10163- Urban Noise: sound pressure level in the city of São Paulo, Brazil

Carolina Moura and Maria Regina Alves Cardoso
Universidade de São Paulo - Faculdade de Saúde Pública (Departamento de Epidemiologia)

The most important source of urban noise is the traffic. The city of São Paulo has 5 million vehicles for a population of 10 million people, however the last study of urban noise dated from 1969. For this reason the objectives of this study were to estimate the sound pressure levels and their variability in urban roads in the city of São Paulo and to study the Brazilian Legislation in the context of noise. 75 points were selected at any position along the length of roads with different characteristics such as width, type of surface, height of the buildings, presence of trees, and type of building use (residential or commercial). The measurements were done from Monday to Friday, (8 am to 6 pm and 8 pm to 12 pm), using a 2236 Mediator (Brüel & Kjaer) - type I, following the NBR 10.151 (Brazilian Legislation). Each measurement lasted 2 minutes. The Brazilian Legislation was evaluated through the noise assessment, control methods and thresholds defined. The number of measurements for each point ranged from 13 to 49 and the time of assessment from 7:43 am to 5:56 pm and from 8:14 to 11:23 pm. For the period of the day, the maximum peak (MaxP) ranged from 84.93 to 110.85 dB(C) [mean 101.11], the equivalent continuous A-weighted sound pressure level (Leq) from 52.02 to 81.44 dB(A) [69.27], the mean maximum (MaxL) from 64.85 to 94.26 dB(A) [82.63], a mean minimum (MinL) from 43.19 to 71.45 dB(A) [56.24], the percentil 10 (Ln1) from 53.92 to 84.37 dB(A) [72.01], the percentil 50 (Ln2) from 49.36 to 78.67 dB(A) [64.93] and the percentil 90 (Ln3) from 45.61 to 73.98 dB(A) [59.30]. On the other hand, for the period of the night, the maximum peak (MaxP) ranged from 81.93 to 105.80 dB(C) [mean 96.64], the equivalent continuous A-weighted sound pressure level (Leq) from 47.67 to 76.95 dB(A) [65.68], the mean maximum (MaxL) from 61.73 to 89.13 dB(A) [78.36], a mean minimum (MinL) from 41.76 to 69.21 dB(A) [52.50], the percentil 10 (Ln1) from 49.02 to 79.41 dB(A) [68.73], the percentil 50 (Ln2) from 45.29 to 75.60 dB(A) [60.81] and the percentil 90 (Ln3) from 43.05 to 72.27 dB(A) [55.31]. The Brazilian Legislation establishes 50dB(A) and 70dB(A) as the maximum limits for the daytime and 45 and 60dB(A) for the nighttime, for environmental noise in residential and industrial areas respectively. The level of urban noise in this city is higher than the official thresholds. The legislation is adequate, however

it has not been obeyed. The results of this study indicate that the problem of urban noise in the city of São Paulo needs to be tackled urgently due to its important public health impact.

10196- HEARING LOSS IN THE OCCUPATIONALLY EXPOSED TO IMPULSIVE NOISE

Szanto Cs.

Institute of Public Health, Cluj-Napoca, Romania.

The study of permanent hearing threshold induced by the exposure to industrial impulsive noise has in view to put into evidence some possible differences as against the auditive effects determined by the noise with continuous action. The results have been comparativelly interpreted between the hearing threshold level of (HTL) in an exposed group to impulsive noise and the one to continuous noise with equal equivalent continuous level for week they being also compared with similar values of a control group, non-exposed to industrial noise. The exposed to impulsive noise was selected 212 forgers. The duration of thys impulses was of 50-80 msec,with variable rhythm in relation to the size of the press ranged between 10-20 heating/min. The pick values for the impulses measurement ranged between L_{pck}=108-127 dBA, and the continuous equivalent level L_{eq}=95-102 dBA.The group exposed to continuous noise comprised 293 workers from the weaving mill. The 300 men from the control group, were all medical staff, researchers and faculty staff. The mean HTL has been recorded by air and bone conduction on age groups, for each group separatelly. The results have been then compared and following the performed analysis it has been estimated that: a) the differences between the exposed to impulsive industrial noise and the controls as well as between than exposed continuously and the controls are statistically significant ($p<0.001$) in all age groups and frequences;b) there are no differences between the hearing of the exposed subjects to occupational noise with an impulsive and continuous character, however. There being a slightly higher decrease in the exposed subjects to continuous noise, to high frequences. The explanation can be a known fact is the energy of the sound is responsible for the permanent loises of the auditive treshold, and in our case, the noises, with an impulsive and continuous character were of approximatelly equal energies. The conclusion is that the impulsive noises with levels equivalent equal to those of the continuous noise, are not more agressive in relation to the auditive effect.

10224- Noise and blood pressure

Da-Yuan Zheng, Ruei-Man Jain, Chiu-Shen Wang, Chang Chuan Chan*

Institute of Occupational Medicine and Industrial Hygiene, National Taiwan University, Rm. 1447, No. 1, 1st Sec. , Jen-Ai Rd., Taipei

Objective：To study the relationship between blood pressure and occupational noise exposure among automobile manufacturing workers.

Background: Blood pressure played an important role in promoting adult worker's health status in aged work force. While chronic effects of noise exposure on blood pressure have been reported, no consistent findings about he association between acute noise exposure and blood pressure increase have been found in past studies. This was due to the limitation of available instruments to measure worker's noise and blood pressure continuously. With newly developed instruments for both measurements and novel study design, we were able to explore such relationship effectively.

Method： We selected 15 male workers with noise exposures greater than 70 dBA (high exposure group) and 5 male workers with noise with noise exposures less than 40 dBA (low exposure group) in an auto industry to investigate the relationship between noise and blood pressure. We used DynaPulse to monitor worker's ambulatory blood pressure for 24 hours continuously. We used Logging Noise Dose Meter to monitor worker's noise exposure levels for 16 hours continuously. We also used questionnaire and health examination data to collect key factors relating to individual's blood pressure, such as BMI, diet, exercise, smoking, alcohol consumption, family history, stress, and blood lipid levels. We used generalized linear mixed models to analyze the data with confounding factors being controlled.

Results: The subjects aged 35-45 with 15-20 years of employment duration in the company. Worker's BMI, total cholesterol levels, and triglycerine levels averged about 25 kg/m^2, 195 mg/dl, 160 mg/dl, respectively. Currently, there were 30% habitual drinkers and 65% smokers. There were only 25% workers having the habit of regular exercise after work. The high exposure group experienced 30% exposure durations above 85dBA over the study period. The systolic, diastolic, and mean arterial blood pressures averaged (sd) at 112(12.8), 62(7.6), and 78(9.0) mmHg for the high exposure group. The systolic, diastolic, and mean arterial blood pressures averaged (standard deviation) at 104(8.7), 60(9.0), and 75(8.1) mmHg for the low exposure group. We found workers' time-weighted average noise exposures and the

durations of noise exposures above 85dBA were significantly associated with increases in systolic, and mean arterial blood pressures.
Conclusions. Our findings suggested that noise exposure had acute effects of increasing blood pressures.

10451- Occupational Noise-Induced Hearing Loss among Aircraft Maintenance Workers in Taiwan

Chih-Hung Ku[1], Yung-Ming Chang[2], Saou-Hsing Liou[1], Chiou-Jong Chan[2], David Christiani[3]
[1]School of Public Health, National Defense Medical Center, National Defense University
[2]Institute of Occupational Safety and Health, Council of Labor Affairs, Executive Yuan, Taipei, Taiwan, ROC
[3]School of Public Health, Harvard University, Boston, MA, USA

Objectives: To study hearing loss among aircraft maintenance workers, a cross-sectional survey was conducted in an international airplane manufacturing company in Taiwan.

Methods: Occupational noise exposure information was collected by a questionnaire, including demographic information, previous working exposure history, present working environmental information, previous medical history, and noise information around homes. Hearing loss information was collected from the annual physical examination conducted at a hospital which conducted annual screening audiometry for the workforce. Hearing level index were classified into: (1) National Institute for Occupational Safety and Health (NIOSH)-at low frequencies: (500Hz+1000Hz+2000Hz)/3, (2) Occupational Safety and Health Administration (OSHA): (2000Hz+3000Hz+40000Hz)/3, (3) American Academic of Otolaryngology-Head and Neck Surgery (AAOHNS)-at high frequencies: (3000Hz+ 4000Hz+6000Hz)/3. Generalized linear models (SAS 8.1, PROC GENMOD) were performed to assess the association between noise and hearing loss, adjusting for potential confounders.

Results: **A** total of 1128 questionnaires were returned by the workers (returned rate= 85%). After adjusting for potential confounders, workers who had ever been exposed to noise are positively correlated with left ear hearing loss at low frequencies (NIOSH: 500Hz, 1000Hz, 2000Hz; OSHA: 2000Hz, 3000Hz, 40000Hz); for a one dB hearing loss in the right ear there is an increase of 0.7 dB hearing loss in the left ear. On the basis of the AAOHNS hearing level index, after adjusting for potential confounders, “working years” were positively correlated with hearing loss at high frequencies (3000Hz, 4000Hz, and 6000Hz) (P=0.0363).

Conclusions: Occupational hazards exist in aircraft manufacturing work environments. Workers who work in such an environment have higher risk of having a hearing loss at the low frequencies (<4000Hz) compared to that who have not work there; however the longer working years, the higher risk is for the workers to have a hearing loss at high frequencies (>4000Hz). A noise-control and hearing-protection project for the aircraft maintenance workers is necessary.

10817- ASSESSMENT OF NOISE EXPOSURES IN NEW RELOCATABLE CLASSROOMS WITH STANDARD AND ADVANCED HVAC SYSTEMS

Derek G. Shendell [1,2], Seung-Min Lee[1], Michael G. Apte [1], Dennis D. DiBartolomeo [1], Douglas P. Sullivan [1], Shawna M. Liff[1, 3], William J. Fisk[1], Leo I. Rainer[4]

[1] Lawrence Berkeley National Lab, Indoor Environments Department, Berkeley, CA, U.S.A.
[2] UCLA School of Public Health, Environmental Sciences and Engineering Program, Los Angeles, CA, U.S.A.
[3] Northeastern University, Boston, MA, U.S.A.
[4] Davis Energy Group, Davis, CA, U.S.A.

Anecdotal evidence suggests heating, ventilation, and air conditioning (HVAC) systems in modular classrooms are not operated effectively. Teachers are usually in charge of thermal control. Due to inadequate training in HVAC system operation and indoor environmental quality (IEQ) issues, and the relatively loud noise produced by the HVAC system while meeting cooling or heating demands, teachers may avoid using mechanical ventilation. Adequate ventilation is an important link between improved IEQ and energy efficiency for schools. Indoor air quality and physical environmental stresses including noise can adversely impact the health of young children and teachers. During the school year these occupants spend the majority of the 7-8 hour school day inside their classrooms. Therefore, classroom noise levels can be assumed to drive personal school day exposures. As part of a field project of IEQ and energy efficiency, we investigated noise levels in four new relocatable classrooms (RCs). The RCs were equipped with both standard and advanced HVAC systems, alternately operated in a case-crossover study design. Classroom noise data, measured as A-weighted decibels (dB(A)), were collected continuously for the 2001-02 school year with sound level meters (SLM; Extech #407736, Type II, 1.5 dB(A) accuracy, 0.1 dB(A) resolution). A SLM was suspended downward below the ceiling at the center of each 960 ft^2 RC from a specially designed mobile located ~7.0 ft above the floor. The microphone placement and orientation complied with ANSI and IEC specifications; weekly calibration was performed. Reflectance off ceiling tiles, walls, and student desks were negligible. Descriptive statistics were calculated for each classroom for six distinct time periods: start of school day to recess; recess to lunch; the unoccupied lunch period; lunch to end of school day; overnight; and, weekend. Data were stratified by HVAC system in operation and summarized for four periods: fall cooling season; fall-to-winter transitional period; winter heating season; and spring. This study suggests HVAC systems and occupants were the dominant sources of noise exposure for the RCs indoor environment. In the cooling season, at one school, school-day time-weighted average (Leq) values, in dB(A), were 60.0 and 61.0; at the other school, the values in September were 52.2 and 55.7, and in October were 54.3 and 56.0. Examining specific early morning and lunch periods when HVAC systems were on but RCs unoccupied, the advanced system contributed less noise (4-8 dB(A)) than the standard system (10-15 dB(A)). Mean observed classroom noise levels for several time periods, as well as school-day and school morning Leq values, exceeded existing school district, state, and international guidelines of 40-50 dB(A).

11114- The influence of road traffic noise annoyance on blood pressure and cardiovascular risk score

Sobotova, L[1,2], Jurkovicova , J[1], Stefanikova, Z[1], Sevcikova, L[1], Volekova, J[1], Aghova, L[1]

[1]Institute of Hygiene, Faculty of Medicine, Comenius University , [2]IHCP, Food Products Unit, Joint Reaserch Center

A number of occupational and community noise studies have focussed on the possibility that noise may be a risk factor for cardiovascular disease. In the present study the influence of self reported road traffic noise annoyance on systolic and diastolic blood pressure levels as well as on cardiovascular risk score is presented.

Our sample (n=465; 39.6% males, 60.4% females, mean age 22.3 ± 2 years old) included the exposed group to road traffic noise (n=220, L_{Aeq} =67±2) and control group (n=245, L_{Aeq} =58.7±6) as well as the groups according several levels of annoyance for each group and for the whole sample. Diastolic and systolic blood pressures (BP) were assessed by a standard method and cardiovascular risk score was calculated. The criteria for normal blood pressure and cardiovascular risk score were established with regard to relatively low age of our sample (systolic BP<=120 mmHg, diastolic BP<=80 mmHg, cardiovascular risk score <=30).

Multiple linear regression revealed association between road traffic noise annoyance and diastolic blood pressure (r^2 =0.46, b=-1.231, F=4.4, p=0.04). Stratified analysis for noise annoyance levels in the total and then in exposed and non exposed samples showed marginal, not significant association between noise annoyance in the total sample (OR_{MH} =0.85 (95% CI= 0.54-1.34) for diastolic BP and for cardiovascular risk score (OR_{MH} =0.84 (95% CI= 0.63-1.10) . Marginal association was found jn the exposed sample between noise annoyance and systolic BP (OR_{MH} =0.73 (95% CI= 0.41-1.16).

These associations show that the level of noise annoyance could be an important factor in these types of studies, even in less homogenous samples.