

# Noise Exposure of Music Teachers: Defining the Problem

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## About this document

- **This is a 2023 pdf version of an older web page**, part of a series.
- Neither content nor links have been updated. Links may not work.
- Please visit [malcolmtattersall.com.au/music/noise-exposure-of-music-teachers/](http://malcolmtattersall.com.au/music/noise-exposure-of-music-teachers/) for an introduction to the whole series.

## Associated documents

- *Noise Exposure of Music Teachers: Introduction*
- *Defining the Problem*
- *Teaching Strategies to reduce noise exposure*
- *Approximating Noise Exposure in small-group woodwind teaching*
- *Hearing Loss, Noise Exposure and the Law*
- *Hearing Protection for music teachers*
- *Links*

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*See the introductory page for important information about this article.*

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## Introduction

Teaching is ideally a rather quiet job, but music teachers teach children how to make noise - special noise, good noise, but still noise. It would not be too surprising if music teachers' noise exposure were closer to musicians' levels than to most teachers' levels, and it is common knowledge that musicians risk hearing loss. After teaching woodwinds for over twenty years and noticing the first signs of hearing impairment, that thought gave me cause for concern.

My concern led me to investigate occupational noise exposure risks and preventive measures. It centred, naturally enough, on my own teaching situation: woodwind teaching (individual and small-group lessons) and some work conducting concert bands, all mainly with 9 - 13 year olds. However, the principles apply equally to brass, percussion and strings, and to older and younger students, though actual levels of exposure must differ.

I should say immediately that there is no need to panic. Common sense would suggest as much: if music teachers were routinely deaf by retirement age, someone would have raised the alarm long ago. However, I did find there is need for concern and for sensible action to minimise harm.

## The teaching situation

A description of the working conditions with which I am primarily concerned may be helpful: The 'small group teaching' discussed here involves the teacher working with one to eight, but usually three to five, students in a room between 3 x 4 and 4 x 5 metres (i.e. between 9 x 12 and 12 x 16 feet). Most of the groups are homogenous as regards skill levels (we don't put beginners with advanced students very often) and many are homogenous as regards instruments. The

students often play in unison but may be singled out for demonstration or testing and may play ensemble items with one or two players per part. Younger students (age 10 - 12) play flute, clarinet and alto sax; bass clarinet, tenor and baritone sax, oboe and bassoon are added to the programme later.

These students come together with peers from similar brass and percussion programmes to play in concert bands of 10 - 75 players, typically 15 - 30 students in primary school and 30 - 60 in secondary school. Concert bands obviously work in larger spaces, from a standard classroom up to a concert hall.

## How much noise is too much?

In Australia, as elsewhere in the Western world, there are legal standards for maximum permissible occupational exposure to noise.<sup>1</sup> Total daily exposure is essentially calculated by adding up the loudness of each time segment in the day and then expressed as the level of a continuous sound which would cause equivalent damage. Hearing damage is cumulative, like lead poisoning, so total exposure matters more than any individual dose unless the individual dose is very large.

The allowable maximum in Australia is currently 85 dB.<sup>2</sup> The organisation which sets the standards did consider reducing it to 80 dB a few years ago but concluded that the health advantages would be small and implementing the tighter standard would be difficult.<sup>3</sup> However, that reduction from 85 to 80 dB will be implemented in Europe in 2006. Elsewhere and in the past the standard has been 90 dB. For our purposes, then, we can accept 80 - 85 dB as being cause for concern and 85 - 90 dB as very likely to cause damage if continued too long.

Peak intensity (which might only be for a second or two) is also subject to legal regulation, and hearing protection must be worn if it ever exceeds 140 db. Fortunately, it does not seem to be an issue for us.<sup>4</sup>

Workplace Health and Safety guidelines for noise exposure tend to mention everyday noise - cement mixers, leaf blowers, and so on - but brochures on noise exposure in the entertainment industry are also available and make interesting enough reading.<sup>5</sup> One observation which stuck in my mind was, 'If you have to raise your voice to be heard a metre away, the noise level is probably excessive.' It reminded me of trying to communicate with flautists in the front row of my band.

The article by Chasin (see [Links](#), which will open in a new window) provides a good introduction to kinds of hearing damage, music-related causes and early symptoms.

## How much noise are instrumental teachers exposed to?

There are very few published studies of the noise levels music teachers are exposed to,<sup>6</sup> and those few look at work practices rather different from those of the typical Australian instrumental teacher. There are rather more studies of orchestral musicians' exposure<sup>7</sup> which can be used to supplement the studies of teachers, and texts on musical acoustics<sup>8</sup> will fill in some remaining gaps.

Because of the way the decibel scale is defined, twice as loud is 3 dB higher, whatever the starting level, so two clarinets should be approximately 3 dB louder than one. (This is the physical power of the sound, not the perceived level. A 3 dB increase will be heard as 'a bit louder' not 'twice as loud.')

Because of the way daily exposure accumulates, doubling the number of similar instruments playing together approximately doubles the exposure in that time (increases it by 3 dB).

Doubling the time exposed to a given sound level also doubles the exposure (increases it by 3 dB), but exposure to a much lower sound level (e.g. more than 10 dB lower) adds very little to the total exposure.

This means that an activity with an average level of 86 dB (e.g. group teaching) for one hour followed by an hour at 60 dB (e.g. chatting in the staffroom) contributes almost exactly the same noise dosage as two hours at 83 dB (e.g. teaching the same students in two smaller groups for one hour each).<sup>9</sup> A further implication is that our total exposure is related to the total number of students we teach in a day: doubling the total number of students in a day will increase our exposure from teaching by about 3 dB.

But what are the actual levels?

Eaton and Behar both measured teachers' exposure in band classes and rehearsals, both primary and secondary (which were similar anyway) and found a range of 84 - 98 dB, averaging 91 dB. Extrapolating Behar's data to smaller groups suggests that exposure levels will be between 78 and 87 dB for 'bands' of 4 - 8 students.

My best approximations for noise exposure in small-group woodwind lessons are derived (at some length, I'm afraid) in *Approximating Noise Exposure*. They are consistent with Behar's levels and with all the other information available to me, so I will take 83 dB as typical for small-group (around four students) woodwind teaching.

Exposure levels for individual types of activity must be added and averaged over the year's work to arrive at the teacher's actual noise dosage. Where more than one kind of activity is involved the formula<sup>10</sup> is not simple enough for everyone to do their own calculations, so I'll present scenarios:

Activities	Exposure (dB) averaged over the year
1. Teach 20 hrs/wk, 40 wks/yr at 83 dB.	79
2. Take half or twice as many students in each group: decrease or increase by approx 2 dB.	77 - 81
3. Take quieter/louder instruments: decrease or increase by another 5 dB.	72 - 86
3. Add 4 hrs/wk at 91 dB taking typical concert bands.	81 - 87

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|---|---------|
| 4. Add your own practice: one hr/day at 90 dB, or 2 hrs/day at 87 dB.               | 85 - 88 |
| 5. Add 60 hrs/yr orchestral playing at 90 dB or 6 hrs/wk private teaching at 83 dB. | 85 - 89 |
| 6. Take out the concert bands   | 84 - 88 |

The values for the changes in items 2 and 3 are backed up on the *Approximating Noise Exposure* page.

Items 4 and 5 raise the question, 'What is occupational exposure?' Usually, of course, it is fairly clear-cut: driving a bulldozer is work, driving a golf ball isn't. But a musician must maintain her skills to retain her job: should her practice be counted as work? An instrumental teacher must maintain his performing skills to be the best teacher he can be: is that work? Whatever the law says, it is important to remember that our noise exposure outside the workplace is greater than average and must be considered if our aural health is to be protected.

Remember also that this 'safe occupational exposure' assumes the rest of our 24 hours is quiet. If we knock off teaching to go to a nightclub our total exposure will be well over the safe limit: three hours per week at 100 dB (not unusual for a nightclub) is more than a full safe load on our ears all by itself.

Brass and percussion, of course, tend to be louder than woodwind, and secondary students make a bigger sound than primary students. On the other hand, string teachers' exposure should be significantly lower.<sup>11</sup>

The table as a whole shows that almost any working pattern that includes substantial group teaching puts our annual exposure into the 80 - 90 dB zone. Each of us has an individual teaching style and several sets of working conditions, so accurate assessment of our individual exposure must depend on measurements taken during our own working week. But even if our particular figures for one or more activities are 3 - 6 dB lower than the figures I used above, we are quite likely to have an annual exposure in the low 80's: not illegal, but not really safe either.

## Annual exposure, daily limits

A kind reader of an earlier version of this article queried my use of annual exposure, on the basis that our WHS legislation is framed in terms of daily exposure.

I originally followed Eaton, Behar and Lee (all Canadian, as it happens) in their approach to using annual exposure, and then checked with a UK expert who confirmed that it was a perfectly reasonable procedure in relation to *risk* assessment. That doesn't mean, unfortunately, that it agrees with Australian *regulations*. The discrepancy means the regulations will demand action in some situations where annualisation suggests the actual risk may not be excessive. That is not entirely a bad thing, since it will tend to give our hearing more protection, rather than less, and as musicians we need all the protection we can find. See *Hearing Loss, Noise Exposure and the Law* for more on this.

## Do I need to be concerned about my students' noise exposure?

Not really. Each of them is only in your situation for an hour or two per week, not your twenty or more hours. Noise exposure is essentially [loudness times duration]; if their exposure duration is 5% of yours, their total exposure is negligible. Exceptions will only arise where they participate in very loud secondary school ensembles such as those discussed by Keefe (see *Links*). And in the longer term most of them, to be realistic, only play for two to five years altogether, not your (potentially) twenty to fifty.

However, do listen to them if they complain about too much noise in their seating position in band (those sitting in front of the brass are likely to be worst off - see orchestral studies) and perhaps discuss safe listening habits, and not just in relation to their own music making, occasionally.

## Who is responsible?

The employer has a legal obligation under WHS legislation to ensure that employees' occupational exposure remains under the mandated limit.<sup>12</sup> That is clear enough except that:

(1) Employers may not know how much noise we are exposed to. Their ignorance does not excuse them, but if we don't tell them there is a potential problem we are unlikely to see any improvement.

(2) Some of us are actually not employees, even in school settings. Some schools provide facilities and administrative support to visiting teachers who are technically still self-employed. Any teachers paid directly by their students are almost certainly in this position, and others paid by the school per term and per student may be as well.

Of course, we are rather more obviously self-employed if we teach in our own studios. There we have no-one but ourselves to blame for unsafe teaching practices but at least we have complete freedom to improve them.

There are some simple strategies which, taken together, can reduce teachers' noise exposure by a useful amount; they are set out in *Teaching Strategies*. They can be implemented by the teacher without needing to rely on the school administration.

But it is also important to remember that excessive noise, in schools as much as in panelbeating shops, is a WHS issue for which the employer is legally responsible. In my view, a music programme cannot be considered properly managed unless the noise exposure of teachers and students within it has been assessed: it is clear that the sound levels are potentially high enough to be dangerous.

## Notes

See *Links* page for details of all references.

<sup>1</sup> Department of Industrial Relations, Queensland 'Workplace Health and Safety (Noise) Advisory Standard 2004.'

<sup>2</sup> Sound levels are measured in decibels (dB). The dB scale is structured to match, approximately, our hearing response. For the purposes of this article it may help to remember that conversation volume is around 50 - 60 dB and lawnmowers around 80 - 90 dB. For more on sound levels and decibels, see Wolfe's web site or any acoustics text.

<sup>3</sup> NOHSC 2001 Annual Situation Report - Occupational Noise p11-12, where it is also noted that

similar reductions have been considered in USA and Europe but rejected for the present. See also Health & Safety Executive (UK) 'Noise - Frequently Asked Questions.'

4 Eaton recorded measurements in this region but thought them to be false readings of the measuring equipment due to incidents like knocking the microphone.

5 Qld Gov't Department of Employment, Training and Industrial Relations div of WHS 'Noise in the music entertainment industry.'

6 Eaton; Behar et al.

7 Lee, Behar et al 'Musicians' noise exposure in orchestra pit.' *Applied Acoustics* 66 (2005) 919-931. Also Meyer, *Acoustics and the Performance of Music*.

8 Meyer; Wolfe.

9 Using the formula for synthesised exposure from Behar.

10 Annualised exposure:

$$L_{exA} = 10 \log (t_1 \cdot 10^{L_1/10} + t_2 \cdot 10^{L_2/10} + t_3 \cdot 10^{L_3/10} + \dots + t_n \cdot 10^{L_n/10}) - 33$$

for activities 1, 2, 3, ...n, where  $t_n$  is the duration of an activity in hours per year and  $L_n$  is its average level in dB. Variants of this formula underlie the 'Noise - Exposure Calculator' spreadsheets on the HSE [UK] site.

11 From the dynamic levels given for each by Meyer, Chapter 3, violins will be (very roughly) 8 dB softer, and trumpets 8 dB louder than clarinets. String teachers might be at the bottom end of the ranges I give for woodwinds, and brass teachers at or a little above the top end, but I do not have enough information to place much confidence in those figures.

12 Qld WHS Regulation 1997 as in force 2005.