Clubbing: The cumulative effect of noise exposure from attendance at dance clubs and night clubs on whole-of-life noise exposure

W. Williams, E. F. Beach, M. Gilliver

National Acoustic Laboratories, 126 Greville Street, Chatswood, NSW, 2067, Australia

Abstract

Anecdotally it has been suggested that exposure to some noise sources through leisure activities could have a significant effect on whole-of-life noise exposure. While exposure levels do vary, a typical night club or dance club attendee was found to experience an equivalent continuous A-weighted noise level of around 98 dB for up to 5 hours with an exposure of 12.2 Pa^2h. This can extend up to 104 Pa^2h in extreme cases. A study of "clubbers" reveals regular clubbing to be a source of high noise exposure, with a sustained period of regular club attendance contributing to a significant portion of whole-of-life noise exposure.

Keywords: Clubbing, leisure noise exposure, music, noise exposure profiles

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Introduction

Clubbing

Night clubs and dance clubs have become a significant part of the entertainment scene for many young adults, and attending such clubs (clubbing) is a common recreational activity for many young people. The average noise levels at these venues have been measured to be in the range of 100 dB A-weighted and over,[1,2] and attendance times have been estimated to be in the order of several hours per week.[1,3] These environmental conditions are certainly amenable to a potential noise hazard[4] with a reported subsequent effect on hearing.[5,6]

What effect does this exposure have on hearing in the long term and how will a few years of regular clubbing affect future hearing health? Currently, the literature agrees that exposure to excessively high levels of noise during non-work and/or leisure activities is harmful to hearing but there appears to be no specific examples looking at the relative importance of leisure and non-work activities compared to workplace activities over the whole life-time.

Materials and Methods

During part of a long-term study under way at the National Acoustic Laboratories (NAL) examining possible hazardous noise exposure from non-work and leisure activities, researchers have had contact with regular attendees at night clubs and dance clubs with the aim of estimating long-term noise exposure levels and studying behavior and attitudes on noise exposure. Members of an Australian dance music website "inthemix", frequented by individuals who are "passionate about dance music, clubs, parties and festivals"[7] were contacted by a NAL researcher and were asked if they would be interested in participating in the research program. Following detailed description of the research, the attendees agreed to participate in the study and undertake a recorded telephone interview lasting about 20 minutes. Ethics approval for all activities discussed here had been confirmed by the Australian Hearing Human Research Ethics Committee.

A total of 24 participants were interviewed, consisting of 7 females and 17 males. Participants represented six of the eight states and territories of Australia. The interview was primarily conducted on a qualitative basis with appropriate demographic information extracted for quantitative purposes. The qualitative data will be discussed elsewhere, not in this presentation.

Noise measurements were made at a number of popular night clubs and dance clubs in the Sydney city area where some survey respondents were known to attend. These measurements were collected by individuals who were carrying and using calibrated personal noise dosimeters as required by appropriate measurement standards.[8] The dosimeters used were CEL-350 *d* Badge Personal Sound Exposure meters marketed by Caselle-CEL (Bedford,

UK), calibrated using a CEL-110 Acoustic Calibrator. The dosimeters were mounted in the appropriate manner with the users' discretion so as to be as unobtrusive as possible during measurements. Devices were used up to several hours at any one time, and the data were analysed using supplied software with International Organization for Standardization (ISO) protocols and definitions.

In all, 10 club measurements were conducted at eight different clubs. For one of these clubs, three measurements were taken at different times representing early, mid and late evening periods to take into account the anecdotally reported incidence of noise levels gradually rising throughout the evening. The measurement parameter was the equivalent continuous A-weighted noise level (L_{Aeq}) in decibels.

Results

Table 1 presents a summary of the relevant subject demographic and attendance data gained from the telephone interviews.

The mean noise level L_{Aeq} for the clubs visited was 97.9 dB (SD = 5.5) with the values ranging from 90.7 to 105.7 dB (n = 10). It was also noted that often noise levels tended to steadily increase as the evening moves on. These results are presented in Figure 1. A first approximation of the level to be expected throughout the evening between 9:00 p.m. and 3:00 a.m. can be estimated from the relationship $L_{Aeq} = 85 + 4.T$ dB, where T is the elapsed time expressed in hours past 9:00 p.m.

Table 1: Participant details and club attendance profiles

	Current age (years)	Age at start of clubbing (years)	Years of clubbing	Club visits per week	Typical duration of club visit
Mean	27.8	17.9	9.9	0.9	5.0
SD	6.0	1.0	6.2	0.5	0.9
Range	21–42	17–21	3.0–25.0	0.3–2.5	4.0–7.0

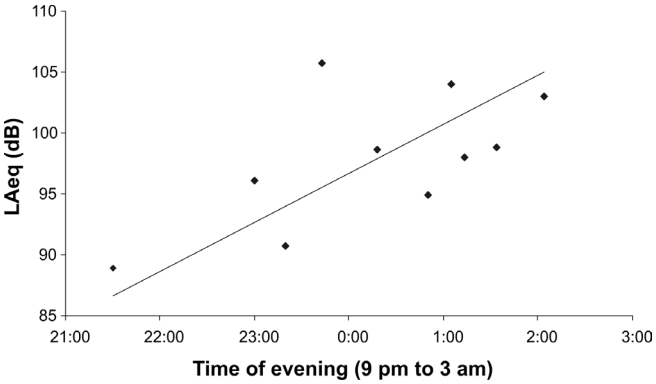

Figure 1: Distribution of average noise levels (L_{Aeq}) at measured clubs; note the general increase in levels with respect to the time of evening

Discussion

The average noise levels measured at the clubs sampled in this work (L_{Aeq} = 97.9 dB, SD = 5.5) agree well with those measured in similar recent studies by the following: Smith *et al,*[1] of 101 dB(A); Serra *et al,*[2] a range of 104.3–112.4 dB(A); Serra *et al*,[6] of 103.4 dB(A); and Goggin *et al*,[9] of 97 dB. The mean attendance time of 5.0 hours per week (SD = 0.9) also agrees with those measured by Smith, *et al,*[1] of 4.3 hours per week, Jokitulppo and Björk[3] of 4.4 hours per week, and Goggin[9] of 4.7 hours per week.

The calculation of the A-weighted noise exposure level ($E_{A,T}$) expressed in Pascal squared hours (Pa^2h) resulting from a measured noise level, L_{Aeq}, over a period of time, T, is

$$E_{A,T} = 4T10^{0.1(LAeq - 100)},$$

where the exposure time is expressed in hours rather than seconds[4] in order to keep the numbers simple. If the mean L_{Aeq} obtained from the club measurements is 97.9 dB with a mean attendance time per event of 5 hours, then the average exposure per attendance is 12.2 Pa^2h. While this exposure is less than the particular example provided by Serra *et al*,[2] of 38 Pa^2h, if the highest exposure for the current sample is considered at 105.7 dB at the maximum duration of 7 hours, the exposure would be 104 Pa^2h.

Now consider the average life-time accumulation of noise exposure for individuals who go clubbing using the above results. With an average attendance of 0.9 visits per week, 52 weeks per year and over a typical period of 9.9 years, the total exposure is 5652.5 Pa^2h. What is the best way to express this exposure with regard to the possible overall effect on hearing over the life-time?

Various researchers have suggested methods of quantifying long-term noise exposure from non-work, recreation, and leisure activities but currently there is no consistent and well-defined method.[1,10-12] A possible method is described below.

This new method compares non-work and leisure noise exposure to prescribed levels of workplace noise exposure. The most convenient way to do this is to take the workplace noise exposure level applied under local occupational health and safety regulations and use this as the maximum level that the society will accept as producing minimum harm. One of the most commonly used criteria is a daily exposure level ($L_{EX,8h}$ or $L_{Aeq,8h}$) of 85 dB.[13] While this is not considered to be an exposure that will produce no hearing loss over the life-time,[14] it is currently considered to present an "acceptable" level of risk by legislators and regulators. Hence, even if not necessarily the safest choice, an $L_{Aeq,8h}$ of 85 dB (1.01 Pa^2h) will be considered to be the acceptable level of exposure for this exercise.

The acceptable daily exposure level is used to compute the acceptable yearly exposure or aye. This unit is numerically the level of noise exposure acceptable over one working year. For convenience, the productive working year is taken to be 220 days in the first approximation, allowing for weekends (104 days), annual leave (20 days), maximum sick leave (10 days), and time spent at non-noisy activities (11 days or 1 day per working month). Thus, 1 aye is equivalent to 222.2 Pa^2h (i.e., 1.01 $Pa^2h \times 220$ days).

Over a working life-time of 42 years ranging from, say, 18–60 years of age, the total acceptable maximum noise exposure under the given circumstances would be 42 aye accumulated at the rate of 1 aye per year. In relative terms, from the data presented above, the average night club/dance club attendee would accumulate 25.7 aye over their average attendance of 9.9 years at 0.9 events per week ($12.2 \times 9.9 \times 0.9 \times 52/222.2$). Thus, this relatively short 10-year period over the whole life cycle, during which clubbing was a regular activity, generated over 60% of the total life-time acceptable noise exposure. Figure 2 shows the rate of noise exposure for work and clubbing.

The cumulative effect of noise exposure from work, clubbing, and combined work plus clubbing is presented in Figure 3. Clubbing can be seen to have a significant effect on the cumulative exposure when compared to that from work alone. For example, an individual who only experiences noise exposure at work equal to the allowable exposure standard has, after 42 years of working, an accumulated exposure of 42 aye. An equivalent worker who also goes clubbing reaches a cumulative exposure of 42 aye before his/her 30th birthday, 25.7 aye being contributed through his/her clubbing activities. By the time of retirement, his/her total accumulation is 67.7 aye. In relative terms, the clubber on his/her 30th birthday has ears that are 30 years "older" than their non-clubbing counterpart.

Just how prevalent noise exposure from clubbing may be is very hard to judge. Smith *et al,*[1] estimated that 11.3% of their sample of 356 of age 18–25 years had received significant noise exposure from night clubs, and Jokitulppo and Björk[3] reported that 34% of their study population (aged between 28 and 58 years) had attended a "night club or pub" during the past week (p. 56). Neither of these studies asked participants the number of years they had attended such activities. Data from Serra *et al*,[6] indicated that attendance at "discos" tended to increase over time from the age of 14 years. However, as their sample only included individuals up to about 18 years there was no upper attendance (age) limit found.

The current study found that 35% of attendees were 30 years of age or older, all having commenced clubbing in their late teens or early 20s. The eldest individual was 42 years and had been clubbing for 25 years. At the average exposure per week of 12.2 Pa^2h, this implies that this individual has already accumulated a minimum life-time exposure equivalent to 71.4 aye, almost twice the exposure that could be expected from work alone. Further studies at NAL are currently under way to examine attendance rate over time (age).

Many of the clubbers interviewed are also likely to experience additional noise exposure from other sources of music-related activities. Data from the interviews indicated that 19 of the 24 clubbers are involved in DJing (playing music), music production, playing in bands, club photography, and listening to music via personal stereo players – music is their passion. If this exposure was quantified and added to the current data, then the level of noise exposure becomes even more significant.

Conclusion

The results of the reported study indicate that noise levels experienced by clubbers are well above the recommended noise exposure levels set for the workplace by many occupational health and safety jurisdictions. Analysis on a life-time exposure basis indicates that that there is a potential significant risk to whole-of-life hearing health from clubbing and like activities, which warrants further investigation.

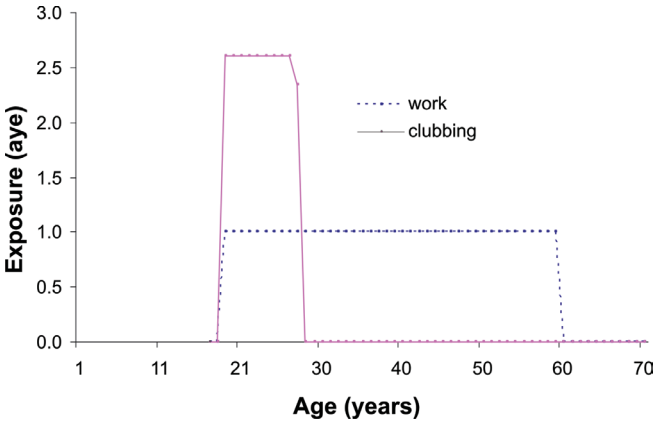

Figure 2: The rate of noise exposure from work and clubbing from the examples provided in the text

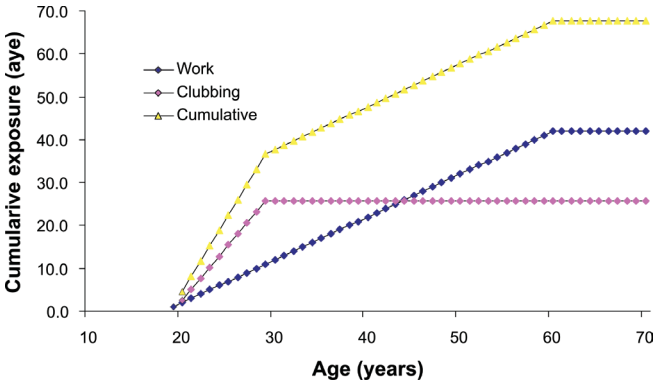

Figure 3: The cumulative effect of noise exposure from work, clubbing, and work plus clubbing from the examples provided in the text

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Address for correspondence:
Dr. Warwick Williams,
National Acoustic Laboratories, 126 Greville Street,
Chatswood, Australia.
E-mail: warwick.williams@nal.gov.au

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