NOISE EXPOSURE OF MUSIC TEACHERS

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1. INTRODUCTION

Music teachers are exposed to different noise sources during the course of their activities (teaching band, choir, etc). The size and activities of their classes varies greatly and so are the noise levels they are exposed to. Although students are also exposed to the same or even higher noise levels while playing or singing, the duration of their noise exposure is much shorter than that of the teachers. On a given day, a student may be exposed to high noise levels for only one music class while a teacher can be exposed to high levels for many class periods. Consequently, the risk of hearing loss due to noise exposure in music classrooms is potentially significant among teachers but not among students.

There is abundant literature dealing with the risk of hearing loss among musicians. However there is very little data regarding the exposure of conductors of music ensembles or of music teachers. The only study of teachers' noise exposure that we are aware of was performed in British Columbia (1). A potential reason for the lack of similar studies is the difficulty in determining a "typical" day or week of teachers. The distribution of activities varies greatly from teacher to teacher (due to differences in resources between schools), from week to week and from day to day for a given teacher. Extra-curricular activities such as competitions, school acts, musicals, etc., requiring bands, orchestras or/and choirs increase both the frequency and number of participants at rehearsals.

The study was based on measuring noise exposure levels from single activities (classes) such as rehearsing of bands or teaching of theory. The choice to focus on an activity was made because the "activity" is more easily defined than determining a "typical" day. The physical environment (acoustical characteristics of each room), activity duration, and the number of students involved were recorded. With the knowledge of the average noise exposure for a particular activity and the total duration of activities in an average day or week, one can estimate the noise exposure of a teacher based on the activities they perform.

2. METHOD

The survey was conducted on 18 music volunteer teachers from 15 different schools in an Ontario School Board. There were no special requirements for the teachers, such as a minimum hearing acuity, age, sex or length of service. Participants were explained the objective of the study and the measurement procedure. They were also advised that the study was anonymous and that their names will not be disclosed.

Measurements were performed using Quest Type Q-300 dosimeters. Dosimeters were calibrated using Quest Type QC-10 calibrator, following the procedure recommended by the manufacturer. A B&K Type 2231 Modular Precision Sound Level Meter was also used as a rough check of the results read on the dosimeters.

Each teacher was followed for a day (or as much of a day as possible). A member of the team attached the dosimeter microphone to the teacher's collar and started recording. Members from the team followed the teacher during the measurement period taking notes of activities performed, their duration and of the acoustical characteristics of the environment.

Back in the Laboratory, the information stored in the memory of the dosimeters was extracted using the QuestSuite Professional computer program. The same program was used for setting the dosimeters and for checking their calibration.

Noise Exposure Level (L_{ex}) and Equivalent Noise Level (L_{eq}) for each activity was calculated from recorded dosimeter data. The noise exposure criterion used was a daily 8 hrs exposure limit of 85 dBA and a 3 dB exchange rate.

3. RESULTS

The frequency distribution of the L_{eq} and L_{ex} can be seen in Figure 1. From the figure, it can be seen that while the mode of the L_{eq} is the 88 – 90 dBA range, the mode of the L_{ex} is the 84 – 86 dBA range. The measured L_{eq} exceeded the 85 dBA limit for 14 teachers (78%), was at the limit on one occasion (5%), and under the limit on 3 occasions (17%). The calculated L_{ex} exceeded the 85 dBA limit for 7 teachers (39%), was at the limit for 4 (22%), and under the limit for 7 (39%). The average measurement duration was 4.5 hrs (std.dev. 1.4 hs).

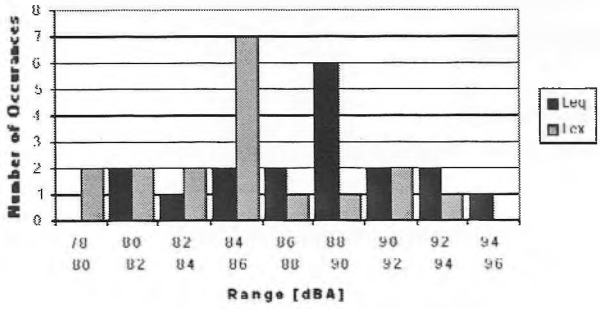

Figure 1. Frequency distribution of L_{eq} and L_{ex}.

Five common activities were considered: Singing, Percussion, Keyboard, Recorder and Band. For each activity the mean, standard deviation and range are stated, where the number of samples allows for those calculations (see Table 1).

Table 1. Leq for each activity in dBA (standard deviation and number of samples given in parentheses).

Activity	Elementary	Secondary	Total
Singing	87.1 (3.8, 14)	88.3 (5.4, 4)	87.3 (4.0, 18)
Percussion	86.9 (3.4, 9)	84 (- , 1)	86.6 (3.3, 10)
Keyboards	84.4 (4.0, 6)	-	84.4 (4.0, 6)
Recorder	88.2 (1.9, 5)	-	88.2 (1.9, 5)
Band	91.7 (3.3, 12)	90.5 (3.6, 19)	90.9 (3.5, 31)

No significant difference between the mean noise exposure levels from elementary or secondary schools was found. However, three of the four singing measurements at the secondary level were of amplified singing (i.e. singing into microphones). The mean Leq for the amplified singing was 90.3 dBA with a standard deviation of 3.1. The overall mean for un-amplified singing is 86.7 dBA with a standard deviation of 4.0.

4. DISCUSSION

The L_{ex} calculated for the majority of the measurements was at or below the 85 dBA level. However, the calculation of Lex assumed that the subject was in a quiet environment outside of the measurement period. This assumption may not be true as extra-curricular activities were not measured and in some cases it was not possible to follow the teachers throughout an entire day. Thus, we can not conclude that the noise exposure of an average music teacher is either safe or unsafe.

However, we can estimate the average L_{eq} for various activities that a music teacher would perform. From this we can calculate a maximum safe exposure time to each activity (the exposure duration for which the L_{ex} will reach 85 dBA). The calculated "safe" exposure durations for each activity can be found in Table 2.

Table 2. "Safe" exposure duration for various activities.

	Hours per Day	Hours per Week
Singing	5.4	27.0
Singing (amplified)	2.4	11.8
Percussion	5.5	27.7
Keyboards	9.4	47.0
Recorder	3.8	19.1
Band	2.1	10.3

It should be noted that the exposure durations calculated in Table 2 assume that the subject is in a quiet environment for the balance of the 8 hrs work day/40 hrs work week.

From Table 2 it is clear that teachers should wear hearing protection when teaching band and amplified singing as the "safe" exposure duration for these activities are only 2.1 and 2.4 hs respectively. Hearing protection may also be needed depending on the schedule of the music teacher.

We recommend that a hearing protection program be instituted where teachers are made aware of the potentially hazardous noise levels, provided with hearing protection (disposable musician earplugs), and educated about the care and use of earplugs. As well, teachers should undergo bi-annual audiometric tests to ensure the hearing protection measures are effective and the teacher's hearing has not been reduced.

REFERENCES

(1) Eaton Stuart: Determining School Music Teacher's Noise Exposure. WCB of BC. 2001

(2) CSA Standard Z107.56-94: Procedures for the Measurement of Occupational Noise Exposure. Canadian Standard Association, 1994.

(3) Ontario Occupational Health and Safety Act and Regulations for Industrial Establishments, Section 139. Ontario Ministry of Labour, Rev 01/98.