

## The Epidemiology and Prevention of NIHL in NZ

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# Introduction

- Two research projects were undertaken (2008 – 2011) in New Zealand industries, funded by HRC OHS Joint Research Partnership Programme.  
Epidemiology of NIHL in NZ - University of Auckland  
Prevention of NIHL in NZ - Massey University
- The findings of each of these research projects are in separate reports (Thorne et al, 2011; Laird et al, 2011, respectively) to the Health Research Council of NZ, ACC and the Department of Labour.

## Epidemiology of NIHL in NZ

- This study, was undertaken to investigate the epidemiology of noise-induced hearing loss (NIHL) in New Zealand.
- Research team, led by Prof Peter Thorne, School of Population Health, University of Auckland.
- Initiated by the ACC and HRC because of the increasing number of claims to ACC and concerns that little was known about;
  - the incidence and prevalence of NIHL in New Zealand,
  - the “at risk” populations and sectors

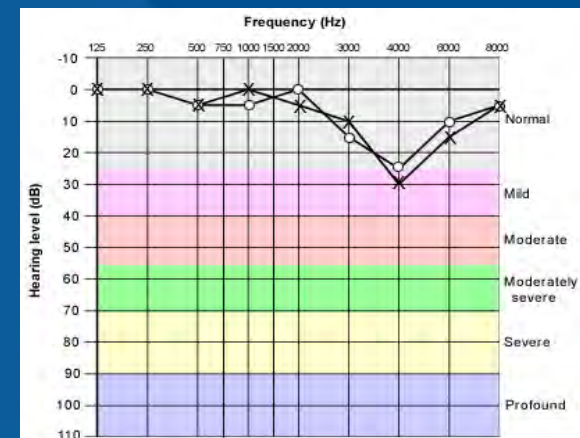
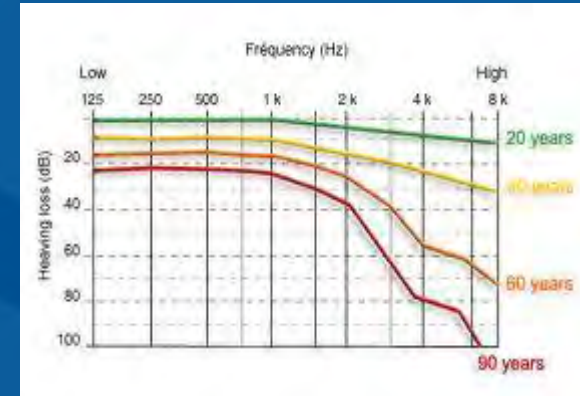
## Epidemiology of NIHL in NZ

- The epidemiology of NIHL is not well understood
- Assessing the incidence and prevalence of a progressive, chronic occupational disease such as NIHL is very difficult.
- It is made even more so by the fact that the hearing loss covers frequencies in the audiogram which are subsequently affected by age and some other otological conditions.



# Epidemiology of NIHL in NZ

- It is difficult to assign the proportion of hearing loss due to age and noise from an audiogram retrospectively and from this determine the prevalence of “pure NIHL” in the population.
- This study, therefore, took a different approach in order to make informed estimates of incidence and prevalence, and to define where the problems occur in the workforce and how this may have changed over time.



## Epidemiology of NIHL in NZ

- Hearing loss also develops from non-occupational leisure and recreational activities.
- In order to try and assess the contribution from the non-occupational setting, studies were also undertaken to determine the extent of non-occupational noise exposure and the possible contribution this may make to overall hearing loss.

## Epidemiology of NIHL in NZ

- The study design was based on a modelling approach developed by the Global Burden of Disease working group of the World Health Organisation (WHO) (Concha-Barrientos, Campbell-Lendrum & Steenland, 2004).
  - a. The model utilises international data (NIOSH, 1998) to establish the estimated *excess risk* of developing hearing loss *above age-related* hearing loss given the level and duration of noise exposure in an occupational setting.

## Epidemiology of NIHL in NZ

b. Using these data, the *proportional attributable fraction* for given sectors and occupational settings can be estimated.

c. From these data estimates of the prevalence and incidence of NIHL (hearing loss  $\geq 25$ dBHL across 1-4kHz) were developed in different sectors and occupational groups and across census years.





## Epidemiology of NIHL in NZ

- d. To verify and assess the sensitivities of these estimates ;
- noise measurements and assessment of hearing loss were undertaken in a sample of 529 workers and 99 companies across the economic sectors.
  - Allowed the estimates to be refined and placed them in a New Zealand context.



## Epidemiology of NIHL in NZ

### Estimates of incidence and prevalence of NIHL in NZ

- Estimates of the prevalence of NIHL ( $\geq 25\text{dBHL}_{\text{Ave1,2,3,4kHz}}$ ) in the NZ workforce, in 2006, range from 29,242 (based on the WHO calculations) to 42,497 (based on New Zealand data collected in this study).
- This gives an incidence in the workforce ranging from 1077 to 1537 new cases of NIHL in 2006.



## Epidemiology of NIHL in NZ

### Estimates of incidence and prevalence of NIHL in NZ

- Extrapolation of the workforce data gives an estimate of the prevalence of NIHL ( $\geq 25\text{dBHL}_{\text{Ave1,2,3,4kHz}}$ ) in the NZ population, in 2006, range from 62,169 (based on the WHO calculations) to 69,613 (based on New Zealand data collected in this study).
- Based on these population data it is estimated that between 1.54 and 1.73% of the New Zealand population had a hearing loss that is solely due to occupational noise exposure.



## Epidemiology of NIHL in NZ

### Estimates of incidence and prevalence of NIHL in NZ

- However, hearing loss is often multifactorial and especially can deteriorate with age - there will be people in the population who have a combination of age and noise related hearing loss.
- Including estimates of this group, the proportion of the New Zealand population who would have only NIHL or some contribution to their total hearing loss from occupational noise exposure is between 2.25% and 2.58% or 90699 to 104088 people (in 2006).



## Epidemiology of NIHL in NZ

### Estimates of incidence and prevalence of NIHL in NZ

- All of these estimates are for unprotected noise exposures and are therefore likely to overestimate the prevalence of NIHL.
- Estimates of future incidence and prevalence were made under the assumption that the current trends in population growth and noisy sector participation would continue. On this basis the total number with NIHL and the number of new cases are predicted to decrease, out to 2040.



# Epidemiology of NIHL in NZ

## Estimates of non-occupational exposures

- Non-occupational noise exposure is a significant issue and some people are exposed regularly to levels of noise in excess of the dose that would be derived from occupational settings.
- Most participants (74.3%) in the studies took part in one or more non-work activities which they considered to be noisy.



## Epidemiology of NIHL in NZ

### Estimates of non-occupational exposures

- Total lifetime noise exposure contributions from both occupational and non-work related activities were calculated in these studies.
- Subjects who are currently less than 30 years old had a larger proportion (60%) of their lifetime noise exposure attributed to non-work related activities, compared to older subjects (41-45%).



# Prevention of NIHL in NZ

## Aim of project;

- Evaluate the effectiveness of existing interventions
- Identify critical factors in the development of interventions
- Identify barriers to the implementation of strategies
- Develop an intervention strategy

Partnership/ collaborative approach (Epidemiology of NIHL research team, stakeholders & industry groups)



# Prevention of NIHL in NZ

Research strategy;

1. Literature Review
2. Workplace Surveys
3. Recommendations for interventions for the prevention of NIHL



# Prevention of NIHL in NZ

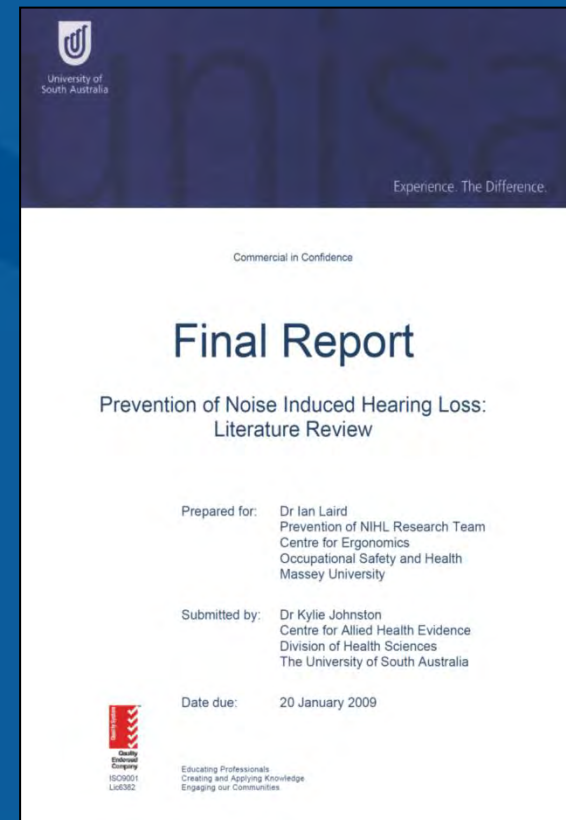
## 1. Evidence based literature review (Johnston, et al, 2009)

### Review questions 1

- How effective are strategies implemented in workplaces to prevent NIHL or noise exposure?
- What are the barriers to implementation of effective interventions?

### Review question 2

- What factors are associated with effective strategies;
  - behavioural psychology?
  - social marketing?



# Prevention of NIHL in NZ

Legislation and enforcement

Introduction of legislation and consequent HLPP have reduced noise exposure and NIHL

Championed by leaders

Strategies championed by leaders and managers are effective in NIHL prevention

Multifactorial approach

Interventions which combine multiple strategies are effective in NIHL prevention

Implement engineering

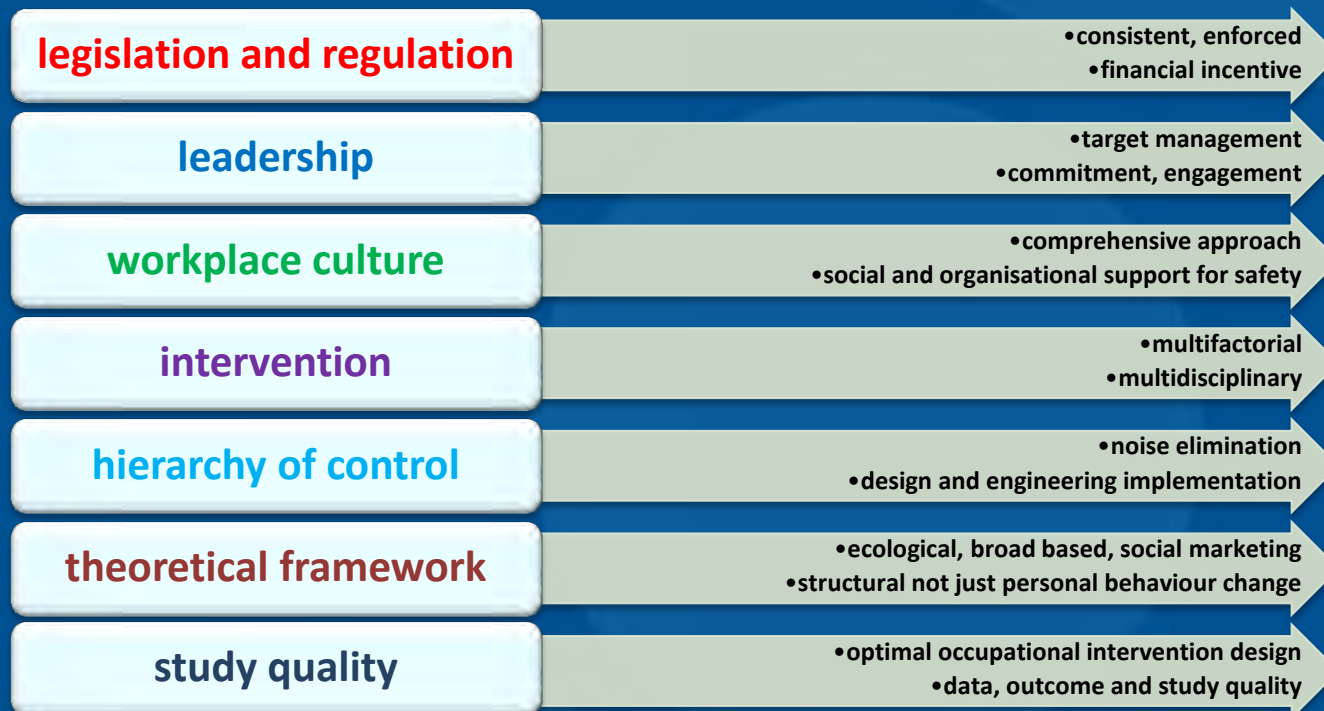
Engineering controls reduce noise exposure but little is known about their implementation

One-off training

One-off training has modest immediate effects, but is insufficient to prevent NIHL in the long term

# Prevention of NIHL in NZ

Effective NIHL prevention will require an approach which takes and combines the best strategies from multiple areas including:



# Prevention of NIHL in NZ

## 2. Workplace surveys - Noise at Work Surveys – 3 Parts

1. Surveys on the interventions currently used in industry and identify barriers to the implementation of noise management strategies.
2. Surveys to determine whether identified “high-risk” sectors and occupations are conforming with current standards (e.g. Codes of Practice) and legislation to prevent NIHL?
3. Surveys of workplace culture in relation to noise exposure and NIHL



# Prevention of NIHL in NZ

## 2.1 Noise at Work Survey (Existing noise sources and controls)

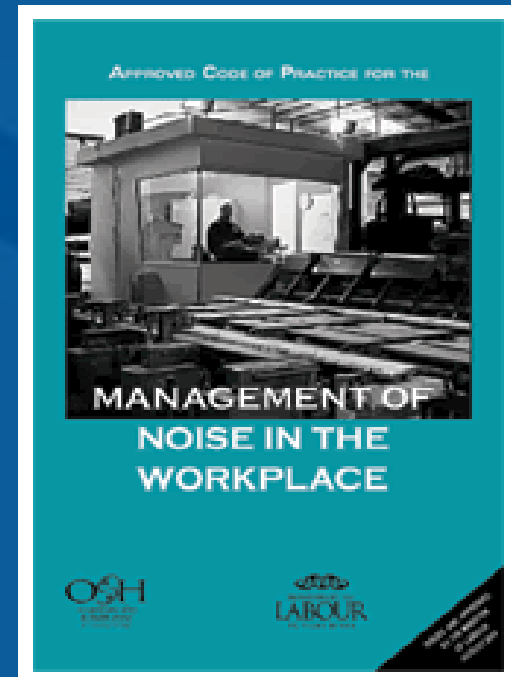
- This provided demographic details of the organisation, including
  - the physical characteristics and details of work areas assessed,
  - identification of existing noise sources,
  - identification and evaluation of existing noise controls and
  - an assessment of the options/ strategies for reducing noise exposure further.



## Prevention of NIHL in NZ

### 2.2 Noise at Work Survey (Conformance assessment)

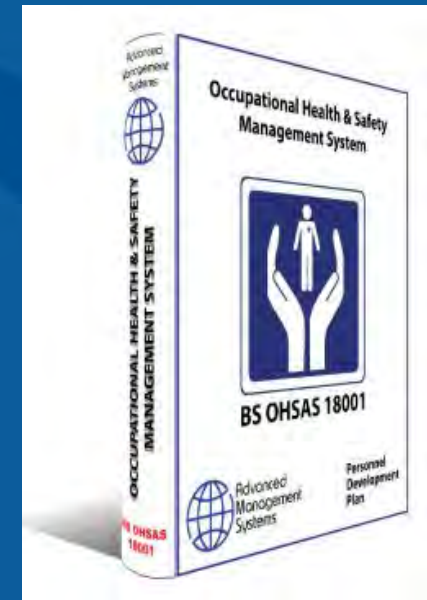
- Audited employers and employees responsibilities under the Health and Safety in Employment Act 1992 with respect to noise, utilising the Approved Code of Practice for the Management of Noise in the Workplace.
- A 10 point conformance scorecard was developed.



## Prevention of NIHL in NZ

### 2.3 Noise at Work Survey (Workplace safety culture)

- This sought information on employer and employee attitudes, perceptions, beliefs and behaviour in relation to noise exposure and noise induced hearing loss and how the employer manages safety generally.
- A variation of “Noise at Work” survey tool (Williams & Purdy, 2005).





# Prevention of NIHL in NZ

## Industry sectors selected with relative risk of NIHL

Risk of NIHL	Industry sector	ANZSIC
<b>High risk</b>	Agriculture,  Manufacturing,  Construction,	A – 0149 Grain, Crop, 0161 Dairy  C – 1211 Bottling, 1340, Knitted products, 1411 Sawmilling, 1491 Wood products, 2221 Steel fabrication  E – 3019 Residential building, 3101 Road construction,
<b>Moderate risk</b>	Hospitality	H – 4511 Cafes, restaurants and bars
<b>Low risk</b>	Education	P – 8010 Preschool, 8021 Primary



## Prevention of NIHL in NZ

3. Results - Case studies of 33 workplaces, 71 work areas and noise exposure from 98 workers were measured

### (Existing noise sources and controls)

- Generally noise sources could be readily identified in the workplaces.
- Although many operations were complex, noise control strategies aimed at the noise source and noise paths could have been investigated further,
- The predominant noise control strategy was that of minimisation, specifically the use of personal hearing protection.

## Prevention of NIHL in NZ

### 3. Results - (Existing noise sources and controls)

Noise control strategies could have been investigated further, including;

- elimination or replacement of old machinery
- more specific engineering modification at noise source
- more specific and direct enclosure of machinery and equipment,
- use of vibration isolation,
- regular maintenance of machinery and equipment,
- implementation of a “buy quiet” purchasing policy.
- administrative controls (not used in any of the organisations surveyed).



# Prevention of NIHL in NZ

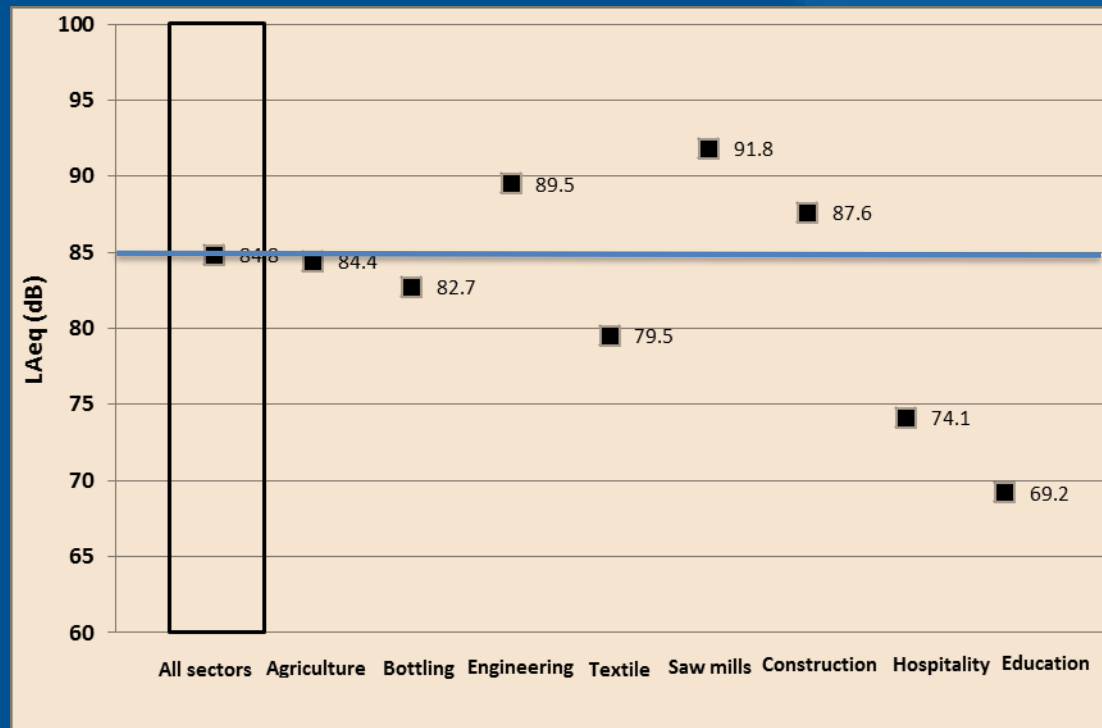
## 3. Results - (Existing noise sources and controls)

### Noise exposure and dose measurements

- Of the high risk industry sectors, median LAeq.8hr values varied widely (80 – 95dB); wood process and sawmills, metal manufacturing and construction operations experienced the highest noise exposures with median LAeq.8hr values of 95 dB, 92 dB and 90 dB respectively.
- Noise dose estimates indicated a very wide range of personal exposures (10 – 600%; 0.1- 6.0 Pa<sup>2</sup>h)
- The moderate risk businesses (cafes and restaurants) surveyed had a median LAeq.8hr values of 74 dB,
- The low risk industry sector (schools) had median LAeq.8hr values of 70 dB

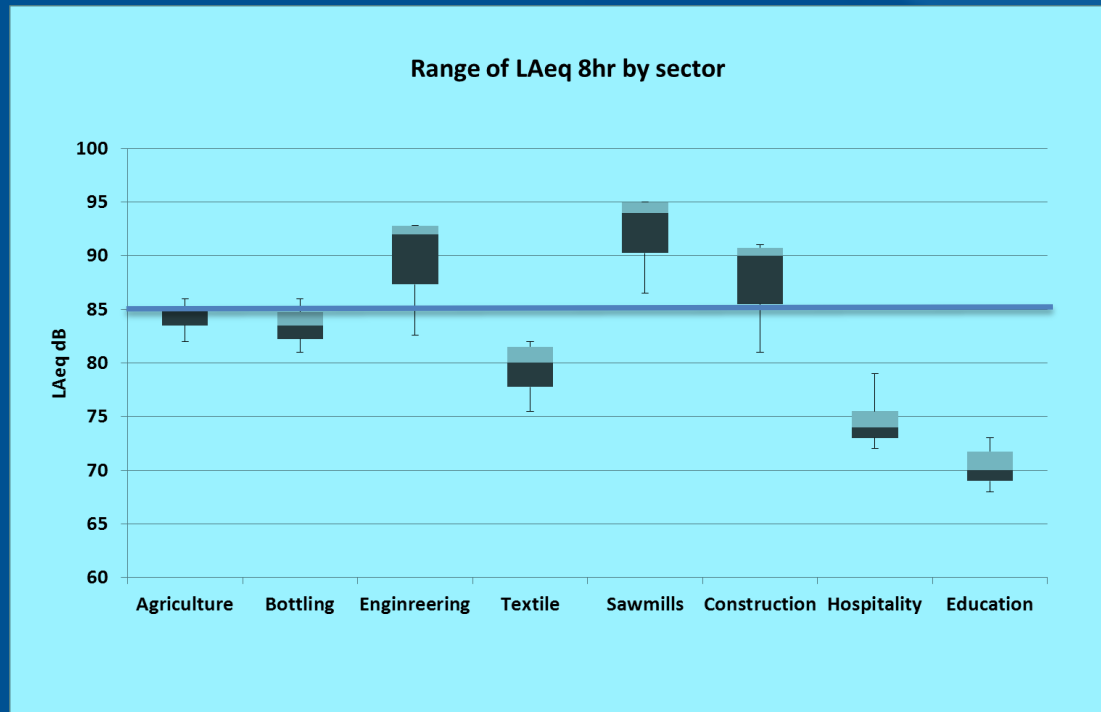
# Prevention of NIHL in NZ

## 3. Results – Mean employee $L_{Aeq8hr}$ levels by sector.



# Prevention of NIHL in NZ

3. Results – Median  $L_{Aeq8hr}$  levels by sector. The box boundaries show the 25th percentile and the 75th percentile. Error bars indicate the 90th and 10th percentiles.



# Prevention of NIHL in NZ

## 3. Results - (Conformance assessment)

Of the 33 case study enterprises, conformance to noise management standards was poor;

- Conformance values across all sectors was very low (median value 2.0 and mean 1.9, sd.1.7 with 10 being total conformance – high risk mean 3.0).
- Little evidence of an awareness of OHS legislation and standards generally and noise management requirements specifically
- Little evidence of an understanding of the need for a hazard management system as it relates to noise exposure
- Majority of businesses did not have a noise control policy.



# Prevention of NIHL in NZ

## 3. Results - (Conformance assessment)

- Some evidence that noise had been identified as a workplace issue
- Little evidence that noise had been assessed as a significant hazard (either qualitatively or quantitatively).
- Some evidence that elimination and isolation strategies were explored to reduce noise exposure, but were not generally utilised.
- Minimisation (use of hearing protection) tended to be employed as the key control strategy.
- Administrative controls were not used in any of the organisations surveyed.
- Noise monitoring or audiometry was not routinely undertaken.



# Prevention of NIHL in NZ

## 3. Results - (Conformance assessment)

- Information or training was generally not provided for noise control/management in the workplace
- Little evidence that employees were involved in decisions concerning hazard identification and control in relation to noise exposure
- Of the “high risk” industry sectors bottling, engineering businesses and farms were the most compliant followed by construction and saw mill/wood processing businesses.
- The “moderate and low risk” sectors, hospitality & education, had mean conformance scores of 0.33(0.57) & 1.7(1.5) indicating that at least some effort was being undertaken to address the noise exposure issue in these sectors.



## Prevention of NIHL in NZ

### 3. Results - (Workplace safety culture/climate)

- 163 respondents provided data.
- Companies with higher compliance scores and higher risk of NIHL also have higher noise levels, as measured by the median value of the LAeq.8hr measures.
- Compliance appears to be unrelated to safety climate or to employee acceptance of noise.
- Employees in noisier workplaces saw fewer barriers to managing noise. Only the “personal responsibility” facet of safety climate was correlated with noise levels.

# Prevention of NIHL in NZ

## 3. Results - (Workplace safety culture/climate)

- Linear regression analysis to identify which of the company-level variables predicted compliance with noise management requirements found that the only predictor accounting for unique variance was **sound level**, as measured by the median LAeq.8hr.
- Safety climate: perceptions of safety as a workplace priority explained little variance in anything. Safety as a personal responsibility did.
- After decades of effort in trying to improve safety management, this is disappointing.



# Prevention of NIHL in NZ

## 3. Results - (Workplace safety culture/climate)

- Maybe perceptions of safety climate (particularly in SB's) **follow** rather than **lead** safety management efforts.
- Hazards are best managed directly rather than indirectly through attempts to change climate through marketing, training, attitude change...
- ... Implications for noise management strategies.
- **To improve safety climate - improve safety.**



# Prevention of NIHL in NZ

## The Need for Solutions

- The outcome of the 2 projects was preparation of a document - **“Recommendations for an Intervention Strategy for the Prevention of Noise Induced Hearing Loss (NIHL) in New Zealand”**. (Laird, Thorne et al, 2011)
- Identifies the strategic issues and makes recommendations for the highest areas of priority for immediate intervention and the most effective intervention options at **National, Industry sector and Organisational** level.

# Prevention of NIHL in NZ

## The Need for Solutions (National level)

- Prevention of NIHL a priority - (OHAP, 2011)
- Integrate related national strategies - Workplace Health and Safety Strategy for New Zealand to 2015; the National Foundation for the Deaf (NFD) National Noise Induced Hearing Loss Strategy.
- Long-term commitment to the development and resourcing of a strategy, which can be effectively initiated or incorporated into existing/ongoing programs.
- Establish a National Forum - multi-layered approach, based on consultation.



# Prevention of NIHL in NZ

## The Need for Solutions (National level)

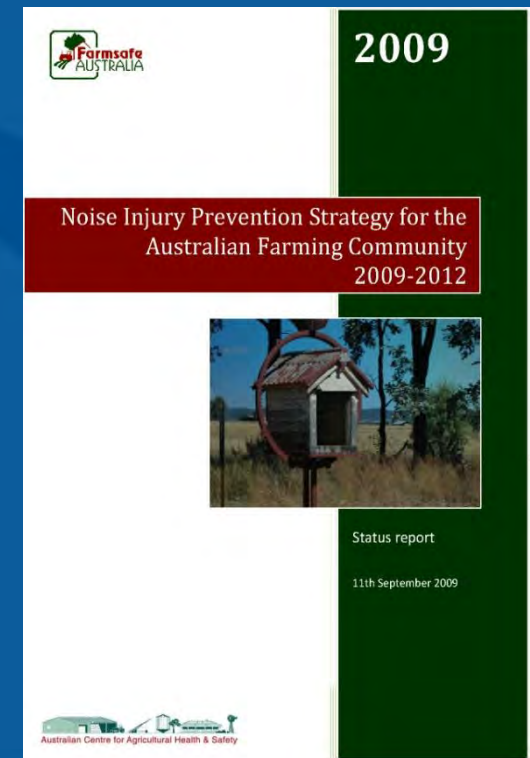
- Population health, community development/ action approach to hearing loss prevention
- Adoption of Prevention through Design (PtD) principles
- Increased enforcement activity of Department of Labour
- Introduction of action levels for noise exposure.
- Change in expectations of noise management options
- Promotion of innovative “best” or “good” practice models
- Development of surveillance schemes for occupational hearing loss and noise exposure
- Provision of technical advice and support for noise management.



# Prevention of NIHL in NZ

## The Need for Solutions (Industry level)

- A model industry level intervention strategy for the prevention of NIHL (applicable in New Zealand industry) has been recently developed by Farmsafe Australia (2009).
- “The Noise Injury Prevention Strategy for the Australian Farming Community 2009-2012” - provides a structure within which to focus efforts to reduce the incidence, severity and impact of noise injury across all members of the farming community.





# Prevention of NIHL in NZ

## The Need for Solutions (Organisational level)

At the organisational level, the further “upstream” from exposure one aims, the more likely one is to achieve the preferred goal of exposure prevention versus control.

- The principle is fundamental to OHS practice, but
- Challenging to implement - Large businesses - Small businesses
- which constitute the largest proportion of NZ businesses, where the burden of exposures to noise and NIHL lie. i.e. agriculture, manufacturing & construction.



# Prevention of NIHL in NZ

## The Need for Solutions (Organisational level)

97% of enterprises in agriculture,  
92% of enterprises in manufacturing,  
98% of enterprises in construction,  
92% of hospitality enterprises and  
75% of education enterprises

have less than 20 employees (NZ  
Statistics, 2010).



# Prevention of NIHL in NZ

## The Need for Solutions (Organisational level)

- **Change our frame of reference** - Small business approach
- Useful models of interventions in small businesses.
- The models highlight the important role of intermediaries and external stakeholders in the “embedment” or “ownership” of the intervention in the small business.
- Legg, S.J., Battisti, M., Harris, L.-A., Laird, I. S., Lamm, F., Massey, C. L. and Olsen, K. B. (2009). Occupational health and safety in small businesses in New Zealand. 31 Technical Report No. 12, National Occupational Health and Safety Advisory Committee, Wellington.



## Prevention of NIHL in NZ

### The Need for Solutions (Organisational level)

We need **significant change in expectations** with respect to policing the requirements of the noise standards (UK noise regulations):-

- Less reliance on PPE is required
  - not an acceptable long term solution unless noise control can be shown to be absolutely impractical
- Much more of a risk based approach is required
- Much better compliance with the duty to reduce noise by engineering means is expected

# Prevention of NIHL in NZ

## The Need for Solutions (Organisational level)

- Risk Assessments should identify a programme of work
- Less assessment and "process", more Action is expected
- If solutions have been identified "stop assessing and start controlling"
- Health Surveillance is required for exposures above 85dB(A)
  - which can be considered to be "a tax on failure to control the risks"



# Prevention of NIHL in NZ

## The Need for Solutions

- Change of thinking -
- Need to set out a vision for the prevention of hearing loss in New Zealand where;  
“hearing is regarded as a special sense that is valued by the community in home, work and leisure environments”.



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