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

CHUA SWEE KIM

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

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
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.
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

Fakulti: Perubatan dan Sains Kesihatan


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 tinggi (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 (β = 0.647, t = 2.479, p = 0.015). Manakala untuk telinga kiri pula, LMAX individu (β = 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 ($\beta = -1.302$, $t = -2.292$, $p = 0.024$). 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 tugas. Pendedahan kepada LMAX yang melebihi 100 dB (A) dapat menjelas 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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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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<td>EPA</td>
<td>Environmental Protection Agency</td>
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<tr>
<td>HPTA</td>
<td>High pure tone average</td>
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<td>LPTA</td>
<td>Low pure tone average</td>
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<tr>
<td>HFHL</td>
<td>High frequency hearing loss</td>
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<tr>
<td>LFHL</td>
<td>Low frequency hearing loss</td>
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<td>LEQ</td>
<td>Equivalent continuous sound level</td>
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<td>LMAX</td>
<td>Maximum level</td>
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<td>LMIN</td>
<td>Minimum level</td>
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<td>MSCA</td>
<td>McCarthy Scales of Children’s Abilities</td>
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<td>WHO</td>
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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