Impairment benefits compensation claims for noise induced hearing loss (NIHL) between 1998-99 and 2008-09 (provisional analyses 30 July 2010)

Monash University Centre for Occupational and Environmental Health

Authors

Dr Samia Radi, MonCOEH, Monash University
Dr Geza Benke, MonCOEH, Monash University
Dr Frederieke Schaafsma, MonCOEH, Monash University
Pr Malcolm Sim, Director, MonCOEH, Monash University

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Accompanying documents to this report

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Executive Summary

Noise Induced Hearing Loss (NIHL) is a traditional occupational disease, which can place a substantial economic and social burden on the Victorian working population. Occupational noise exposure is the main cause of NIHL in the community. NIHL is a preventable disease, if appropriate noise control programs are implemented in industry. It is irreversible, but it does not progress once exposure to noise is discontinued.

There has been a considerable increase in NIHL claims accepted by WorkSafe Victoria since there were changes to the threshold in 1997. A similar change has been noted in New Zealand (Thorne et al 2008). A better understanding of NIHL profiles and identification of at risk groups should help provide scope for developing effective strategies to prevent hearing loss in the future for implementing preventive measures in the workplace and to better understand reasons for the increase in claims.

This paper describes an analysis of the demographic and occupational characteristics of workers covered by WorkSafe Victoria who lodged a NIHL impairment benefits claim during the period 1998-99 to 2008-09.

The main findings and policy implications are presented in this executive summary.

Main findings

- Most claimants were males (96.4%).
- The percentage of rejected claims versus accepted claims was around 20% over the period. Unsuccessful claimants were younger than successful claimants (57.8 years versus 59.6 years) and the percentage of rejected claims increased with increasing workplace size.
- Claimants' mean age was 59.6 years age and ranged from 22 to 90 years. Mean age at claim lodgement increased steadily over the period from 56 years to 61.6 years. Overall, the 56-65 year age group accounted for more than half the number of claims (55.1%) and the 66+ year age group for almost one in four claims (22.6%). These two age groups experienced the highest rise in the number of claims across the period, with a fourfold and tenfold increase respectively.
- Two industries accounted for three-quarters of the accepted claims (manufacturing 36.1% and construction 19.6%). In both industries, the number of claimants increased more in higher age groups, which was a similar pattern to that seen for all claims.
- The three occupations with the highest number of claims were tradespersons and related workers, intermediate production and transport workers, and labourers and related workers (34.5%, 29.4% and 25.7% respectively). They accounted for 89.6% of all claims:
    - The increase in claims followed the general pattern in intermediate production and transport workers and was steadier over time in tradespersons. In labourers and related workers, the number of claims fluctuated over the period, departing from the overall trend.
    - As observed in overall claims, the increase in the number of claims in these occupations was higher in older claimants. The sharper rise in claimants aged 66 years and above was in tradespersons with a nineteen fold increase over the period.
    - The number of claimants in the three higher risk occupations increased in the manufacturing and construction industries. The lower rise was in labourers and related workers.
- The number of claims was affected by the workplace size:

- Claimants' mean age decreased with increasing workplace size. The likelihood of being employed in a small workplace compared to a large workplace was increased by 1.5 in claimants aged 66 years and above compared to the younger claimants group.
- In manufacturing, construction, trade, transport and storage, and finance, property and business services, claimants were more likely to work in a small or medium size workplace than in a large workplace.
- In community services, claimants were 2.6 and 1.2 times more likely to work in large workplaces than in medium and small workplaces respectively.
- Tradespersons were more likely to be employed in small or medium workplaces than in large workplaces.
- The odds for claimants of being employed in a medium size workplace compared to a large workplace were the highest in construction and manufacturing, with a 5.3 and 3.9 increase respectively.

- The number of claims was fourfold higher in 2008-09 compared to 1998-99. There was a sharp increase in the number of claims between 2003-04 and 2005-06, resulting in a twofold increase within two years. This rise was mainly observed in claimants over 56 years, in the two industries with higher number of claimants, and in tradespersons.
- Overall yearly incidence rates doubled from 15.1 in 1999-00 to 27.2 new claims per 100,000 workers in 2008-09. This was due to a sharp increase in the incidence rate between 2004-05 and 2006-07. The rise was similar in small, medium and large workplaces.
- The two industries with the highest incidence rates were construction and manufacturing. In both industries, incidence rates followed the general pattern.
  - In construction, incidence rates decreased in medium workplaces but doubled in small workplaces.
  - In manufacturing, incidence rates were comparable in small, medium and large workplaces until 2002-03 but from 2003-04 onward, there was a sharp increase. This upward trend was twice higher in small and medium workplaces compared to large workplaces.
- In finance, property and business services industry in contrast with the other industries, incidence rates decreased from 2005-06 onward. In 2008-09, they were

almost at the same level as at the beginning of the period. Incidence rates in small, medium and large workplaces were comparable from 2006-07 onward.

- In community services, after an initial rise, incidence rates decreased except in 2004-05 where a sharp rise was observed. The highest incidence rates were experienced by large workplaces and the lowest by small workplaces.
- In transport and storage, incidence rates more than doubled over the period but no steady pattern was observed. Incidence rates were lower in medium size workplaces and higher in large workplaces.

- In trade, the trend was stable over time except between 2004-05 and 2005-06 where it almost doubled. Large workplaces experienced the highest incidence rates over the period.

Background

In Australia, one in six Australians is affected by hearing loss. Prevalence rates for hearing loss are associated with increasing age, rising from less than 1% for people aged younger than 15 years to three in every four people aged over 70 years and with an ageing population, hearing loss is projected to increase to one in every four Australians by 2050 (Access Economics 2006).

Hearing loss in the community places a substantial economic and social burden on the Australian population. In 2005, the real financial cost of hearing loss was estimated to be $11.75 billion or 1.4% of gross domestic product with the largest financial cost component being productivity loss, which accounts for over half (57%) of all financial costs ($6.7 billion). There were an estimated 158,876 people not employed in 2005 due to hearing loss. The productivity cost arises due to lower employment rates for people with hearing loss over 45 years and subsequent losses in earnings (Access Economics 2006).

In a study conducted in South Australia in 1998, about one third of hearing loss (37%) was due to excessive noise exposure (cited in Kurmis et Apps 2007 and in Access Economics 2006). Nearly half the people with hearing loss are of working age (15-64 years) (Access Economics 2006). According to the World Health Organisation, 7% of the disabling hearing loss in adults is attributed to occupational noise in Australia (Nelson et al 2005).

Australian national statistics on occupational noise induced hearing loss (NIHL) claims have been published and are accessible through an internet-based national database called ‘National Data Set for compensation-based statistics’ (http://nosi.ascc.gov.au/Default.aspx). These statistics include all accepted workers’ compensation claims that resulted in a fatality, permanent incapacity or temporary incapacity with an absence from work of one working week or more, during the period from 1997-98 to 2007-08. Across Australia, industry sectors with the highest number of claims were respectively manufacturing and construction, accounting for more than 50% of all claims each year across the period between 1997-98 and 2007-08. The occupation groups with the highest number of claims were tradespersons and related

workers, intermediate production and transport workers, and labourers and related workers. They accounted for 85% of all claims over the same period.

However, there are limitations in using national compensation data to develop a tailored preventative approach in Victoria as the way in which hearing loss claims are assessed varies substantially across schemes within Australia, each jurisdiction having developed their own guides to the assessment of NIHL and set hearing loss thresholds. Furthermore, pooled national data do not capture each jurisdiction's industry distribution or population characteristics. Australia as a whole experienced a steady number of deafness claims after a sharp decrease from 6000 claims in 1997-98 to 4020 claims in 1999-00. In 2007-08, there were 3690 claims reported in the national database. A report published by the Institute of Actuaries of Australia in 2009 compared the New South Wales and Victorian schemes for hearing loss claims. In both jurisdictions, an impairment threshold increase in the 1990's in response to rising compensation claims was followed by a significant reduction in the number of claims the following years. However, both jurisdictions did not follow the same trend in recent years. While the number of claims was steady in New South Wales in the last 5 years, Victoria experienced an upward trend. The number of claims was noted to have more than doubled over the period 2004-05 to 2008-09 (Institute of Actuaries of Australia 2009).

The current analysis was prompted by the dramatic increase in NIHL claims experienced in Victoria in the last five years (Institute of Actuaries of Australia 2009) with similar trends observed in other countries such as New Zealand (Thorne et al 2008). The age of workers lodging hearing loss claims is higher compared to general claims (Institute of Actuaries of Australia 2009). While irreversible once acquired, NIHL is a preventable disease as it does not progress once exposure to noise is discontinued. However unlike other occupational diseases, hearing loss is a gradual process and it may be noticed only after several years of exposure and significant damage to the ear. A better understanding of hearing loss profiles and identification of at risk groups should help provide scope for developing effective strategies to prevent hearing loss in the future and for implementing preventive measures in the workplace. A recent Cochrane systematic literature review showed that there is however little evidence that hearing loss protection programs are effective. The lack of effectiveness

is related to often poor quality programs with a large variation in their implementation (Verbeek et al 2009, Daniell et al 2006).

The aim of the current analysis was to identify higher risk groups in relation to occupational and demographic characteristics in the working population claiming for NIHL related impairment benefits payment over the period between 1 July 1998 and 30 June 2009 in Victoria. The results of this analysis should also provide a rationale for future research in this area in order to help implement efficient preventive measures at an early stage and therefore reduce the incidence of hearing loss.

Methods

Population

The source of data was the computerised database of the Victorian workers' compensation authority (VWA), WorkSafe Victoria. The scope of the population covered by the dataset comprises all VWA insured workplaces that employ workers. The records exclude a number of workplaces such as Commonwealth employers and Commonwealth government trading enterprises, which are insured through Comcare. Sole traders, self-employed and contractors are usually not included in the VWA records as they do not have employees. The data also excludes 36 self-insurers (as at 30 June 2010). Self-insurers are organisations approved by the VWA to manage and be liable for their own workers' compensation claims and are therefore not included in the VWA collection. They represent approximately 8% of the VWA scheme, based on remuneration.

The database included all claims (5510 claims) lodged for impairment benefits payment between 12 November 1997 and 30 June 2009. Claims lodged between 12 November 1997 (date at which the threshold of Whole Person Impairment (WPI) for accepting NIHL claims was increased from 7 to 10%) and 30 June 1998 were excluded from the analysis as this period is a transition and incomplete financial year (102 claims).

Variables

Affliction nature

Claims were identified by the coded affliction nature. The affliction nature was encoded using the "Type of Occurrence Classification System" (TOOCS 2.1, May 2002). The TOOCS was developed for use in coding workers' compensation claims reported to workers' compensation agencies. Claims were included if the affliction nature code was deafness (codes 250 or 771, n=5183 claims) and excluded if the affliction nature was either: 1) not related to hearing (206 claims), 2) related to another disease of the ear or mastoid (12 claims), or 3) related to an acute hearing loss (audio shock / audio shriek (codes 259 or 772, n=1 claim) or traumatic deafness from air pressure or explosion (codes 152 or 312, n=6 claims)).

Allocation of a claim to a financial year

Data were analysed per financial year (from 1 July to 30 June). A claim is allocated to a particular financial year according to the date the claim is received by the insurer, resulting in either an impairment benefit payment (accepted claim) or none (rejected claim).

Industry classification

The set date of injury is either the last date of the worker's employment during which they were exposed to noise, or if the worker is still employed with the same employer they had exposure to noise, the date the claim is lodged. Industry and occupation were recorded according to the employer liable for the claim. The industry in which NIHL occurred was classified using the WorkCover Industry Classification (WIC). The results are presented using the industry classification at the broader level (12 categories). As the number of claims was small in some industries, they were collapsed in one single category (agriculture, forestry, fishing and hunting; communication; electricity, water and gas; mining; public administration; and recreation, personal and other services).

For incidence rates calculation, the number of employees by industry and by workplace size according to the employer remuneration was provided by WorkSafe Victoria for each quarter from financial year 1999-00. The number of employees per financial year was obtained by calculating the mean over the four quarters.

Occupation classification

Occupations at the time of NIHL injury were categorised according to the Australian Standard Classification of Occupations (ASCO) Second Edition, July 1997 (ABS Cat. No. 1222.0) using the 9 major groups. Due to small sample size, advanced, intermediate and elementary clerical and services workers were pooled (clerical and services workers). In the multivariate analysis, clerical workers, professionals, associate professionals, and managers were further pooled in one single category (other occupations).

Workplace size

The employer remuneration is the remuneration of all workplaces owned by one business. This can be equal to the workplace remuneration when there is only one workplace. Workplaces and employers size was categorised using the VWA remuneration classification. Workplaces or employers were classified as small (up to $1 million), medium ($1-20 millions) or large (over $20 millions). As the workplace remuneration was missing for 17.7% (917 claims out of 5183 claims), we used the employer remuneration as a proxy for the workplace size.

Data analysis

Age was expressed as mean. A Student's t-test was used to compare two groups for age and analysis of variance was used to compare more than two groups for age. Groups for categorical variables (claim outcome, gender, age groups, industry, occupation, and workplace size) were compared using a Pearson chi square test and trends over time were compared using a chi square trend test. Tests were two-sided and p values smaller than 0.05 were considered significant.

A multivariate model was used to analyse the independent effect of demographic (gender, age group) and occupational factors (industry and occupation) for the likelihood of reporting employment in a small or medium workplace compared to a large workplace. Multivariate models allows for taking into account the differences in distribution of the factors included. As the workplace size was coded using three categories, a nominal multinomial logistic regression was used to determine the demographic and occupational factors associated with employment in a small or medium workplace compared to employment in a large workplace. Ordinal logistic regression was not used as this model assumes a proportional risk between the dependent variable categories (i.e. workplace size). The results were expressed as odds ratios. They were considered significant when the 95% confidence interval excluded the value of 1.

Incidence measures the number of new cases of a disease in a specified period of time and is divided by the size of the population under consideration. Incidence rates were expressed per 100,000 workers and were calculated as the number of incident cases divided by the number of workers covered by WorkSafe Victoria. They were calculated

using the ANZSIC 2006 first edition classification and by workplace size using the employer remuneration.

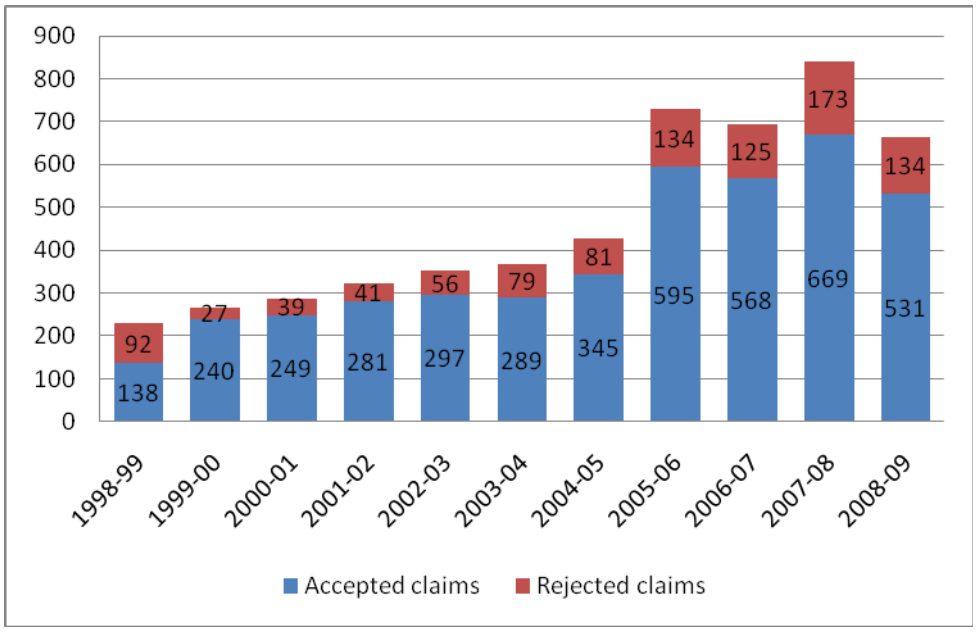
Data analysis was performed using the Stata 9 statistical software package.

Results

Comparison of accepted and rejected impairment benefits claims

A total of 5183 NIHL were analysed. Overall, 81.1% of the claims lodged (4202 claims) were successful. The percentage of accepted claims varied over the study period. In 1998-99, it was lower (60.0%) compared to the following financial years where the highest percentage of successful claims was observed (89.9%). It decreased steadily afterwards to stabilise around 80.0% during the last two years of the period (Figure 1).

Figure 1. Claims outcome by financial year

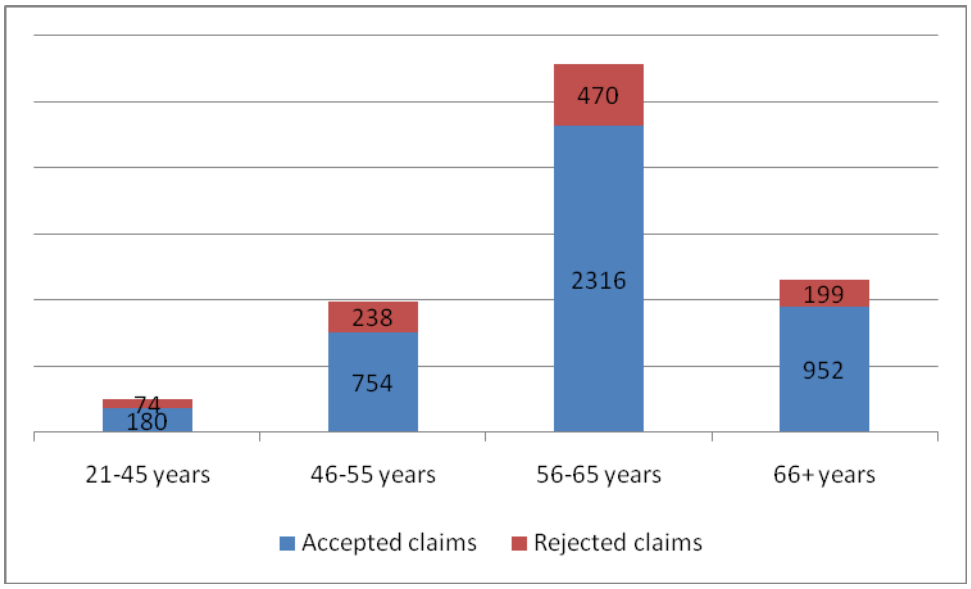


Demographic characteristics

The percentage of rejected claims was significantly lower in men compared to women (18.4% versus 30.6%).

Mean age was significantly lower in unsuccessful claimants (57.8 years) than in successful claimants (59.6 years). When comparing age groups, the percentage of rejected claims decreased with age, ranging from 29.1% in the 21-45 year age group to 17.3% in the 66+ year age group (Figure 2).

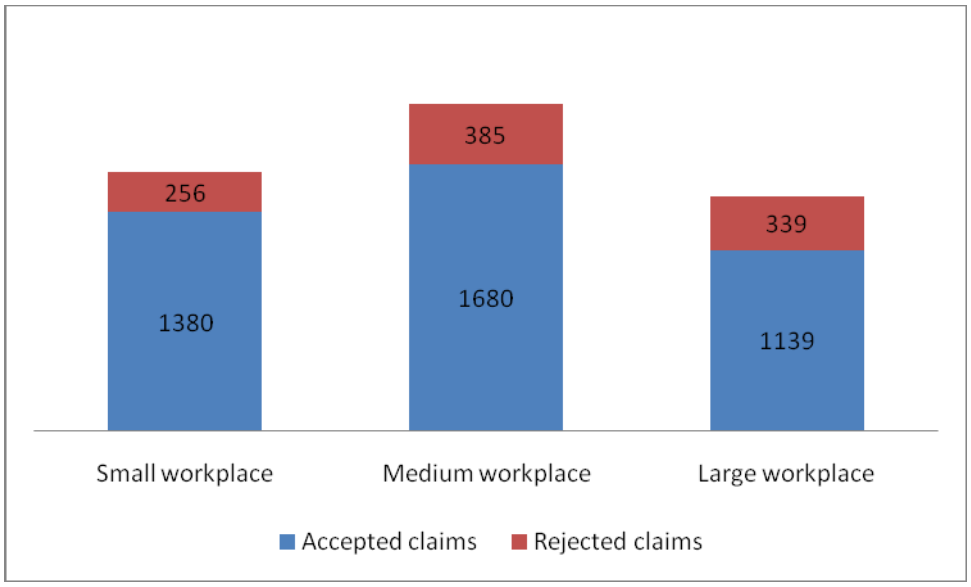
Figure 2. Claims outcome by age



Workplace characteristics

There were no significant differences in the percentage of rejected claims between industries and occupations. However, there was an increase in the percentage of rejected claims with increasing workplace size (16.9%, 19.4% and 24.0% respectively in small, medium and large size workplaces) (Figure 3).

Figure 3. Claims outcome by workplace size



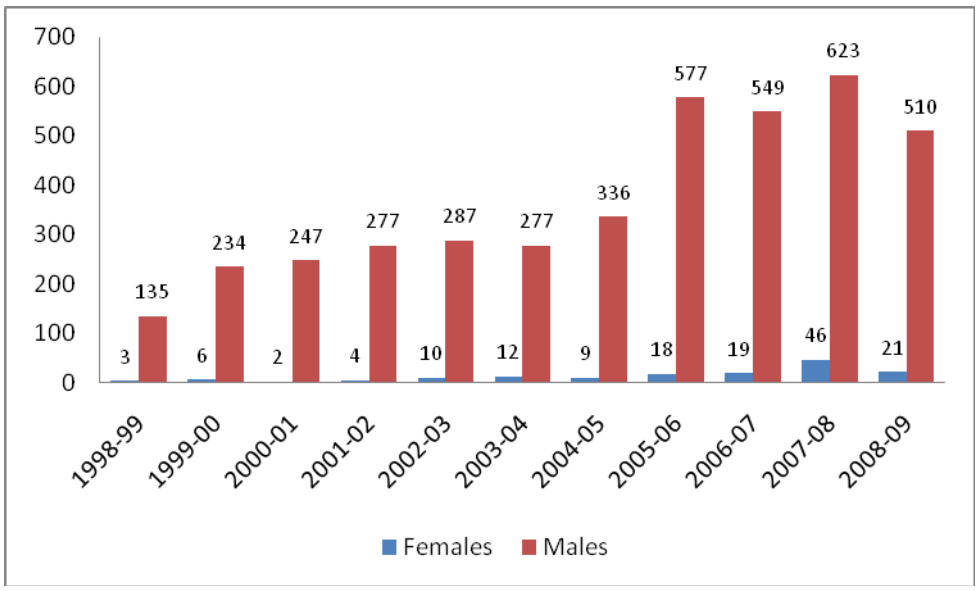
Description of accepted impairment benefits claims

Number of claims

Men were predominant in the successful claimants' population (n=4052, 96.4%) while women accounted only for 3.6% of the claimants (n=150).

The number of claims was nearly four times higher in 2008-09 compared to 1998-99. Over the first 7-year period, the number of claims increased by 2.5 times from 138 claims in 1998-99 to 345 claims in 2004-05. While no change in criteria for accepting claims occurred, there was a sharp increase the following year with the number of claims almost doubling between 2004-05 and 2005-06. The highest number of claims was recorded in 2007-08 and was followed by a 20% decrease in 2008-09 (Figure 4).

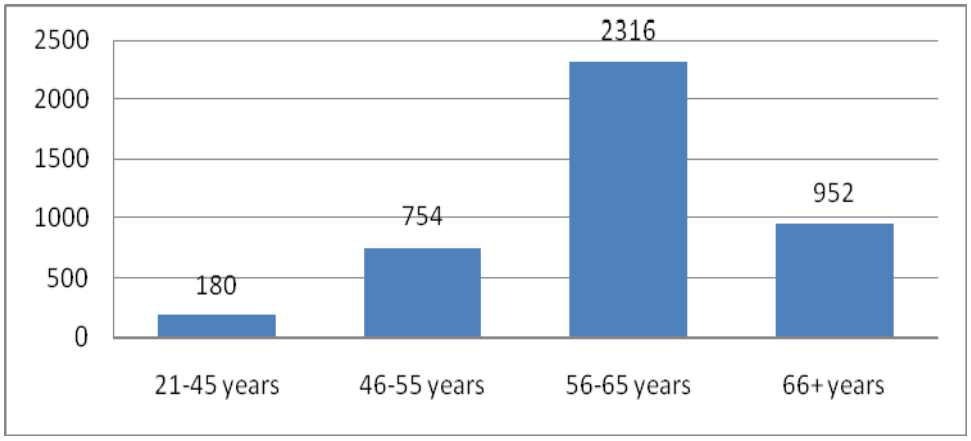
Figure 4. Number of claims by financial year



Age

Claimants' mean age was 59.6 years age and ranged from 22 to 90 years. The number of claims increased sharply from age 21-45 to 56-65 years and decreased rapidly after 65 years. The highest number of claims was in the 56-65 years age group (55.1%) (Figure 5).

Figure 5. Distribution of claims according to age

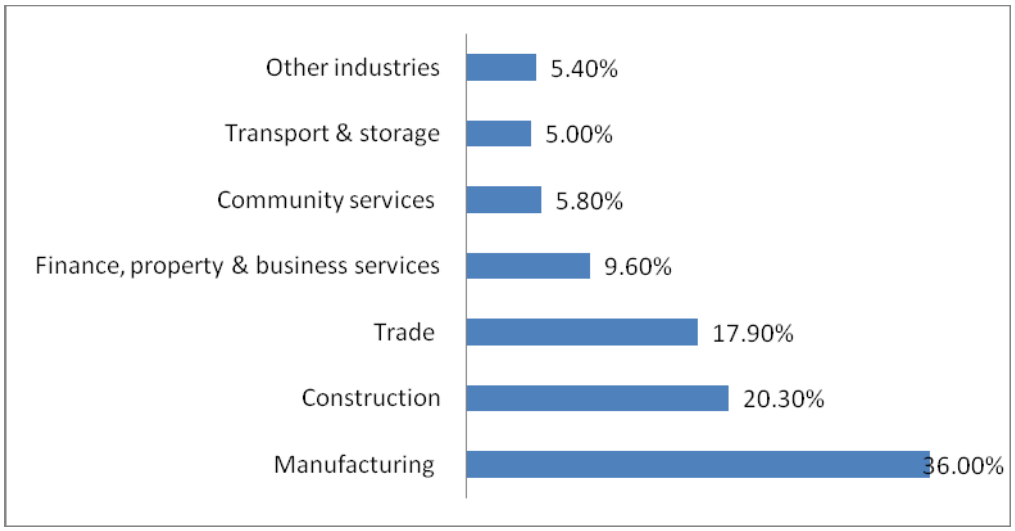


There were no significant differences between industry and occupation types for mean age or for age group distribution.

Industry

Three industries accounted for three-fourth of the claims (manufacturing 36.0%, construction 20.3% and trade 17.9%) (Figure 6). The percentage of claims generated by the other industries ranged from 9.6% (finance, property and business services) to 0% (communication).

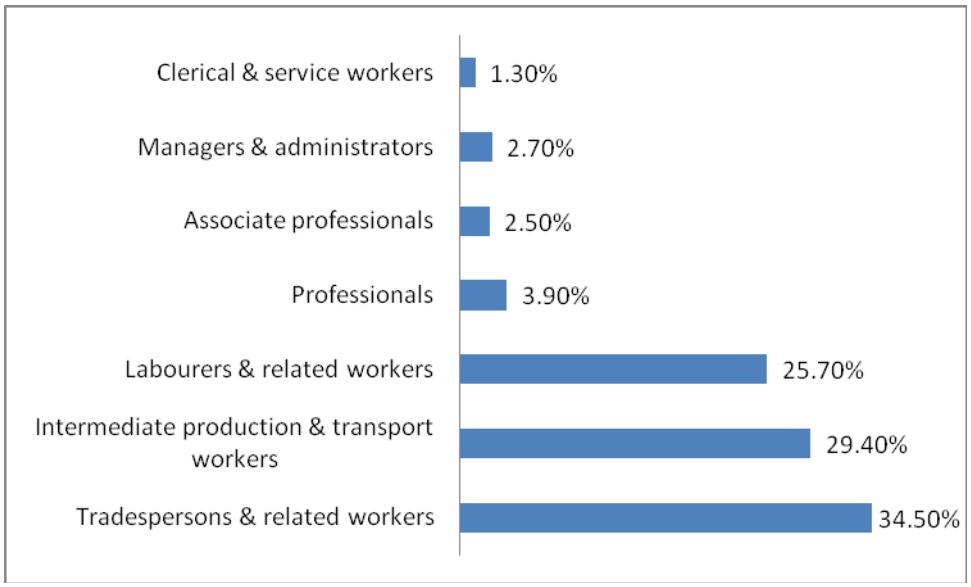
Figure 6. Percentage of claims by industry



Occupation

The three occupations with the highest number of claims were tradespersons and related workers, intermediate production and transport workers, and labourers and related workers (34.5%, 29.4% and 25.7% respectively) (Figure 7). They accounted for 89.6% of all claims.

Figure 7. Percentage of claims by occupation



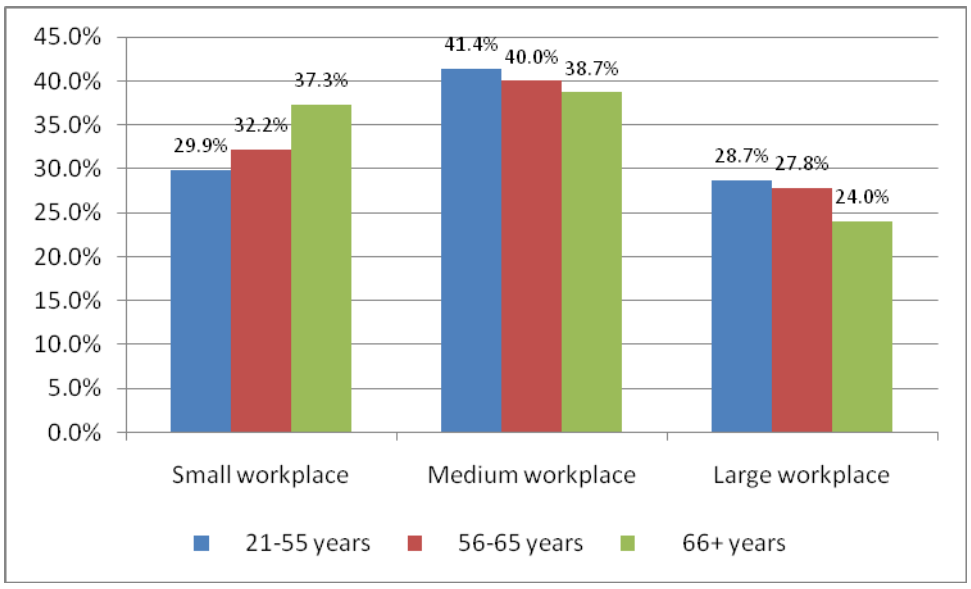
Workplace size

According to WorkSafe Victoria's employer remuneration categories, small (up to $1 million), medium ($1-20 million) and large workplaces (over $20 millions) accounted respectively for 32.9%, 40% and 27.1% of the claimants. The number of claims according to the workplace size differed between age groups, industries and occupation groups but not between genders.

Workplace and age

Claimants' mean age decreased with increasing workplace size (60.1, 59.4 and 59.2 years for small, medium and large workplaces respectively). As a result, the percentage of workers employed by large workplaces was lower in older claimants (Figure 8).

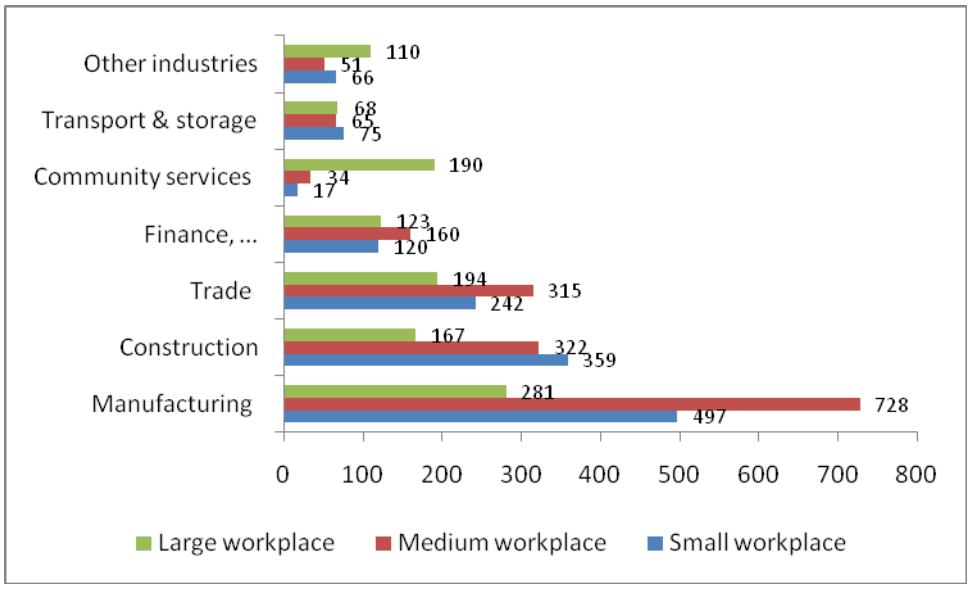
Figure 8. Workplace size according to age



Workplace size and industry

In construction, the number of claims decreased with increasing workplace size. The reverse (increasing number of claims with increasing workplace size) was observed in community services. In manufacturing and trade, the number of claims was lower in large workplaces and higher in medium workplaces compared to large workplaces (Figure 9).

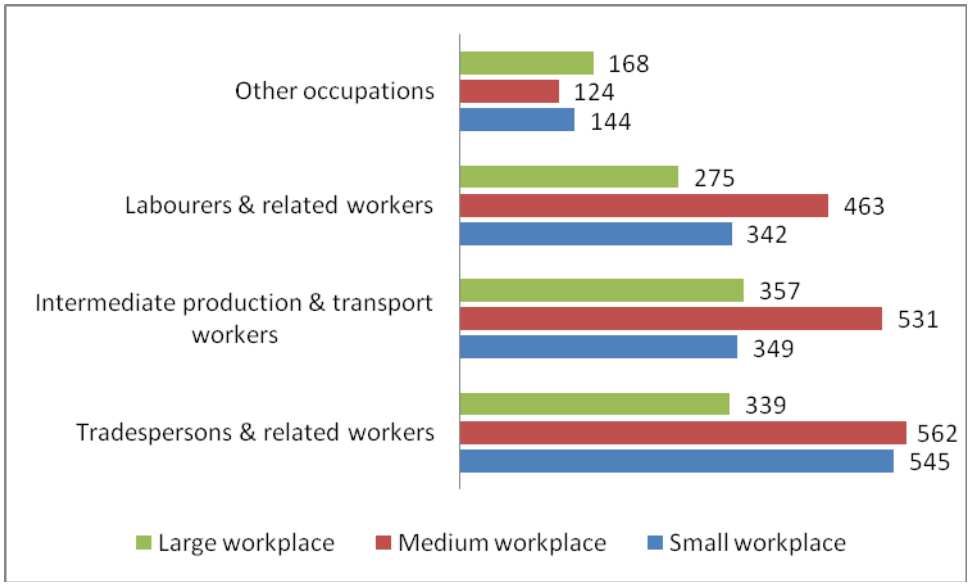
Figure 9. Number of claims by industry and workplace size



Workplace size and occupation

In the three higher risk occupations, the highest number of claims came from medium size workplaces and the lowest from large workplaces (Figure 10).

Figure 10. Number of claims by occupation and workplace size



Multivariate analysis

In regards to claimants' age, industry and occupation, adjusted results were slightly different form crude associations. Table 1 shows the likelihood of being employed in a small or medium workplace compared to a large workplace according to demographic and occupational factors taken into account together. For each factor, the reference group is the group with the lowest number of claims.

The likelihood of being employed in a small workplace compared to a large workplace was increased by 1.5 in claimants aged 66 years and above compared to claimants aged 21 to 55 years but the increased odds of working in medium workplaces compared to large workplaces were not significant in this age group. They were no significant differences in the workplace size for claimants aged 56-65 years compared to the younger age group.

In community services as seen previously, claimants were respectively 2.5 and 1.2 times more likely to work in large workplaces than in medium or small ones. In contrast in manufacturing, construction, trade, and finance, property and business services, claimants were more likely to work in a small or medium workplace than in a large workplace. The odds for claimants of being employed in a medium workplace compared to a large workplace were the highest in construction and manufacturing, with a 5.3 and 3.9 increase respectively. In construction, this result was different from the crude analysis showing a higher number of claims in small workplaces (Figure 9).

Intermediate production and transport workers and labourers were more likely to be employed in medium workplaces than in large workplaces but they were no significant differences between the likelihood of being employed in a small or a large workplace for these occupations. Tradespersons were respectively 1.4 and 1.7 times more likely to be employed in small and medium workplaces than in large workplaces.

Table 1. Likelihood of being employed in a small or a medium workplace compared to being employed in a large workplace, according to demographic and occupational characteristics (significant odds ratios are in bold)

Comparison to large workplaces	Small workplaces	Medium workplaces
Gender		
Females	Reference	Reference
Males	0.85	1.21
Age		
21-55 years	Reference	Reference
56-65 years	1.12	0.97
66+ years	**1.52**	1.10
Industry type		
Other industries	Reference	Reference
Transport & storage	**2.11**	**1.98**
Community services	**0.82***	**0.39****
Finance, property & business services	**1.63**	**2.68**
Trade	**2.09**	**3.38**
Construction	**3.51**	**3.91**
Manufacturing	**2.94**	**5.33**
Occupation		
Other occupations	Reference	Reference
Labourers and related workers	1.04	**1.71**
Intermediate production & transport workers	0.82	**1.48**
Tradespersons	**1.40**	**1.67**

* The odds of being employed in a large workplace compared to a small workplace were increased by 1.22 (=1/0.82).

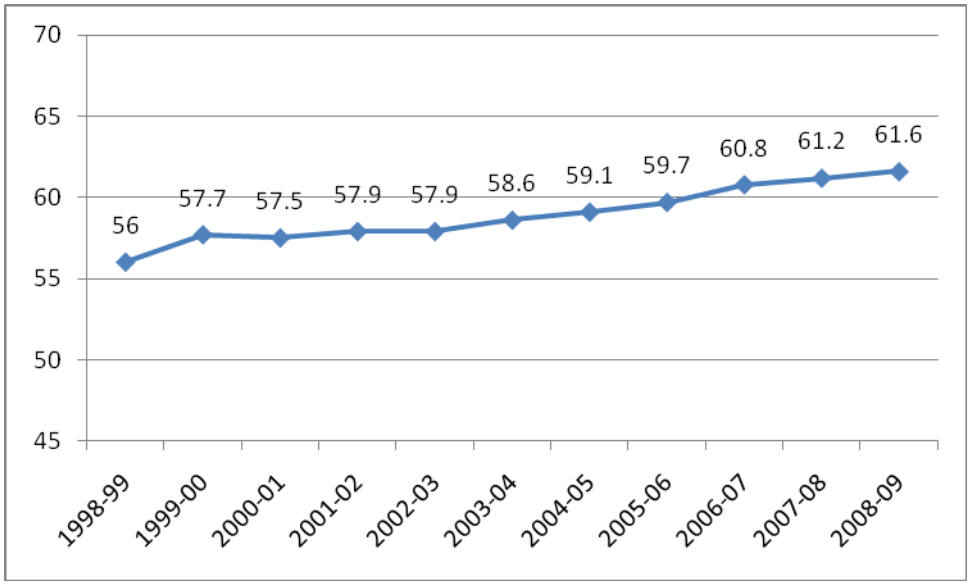
** The odds of being employed in a large workplace compared to a medium workplace were increased by 2.56 (=1/0.39).

Characteristics of accepted claims over time

Age

Mean age at claim lodgement increased steadily over the period from 56 years to 61.6 years (Figure 11).

Figure 11. Mean age at claim lodgement by financial year

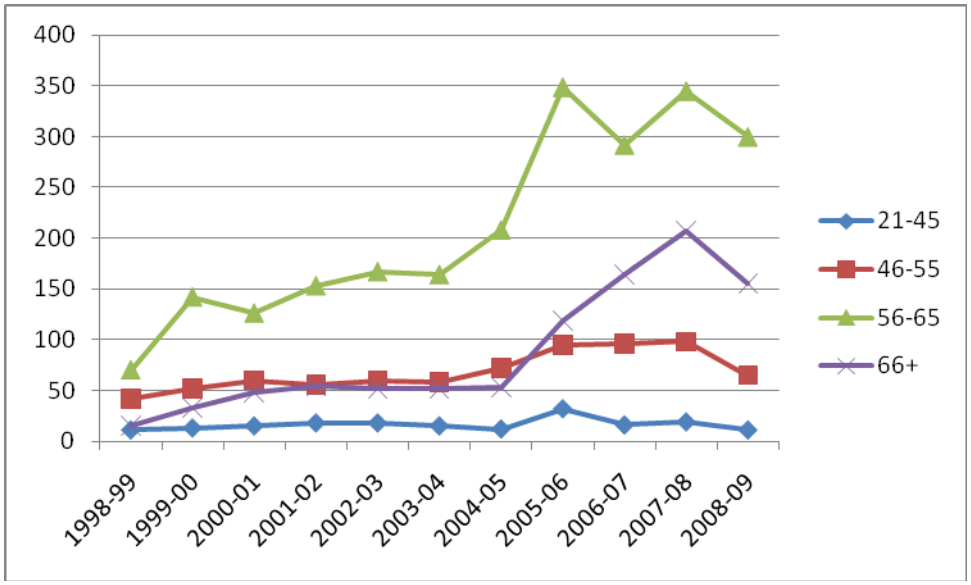


The 56-65 age group had the highest number of claims, followed by the 66-75 age group. Both age groups had also the highest rise in the number of claims across the period, the number of claims in these age groups increased by fourfold and tenfold respectively. Between 2003-04 and 2005-06 alone, there was a sharp rise in the number of claims in both groups, resulting in a twofold increase within two years.

In the 46-55 year age group, there was a more than twofold rise in the number of claims between 1998-99 and 2007-08

In claimants aged 45 years and below, the number of claims was steady over the period (Figure 12).

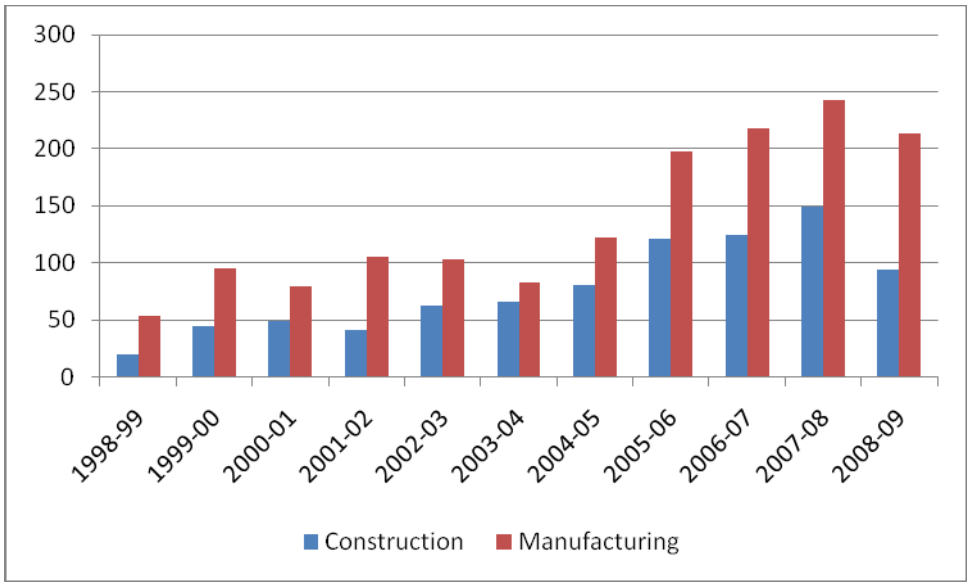
Figure 12. Number of claims by age and financial year



Industry

The number of claims in the two higher risk industries doubled between1998-99 and 1999-00 and further doubled between 2003-04 and 2005-06. However, a slight decrease was observed in 2008-09 (Figure 13). In both industries, the trend over the period was not different from the overall increase in the number of claims.

Figure 13. Evolution of the number of claims in the two higher risk industries



In these industries with highest numbers of claims, the number of claimants increased more over the period in higher age groups, which was a similar pattern to that seen for all claims.

Occupation

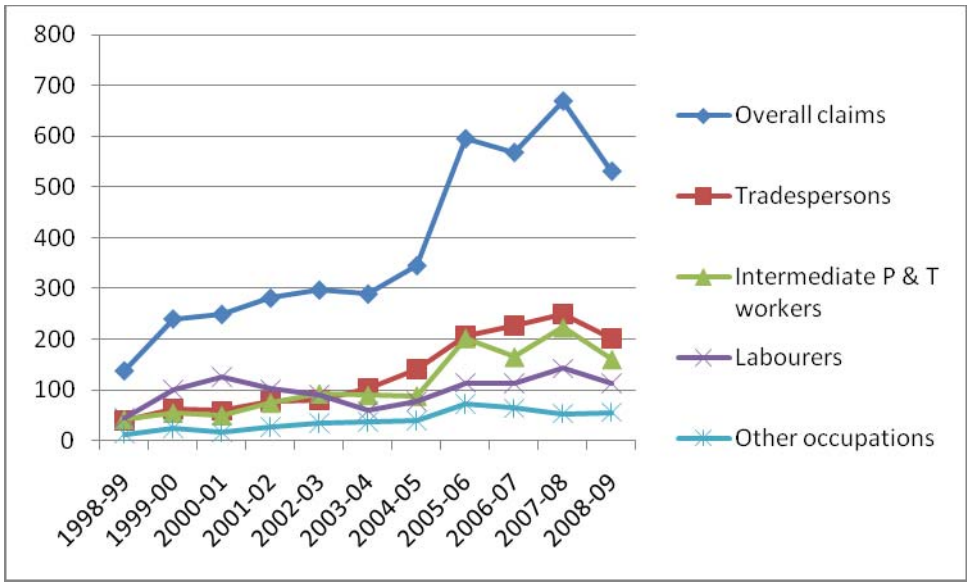
The larger rise in claims was observed in tradespersons respectively followed by intermediate production and transport workers, and labourers. However, the trends differed among these three occupation groups.

In tradespersons, unlike the overall claims trends where there was a sharp increase in the middle of the period, the percentage of claims increased steadily over time except during the last financial year.

In intermediate production and transport workers, the increase followed the overall trend, rising steadily until 2004-05 but more than doubling in 2005-06.

Labourers and related workers experienced an increase in the percentage of claims during 3 consecutive years between 1999 and 2002, accounting for the main cause of NIHL during this period. Afterwards, the number of claims in this occupation remained stable, with some fluctuation by year with a similar number of claims in 2000-01 and 2007-08, departing from the overall trend over the period (Figure 14).

Figure 14. Evolution of the number of claims according to occupation groups



In the three higher risk occupations, the increase in the number of claims followed the general pattern with higher rise over time in older claimants. As a whole, the sharp increase in claimants aged 66 years and above was observed in tradespersons with a nineteen fold rise in this age group compared to a eightfold and sevenfold increase in intermediate production and transport workers and in labourers and related workers respectively (Figures 15, 16 and 17).

Figure 15. Evolution of the number of claims according to age in tradespersons

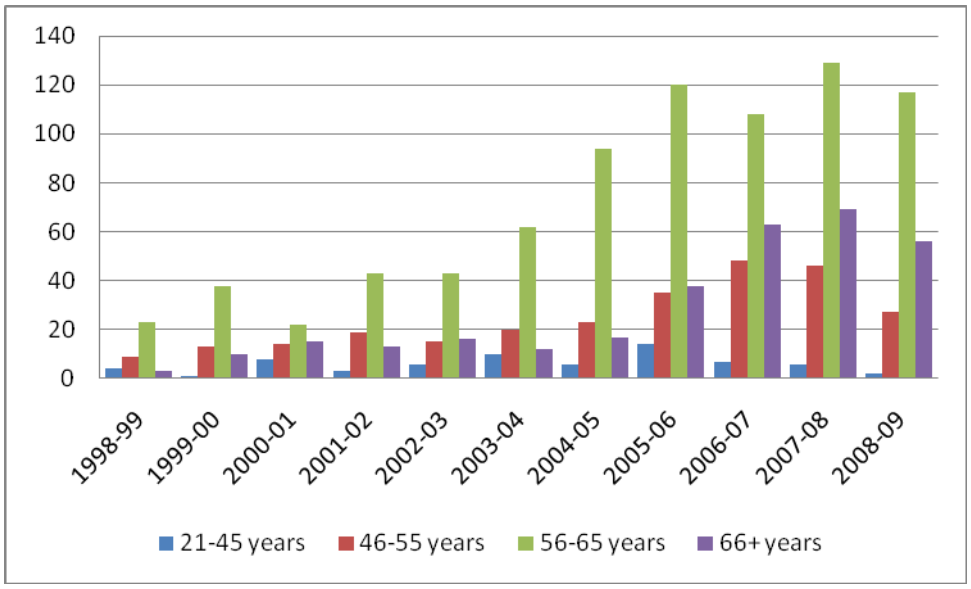


Figure 16. Evolution of the number of claims according to age in intermediate workers

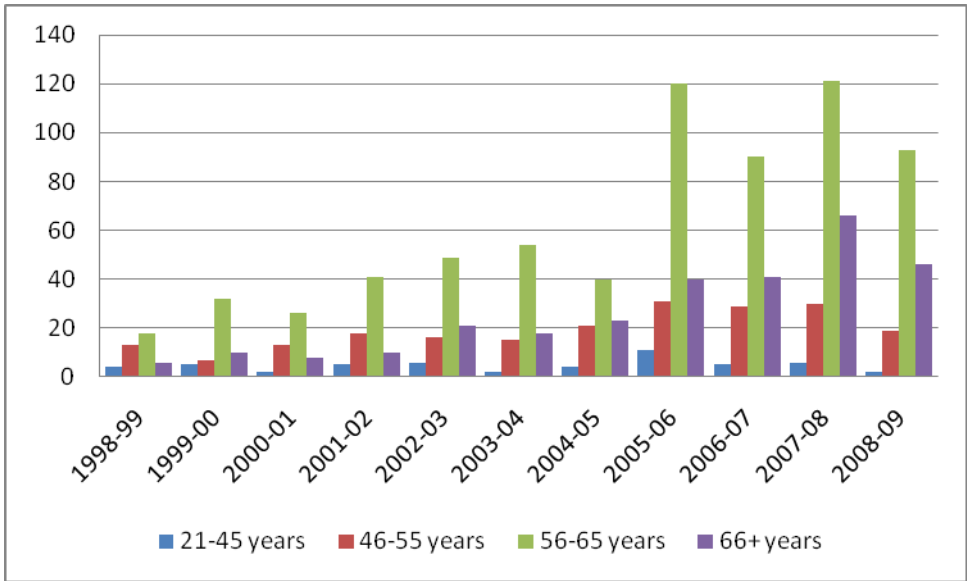
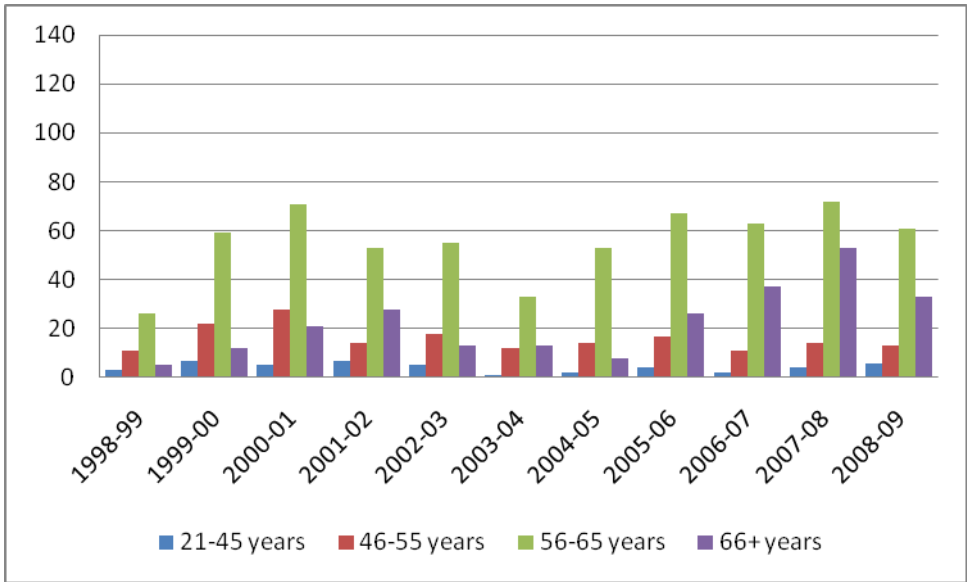


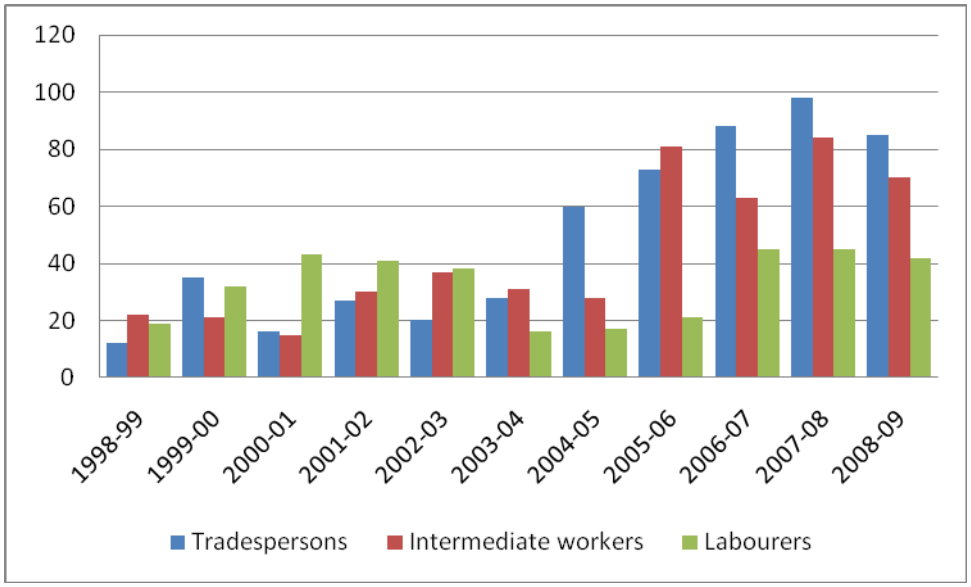
Figure 17. Evolution of the number of claims according to age in labourers



The number of claimants in the three higher risk occupations increased in the manufacturing and construction industries. The lower rise was in labourers and related workers.

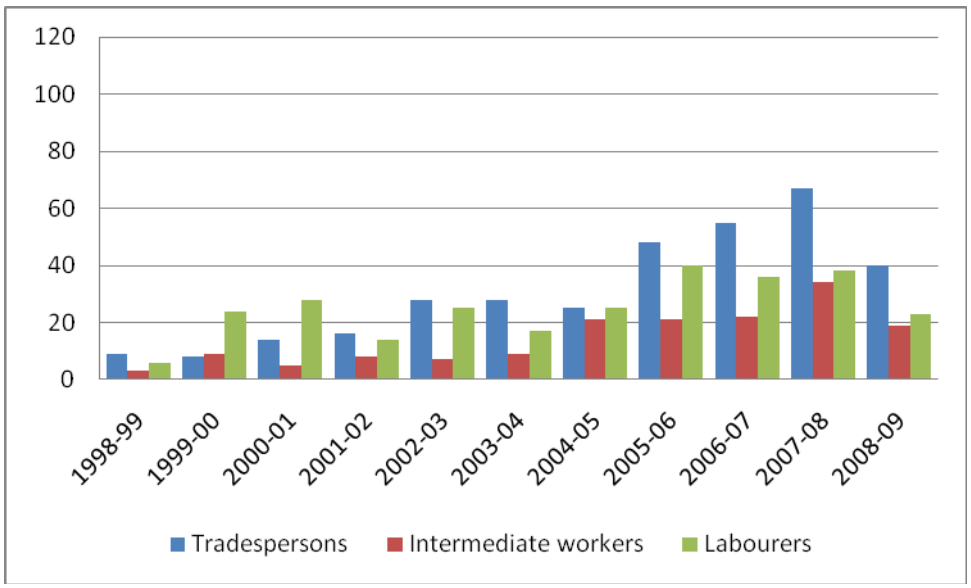
In the manufacturing industry, the higher rise in claims over the period was observed in tradespersons with a sevenfold increase, followed by intermediate production and transport workers, and labourers and related workers (three and twofold increase respectively) (Figure 18).

Figure 18. Proportion of claims by high risk occupation in manufacturing



In construction, the number of claims in intermediate production and transport workers was multiplied by six over the period and by four in tradespersons and labourers and related workers (Figure 19).

Figure 19. Proportion of claims by high risk occupation in construction

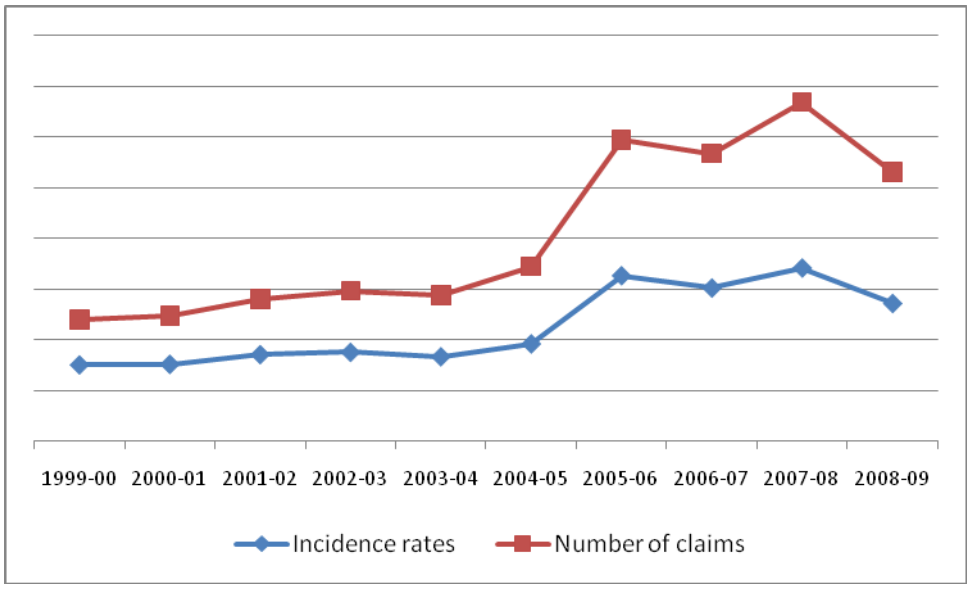


Incidence rates

Overall rates

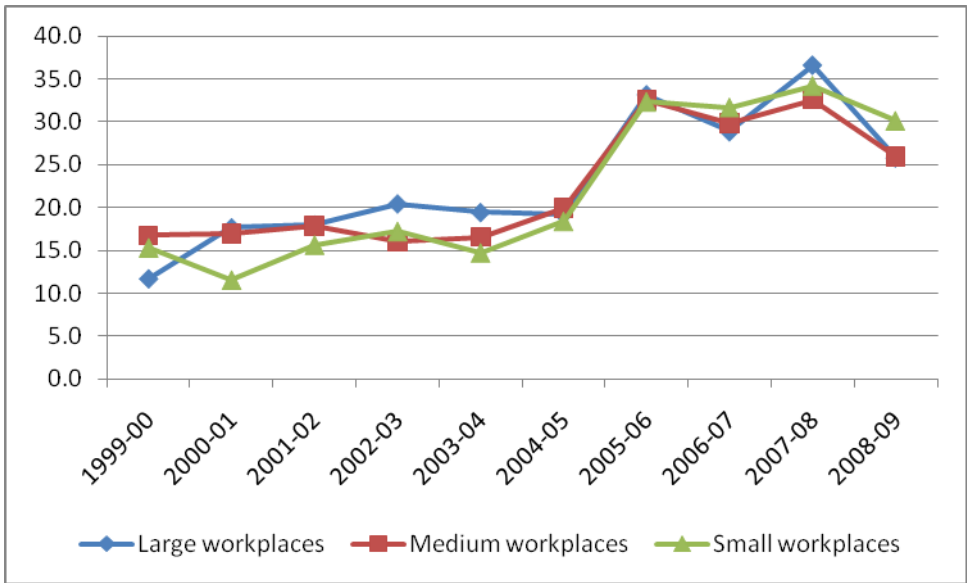
The overall number of claims and NIHL incidence rates followed the same pattern over the period. However while the number of claims was nearly four times higher at the end of the period, overall claims incidence rates almost doubled over the period from 15.1 in 1999-00 to 27.2 per 100,000 workers in 2008-09 (Figure 20).

Figure 20. Number of claims and incidence rates by financial year (figures not to the scale)



The rise was similar across large, medium and small workplaces. During the period, the incidence rate was relatively steady until 2003-04 but a sharp increase was observed between 2004-05 and 2005-06. The incidence stabilised again the following years (Figure 21).

Figure 21. Overall incidence rates by workplace size and financial year

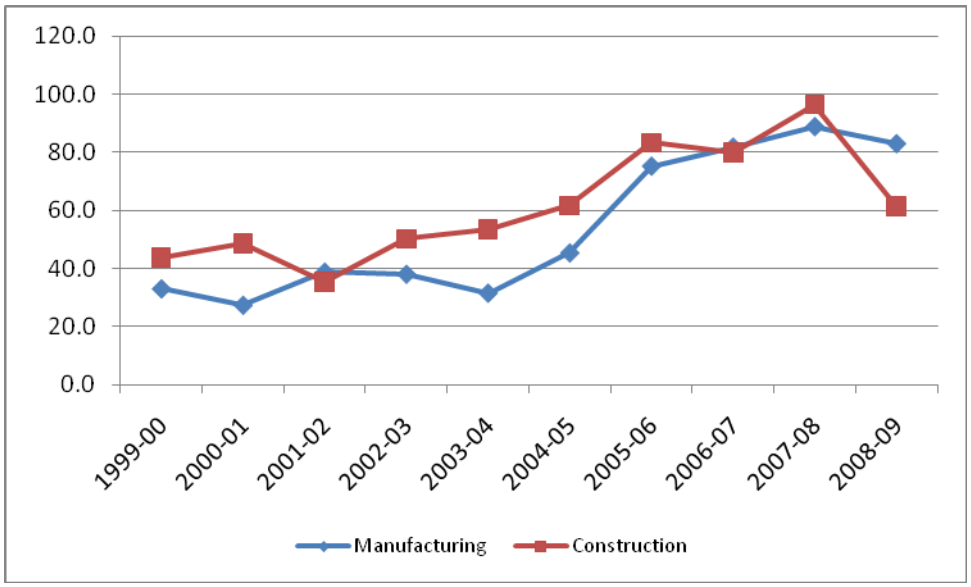


Industry-specific incidence rates

Incidence rates were calculated using the employee count as a denominator. These numbers were provided by WorkSafe Victoria by industry coded following the 2006 ANZSIC classification. As there were differences between the ANZSIC and WIC classifications, we collapsed WIC categories when appropriate to match the ANZSIC classification. All incidence rates are provided in the appendix.

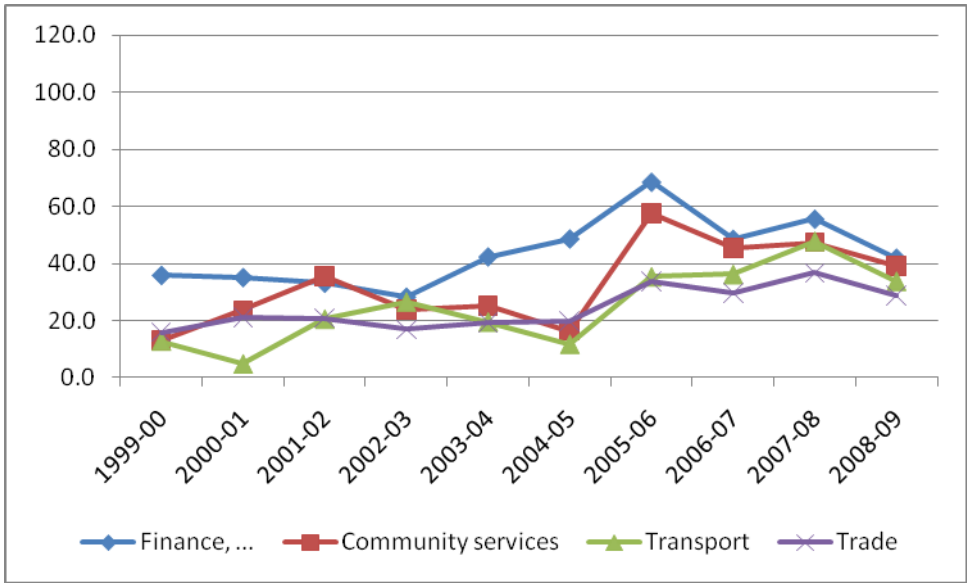
Construction and manufacturing experienced the highest incidence rates over the period. While incidence rates increased steadily over time in construction until financial year 2007-08, in manufacturing they rose sharply between 2003-04 and 2005-06 and more than doubled during this short period of time. As a result, incidence rates were lower in manufacturing than in construction at the beginning of the period but reached the same level as construction toward the end of the period (Figure 22).

Figure 22. Incidence rates in manufacturing and construction by financial year



In finance, property and business services industry in contrast with the other industries, incidence rates decreased from 2005-06 onward. In 2008-09, they were almost at the same level as at the beginning of the period. In community services, after an initial rise, incidence rates decreased except in 2004-05 where a sharp increase was observed. In transport and storage, incidence rates more than doubled over the period but no steady pattern was observed. In trade, the trend was stable over time except between 2004-05 and 2005-06 where it almost doubled (Figure 23).

Figure 23. Incidence rates in other industries by financial year



Industry-specific rates in higher risk industries according to the workplace size

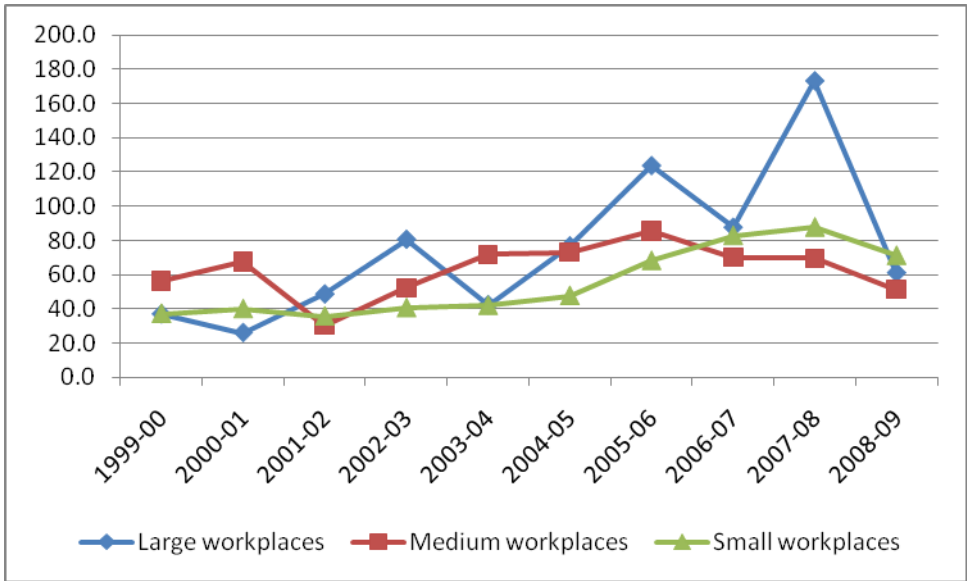
Construction

In construction, incidence rates were stable in small workplaces until 2003-04 and rose steadily afterward. This resulted in a twofold increase in incidence rates over the period.

Incidence rates in medium workplaces decreased over time. While they were the highest rates at the beginning of the period, it was the lowest at the end of the period.

In large workplaces, they followed an upward although heterogeneous trend until 2007-08 where they were almost five times as high as in 1999-00 (Figure 24).

Figure 24. Incidence rates in construction by financial year

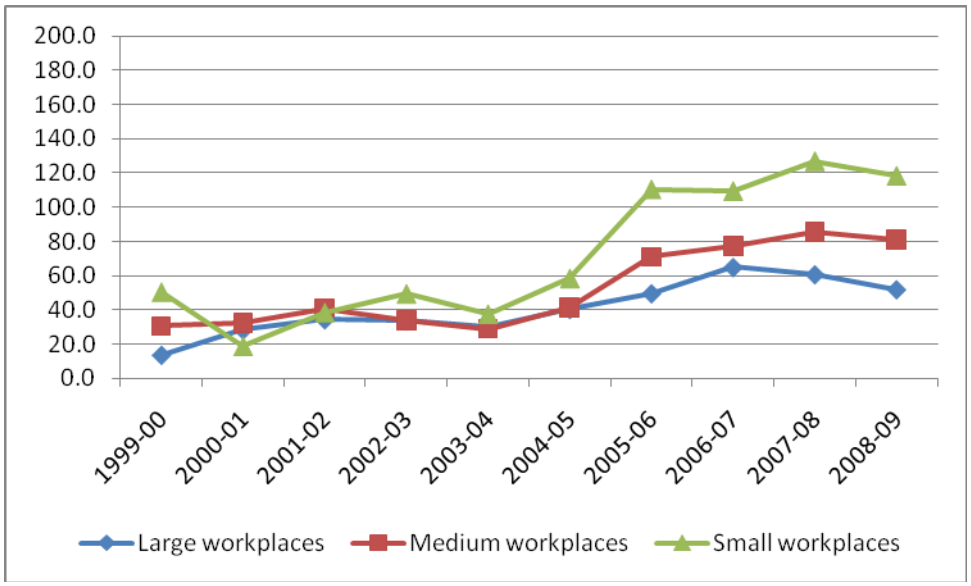


Manufacturing

In manufacturing, while incidence rates were similar in small, medium and large workplaces at the beginning of the period, there was an increase in incidence rates in all workplaces from 2003-04. However, the upward trend was twice higher in small and medium workplaces compared to large workplaces (3.1, 2.8 and 1.5 rise respectively from 2003-04 to 2008-09).

In contrast with overall and construction incidence rates, the decrease in 2008-09 was slight (Figure 25).

Figure 25. Incidence rates in manufacturing by financial year

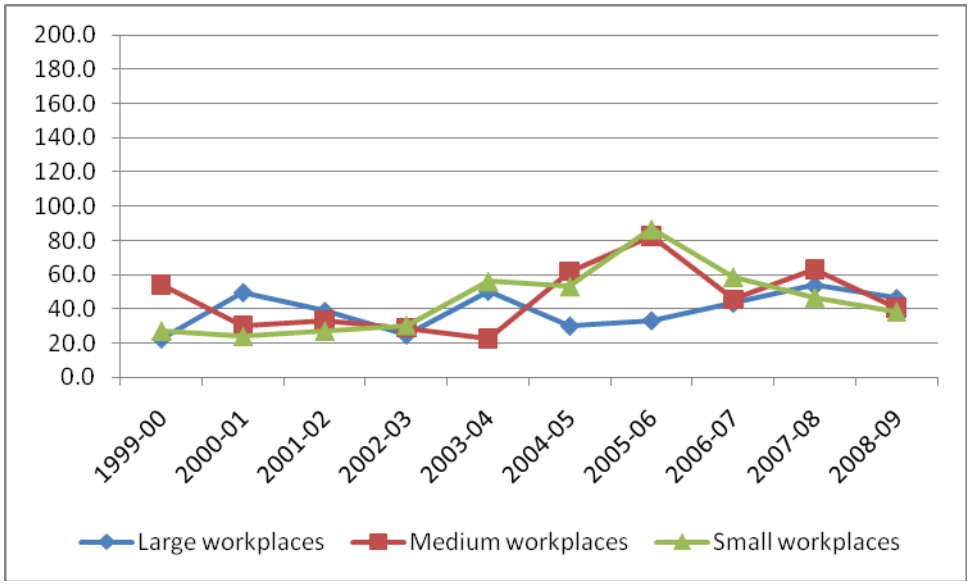


Finance, property and business services

Small and medium workplaces experienced similar incidence rates over the period except during two years (1999-00 and 2003-04). In both types of workplaces after an increase from 2002-03 and 2003-04 for small and medium workplaces respectively, a downward trend was observed from 2005-06.

In large workplaces, incidence rates decreased in 2003-03 and became twice as lower as rates in small and medium workplaces in 2004-05 and 2005-06. They rose afterwards. This resulted in comparable incidence rates in small, medium and large workplaces from 2006-07 onward (Figure 26).

Figure 26. Incidence rates in finance, property and business services by financial year



Community services

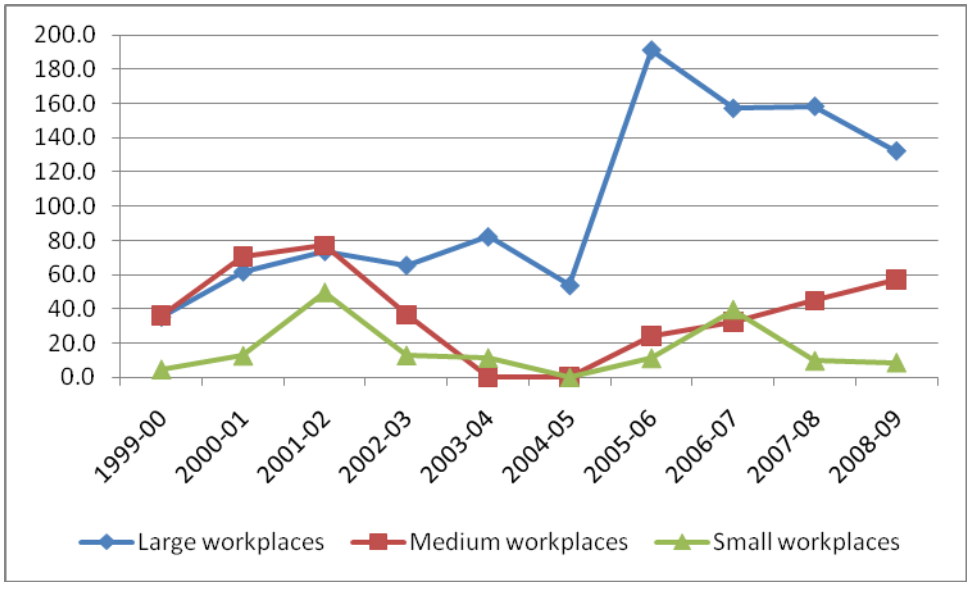
In community services, the highest incidence rates were experienced by large workplaces and the lowest by small workplaces.

In large workplaces, rates were relatively steady until 2004-05 but in 2005-06 they were almost multiplied by four. A subsequent decrease was observed afterwards but rates still remained high at the end of the period.

In medium workplaces, incidence rates decreased dramatically between 2001-02 and 2003-04, remained stable during two consecutive years and rose steadily afterwards. As a result, incidence rates were twofold higher at the end of the period compared to the beginning of the period.

Small workplaces experienced very low incidence rates with some fluctuation over the period (Figure 27).

Figure 27. Incidence rates in community services by financial year

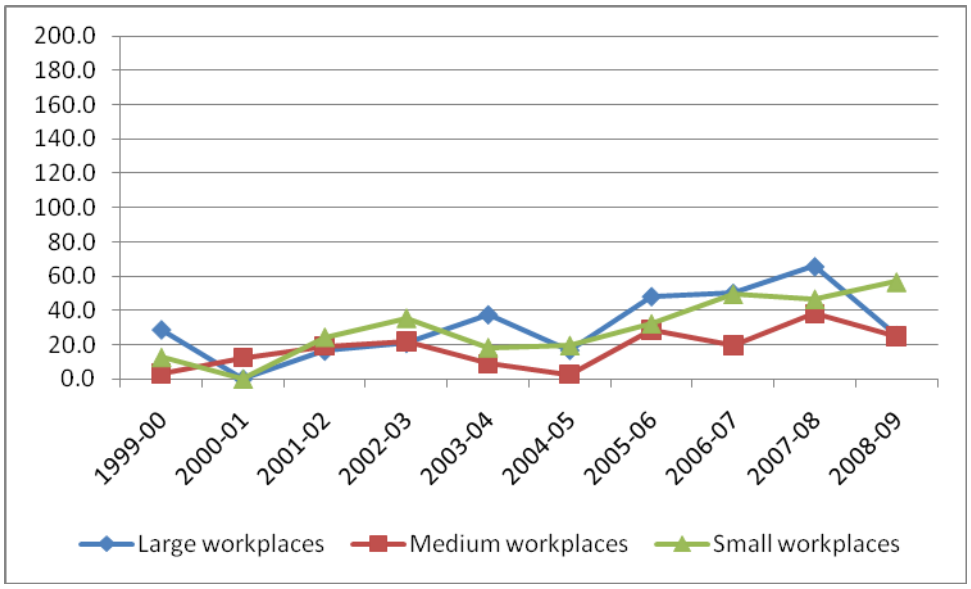


Transport and storage

In this industry, incidence rates were lower in medium size workplaces and higher in large workplaces.

Incidence rates were steady over the period in large workplaces (28.8 new claims per 100,000 workers in 1999-00 compared to 25.4 new claims per 100,000 workers in 2008-09). In contrast, they increased by 7.3 times in medium workplaces and by 4.5 times in small workplaces (Figure 28).

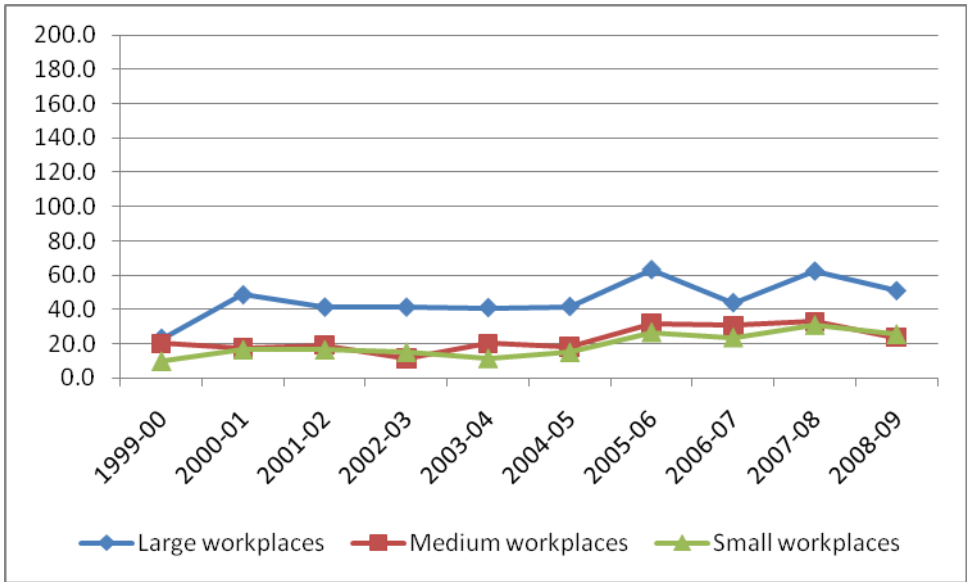
Figure 28. Incidence rates in transport and storage by financial year



Trade

In trade, large workplaces experienced the highest incidence rates over the period. Rates were lower and similar in small and medium workplaces. They more than doubled over time in small and large workplaces and remained steady in medium workplaces (Figure 29).

Figure 29. Incidence rates in trade by financial year



Limitations

Results for financial year 2008-09

The sharp upward trend starting from 2003-04 was not continued in 2008-09. The date of claim lodgement is the date the insurer received the claim. However, there can be delays in including a claim into the database as there may be several months between the time the claim is lodged and the time it is resolved. Therefore, figures for the last financial year of the period may be underestimated. Consolidated data, once complete, will confirm whether there was a true decline in number of claims for 2008-09.

Industry classification

WorkSafe Victoria classifies industries using their own codes. These codes differ from the 1993 and 2006 Australian and New Zealand Standard Industrial Classification (ANZSIC). Compared to the 2006 ANZSIC classification, retail and wholesale trade are coded in one single category, financial and insurance services are collapsed with rental, hiring and real estate services to form the finance, property and insurance services category, accommodation and food services are coded together with arts and recreational services, community services are the combination of education and training together with health care and social assistance, while public administration is the combination of public administration and safety, and administrative and support services in the WIC. There may however be some misclassifications due to this broad matching.

Workplace size

The workplace size was provided using the employer remuneration but not the actual number of workers by workplace. Workers' remuneration may differ depending on their skills and occupation. We could not classify workplaces according to the number of workers from the information provided.

Discussion

Number of claims

The recent NIHL claims increase in Victoria and particularly in older workers has also been found in some other countries. New Zealand experienced a similar rise in the number of new NILH claims which doubled between 1995-96 and 2005-06. One third or more claims were made by individuals older than the usual retirement age in New Zealand. In New Zealand as in Victoria, the age distribution profile of new claims shifted towards older age groups and rates in the older age groups increased more over the period than in the younger age groups (Thorne et al 2008).

In Washington State in the USA, a sharp increase in workers' compensation claims for hearing loss was also reported but in earlier years (between 1984 and 1998) with a higher increase in claimants above 65 years. The authors concluded that the striking rise over this period may be partly explained by changes in the reporting of NIHL, particularly in older claimants who prefer to lodge a claim after retirement when noise exposure has ceased. Interestingly, the claims increase was less for self-insurers than for State fund claims (which usually comprises smaller workplaces), suggesting a more stable workforce, more resources, and greater access to the workplace for claim investigation for self-insurers compared to smaller non self-insured employers. Another suggested contributing factor for the increase in NIHL claims in Washington State was the involvement of a small percentage of health care providers identified as the principal provider for a major proportion of accepted claims, preferentially in older workers (Daniell et al 2002).

Demographic characteristics

Claims were lodged almost exclusively by males. This is likely to be explained by gender differences in industry and occupation profiles. According to the successive Australian censuses, males are predominantly employed in two noisy industries, manufacturing and construction, while females are more often employed in health care and retail trade. In 2006 in Australia, 22.1% of males (and 4.6% of females) were technicians and trades workers. This category includes tradespersons who accounted for the highest number of claims in the Victorian data.

The increase in the number of claims with increasing age is consistent with the disease pattern, as hearing loss rate increases with years of exposure to noise. However while NIHL is of gradual onset, the rate of hearing loss is greater during the first 10-15 years of exposure and decreases as the hearing threshold increases (Rubak et al 2006). On the other hand, in contrast with NIHL age-related hearing loss accelerates over time (ACOEM 2003). With aging, presbycusis in someone who has some underlying NIHL may lead to levels where the combined hearing loss impairs speech communication and impacts on the individual quality of life and may prompt the worker to lodge a claim for NIHL well after the noise exposure has ceased.

It is unlikely that noise exposure levels have increased in the past ten years to explain the higher number of claims and this would not explain the higher rise in older workers. The increasing number of older claimants over the period may be due to other factors. First, awareness about occupational noise exposure may have recently increased through information campaigns in a population that was exposed earlier in their career. Opportunities for hearing screening through audiometry assessments in the workplace or elsewhere may also increase the likelihood of workers having their NIHL detected. Second, workers may prefer to lodge a claim when they are no longer employed. In our analysis, one in four claims was lodged by individuals aged over 65 years, the usual retirement age. The national statistics also show an increase over time in the number of NIHL claimants aged 65 years and above but to a lesser extent (twofold rise between 1998-99 and 2007-08).

Industries and occupations

In Victoria as in whole Australia, the two main industries with the highest numbers of claims were manufacturing and construction over the 1998-99 to 2008-09 period. The Australian NHEWS (National Hazard Exposure Worker Surveillance) survey identified them as the main industries in which workers reported that they were exposed to loud noise (Safe Work Australia 2010). Likewise in Europe, of the cases of NIHL reported in 2001, 51% were in the manufacturing sector, followed by construction (17%). In other countries, noise measurements were performed based on compensation claims in industries with the highest reporting of NIHL (Kock 2004, Daniell 2006). These industries were manufacturing, construction, printing and childcare. In the

manufacturing industry, metal production and the wood production exhibited the highest exposure levels of noise (Kock et al 2004).

Tradespersons and related workers, intermediate production and transport workers, and labourers and related workers accounted for nine in ten claims in the Victorian compensation scheme. Blue-collar workers are more exposed to noise compared to white-collars. The NHEWS survey reported technicians and trades workers, labourers, and machinery operators and drivers were reported to be the occupations with the greatest percentage of workers who reported exposure to loud noise, using the ANZSCO first edition classification of occupations. These results are in line with ours despite the different occupation classifications used as these occupation groups are more at risk of NIHL. In the Third European survey on working conditions 2000, craft workers and machine operators were identified as having the greatest exposure to high levels of noise (Schneider et al 2005).

Workplace size

We found that the larger the workplace, the lower the percentage of accepted claims was. This may be explained by the fact that when noise exposure occurs in large workplaces, there may be more likely to be efficient control measures to reduce noise levels below the exposure standard so that workers' exposure is less likely to damage their hearing. Also, there may be more likely to be an effective hearing loss monitoring program, so that affected workers can be identified early and removed from exposure.

In our analysis, claimants employed in the higher risk industries (manufacturing, construction and trade) as well as in finance, property and business services were more likely to be employed in small or medium workplaces than in large workplaces. These may not provide appropriate noise control measures compared to larger workplaces due to a lack of knowledge as well as of human and economic resources. These findings are consistent with the NHEWS survey where workplaces with less than 20 workers were more likely to provide no control measures or hearing protection devices only compared to large workplaces. Some studies suggested that an increasing use of hearing protection devices increased with increasing noise exposure (Kock et al 2004, Daniell et al 2006). However, hearing protectors' effectiveness is influenced by numerous factors including proper training on their use (El Dib et al 2009). The NHEWS

survey also reported that workers employed by workplaces with less than 200 workers were less likely to report comprehensive noise control measures. There is however little evidence that hearing loss protection programs are effective. There is a large variation in their implementation and many programs are of poor quality (Verbeek et al 2009, Daniell et al 2006).

To the contrary to the highest risk industries, NIHL claimants working in the community services sector were more likely to be employed in large workplaces than in small or medium ones. In community services, unlike in well known noisy industries, exposure to noise may be intermittent, not sufficient to prompt control measures but sufficient in certain circumstances to damage the hearing.

In our analysis, the likelihood of being employed in a small workplace was significantly higher in claimants aged 66 years and above. Older claimants may have started their working life in a small business and spent their carrier with the same type of employer. Unfortunately, the data did not provide us with claimants work history.

Incidence rates

In Victoria, the highest industry-specific incidence rates were found in construction and manufacturing. These industries experienced a higher increase over time in incidence rates in smaller workplaces.

In Washington State in the USA between 1984 and 1991, overall yearly incidence rates were 29.7 per 100,000 workers. Half of accepted claims originated in the lumber and wood products, construction, and primary metal industries. As in the Victorian data, the incidence of claims increased in the study period (Daniell et al 1998).

In Europe, according to the European Occupational Diseases Statistics (EODS) data from 2001, 4068 cases of NIHL were recognised in the 12 member states of this pilot project (including Belgium, Denmark, Spain, Ireland, Italy, Luxembourg, the Netherlands, Austria, Portugal, Finland, Sweden and the United Kingdom). NIHL was the fourth most common occupational disease recognised in 2001, after hand or wrist tenosynovitis (5379 cases), epicondylitis of the elbow (4585), and contact dermatitis (4457). The incidence rate was 4.7 per 100,000 workers. About 97% of the cases occurred in men. The highest numbers of cases were registered in the 50–54 and 55–

60 age groups. These figures are at least three times lower than incidence rates experienced by Victoria in 2000-01 (15.2 per 100,000 workers) or in 2001-02 (17.1 per 100,000 workers). Differences may partially be explained by differences in workplace size, particularly in manufacturing. However, these figures do not provide an exact picture of NIHL in Europe as different countries use different hearing loss threshold and age limit criteria for defining hearing loss caused by occupational noise (Schneider et al 2005).

Conclusion

This analysis enabled us to calculate NIHL incidence rates in the different industry sectors and to further calculate them according to workplace size. This highlights the need for effective prevention measures in workers exposed to high levels of noise, particularly those employed in smaller workplaces.

NIHL has a long latency period and recent NIHL claims in older claimants may reflect noise exposure in the late 1970's. In the same way, current exposure will generate claims in the future but it is difficult to ascertain the number of likely claims without knowledge of the recent and current noise exposure levels.

Over the past 10 years, most of the submitted claims have been accepted as they fulfil the threshold criterion. On the other hand, noise exposure levels are less likely to have risen during this short period of time. This suggest that eligible people who have not claimed previously are doing so as a result of increased awareness of their condition, either in response to increased opportunity to have hearing tests and/or publicity about submitting a claim.

Future research implications

- The use of hearing protector devices is often the first line noise control measure. Efforts to improve compliance to hearing protection devices use should be focused on both the worker and the management:
    - Qualitative research methods could assess the barriers and enablers to the proper use of hearing protectors testing behavioural theories and give ground to effective interventions in higher risk groups.
    - An intervention study could use the qualitative research findings to test the effectiveness of a tailored approach in improving the use of hearing protector devices in higher risk industries.
- The contribution of recreational noise to hearing loss should be assessed, particularly in the younger population. The main sources of exposure to high levels of noise in this age group are the use of portable music players or listening to loud music in other circumstances. The use of music players is particularly widespread in teenagers and young adults. Early damage to hearing in this population may contribute to an occupational NIHL claim to be accepted in the future while a recreational component may have contributed to reach the threshold. Identification of early hearing loss may help inform policy makers and provide grounds for implementing regulatory technical limitations in music player devices and others.

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Appendix

Table 2. Overall NIHL incidence rates by financial year expressed per 100,000 workers

Overall incidence rates	**1999-00**	**2000-01**	**2001-02**	**2002-03**	**2003-04**	**2004-05**	**2005-06**	**2006-07**	**2007-08**	**2008-09**
Agriculture, forestry, fishing & hunting	32.7	32.3	38.9	30.6	39.7	41.6	37.9	36.8	36.3	31.8
Community services	13.0	23.7	35.5	23.9	25.3	16.4	57.6	45.3	47.4	39.2
Construction	43.8	48.5	35.4	50.2	53.4	61.7	83.3	80.1	96.4	61.5
Electricity, gas & water	5.7	5.7	5.3	26.1	25.9	22.6	4.3	24.4	14.9	6.9
Finance, property & business services	35.9	35.1	33.1	28.2	42.3	48.7	68.6	48.5	55.6	41.9
Manufacturing	33.0	27.3	38.7	38.0	31.5	45.3	75.2	81.7	88.8	82.9
Mining	20.9	132.9	29.5	46.7	37.1	41.4	56.5	55.0	61.8	54.9
Public administration	3.2	15.6	14.6	25.9	3.2	6.4	27.5	10.7	2.6	25.4
Recreation, personal & other services	25.6	19.1	10.4	13.7	21.7	12.6	37.5	17.0	26.0	29.1
Trade	15.9	21.2	20.8	16.9	19.2	19.9	33.8	29.7	36.7	28.7
Transport & storage	12.8	4.7	20.5	26.5	19.5	11.7	35.3	36.2	47.8	33.8
Total	**15.1**	**15.2**	**17.1**	**17.6**	**16.7**	**19.2**	**32.7**	**30.3**	**34.2**	**27.2**

Table 3. NIHL incidence rates in large workplaces by financial year expressed per 100,000 workers

Large workplaces incidence rates	**1999-00**	**2000-01**	**2001-02**	**2002-03**	**2003-04**	**2004-05**	**2005-06**	**2006-07**	**2007-08**	**2008-09**
Agriculture, forestry, fishing & hunting	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	114.5
Community services	35.5	61.9	73.7	65.5	82.2	53.9	191.0	157.1	158.2	132.2
Construction	36.8	25.9	48.5	80.5	42.3	76.7	123.6	87.5	173.2	61.0
Electricity, gas & water	11.3	10.9	10.0	47.3	18.7	31.5	7.7	28.5	6.3	6.1
Finance, property & business services	22.9	49.9	38.8	25.1	50.7	30.3	33.5	43.7	53.9	46.5
Manufacturing	13.7	28.5	34.5	33.8	30.4	40.5	49.7	65.1	60.8	52.1
Mining	0.0	115.5	72.1	38.6	45.3	51.8	41.5	122.0	141.5	166.4
Public administration	0.0	14.1	7.3	24.2	3.2	5.7	22.8	13.1	3.2	32.6
Recreation, personal & other services	23.1	5.2	0.0	5.2	14.1	12.6	12.1	0.0	32.9	17.0
Trade	23.0	48.5	41.2	41.2	41.0	41.6	63.2	43.9	62.4	50.9
Transport & storage	28.8	0.0	16.4	20.9	37.6	16.8	48.2	50.1	65.7	25.4
Total	**11.7**	**17.7**	**18.0**	**20.5**	**19.4**	**19.2**	**33.2**	**28.9**	**36.6**	**25.8**

Table 4. NIHL incidence rates in medium workplaces by financial year expressed per 100,000 workers

Medium workplaces incidence rates	**1999-00**	**2000-01**	**2001-02**	**2002-03**	**2003-04**	**2004-05**	**2005-06**	**2006-07**	**2007-08**	**2008-09**
Agriculture, forestry, fishing & hunting	0.0	16.0	13.3	15.9	0.0	11.3	11.4	21.5	0.0	0.0
Community services	36.2	70.6	77.0	36.6	0.0	0.0	24.2	32.3	44.8	57.3
Construction	56.2	67.7	30.5	52.4	71.7	73.1	85.6	70.1	69.5	51.4
Electricity, gas & water	0.0	0.0	0.0	0.0	44.3	13.5	0.0	23.2	33.2	9.2
Finance, property & business services	54.2	30.2	33.2	28.9	22.8	61.8	82.5	45.5	62.9	40.6
Manufacturing	30.6	32.2	41.0	33.8	28.9	41.3	71.1	77.5	85.7	80.9
Mining	50.9	53.5	0.0	77.2	45.2	46.0	89.6	26.4	23.7	0.0
Public administration	3.2	0.0	6.9	0.0	0.0	0.0	2.7	0.0	0.0	0.0
Recreation, personal & other services	3.6	1.7	1.8	1.7	3.1	1.5	7.6	4.2	0.0	2.4
Trade	20.2	17.3	19.2	11.4	20.2	18.1	31.5	30.6	32.9	23.7
Transport & storage	3.4	12.5	19.3	22.0	8.9	2.8	28.9	19.8	38.1	24.7
Total	**16.8**	**17.0**	**17.9**	**16.0**	**16.6**	**19.9**	**32.5**	**29.8**	**32.6**	**25.9**

Table 5. NIHL incidence rates in small workplaces by financial year expressed per 100,000 workers

Small workplaces incidence rates	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09
Agriculture, forestry, fishing & hunting	15.3	7.7	9.6	8.3	0.0	15.4	24.5	15.0	19.4	13.6
Community services	4.6	12.6	49.5	12.7	11.3	0.0	11.1	39.4	9.6	8.6
Construction	37.2	40.0	35.7	40.6	41.9	47.7	68.2	82.9	87.8	71.2
Electricity, gas & water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Finance, property & business services	27.3	24.1	27.3	30.5	56.2	53.2	86.8	58.8	47.0	38.5
Manufacturing	50.4	18.7	38.5	49.4	37.5	58.4	110.6	109.6	127.0	118.5
Mining	0.0	327.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Public administration	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recreation, personal & other services	0.0	2.6	2.8	2.5	2.4	0.0	6.3	3.6	4.6	5.2
Trade	9.9	16.6	16.6	15.2	11.6	15.1	26.7	23.7	30.9	25.6
Transport & storage	12.7	0.0	24.5	35.6	18.4	19.7	32.3	49.7	46.8	56.7
Total	**15.3**	**11.6**	**15.6**	**17.2**	**14.7**	**18.4**	**32.3**	**31.7**	**34.2**	**30.1**

List of figures

List of tables