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Abstract

The aim of this study was to assess the risk of noise induced hearing loss (NIHL) in shearing and investigate practicable control methods. Woolshed surveys included shed construction data, noise dosimetry and area noise sampling. The noise exposures from 40 personal measurements were all above the 85 dB(A) action level, lying in the range 86-90 dB(A). Shearers had the highest exposure, “near field” noise coming from the action of the cutting edge in the shearing comb, but also from downtubes and gears. Noise for sorters and pressers was contributed to by the stereo system (found in all shearing sheds). Lined sheds seemed to have slightly higher noise levels than unlined sheds. None of the shearing crews had hearing protection available. Redesign of the shearing equipment primarily the handpiece but also the downtubes and gears could potentially reduce the exposure by 2-3 dB(A) and possibly more. In the meantime shearing crews need to wear hearing protection and be subject to audiometric surveillance.

Introduction

Agriculture is a hazardous industry, with New Zealand studies identifying noise induced hearing loss (NIHL), low back pain, chemical related morbidity and mental health as being of concern. (Firth, Herbison et al. 2001) One study including arable, dairy, mixed and sheep farming shows that the latter had the highest noise exposures, a median level equivalent (Leq) of 86.8 dB(A), interquartile range 84.3-90.7). (Firth, Herbison et al. 2006) The main activities being carried out by those with exposures above the 85 dB(A) exposure standard were riding a motorcycle, driving heavy machinery and using hand held power tools, including shearing hand-pieces. “Grab” sampling has shown that noise levels in shearing sheds can be intense, with levels up to 97dB(A). (Occupational Safety and Health Service of the Department of Labour 1995). Most shearing is however carried out by contractors, so the burden of exposure is not primarily carried by farm owners or operators.

There are three distinct groups of workers in shearing sheds, the shearers themselves; wool sorters who collect the fleece from the shearers, sort and “skirt” it and the pressers who process the bales. The hazards of shearing have been described, and include manual handling and biological agents. The

noise environment will be slightly different for the three occupational groups. The shearers are close to the shearing plant (the drive, including the “down tubes” and “elbows”, generally the responsibility of the farm owner) and the hand pieces and combs which are their own responsibility (figure 1). The sorters work close to the shearers. The pressers operate various types of wool press, wooden and metal, variously actuated and some of which are noisier than others (Figure 2). The acoustic environment can be dominated by the “radio”, usually a stereo system, and is modified by the construction of the shed. How these factors interact to influence the acoustic environment in shearing sheds has not however been fully described to date. The aims of this study were to carry out a noise survey in a sample of New Zealand Shearing Sheds, describe the noise exposure associated with shearing activities and help to define the acoustic environment.

Methodology

Study population and sampling

The New Zealand Shearing Industry Health and Safety Committee (the Committee) identified shearing contractors in the North and South Island of New Zealand to participate in the study. Each contractor was contacted by telephone and the purpose

of the study explained. Each were then sent copies of employer and employee information sheets, and appointments were made for follow up on-site.

Questionnaire

An environmental assessment form was developed in association with the Committee, this included the number of people working in the shearing crew, type of shearing (normal full shear, crutching etc.) number of sheep sheared, hours of work, shed construction (materials used for frame, walls, roof and lining) and the type of woolshed equipment in use (shearing plant and wool press). The use of hearing protection was observed, as was personal stereo use.

Environmental survey

Noise dosimetry was carried out using Cirrus Research doseBadge wireless personal noise dosimeters (Class 2 instruments) calibrated before and after measurement using the combined reader/calibrator unit. The Badges were mounted in the hearing zone of the participant, and the data downloaded to the reader and then to the doseBadge software for later analysis.

Grab samples were taken for specific activities using a Brüel and Kjær type 2260 type 1 sound level meter to record A weighted sound pressure levels and octave band analyses.

These were video-taped for later analysis.

Analysis

The data was transferred manually to SPSS version 14. The analyses were initially descriptive, with, depending on the distribution of the noise levels within comparison groups, ttests or the equivalent non-parametric Mann Whitney U test used to test for “between group” differences.

Results

A total of 9 contractors were approached and all agreed to participate. Surveys were carried out in 16 sheds.

A total of 122 individuals were working in the sheds during the survey, the majority being shearers. The majority (80, 66%) identified their ethnic group as New Zealand Maori, with 42 (34%) New Zealand European. A total of 15,381 sheep had been shorn and as the survey was carried out in January (summer in New Zealand) the activities recorded were normal shearing. The median duration of the working day was 8 hours, with a minimum of 7 and maximum of 10.

Wood framed shed construction was most common, with only one steel framed shed represented. The vast majority of sheds (13, 81%) had corrugated iron walls, with 75% having a corrugated iron roof. Most sheds (11, 69%) were unlined and 5 (31%) had a wooden or plywood lining.

There was no hearing protection in evidence and only 2 individuals used personal stereos.

A total of 40 dosimetry measurements were made, 25 shearers, 9 wool pressers and 6 pressers. The distribution of the noise exposures had a reasonably normal distribution, with a mean of 89 dB(A), 95% confidence interval (CI) 88-90. Those for the individual occupations (shearers, wool sorters and pressers) were non-normal (as depicted in the box-plots, figure 3), and the medians and inter-quartile ranges are reported in table 1.

The shearers had the highest noise exposure, with pressers and sorters progressively less. The noise exposure common to all the occupational groups was the radio.

Table 1. Noise exposures of occupational groups.

Occupation	N	Mean Duration (h.mm)	Median Leq	Inter-quartile range	Min-max
Shearer	25	7.40	90	88.5-91.5-	84-93-
Sorter	9	6.72	87	85-89	85-91-
Presser	6	6.24	89	87-90	88-90-

A comparison of all the dosimetry readings taken in unlined sheds were compared with those in lined sheds. This showed median levels in unlined sheds of 88.5 dB(A) and lined sheds of 90 dB(A). An independent samples Mann-Whitney U test showed that this difference was significant ($p < 0.05$).

The noise sources for shearers comes from the drive, transmitted through a down tube, through a set of gears in the “elbow” and through another drive tube to the hand piece, containing gears and the cutting comb. The noise for the shearers was near-field, the shearing hand piece being, at most, an arm’s length away, with the elbow and drive tubes at varying distances according to posture and activity. Impact noise was evident from movement of the sheep and the elbow striking the sides of the pen. Reductions in noise exposure of 1-2 dB(A) were noted on later video analysis of the area noise samples. There were two main designs of plant in use with roughly equal numbers (18:15) and 6 which were of miscellaneous design or were “missing data”. There was no significant difference in noise levels between the two main design types.

Noise for sorters comes from the activities of the shearers, with whom they are in close proximity for about half of the time. They also use plastic scrapers to clean up the wool off the shearing board, producing impulse noise. Greater reductions in area noise monitoring were evident, with radio “intermissions” showing reduced levels in the order of 3 dB(A).

Sorters are exposed to impact noise from metal catches on metal wool presses and also help with penning the sheep, so they are near the shearers at times. The same comments apply to the background noise.

Discussion and Conclusions

The main source of noise for shearers was, unsurprisingly, the mechanical noise from the down-tubes, elbow and handpiece. The variation in the levels (2 dB or so) reflect differences in both hand piece and shearing plant design and maintenance, the former the responsibility of the shearer and the latter the farmer. Further investigation by the Acoustics Research Group in the Department of Mechanical Engineering at the University of Canterbury (Submitted for peer review) has shown that there are significant differences in noise levels between models of shearing plant when new, with scope for design improvements in the down tubes, the gears and the handpiece to reduce rub, backlash and friction noise respectively.

The pressers had noise exposures somewhat similar in level to the shearers, but influenced by the fasteners and catches on the press.

The noise exposure of all the groups was affected by the music in sheds. The politics of the type of music listened to and the intensity at which it is played has yet to be investigated, but seems to be a function of the hierarchical social system within each shearing crew.

No one was observed to use hearing protection, but few individuals used personal stereos either.

Paradoxically, lined sheds seem to be noisier, but the lining will not be acoustically absorptive and those with no lining may transmit and thus diffuse more noise.

The survey does have limitations. It was a convenience sample, however there is no reason to suppose that the noise exposures would be any different as a result. Although the contractors were identified by the Committee, all shearers use a standard range of hand pieces. The sheds were not however chosen to

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reflect a range of acoustic environments, the majority of them being wood and corrugated iron. We also had small numbers leading to less precision in the estimates of the exposure of sorters and pressers, but to some extent this was due to the ratio of numbers of shearers sorters and pressers, generally in the order of 3 or 4:2:1 respectively. Because of the dynamic nature of the job, the near field exposures of the shearers and their proximity to one another it was also difficult to characterise the noise sources using area monitoring.

It is clear that there are opportunities

for noise reduction at source. There are undoubtedly design modifications which can be made to hand pieces, however these will not be without cost, which will have to be borne by the shearers themselves.

Keeping the comb sharp puts less stress on the equipment and this will help, although we could not measure the effect.

The issues surrounding the music in sheds is likely to be a complex one, but one which could reduce the exposures significantly for all the groups, those more remote from the shearing

potentially gaining more benefit. Education as to what levels are harmful, and some simple noise monitoring equipment to measure the noise and keep the listening level reasonable, would help.

Maintenance of the plant and the acoustic environment of the shed would also reduce exposure and are the responsibility of the farm owner or operator. Proper maintenance of the gear could be insisted upon, but the expense of acoustically treating sheds which are in use for a matter of weeks (or days) in the year might be more problematic.



Figure 1. Shearers and sorters.



Figure 2. Woolpress.



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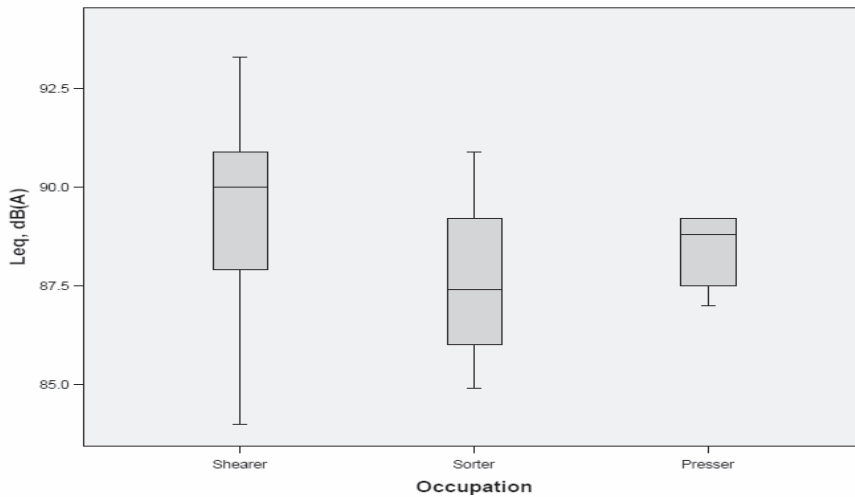


Figure 3. Box plots of noise levels for groups.

This group of workers really do need to use hearing protection, which was not in evidence at all. Education and training would undoubtedly help, but the social cohesion and identity of this group might prove a problem in trying to promote attitudinal change.

We have not, as yet, been able to perform base-line (in the quiet) and compared this with monitoring (after noise exposure) hearing tests to detect temporary threshold shift (TTS).

Although there is debate surrounding

the issue regarding whether TTS leads to Permanent Threshold Shift (PTS) it probably does indicate cochlear strain. Such evidence may strengthen the case for proactivity in the use of hearing protection.

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