UNIVERSITI PUTRA MALAYSIA

IMPACT OF NOISE AND HEARING ON TASK AND ACADEMIC PERFORMANCE OF PRIMARY SCHOOL CHILDREN IN KUALA LUMPUR

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By

CHUA SWEE KIM

Thesis Submitted in Fulfilment of the Requirement for the Degree of Master of Science in the Faculty of Medicine and Health Sciences Universiti Putra Malaysia

September 2001

This work is especially dedicated to

My loving and caring grandmother, father and family members

My love

All the children

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

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Chairman: Associate Professor Dr. Zailina Hashim

Faculty: Medicine and Health Sciences

Noise poses a serious threat to children's hearing, health, learning and behavior. This study was done to determine the effects of noise and hearing on task and academic performance of primary school children in Kuala Lumpur. A total of 110 Standard One Malay children aged from 6 ½ to 7 ½ years were recruited in this study according to stratified random sampling. Environmental noise levels and personal noise exposures were measured by using sound level meter and noise dosimeter, respectively. A personal questionnaire and audiometric tests was administered on all the respondents. Seven tests in the McCarthy Scales of Children's Abilities constituted the tests in the Task Performance. Task Performance was carried out twice on the same respondents in quiet and noise condition. The child's academic performance was determined by his latest examination result in the school.

Environmental noise measurement indicated that a mean equivalent continuous sound level (LEQ), maximum level (LMAX) and minimum level (LMIN) of at least 60 dB (A) was found inside and outside the classrooms irrespective of school days or holidays. The respondents were exposed to an average sound level of 85.6 dB (A), a

maximum level of 109.6 dB (A) and a minimum level of 51.7 dB (A). Audiometric test results showed that 45.2% respondents experienced high frequency hearing loss (HFHL) and 61.5% had low frequency hearing loss (LFHL). A typical noise dip was found at 6000 Hz.

There was a significant difference in Verbal Memory 2 ($t = 2.236$, $p = 0.027$). At high pure tone average (HPTA), significant differences were found in Tapping Sequence and Verbal Memory 2 for normal hearing ($t = 3.173$, $p = 0.002$) and hearing impaired respondents ($t = 2.012$, $p = 0.050$), respectively. At low pure tone average (LPTA), there was also a significant difference in total scores ($t = 2.380$, $p = 0.022$) and Verbal Memory 2 ($t = 2.748$, $p = 0.009$) for normal respondents. Respondents with LFHL performed significantly poorer than their normal hearing peers in all subjects ($t = 2.347$, $p = 0.021$), Malay Language ($t = 2.042$, $p = 0.044$) and English Language ($t = 2.642$, $p = 0.010$).

By using Pearson's Correlation, personal LMAX was found to have significant correlation with left ear thresholds at HPTA ($r = 0.309$, $p = 0.002$) and LPTA ($r = 0.213$, $p = 0.032$). Results from Multiple Regression showed that there were significant relationships between right ear thresholds at HPTA with house environment scores ($\beta = 0.647$, $t = 2.479$, $p = 0.015$). As for the left ear, personal LMAX ($\beta = 0.600$, $t = 2.690$, $p = 0.008$) was found to have significant relationship with HPTA thresholds. At LPTA, significant relationships were found between left ear thresholds with clinical history scores ($\beta = -1.302$, $t = -2.292$, $p = 0.024$). There was a significant relationship between academic performance with personal LMAX ($F = 5.935$, $p = 0.017$) and hearing category at HPTA ($F = 4.560$, $p = 0.036$). In conclusion, noise exerts variable effects on task performance. Exposure to LMAX of over 100 dB (A) tended to have some effects on hearing thresholds and academic performance.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

KESAN BUNYI BISING AND PENDENGARAN KE ATAS PRESTASI TUGASAN AND AKADEMIK DI KALANGAN MURID-MURID SEKOLAH RENDAH DI KUALA LUMPUR

Oleh

CHUA SWEE KIM

September 2001

Pengerusi: Profesor Madya Dr. Zailina Hashim

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Bunyi bising merupakan satu ancaman ke atas pendengaran, kesihatan, pembelajaran dan tingkahlaku kanak-kanak. Kajian ini dilakukan untuk menentukan kesan bunyi bising dan pendengaran ke atas prestasi tugasan dan akademik di kalangan murid-murid sekolah rendah di Kuala Lumpur. Sejumlah 110 orang kanak-kanak Melayu Darjah Satu yang berumur dari 6 ½ ke 7 ½ tahun telah dipilih sebagai responden berdasarkan kaedah persampelan berstrata. Alat pengukur bunyi dan dosimeter bunyi bising digunakan untuk mengukur tahap bunyi bising persekitaran dan pendedahan bunyi bising individu. Borang soal selidik dan ujian pendengaran telah dijalankan ke atas semua responden. Ujian Prestasi Tugasan yang terdiri daripada tujuh ujian yang dipilih dari McCarthy Scales of Children's Abilities dijalankan sebanyak dua kali dalam situasi sunyi dan bising. Prestasi akademik kanak-kanak ditentukan oleh keputusan peperiksaan terkini.

Pengukuran bunyi bising persekitaran mendapati tahap bunyi berterusan equivalen (LEQ), tahap maksimum (LMAX) dan tahap minimum (LMIN) mencapai sekurang-kurangnya 60 dB (A) di dalam dan di luar bilik darjah pada hari bersekolah atau hari

cuti. Responden terdedah kepada 85.6 dB (A) purata tahap bunyi, tahap maksimum 109.6 dB (A) dan tahap minimum 51.7 dB (A). Ujian pendengaran menunjukkan bahawa terdapat 45.2% responden mengalami hilang pendengaran pada frekuensi tinggi (HFHL) dan 61.5% mempunyai hilang pendengaran pada frekuensi rendah (LFHL). Terdapat satu lurah bunyi bising yang tipikal pada 6000 Hz.

Terdapat perbezaan yang signifikan di Memori Verbal 2 ($t = 2.236$, $p = 0.027$). Pada purata frekuensi tinngi (HPTA), terdapat perbezaan yang signifikan di Urutan Ketukan dan Memori Verbal 2 di kalangan responden normal ($t = 3.173$, $p = 0.002$) dan responden yang hilang pendengaran ($t = 2.012$, $p = 0.050$) masing-masing. Perbezaan yang signifikan juga didapati di jumlah skor ($t = 2.380$, $p = 0.022$) dan Memori Angka 2 ($t = 2.748$, $p = 0.009$) bagi responden normal pada purata frekuensi rendah (LPTA). Pencapaian akademik bagi responden yang mempunyai LFHL adalah lebih teruk daripada responden normal dalam semua matapelajaran ($t = 2.347$, $p = 0.021$), Bahasa Melayu ($t = 2.042$, $p = 0.044$) dan Bahasa Inggeris ($t = 2.642$, $p = 0.010$).

Dengan menggunakan Korelasi Pearson, LMAX individu didapati mempunyai korelasi yang signifikan dengan ambang pendengaran telinga kiri pada HPTA ($r = 0.309$, $p = 0.002$) dan LPTA ($r = 0.213$, $p = 0.032$). Keputusan dari Multiple Regression menunjukkan bahawa terdapat hubungan yang signifikan antara ambang pendengaran telinga kanan pada HPTA dengan skor persekitaran rumah ($\beta = 0.647$, $t = 2.479$, $p = 0.015$). Manakala untuk telinga kiri pula, LMAX individu ($\beta = 0.600$, $t = 2.690$, $p = 0.008$) didapati mempunyai hubungan yang signifikan dengan ambang pendengaran HPTA. Pada LPTA, hubungan yang signifikan didapati antara ambang pendengaran telinga kiri dengan skor sejarah klinikal (β = -1.302, t = -2.292, p = 0.024). Terdapat hubungan yang signifikan antara prestasi akademik dengan LMAX individu (F = 5.935, p = 0.017) dan kategori pendengaran pada HPTA (F = 4.560, p = 0.036). Secara kesimpulan, bunyi bising mendatangkan kesan yang berlainan ke atas prestasi tugasan. Pendedahan kepada LMAX yang melebihi 100 dB (A) dapat menjejas pendengaran dan prestasi akademik.

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I certify that an Examination Committee met on 3rd September 2001 to conduct the final examination of Chua Swee Kim on her Master of Science thesis entitled "Impact of Noise and Hearing on Task and Academic Performance of Primary School Children" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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This thesis submitted to the Senate of Universiti Putra Malaysia has been accepted as fulfillment of the requirement for the degree of Master of Science.

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Date: 10 JAN 2002

DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

CHUA SWEE KIM

Date: 21 Nov 2001

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LIST OF ABBREVIATIONS/NOTATIONS

EPA	Environmental Protection Agency
HPTA	High pure tone average
LPTA	Low pure tone average
HFHL	High frequency hearing loss
LFHL	Low frequency hearing loss
LEQ	Equivalent continuous sound level
LMAX	Maximum level
LMIN	Minimum level
MSCA	McCarthy Scales of Children's Abilities
WHO	World Health Organization

CHAPTER 1

INTRODUCTION

Introduction

Noise is a normal feature of life and provides one of the most effective alarm systems in man's physical environment. It is an accompaniment to most human activity and as such may constitute a hazard or stimulant. Noise is generally identified as any unwanted sound that may have adverse effects on man.

With increasing population and urbanization, exposure to high intensity traffic is becoming a critical environmental problem in recent years. High intensity traffic poses a threat to our physical and mental health. Road traffic noise is a frequent, unavoidable and continuously increasing environmental factor of modern life. The acoustic study implemented throughout a neighborhood of Valencia (Spain) revealed that traffic was the major source of noise, followed by noise from neighbors and factories (Aparicio *et al.*, 1993). Noise acts as a nonspecific stressor on the human organism. Thus, the pathways of noise processing may be different with greater emphasis on either the sympathicotonic or humoral axis.

Of the many health hazards related to noise, hearing loss is the most clearly observable and measurable by health professionals. For many of us, there may be a risk that exposure to the stress of noise increases susceptibility to disease and infection. The more susceptible person may experience noise as a complicating factor in heart problems and other diseases. Noise that causes annoyance and irritability in healthy persons may have serious consequences for those already ill in mind or body.

More than 20 million Americans are exposed to hazardous noise on a regular basis that could finally lead to hearing loss (Consensus Conference on Noise and Hearing Loss, 1990). In United States, occupational deafness is among the 10 leading occupational diseases (Hearing Institute For Children and Adults, 1998). Live or recorded high-volume music, lawn-care equipment and some household appliances are examples of non-occupational sources of potentially hazardous noise. Noise induced hearing loss (NIHL) is preventable except for certain cases of accidental exposure.

Besides that, noise can also lead to other forms of non-auditory effects. Children attending kindergartens situated in areas with traffic noise > 60 dB (A) had higher systolic blood pressure and diastolic blood pressure and lower mean heart rate than children in quiet areas (Regecova and Kellerova, 1995). Study by Nivision and Endresen (1993) showed a strong correlation between the subjective noise responses of annoyance and sensitivity and health complaints among 47 women and 35 men living beside a street with moderate to heavy traffic.

Noise affects communication, it creates a ripple of effects, with a negative impact on a person's social, vocational and emotional well-being. Therefore, children study in schools that are located near busy and noisy road are at risk of experiencing the health effects of noise, especially hearing loss. Hearing loss can result in the loss of concentration and lowering of attention. Consequently, hearing-impaired students will