_____

F4. Khung các loại cửa <u>phòng khách</u> của ngôi nhà thuộc loại nào trong số các loại khung dưới đây? Xin chọn đánh giá câu trả lời thích hợp:

1. Nhôm 2. Gỗ 3. Nhựa 4. Ngoài ra _____

F5. Các cửa của <u>phòng khách</u> (cửa sổ, cửa ra vào) của ngôi nhà có hướng ra mặt đường hay không? 1. Không 2. Có

F6. Kính các loại cửa hướng ra bên ngoài của <u>phòng ngủ</u> của ngôi nhà (cửa sổ, cửa ra vào) là loại kính bao nhiêu lớp? nếu là kính đôi nhiều lớp, xin xếp vào loại kính hai lớp.

1. Trên 3 lớp 2. Hai lớp 3. Một lớp 4. Ngoài ra_____

Dự án hợp tác nghiên cứu khoa học giữa
Đại học Nông Lâm Thành phố Hồ Chí Minh và Đại học Shimane

PHIẾU KHẢO SÁT VỀ TIỆN NGHI MÔI TRƯỜNG SỐNG VÀ SỨC KHỎE

ID: 2020 -A...- 00...
Ngày: ...../06/2020
Họ tên người trả lời phỏng vấn: .....
Địa chỉ: .....
GPS: .....
Liên hệ: .....
Người phỏng vấn: .....

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KHOA KIẾN TRÚC
ĐẠI HỌC SHIMANE – NHẬT BẢN

Hồ Chí Minh, 2020

1. Thường xuyên 2. Thỉnh thoảng 3. Hầu như không

6. Mỗi ngày, anh(chị) thường đi ngủ và thức dậy lúc mấy giờ?

	Đi ngủ	Thức dậy
Các ngày trong tuần	_____h	_____h
Cuối tuần (ngày lễ)	_____h	_____h

7. Trong <u>khoảng 4 tuần qua,</u> anh(chị) đánh giá thế nào về chất lượng giấc ngủ của mình?
1. Rất tốt 2. Khá tốt 3. Khá tệ 4. Rất tệ

8. Hãy trả lời câu hỏi này liên quan đến giấc ngủ của anh(chị):
(1) Anh(chị) có gặp rắc rối với giấc ngủ không? 1. Không 2. Có
(2) Nếu trả lời "Có" ở câu hỏi trên, vui lòng chọn số thích hợp cho từng mục sau:

	1 Hiếm khi/ Hoàn toàn không	2 1-2 lần/ tuần	3 Nhiều hơn 3 lần/ tuần
(1) Khó đi vào giấc ngủ	( )	( )	( )
(2) Khi bị thức giấc vào buổi đêm, khó ngủ trở lại.	( )	( )	( )
(3) Bị thức giấc sớm vào buổi sáng	( )	( )	( )
(4) Không cảm thấy đã được ngủ ngon vào sáng hôm sau.	( )	( )	( )
(5) Cảm giác buồn ngủ vào ban ngày và không thể làm việc tốt	( )	( )	( )
(6) Khác ( )	( )	( )	( )

(3) Nếu anh (chị) có rắc rối với giấc ngủ, anh(chị) có nghĩ nguyên nhân là do tiếng ồn máy bay không? 1. Không 2. Có

9. Anh(chị) có thấy máy bay qua nhà mình không? 1. Không **2. Có**
Nếu "Có", thì bao nhiêu lần 1 ngày ? _____ lần

10. Phòng ngủ của anh(chị) có <u>thường</u> mở cửa sổ không?
1. Hiếm khi 2. Thỉnh thoảng 3. Thường xuyên 4. Luôn Luôn

11. Nhà anh(chị) có lắp đặt điều hòa không? 1. Không 2. Có

12. Trong cuộc sống hàng ngày các yếu tố thời tiết cũng như điều kiện môi trường tác động đến chúng ta rất nhiều, anh(chị) nhạy cảm ở mức độ nào đối với các yếu tố dưới đây?

	1 Hoàn toàn không	2 Một phần nào	3 Không quá mức	4 Nhiều	5 Cực kỳ
(1) Lạnh	( )	( )	( )	( )	( )
(2) Nóng	( )	( )	( )	( )	( )
(3) Tiếng ồn	( )	( )	( )	( )	( )
(4) Độ rung	( )	( )	( )	( )	( )
(5) Chất hóa học	( )	( )	( )	( )	( )
(6) Mùi hôi	( )	( )	( )	( )	( )
(7) Bụi, phấn hoa, không khí bẩn	( )	( )	( )	( )	( )

20. Anh(chị) có thường xuyên tập thể dục trên 30 phút không?

1) Hoàn toàn không	( )
2) 1 hoặc 2 lần trong tháng	( )
3) Khoảng 1 lần 1 tuần	( )
4) 2-3 lần/tuần	( )
5) 4-5 lần/tuần	( )
6) Hầu như mỗi ngày	( )

21. Dưới đây là danh sách những điều anh(chị) cảm thấy và hành xử. Anh(chị) có thường xuyên cảm thấy như vậy không?

		Tuần trước				Gần như mỗi ngày trong 2 tuần
		Hầu như không hoặc ít hơn 1 lần/ ngày	1-2 ngày	3-4 ngày	5-7 ngày	
1	Tôi cảm thấy ăn không ngon miệng	( )	( )	( )	( )	( )
2	Tôi không thể rũ bỏ buồn chán	( )	( )	( )	( )	( )
3	Tôi gặp vấn đề trong việc tập trung vào những việc tôi đang làm	( )	( )	( )	( )	( )
4	Tôi cảm thấy rất chán nản	( )	( )	( )	( )	( )
5	Ngủ không yên	( )	( )	( )	( )	( )
6	Tôi cảm thấy buồn	( )	( )	( )	( )	( )
7	Tôi không thể bắt đầu một việc gì	( )	( )	( )	( )	( )
8	Không gì khiến tôi cảm thấy vui	( )	( )	( )	( )	( )
9	Tôi cảm thấy mình như một người xấu	( )	( )	( )	( )	( )
10	Tôi mất hứng thú với các hoạt động thường làm trước đây	( )	( )	( )	( )	( )
11	Tôi ngủ nhiều hơn bình thường	( )	( )	( )	( )	( )
12	Tôi cảm thấy tôi đang di chuyển quá chậm	( )	( )	( )	( )	( )
13	Tôi cảm thấy bồn chồn	( )	( )	( )	( )	( )
14	Tôi đã ước tôi có thể chết đi	( )	( )	( )	( )	( )
15	Tôi muốn làm đau bản thân mình	( )	( )	( )	( )	( )
16	Tôi thấy mệt mỏi trong mọi lúc	( )	( )	( )	( )	( )
17	Tôi không thích bản thân mình	( )	( )	( )	( )	( )
18	Tôi giảm cân rất nhiều mà không cần nỗ lực gì cả	( )	( )	( )	( )	( )
19	Tôi gặp nhiều vấn đề về giấc ngủ	( )	( )	( )	( )	( )
20	Tôi không thể tập trung vào những điều quan trọng	( )	( )	( )	( )	( )

22. Anh(chị) có bao nhiêu khó khăn để nghe và hiểu các từ trong cuộc trò chuyện bình thường (ngay cả có máy trợ thính)?

1. Tuyệt vời 2. Một vài 3. Ít 4. Không có

1	Anh(chị) có bị điếc ở một hoặc cả 2 tai không ?	Có	Thỉnh thoảng	Không
2	Anh (chị) có bao giờ gặp khó khăn nào khi nghe với một hoặc 2 tai không ?	( )	( )	( )
3	Bây giờ anh (chị) có bị ù tai hay ù ở 1 hoặc 2 tai không ?	( )	( )	( )
4	Bây giờ anh (chị) có sử dụng máy trợ thính không ?	( )	( )	( )

5. Câu nào mô tả đúng nhất khả năng nghe ở tai TRÁI của anh (chị) (không có máy trợ thính) ?

Cam kết đồng ý cho phép xử lý dữ liệu cá nhân

Dữ liệu cá nhân có được thông qua khảo sát này sẽ chỉ được sử dụng cho các mục đích sau:

(1) Nghiên cứu đánh giá về môi trường

(2) Lưu trữ trong kho dữ liệu chung về môi trường

Thông tin cá nhân sẽ được lưu trữ trong máy chủ của Đại học Nông Lâm và Đại học Shimane. Nhóm nghiên cứu sẽ quản lý thông tin cá nhân của người trả lời một cách thích hợp.

☐ Tôi đồng ý và xác nhận thông tin.

NGÀY

TÊN

(Chữ ký)

QUESTIONNAIRE 2020.09 (English version)
used for survey on residents' reactions during Corona pandemic around Tan Son Nhat Airport

QUESTIONNAIRE ON LIVING ENVIRONMENT AND HEALTH

ID: 2020-00x
Date: September xx, 2020
Interviewee:
Address:
GPS:
Contact:

Interviewer:

flyover					
(6) Exhausted gas factories	( )	( )	( )	( )	( )
(7) Smoke discharged from factories	( )	( )	( )	( )	( )
(8) Odors					

7. In daily life, how disturbed are you by aircraft flyovers in the following cases?

	1 Not at all	2 Slightly	3 Moderately	4 Very	5 Extremely
(1) When you have conversation indoor	( )	( )	( )	( )	( )
(2) When you communicate with the phone	( )	( )	( )	( )	( )
(3) When you listen to TV/radio indoor	( )	( )	( )	( )	( )
(4) When you concentrate or read books indoor	( )	( )	( )	( )	( )
(5) When you rest indoor	( )	( )	( )	( )	( )
(6) When you fall asleep	( )	( )	( )	( )	( )
(7) When you are awakened in your sleep	( )	( )	( )	( )	( )
(8) When you want to open windows but cannot because of noise	( )	( )	( )	( )	( )
(9) When you are affected by vibration by aircraft flyovers	( )	( )	( )	( )	( )
(10) When you are afraid of possible accidents caused by aircrafts	( )	( )	( )	( )	( )
If your house has garden, balcony or terrace, please answer the following three questions:					
(11) When you work in garden, balcony or terrace	( )	( )	( )	( )	( )
(12) When you have conversation in the garden, balcony or terrace	( )	( )	( )	( )	( )
(13) When you rest in the garden, balcony or terrace	( )	( )	( )	( )	( )

8. Thinking about the last 4 months or so, what number from 0 to 10 best shows how much you are bothered, disturbed, or annoyed by aircraft noise?

0 1 2 3 4 5 6 7 8 9 10

Not at all Extremely

9. How often do you have any trouble getting to sleep or staying asleep?

1. Often 2. Somtimes 3. Almost never

(2) Hotness	( )	( )	( )	( )	( )
(3) Noise	( )	( )	( )	( )	( )
(4) Vibration	( )	( )	( )	( )	( )
(5) Chemicals	( )	( )	( )	( )	( )
(6) Odors	( )	( )	( )	( )	( )
(7) Dust, pollen, polluted air	( )	( )	( )	( )	( )

In the next part, do you mind answering some questions relating personal information?

16. What is your present job?

1) Employed -> (Occupation)_____ ( )
2) Farmer ( )
3) Student ( )
4) Housewife ( )
5) Retired ( )
6) Unemployed ( )

17. Thinking about the last 4 months, how long in a day do you stay at home?

1. Under 8 hours 2. 8-15 hours 3. Over 15h hours

18. In general, would you say your health is...?

1) Excellent ( )
2) Very good ( )
3) Good ( )
4) Fair ( )
5) Poor ( )

19. Using a scale of 0 to 10, where 0 means "Very dissatisfied" and 10 means "Very satisfied", how do you feel about your life as a whole right now?

0 1 2 3 4 5 6 7 8 9 10

↓ ↓

Very dissatisficd Very satisfied

20. Thinking about the amount of stress in your life, would you say that most days are?

1) Not at all stressful ( )
2) Not very stressful ( )
3) A bit stressful ( )
4) Quite a bit stressful ( )
5) Extremely stressful ( )

21. Do you usually have periodic health examination?

1) No ( )
2) Yes ( )

22. Which health facility do you usually visit? _____

23. Here is a list of medical conditions that usually last for some time. Have you ever had any of these conditions? In the first column, check "yes" or "no" for each condition, then, for each "yes", please answer every question across the page.

Other salty foods:			
( )	( )	( )	( )
( )	( )	( )	( )
( )	( )	( )	( )
( )	( )	( )	( )

27. Do you eat or drink salty food or soup?

1. Not eat much 2. Once a day 3. Every meal

28. Do you think about the nutritional balance of the diet?

1. Don't think 2. Think a little 3. Think 4. Think a lot

29. How often do you drink alcohol?

1. Not at all 2. 2-3 times a month or less
3. 1-4 days a week 4. Almost everyday

30. Do you smoke cigarettes?

1. Not at all 2. I smoked before but stopped
3. 20 or less per day 4. More than 20 per day

31. How often do you do physical activity over 30 minutes?

1) Not at all	( )
2) Once or twice a month	( )
3) About once a week	( )
4) 2-3 times a week	( )
5) 4-5 times a week	( )
6) Almost everyday	( )

32. How much difficulty do you have hearing and understanding words in a normal conversation (even with a hearing aid)?

1. A great deal 2. Some 3. A little 4. None

1	Do you have deafness in one or both ears?	Yes	Sometimes	No
2	Do you now have any other trouble hearing with one or both ears?	( )	( )	( )
3	Do you now have tinnitus or ringing in one or both ears?	( )	( )	( )
4	Do you now use a hearing aid?	( )	( )	( )

5. Which statements best describe your hearing in your LEFT ear (without hearing aid)?

1. Good 2. Little trouble 3. A lot of trouble 4. Deaf

6. Which statements best describe your hearing in your RIGHT ear (without hearing aid)?

1. Good 2. Little trouble 3. A lot of trouble 4. Deaf

33. Below is a list of the way you might have felt or behaved. Please check the boxes to tell me how often you have felt this way in the past week or so.

	Last week				Nearly every day for 2 weeks
	Not at all or less than 1 day	1-2 days	3-4 days	5-7 days	

35. How many vehicles are your family using for daily transport?

1. Bicycles: _____( )
2. Motorbikes: _____( )
3. Cars: _____( )
4. Others:_____( )

36. How much do you use the following means of transportation?

	1 Actively use	2 Use	3 No preference	4 Seldom use	5 Not use at all
(1) Cars	( )	( )	( )	( )	( )
(2) Trains	( )	( )	( )	( )	( )
(3) Motorbikes	( )	( )	( )	( )	( )
(4) Buses	( )	( )	( )	( )	( )
(5) Airplanes	( )	( )	( )	( )	( )
(6) Bicycles	( )	( )	( )	( )	( )
(7) Walking	( )	( )	( )	( )	( )

37. How good is the use of the following means of transportation for the society?

	1 Should be used frequently	2 Should be used	3 No preference	4 Should be seldom use	5 Should not be used at all
(1) Cars	( )	( )	( )	( )	( )
(2) Trains	( )	( )	( )	( )	( )
(3) Motorbikes	( )	( )	( )	( )	( )
(4) Buses	( )	( )	( )	( )	( )
(5) Airplanes	( )	( )	( )	( )	( )
(6) Bicycles	( )	( )	( )	( )	( )
(7) Walking	( )	( )	( )	( )	( )

38. How safe is the following means of transportation?

	1 Extremely safe	2 Safe	3 Neither safe nor dangerous	4 Dangerous	5 Extremely dangerous
(1) Cars	( )	( )	( )	( )	( )
(2) Trains	( )	( )	( )	( )	( )
(3) Motorbikes	( )	( )	( )	( )	( )
(4) Buses	( )	( )	( )	( )	( )
(5) Airplanes	( )	( )	( )	( )	( )
(6) Bicycles	( )	( )	( )	( )	( )
(7) Walking	( )	( )	( )	( )	( )

39. In which category do you classify your family incomes?

1. Under 10M VND 2. From 10M to 20M VND 3.More than 20M VND

3 1 layer ( )
4 Others_____ ( )

F5. Which type of frame among the following types do your living room windows and doors have?

1 Aluminum frame ( )
2 Wooden frame ( )
3 Plastic frame ( )
4 Others_____( )

F6. How many glass layers do your bedroom windows and doors have? If they are multi-layer doubled-pane windows/doors, please specify as 2 layers.

1 More than 3 layers ( )
2 2 layers ( )
3 1 layer ( )
4 Others_____( )

F7. Which type of frame among the following types do your bedroom windows and doors have?

1 Aluminum frame ( )
2 Wooden frame ( )
3 Plastic frame ( )
4 Others_____ ( )

F8. Does the house have the soundproofing materials and products?

1) No ☐
2) Yes ☐

F9. Are air-conditioners installed in the house?

1) No ☐
2) Yes ☐

THANK YOU VERY MUCH!

QUESTIONNAIRE 2020.09 (Vietnamese version)
used for survey on residents' reactions during Corona pandemic around Tan Son Nhat Airport

Dự án hợp tác nghiên cứu khoa học giữa
Đại học Nông Lâm Thành phố Hồ Chí Minh và Đại học Shimane

PHIẾU KHẢO SÁT VỀ TIỆN NGHI MÔI TRƯỜNG SỐNG VÀ SỨC KHỎE

ID: 2020 -A...- 00...
Ngày: ...../...../2020
Họ tên người trả lời phỏng vấn: .....
Địa chỉ: .....
GPS: .....
Liên hệ: .....
Người phỏng vấn: .....

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KHOA KIẾN TRÚC
ĐẠI HỌC SHIMANE – NHẬT BẢN

Hồ Chí Minh, 2020

7. Trong cuộc sống hàng ngày, khi máy bay bay qua, anh(chị) cảm thấy bị làm phiền ở mức độ nào trong các trường hợp dưới đây?

	1 Hoàn toàn không	2 Một phần nào	3 Không quá mức	4 Nhiều	5 Cực kỳ
(1) Làm phiền anh(chị) khi đang nói chuyện trong nhà?	( )	( )	( )	( )	( )
(2) Làm phiền anh(chị) khi nghe điện thoại trong nhà?	( )	( )	( )	( )	( )
(3) Làm phiền anh(chị) khi nghe đài, vô tuyến trong nhà?	( )	( )	( )	( )	( )
(4) Làm phiền anh(chị) khi anh(chị) đang tập trung suy nghĩ, hay đọc sách trong nhà?	( )	( )	( )	( )	( )
(5) Làm phiền khi anh(chị) nghỉ ngơi trong nhà?	( )	( )	( )	( )	( )
(6) Làm anh(chị) khó khăn khi bắt đầu vào giấc ngủ?	( )	( )	( )	( )	( )
(7) Làm anh(chị) bị thức giấc khi đang ngủ say?	( )	( )	( )	( )	( )
(8) Làm anh(chị) không thể mở cửa sổ bởi quá ồn trong khi anh(chị) muốn mở cửa?	( )	( )	( )	( )	( )
(9) Làm anh(chị) khó chịu vì rung do máy bay bay qua?	( )	( )	( )	( )	( )
(10) Làm anh(chị) lo sợ bị ảnh hưởng khi tai nạn máy bay xảy ra?	( )	( )	( )	( )	( )
Nếu nhà anh(chị) có sân vườn, ban công, sân thượng xin hãy trả lời 3 câu hỏi dưới đây					
(11) Làm phiền anh(chị) khi anh(chị) làm gì đó ở sân vườn, ban công, sân thượng?	( )	( )	( )	( )	( )
(12) Làm phiền anh(chị) khi nói chuyện ở sân vườn, ban công, sân thượng?	( )	( )	( )	( )	( )
(13) Làm phiền anh(chị) khi anh(chị) nghỉ ngơi ở sân vườn, ban công, sân thượng?	( )	( )	( )	( )	( )

8. <u>Trong 4 tháng qua</u>, tiếng ồn từ máy bay đã làm phiền anh(chị) hoặc gây khó chịu cho anh (chị) ở mức độ nào (thang đo từ 0 đến 10)?

0 1 2 3 4 5 6 7 8 9 10

Hoàn toàn không Cực kỳ

9. Anh(chị) có thường xuyên gặp vấn đề về giấc ngủ không?

1. Thường xuyên 2. Thỉnh thoảng 3. Hầu như không

10. Mỗi ngày, anh(chị) thường đi ngủ và thức dậy lúc mấy giờ?

Trong phần tiếp theo, anh(chị) có thể trả lời một số câu hỏi liên quan đến thông tin cá nhân được không?

16. Công việc hiện tại của anh(chị) là gì?

1. Đi làm (Nghề nghiệp:_____)
2. Nông dân 3. Học sinh 4. Nội trợ 5. Nghỉ hưu 6. Tự do

17. Trong 4 tháng qua anh (chị) thường ở nhà bao nhiêu tiếng 1 ngày?

1. Dưới 8 tiếng 2. Từ 8-15 tiếng 3. Trên 15 tiếng

18. Anh(chị) cảm thấy thế nào về tình trạng sức khỏe bản thân?

1. Tuyệt vời 2. Rất tốt 3. Tốt 4. Khá 5. Kém

19. Sử dụng thang đo từ 0 đến 10, trong đó 0 là "Rất không hài lòng" và 10 là "Rất hài lòng", anh(chị) cảm thấy thế nào về cuộc sống của mình hiện tại?

0 1 2 3 4 5 6 7 8 9 10

↓ ↓

Rất không hài lòng Rất hài lòng

20. Nghĩ về những căng thẳng trong cuộc sống, anh(chị) nói thế nào về mức độ căng thẳng trong hầu hết các ngày?

1. Hoàn toàn không 2. Không hẳn lắm 3. Một chút
4. Khá căng thẳng 5. Cực kỳ căng thẳng

21. Anh (chị) có thường xuyên kiểm tra sức khỏe định kỳ không? 1. Không 2. Có

22. Anh(chị) thường đến cơ sở khám chữa bệnh nào?

_____

23. Dưới đây là danh sách các bệnh lý thường kéo dài trong một thời gian. Trong cột đầu tiên, hãy kiểm tra "Có" hoặc " Không" đối với mỗi điều kiện, sau đó đối với mỗi điều kiện "Có", vui lòng trả lời câu hỏi trang dưới đây.

Bạn đã bao giờ mắc.....? 1. Không 2. Có	Năm bắt đầu?	Đã gặp bác sĩ chưa? 1. Chưa 2. Có	Đã bao giờ nhập viện vì nó? 1. Chưa 2. Có	Uống thuốc theo chỉ định bác sĩ? 1. Chưa 2. Có	Mắc trong vòng 12 tháng qua? 1. Chưa 2. Có
Bệnh tim mạch ( )		( )	( )	( )	( )
Huyết áp cao hoặc tăng huyết áp ( )		( )	( )	( )	( )
Tăng lipid máu ( )		( )	( )	( )	( )
Đột quỵ, đột quỵ nhẹ hay Cơn thiếu máu não thoáng qua (TIA) ( )		( )	( )	( )	( )
Hen suyễn ( )		( )	( )	( )	( )
Tiểu đường ( )		( )	( )	( )	( )
Ung thư ..... ( )		( )	( )	( )	( )
Trầm cảm hoặc rối loạn thần kinh ( )		( )	( )	( )	( )
Khác _____ _____ _____		( ) ( )	( ) ( )	( ) ( )	( ) ( )

33. Dưới đây là danh sách những điều anh(chị) cảm thấy và hành xử. Anh(chị) có thường xuyên cảm thấy như vậy không?

		Tuần trước				Gần như mỗi ngày trong 2 tuần
		Hầu như không hoặc ít hơn 1 lần/ ngày	1-2 ngày	3-4 ngày	5-7 ngày	
1	Tôi cảm thấy ăn không ngon miệng	( )	( )	( )	( )	( )
2	Tôi không thể rũ bỏ buồn chán	( )	( )	( )	( )	( )
3	Tôi gặp vấn đề trong việc tập trung vào những việc tôi đang làm	( )	( )	( )	( )	( )
4	Tôi cảm thấy rất chán nản	( )	( )	( )	( )	( )
5	Ngủ không yên	( )	( )	( )	( )	( )
6	Tôi cảm thấy buồn	( )	( )	( )	( )	( )
7	Tôi không thể bắt đầu một việc gì	( )	( )	( )	( )	( )
8	Không gì khiến tôi cảm thấy vui	( )	( )	( )	( )	( )
9	Tôi cảm thấy mình như một người xấu	( )	( )	( )	( )	( )
10	Tôi mất hứng thú với các hoạt động thường làm trước dây	( )	( )	( )	( )	( )
11	Tôi ngủ nhiều hơn bình thường	( )	( )	( )	( )	( )
12	Tôi cảm thấy tôi đang di chuyển quá chậm	( )	( )	( )	( )	( )
13	Tôi cảm thấy bồn chồn	( )	( )	( )	( )	( )
14	Tôi đã ước tôi có thể chết đi	( )	( )	( )	( )	( )
15	Tôi muốn làm đau bản thân mình	( )	( )	( )	( )	( )
16	Tôi thấy mệt mỏi trong mọi lúc	( )	( )	( )	( )	( )
17	Tôi không thích bản thân mình	( )	( )	( )	( )	( )
18	Tôi giảm cân rất nhiều mà không cần nỗ lực gì cả	( )	( )	( )	( )	( )
19	Tôi gặp nhiều vấn đề về giấc ngủ	( )	( )	( )	( )	( )
20	Tôi không thể tập trung vào những điều quan trọng	( )	( )	( )	( )	( )

34. Dưới đây là danh sách những điều anh(chị) cảm thấy và hành xử. Anh(chị) có thường xuyên cảm thấy như vậy không?

		Có	Thỉnh thoảng	Không
1	Anh (chị) có đau đầu không?	( )	( )	( )
2	Anh (chị) có cảm giác chóng mặt không?	( )	( )	( )
3	Anh (chị) có trải qua cảm giác không minh mẫn không?	( )	( )	( )
4	Anh (chị) có trải qua cảm giác tay chân nặng nề không?	( )	( )	( )
5	Anh (chị) có bị đau ở nhiều nơi trên cơ thể không?	( )	( )	( )
6	Anh (chị) của bạn có nặng nề hoặc không minh mẫn không?	( )	( )	( )
7	Miệng của Anh (chị) có tiết nhiều nước bọt không?	( )	( )	( )
8	Anh (chị) có cứng hay đau cổ vai gáy không?	( )	( )	( )
9	Anh (chị) có bị mờ mắt không?	( )	( )	( )

	1 Cực kỳ an toàn	2 An toàn	3 Không an toàn lắm	4 Nguy hiểm	5 Cực kỳ nguy hiểm
(1) Xe hơi	( )	( )	( )	( )	( )
(2) Tàu	( )	( )	( )	( )	( )
(3)Xe gắn máy	( )	( )	( )	( )	( )
(4) Xe buýt	( )	( )	( )	( )	( )
(5) Máy bay	( )	( )	( )	( )	( )
(6) Xe đạp	( )	( )	( )	( )	( )
(7) Đi bộ	( )	( )	( )	( )	( )

39. Xin anh(chị) vui lòng cho biết khoảng thu nhập của gia đình?

1. Dưới 10 triệu đồng 2. Khoảng 10-20 triệu đồng 3. Hơn 20 triệu đồng

40. Trong 4 tháng qua, thu nhập của gia đình anh (chị) có bị ảnh hưởng không?

1. Không 2. Có

41. Anh(chị) từng học ở những trường nào?

1. Trường THCS _____
2. Trường THPT _____
3. Đại học/ Học viện _____
4. Khác _____

42. Xin vui lòng cho chúng tôi biết thông tin dưới đây liên quan đến tình trạng sức khỏe của anh(chị) :

(1) Chiều cao _____cm (2) Cân nặng _____kg

(3) Huyết áp trên _____mmHg (4) Huyết áp dưới _____mmHg

(5) Độ tuổi_____ tuổi

43. Ngoài các câu hỏi trên, nếu anh(chị) có ý kiến gì về môi trường sống hiện nay, xin cho biết

_____

_____

_____

_____

_____

44. Anh(chị) đã từng tham gia khảo sát tương tự trước đây chưa?

1. Chưa từng tham gia
2. Đợt 1: Tháng 8 năm 2019
3. Đợt 2: Tháng 6 năm 2020
4. Cả đợt 1 và đợt 2

*** Phần này sinh viên thực hiện phỏng vấn xin hãy quan sát và tự điền câu trả lời (nếu không rõ, xin hỏi lại người trả lời phỏng vấn để có câu trả lời đúng)**

F1. Giới tính của người trả lời phỏng vấn? 1. Nam 2. Nữ

F2. Cấu tạo ngôi nhà thuộc loại nào trong các cấu tạo dưới đây?

1. Làm từ gỗ 2. Xây từ gạch 3. Nhà lắp ghép
4. Nhà bê tông cốt thép 5. Tường gạch và khung bê tông cốt thép
6. Ngoài ra_____