HRRI Working Paper 14-02
Industrial Relations Center
University of Minnesota

An Assessment of the Effects of Increased Regulatory Enforcement on Occupational Hearing Loss Workers' Compensation Claims: Oregon 1984-1998

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Abstract

Background

Hearing loss from occupational exposures has been found to be a common and serious problem affecting workers. This paper examines the effect that increasing legislative enforcement of existing regulations has on improving worker safety.

Methods

Workers' compensation claim data from Oregon was examined for the period of 1984-1998 to examine trends and severity of hearing loss claims. In 1990, Oregon enacted legislative reforms to improve enforcement of safety standards in the state. This study examined the periods of pre-and-post legislative reforms with respect to hearing loss claims.

Results

It was found that hearing loss claims decreased significantly following the legislative reforms, although the average cost per claim increased. Age, tenure and evidence of moral hazard claiming were also discovered.

Conclusion

Increased enforcement of regulations by Oregon improved the safety of workers from occupational hearing loss. Nevertheless, hearing loss remains problematic, and continued efforts are required to improve worker safety.

Key Words: Hearing loss, workers' compensation, occupational safety, public health.

Introduction

A prolific body of research has demonstrated that hearing loss due to occupational factors represents a major health problem affecting millions of workers in the United States and abroad. Of all causes of occupational hearing loss, noise has been identified as the most pervasive.[1] The National Institute for Occupational Safety and Health (NIOSH) has estimated that approximately 30 million American workers are exposed to on-the-job noise levels that have the potential to damage auditory function.[2] In addition to noise induced hearing loss (NIHL), a variety of other occupational factors have also been identified by investigators as risks to hearing, including exposure to ototoxic industrial chemicals and solvents, carbon monoxide, and lead. [3-6] Moreover, individual characteristics such as age, gender, and race have been hypothesized to affect susceptibility to hearing loss, with the consensus of investigators of such studies finding the current evidence supportive but inconclusive and in need of further research.[7-11]

In general, the research conducted to assess the widespread effect of occupational hearing loss have followed two primary strategies: examining groups of individuals within specific occupations and using population-based data to assess hearing loss rates across occupations over time. Examples of occupations that have been specifically examined include construction workers, farm workers, airline employees, welders, sawmill workers, discotheque employees, ambulance personnel, railway workers, symphony musicians and firefighters.[12-21] Along with estimating the rates of hearing loss among occupational groups, this line of research is particularly valuable in determining

what specific job activities and environmental exposures puts employees most at risk, and thereby allow for the prioritization and development of effective interventions to mitigate such risks. In contrast, studies that utilize population-based methodologies offer the unique advantages of being able to compare the relative rates of hearing loss between industries and occupations, examine trends across occupations, and determine where interventions are most required and where they have had the greatest and least effectiveness. Examples of such research has been through the use of surveillance studies performed in Michigan and the United Kingdom and the analysis of workers' compensation data from the United States, Canada and Australia.[22-28]

Workers' compensation data is quite useful in assessing occupational injury because it allows for the examination of large populations of employees to be examined for specific maladies over time, and often includes important demographic variables in addition to information on the frequency, severity and costs associated with occupational injuries. The most extensive workers' compensation study to examine occupational hearing loss used Washington State data for the period of 1984-1991. Among the most important findings of the Washington State study was the detection of an increasing rate of accepted hearing loss claims, despite the enactment of the Hearing Conservation Amendment by the Occupational Safety and Health Administration in 1983 which articulated acceptable workplace noise exposure where possible, and advocated the use of protective hearing equipment and regular hearing examinations in cases where noise level reductions below specified limits were not possible.[29] The study further identified the primary metal, lumber and wood, and transportation equipment manufacturing industries as having the

highest incidence of accepted claims, demonstrated an association between age and claim rate, reported a claim denial rate of about 30%, and quantified $23 million dollars for total disability costs during the time period examined.[24-25]

This study uses workers' compensation data from Oregon for the period of 1984-1998 to provide new information on occupational hearing loss claim trends and examine factors that may influence such trends. Importantly, Oregon enacted a set of legislative reforms in 1990 with the passage of SB1197 and SB1198 to strengthen the enforcement of workplace safety standards and concurrently improve the regulations guiding workers' compensation claim acceptance. In particular, these acts established penalties against employers that violated existing safety and health regulations and necessitated that claims be supported by objective medical evidence demonstrating that the primary cause of injury was by occupational factors in order to be compensable.[30] Additionally this study aims to contribute to the literature on occupational hearing loss by examining claim patterns between and within industries and occupations, investigating claimant demographics, assessing disability types and costs associated with the claims, analyzing denial rates, and comparing the results to past findings of workers' compensation research. Oregon collects information that enables us to determine claimant tenure, average weekly wage replacement rate and shift. Thus, these three dimensions will be used to forward the understanding of hearing loss in the workplace. As this investigation covers a period of fifteen years, and includes the periods before and after the legislative reforms, it provides the basis for assessing the effects of their initiative on hearing loss claims.

Materials and Methods:

Workers' compensation claim data for Oregon was obtained from the Workers' Compensation Division of Oregon's Department of Consumer and Business Services. All claims with date of injury occurring between 1984 through 1998 in which the nature of injury was coded as deafness, hearing loss or impairment (including tinnitus and disorders of ear mastoid and hearing) was included in the analysis. Of these cases, the only source of injury was listed as "noise", with the event causing injury as either "exposure to noise over time", "exposure to noise in single incident", or "exposure to noise- unspecified", and body part injured as "ears". In all analyses, except those involving claim denials, only claims accepted as compensable claims (not denied following adjudication) were included in the analysis.

In this study, day, evening and night shifts were defined as follows: If an individual started their job at 5:00 a.m. or later and ended before 6:00 p.m. they were defined as working the day shift. Individuals working the evening shift were defined as those that started their jobs at 10:00 a.m. or later and ended their jobs after 6:00 p.m. but not later than 2:00 a.m. Those not working the day shift or evening shift were categorized as night shift workers.

The replacement rate measures the fraction of lost wages that temporary total indemnity payments replace. Temporary total disability benefits are a function of average weekly wages subject to a minimum and maximum benefit amount. The replacement rate

was calculated using claimant data on average weekly wage along with benefit formula information obtained from Workers' Compensation Division of Oregon's Department of Consumer and Business Services over the 1984-1998 period.

To calculate hearing loss claim rates by age, gender, and occupation, the number of claims in a particular employment category was compared to estimates of the number of individuals in Oregon employed in that category. Population employment estimates for Oregon were computed using data from the Current Population Survey (CPS) Annual Earnings Files (the outgoing rotation groups) for Oregon from 1984-1998. The CPS data contains information on various demographics of characteristics of workers including 3-digit Standard Occupation Classification (SOC), gender, and age along with associated weights that allows estimates of population employment in each category to be calculated. The CPS sample for Oregon over the 1984-1998 period contained 24,244 individuals. To calculate claim rates by two-digit Standard Industrial Classification (SIC) code employment population data by two-digit SIC industry from 1984 to 1998 was obtained from the Oregon Department of Industry.

To investigate the determinants of whether a hearing loss claim was denied or not a multivariate logistic regression was estimated using age, gender, years tenure in job, replacement rate, hours of work per week, and event causing injury (exposure to noise over time, exposure to noise in single incident, or exposure to noise, unspecified) as predictor variables. All statistical analysis was performed using Stata version 7.0 software.

Results:

Over the fifteen-year period of 1984-1998, there were a total of 2,039 claims of hearing loss filed by workers in the state of Oregon, averaging 135.93 claims per year. Of those claims, 1,363 (66.85%) were accepted as occupationally caused cases of hearing loss, while 676 (33.15%) were denied under administrative adjudication, and thus the number of accepted claims averaged 90.86 per year. An analysis of claims by industry using 2-digit SIC codes found that the greatest number of accepted claims were made by those in the lumber and wood products industry with 475 (34.85%), followed by those in the paper and allied products industry with 204 (14.97%) and those in the industrial machinery and equipment industry with 81 (5.94%). Accepted claims were also examined using 3-digit SOC codes, and found that the highest number of the claims were filed by millwrights with 69 (5.1%), miscellaneous machine operators with 67 (5.0%), and production operation supervisors with 54 (4.0%). A full breakdown for claims of all industries and occupations that averaged at least 1 claim per year with 15 or more accepted claims are provided in Figures 1 and 2.

The rate of claims was computed by dividing the number of claims by the average workforce of those populations where claims were made as estimated with the CPS data for all years examined. For the period of 1984-1998, the overall average rate for accepted hearing loss claims per 10,000 employees was 0.71. Between 1984-1990, the average claim rate per 10,000 was 1.13, with a peak of 1.5 claims per 10,000 in 1989, and then significantly declined, and by 1998 the claim rate had fallen to under 0.2 claims per

10,000 and had averaged 0.50 claims between 1990-1998. This decrease is also reflected in a drop of the annual average number of claims from 123.5 for the pre-legislative reform period of 1984-1989 to 71.3 for the post-legislative reform period of 1990-1998. The hearing loss claim rate by year is presented in Figure 3. For industries in which there were 15 or more claims reported during the time period examined, workers in the paper and allied products industry were discovered to have the highest annual rate of 15.19 per 10,000 employed, followed by those in the stone, clay and glass industry with a rate of 7.09, and workers in the lumber and wood products industry with a rate of 5.31. Among occupations in which 15 or more claims were reported, machinery maintenance operators had the greatest average annual rate of 61.18 claims per 10,000 workers, followed next by woodworking machine operators with 15.2, and grader/dozer/scraper operators with a rate of 13.97. The claim rates for industries and occupations that had 15 or greater claims during the 1984-1998 period, as well as the pre-legislative and post-legislative reform periods are provided in Table 1.

The costs, indemnity (time-off work), and disability type associated with accepted hearing loss claims were analyzed to assess injury severity. During 1984-1998, the total cost of all workers' compensation claims for occupational hearing loss was $6,889,614.71. On average, the total cost per claim was $5,054.74 (SD = $7,218.59). The largest portion of payment was for permanent partial disability (PPD) averaging $4,239.52 (SD = $5,620.44) per claim, followed by medical payments of $493.04 (SD = $1,451.95), total temporary disability (TTD) payments of $269.32 (SD = $2,842.77), and vocational rehabilitation payments of $52.85 (SD = $712.45). The average indemnity

period for TTD claims was 3.32 days (SD = 32.92). These costs were also compared by industry and occupation and are presented in Table 2. However, while the rate of claims decreased over time, their average associated costs increased from $3,669.23 during 1984-1989 to $6,705.34 during 1990-1998. As the average indemnity period only increased marginally from an average of 3.07 days to 3.64 days during these respective time periods, and the associated average costs for TTD increased slightly from $257.91 to $282.90 and vocational rehabilitation from $46.73 to $57.99, the large growth in average claim costs were driven primarily from steep increases in the average PPD and medical costs. The changes in average costs for the pre-and-post legislative reform periods are shown in Figure 4.

The sources of injury associated with the claims were computed and exposure to noise was attributed to be the sole causative factor for hearing loss. In the majority of cases, cumulative exposure was cited, with 1033 (75.78%) classified as "exposure to noise over time." For 63 (4.62%) of the claims, the injury event indicated was "exposure to noise in single incident." In the remaining 267 (19.58%) claims, the cause recorded was simply "exposure to noise, unspecified." Those claims in which the cause of injury was indicated to be cumulative exhibited a high concentration among older age groups, with less than 1% of these claims being made by persons aged 25 or below, 5.2% by those between 26-35 years of age, 18.9% by those between 36-45 years of age, 38.43% filed by those between 46-55 years of age, 36.2% by those between 56-64 years of age, and 1.0% filed by those over the age of 65. Conversely, the claims reporting single incident as source of injury were more uniformly distributed across age groups, with claims equaling 22.22%,

15.87%, 26.98%, 25.39%, 9.52%, and 0% for the aforementioned age categories respectively. The claims in which injury from a single incident was reported had longer periods of indemnity time (10.14 days) than from those reporting cumulative exposure (2.90 days), higher associated medical costs ($1,218.85 versus $468.26), lower payments for PPD ($2,614.54 versus $4,513.63), and lower average total cost ($4,474.79 versus $5,318.17).

Claim denials were highest for those claimants having less than one year of tenure at the time of reporting their injury (59.83%) as compared to those with greater than one year of tenure at the time of claim (31.53%). For those claims that were accepted, the preponderance (50.84%) were by individuals with over 20 years of tenure, followed respectively by those with tenure between 16-20 years (15.19%), 11-15 years (11.45%), 6-10 years (9.83%), 1-5 years (8.8%), and under 1 year (3.89%). A logistical regression inclusive of tenure, age, gender, replacement rate, number of hours worked, shift worked, and whether the injury was due to a single event was conducted, and revealed that tenure was significant and negatively related to claim denial ($p<.001$) and claims that were attributed to a single event were less likely to be denied ($p <.001$) than those attributed to exposure to noise over time. The analysis further found that replacement rate was a significant predictor of claim denials, as claimants with higher replacement rates were more likely to be denied ($p <.001$). No significance was discovered for age ($p = .53$), evening shift ($p = .12$), night shift ($p = .35$), or number of hours worked ($p = .76$) with respect to the likelihood of claim denial.

A breakdown of the demographic information in the workers' compensation data demonstrates that the vast majority of the accepted claims 1327 (97.36%) were those made by males. The average age of claimants in the accepted claim group was 50.6 years of age, which was higher than for the average age of 37.06 years for employees in the Oregon workforce as estimated using the CPS. In general, the number of claims for occupational hearing loss increased with age until age 65. Of all accepted claims, workers 25 years old and under constituted 18 (1.32%), workers between 26-35 years of age 82 (6.02%), workers between 36-45 of age 267 (19.59%), workers between 46-55 years of age 505 (37.05%), and workers between 56-65 years of age 478 (35.07%). There was a sharp drop in accepted claims of workers aged 65 years and older, with only 13 (0.95%) of the accepted claims filed by those in this age category.

Of the claimant age groups examined, those between 26-35 years of age had the longest period of indemnity, averaging 19.71 days per claim (SD = 86.7), while those whose age was 65 or greater reported the lowest indemnity time of 0 days per claim (SD = 0). On the other hand, those 65 and over had the highest average total cost for all age groups associated with their claims, amounting to $6,928.84 (SD = $7,798.69), while those from the youngest group of 25 and under had the lowest average total cost per claim of $1,724.50 (SD = $2,854.72). The average length of indemnity for female claimants was 9.91 days (SD = 43.0) and was about three times greater than for those of males who averaged 3.14 (SD = 32.61), although the average total cost associated with female claimants of $2,150.36 (SD = $3,429.95) was lower than the average total cost by male claimants of $5,133.53 (SD = $7,278.53).

Discussion

This study used workers' compensation data from Oregon for 1984-1998 to examine the incidence of hearing loss claims among occupations and industries in the state. During this time the rate of accepted claims averaged 0.71 per 10,000 workers annually. Not surprisingly, those industries that are commonly associated with high noise levels tended to have the highest claim rates, with the highest rates found in the paper and allied products, stone/clay/glass products, lumber and wood, and primary metal industries. For those occupations in which at least one claim per year was reported on average, machinery maintenance operators were found to have an annual rate of 61.18 per 10,000 workers, which was over four times greater than the occupations with the next highest claim rates. We believe that this points to the need for particular diligence in addressing the risks of hearing loss among workers in this category.

A key finding of this study was that the hearing loss claim rate decreased substantially following Oregon's adoption of SB1197 and SB1198 in 1990 and continued steadily downward through 1998. During the period of 1990 and 1992, the number of OSHA consultations with employers approximately tripled from previous levels, and during this time, there was about a 600% increase in the number of citations issued against employers for safety violations.[30] Thus while OSHA originally promulgated workplace noise standards in their Hearing Conservation Program in 1983, it appears that it was not effectively enforced in Oregon until 1990. We believe the large decline in hearing loss claim rate is attributable to the state's commitment to exert the OSHA standards, and

justifies continued investigation by researchers using other means to determine if this was in fact the result of this change in policy for the purpose of serving as a model for other states in the future.

While the rate of hearing loss claims were found to be declining, they were also discovered to be increasingly expensive. Between the periods of 1984-1989 and 1990-1998, the average total cost of accepted claims almost doubled. While on the positive side, the increase in claim cost was not accompanied by a large increase in average time-off, and vocational training required for the continuation of employment remained negligible, the driving force behind the increase in costs was higher amounts awarded for PPD and medical costs. Although some of the differential in expenses for these time periods may reflect a general upsurge in the costs of medical treatment and inflationary increases in compensation payments, it is also possible that because the new legislation increased the burden on employees to prove the primary source of their injuries are occupationally related to be compensable, workers are waiting until their hearing impairments are becoming more severe in nature before filing a claim. This opinion is bolstered by the fact that when compensation is awarded for hearing loss, the PPD criteria centers around the extent to which the loss affects claimants daily living as opposed to work capabilities.[31] Alternatively, it is also possible that as consequence of the legislative changes, some individuals may overestimate the impact of improved safety interventions and thus wait until damage becomes more pronounced before seeking medical attention. Because of the potential negative ramifications that these explanations

engender, we contend that both these hypotheses of unintended effects from the legislation warrant further examination in the future.

A claim denial rate of 33.15% was found for Oregon occupational hearing loss claimants, which was quite similar to the denial the rate of 30% that was reported by the previous research conducted on Washington State.[24] This rate was over three times greater than the average denial rate of 10.07% for all workers' compensation claims filed by Oregon employees during the same period and indicates that moral hazard may be problematic with respect to workers' compensation claims citing occupational hearing loss injury. In the past, other investigators have reported faking and exaggeration rates among workers seeking compensation for hearing loss to range from 9% to 30%.[28, 32-33] Indeed, because the preference of some individuals is to shirk rather than work particularly when job satisfaction is low, and noise has been found to have negative impact on job satisfaction,[34] hearing loss is an attractive area for disenchanted employees to file false claims. Our opinion is also supported by the significantly higher denial rates for claims of cumulative hearing loss claims among young claimants with under one year of tenure, as contrasted to the lower and evenly distributed denial rates found among those claimants that reported a single event as source of injury. Further, the finding that claimants with higher replacement rates had greater denial rates lends more credence to this supposition.

The pattern of accepted claims also revealed that occupational hearing loss tends to strongly increase until workers are between 46-55 years of age, level off for the next

decade, and then fall sharply among employees over the age of 65. This finding mirrors that reported by the Washington State researchers in the past.[25] One potential explanation for this lies in some medical literature that has found that hearing loss caused by noise exposure and from presbycusis may not be discernible as individuals get increasingly older.[35-37] To this extent, older workers may have a more difficult time in the adjudication process demonstrating their hearing loss was primarily due to occupational factors as opposed to aging, and therefore choose not to file a claim. A second explanation may be that as the vast majority of disability settlements of occupational hearing loss are paid as PPD, individuals may file for this disability payment when at a younger age. Because the Oregon data did not provide any unique claimant identifiers, it is not possible to determine if the claimants filed multiple claims over their history of employment. In addition, this study's demographic analysis found that over 97% of claimants were male, and again quite similar in this respect to the earlier findings reported by the Washington State investigators. However, it is our belief that this gender difference is largely indicative of the overwhelmingly male composition of the workers in occupations that are subject to high levels of noise, and as we have no precise measures of noise exposure, it cannot be concluded that women are less at risk of hearing loss than males on the basis of the workers' compensation data used in this investigation.

This study has several limitations. First, as Oregon increased the burden of proof for workers' compensation claims in conjunction with increased regulatory enforcement, the decreased hearing loss claim rate attributed to increased enforcement in this paper may have been confounded with a burden of proof effect. Second, is that the number of

workers' compensation claims reported is likely to significantly under-represent the actual number of workers and rate among those in the working population that experience occupational hearing loss. Because occupational hearing loss occurs in most cases from cumulative noise exposure, and is not immediately observable, there are probably many workers that suffer from this injury but are unaware of their condition. Moreover, as all claims of occupational hearing loss in Oregon was attributed to noise, and past research has demonstrated that exposure to ototoxic agents such as chemicals and solvents can also induce hearing loss, it is conceivable that some workers suffered hearing loss from these exposures but did not attribute injury to these sources.

Last, we would caution against interpreting the denial rate as an exact measure of false claiming. As the burden of proof in workers' compensation claims necessitates that claimants demonstrate their injuries were occupationally caused to be compensable, in some cases hearing damage may have occurred among younger individuals with low job tenure, but they were unable to meet the burden of proof for claim acceptance. Nevertheless, because of the aforementioned evidence we feel that a high priority continue to be placed on the assessment and verification of hearing loss claims, so that available financial resources be allocated most efficiently for addressing the needs of employees that are truly injured.

Overall, this study has found that occupational hearing loss is still in need of continued attention to improve the safety and health conditions of employees in the workplace. Our analyses strongly support that when the current OSHA Hearing

Conservation Amendment standards are more rigorously enforced, greater efficacy for decreasing the rate of occupational hearing loss is achieved. The trend of rising PPD and medical costs associated with accepted claims may point to some inadvertent consequences from the legislative initiative, and future research should be directed to assess the merit of the hypotheses, and develop measures to correct these problems if found to be valid. Greater emphasis should also be placed on developing further measures to improve the safety and working environment within those industries and occupations where hearing loss rates were identified to be the highest.

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Table 1

Hearing Loss Claim Rates per 10,000 Employees By Industry and Occupation

Industry	1984-1998	1984-1989	1990-1998
Paper & Allied Products	15.19	18.53	12.91
Stone/Clay/Glass Products	7.09	3.80	9.66
Lumber & Wood Products	5.31	6.37	4.45
Primary Metal Industries	4.40	7.04	2.40
Electric/Gas/Sanitary Services	3.78	2.97	4.22
Industrial Machinery & Equipment	3.50	7.23	0.82
Transportation by Air	3.29	6.37	2.05
Heavy Construction (except building)	2.95	3.72	2.23
Educational Services	2.33	3.27	1.60
Transportation Equipment	1.66	1.70	1.65
Fabricated Metal Products	1.59	1.98	1.11
General Building Contractors	1.21	1.88	0.70
Trucking & Warehousing	0.94	0.80	1.17
Food & Kindred Products	0.82	0.76	0.92
Special Trade Contractors	0.75	1.48	0.35
Wholesale Trade (durable goods)	0.59	0.65	0.51
Automotive Dealers/Service Stations	0.54	0.51	0.58

Occupation	1984-1998	1984-1989	1990-1998
Machinery Maintenance	61.18	80.00	44.28
Woodworking Machine Operators	15.20	10.15	25.13
Grader/Dozer/Scraper Operators	13.97	14.06	13.86
Millwrights	13.31	17.21	10.79
Furnace/Kiln/Oven Operators (except food)	6.55	9.53	4.56
Firefighters	5.51	5.28	5.66
Machine Feeders	5.30	4.78	5.95
Police & Detectives	5.04	14.69	3.27
Construction Trades	5.01	8.62	2.73
Industrial Machinery Repairers	4.76	6.02	4.09
Misc. Machine Operators	4.54	5.88	3.73
Sawing Machine Operators	4.00	5.07	3.08
Truck/Tractor Operators	2.63	3.55	2.16
Graders & Sorters (nonagricultural)	2.61	3.24	2.16
Welders & Cutters	2.60	5.08	1.31
Electricians (except apprentices)	2.59	6.15	1.37
Machinists (except apprentices)	2.46	3.65	1.68
Supervisors-Production Operations	2.43	4.03	1.50
Production Inspectors/Checkers/Examiners	2.30	4.51	0.67
Assemblers	1.60	2.76	1.04
Freight/Stock/Material Handlers	1.55	2.34	0.98
Laborers (except construction)	1.46	2.11	0.98

Table 2

Average Cost of Hearing Loss Per Claim Amounts by Industry and Occupation

Industry	TTD	PPD	Medical	Total Cost
Wholesale Trade (durable goods)	$2,600.93	$6,915.09	$1,494.18	$11,494.88
Heavy Construction (except building)	$358.52	$7,114.99	$1,141.61	$9,597.75
Transportation Equipment	$15.65	$7,615.41	$667.93	$8,299.00
Special Trade Contractors	$2,785.05	$2,757.59	$2,104.70	$7,740.04
Primary Metal Industries	$1,443.27	$2,607.49	$1,737.31	$5,788.06
Lumber & Wood Products	$301.56	$4,923.25	$452.90	$5,705.66
Electric/Gas/Sanitary Services	$75.50	$4,814.87	$726.32	$5,616.69
Educational Services	$667.03	$3,735.65	$449.97	$4,997.99
Paper & Allied Products	$0.16	$4,637.13	$328.38	$4,973.41
Automotive Dealers/Service Stations	$433.30	$3,553.50	$636.15	$4,630.55
Food & Kindred Products	$0.00	$3,879.56	$634.52	$4,514.08
Industrial Machinery & Equipment	$126.81	$3,559.97	$285.87	$3,972.65
Trucking & Warehousing	$101.73	$3,000.15	$710.80	$3,873.19
Fabricated Metal Products	$6.50	$3,197.08	$382.62	$3,586.02
Stone/Clay/Glass Products	$0.00	$3,303.08	$272.91	$3,575.99
General Building Contractors	$0.00	$1,501.73	$711.16	$2,212.89
Transportation by Air	$13.00	$1,236.49	$428.73	$1,678.23

Occupation	TTD	PPD	Medical	Total Cost
Graders & Sorters (nonagricultural)	$0.00	$6,407.26	$170.39	$6,557.65
Firefighters	$0.00	$5,382.30	$445.26	$5,827.57
Machinery Maintenance Operators	$850.52	$4,167.31	$612.69	$5,630.51
Truck/Tractor Operators	$0.00	$5,206.43	$290.08	$5,496.51
Industrial Machine Repairers	$0.00	$4,952.44	$462.44	$5,414.88
Sawing Machine Operators	$1,434.62	$3,004.24	$217.45	$5,117.10
Supervisors-Production Operations	$0.00	$4,801.30	$293.13	$5,094.43
Misc. Machine Operators	$0.03	$4,519.91	$435.25	$4,885.66
Police & Detectives	$9.48	$4,149.74	$620.10	$4,779.32
Assemblers	$49.11	$3,741.70	$882.70	$4,673.51
Freight/Stock/Material Handlers	$5.53	$4,038.68	$490.68	$4,534.90
Construction Trades	$0.00	$4,070.11	$433.39	$4,503.50
Welders & Cutters	$5.11	$4,129.83	$337.39	$4,472.33
Grader/Dozer/Scraper Operators	$4.93	$3,852.40	$572.73	$4,430.07
Woodworking Machine Operators	$0.00	$3,988.97	$256.72	$4,245.69
Millwrights	$1.61	$3,747.01	$256.74	$4,005.36
Furnace/Kiln/Oven Operators (except food)	$0.00	$3,613.21	$252.53	$3,865.74
Machinists (except apprentices)	$149.86	$3,246.00	$358.45	$3,754.32
Laborers (except construction)	$46.04	$3,168.73	$337.93	$3,552.71
Machine Feeders	$0.00	$3,147.29	$313.61	$3,530.64
Electricians (except apprentices)	$8.04	$3,033.61	$395.46	$3,437.11
Production Inspectors/Checkers/Examiners	$0.06	$2,583.78	$244.11	$2,827.94

Figure 1

Number of Accepted Hearing Loss Claims by Occupation

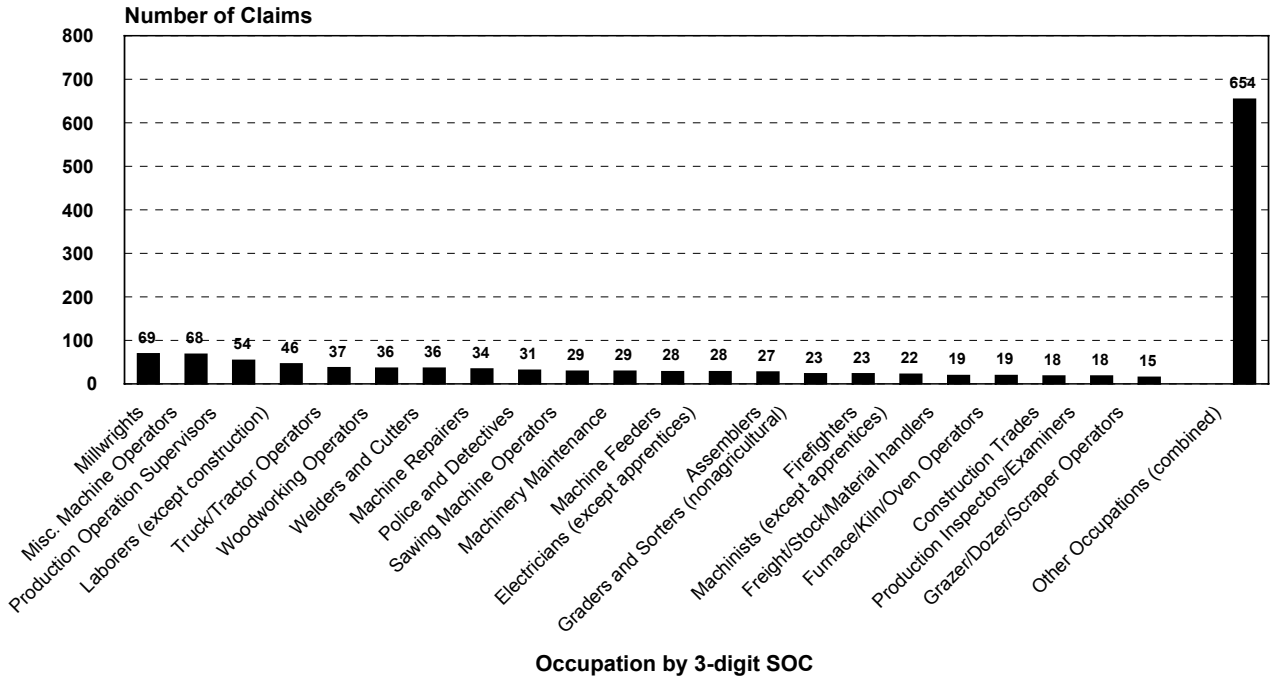

Figure 2

Number of Accepted Occupational Hearing Loss Claims by Industry

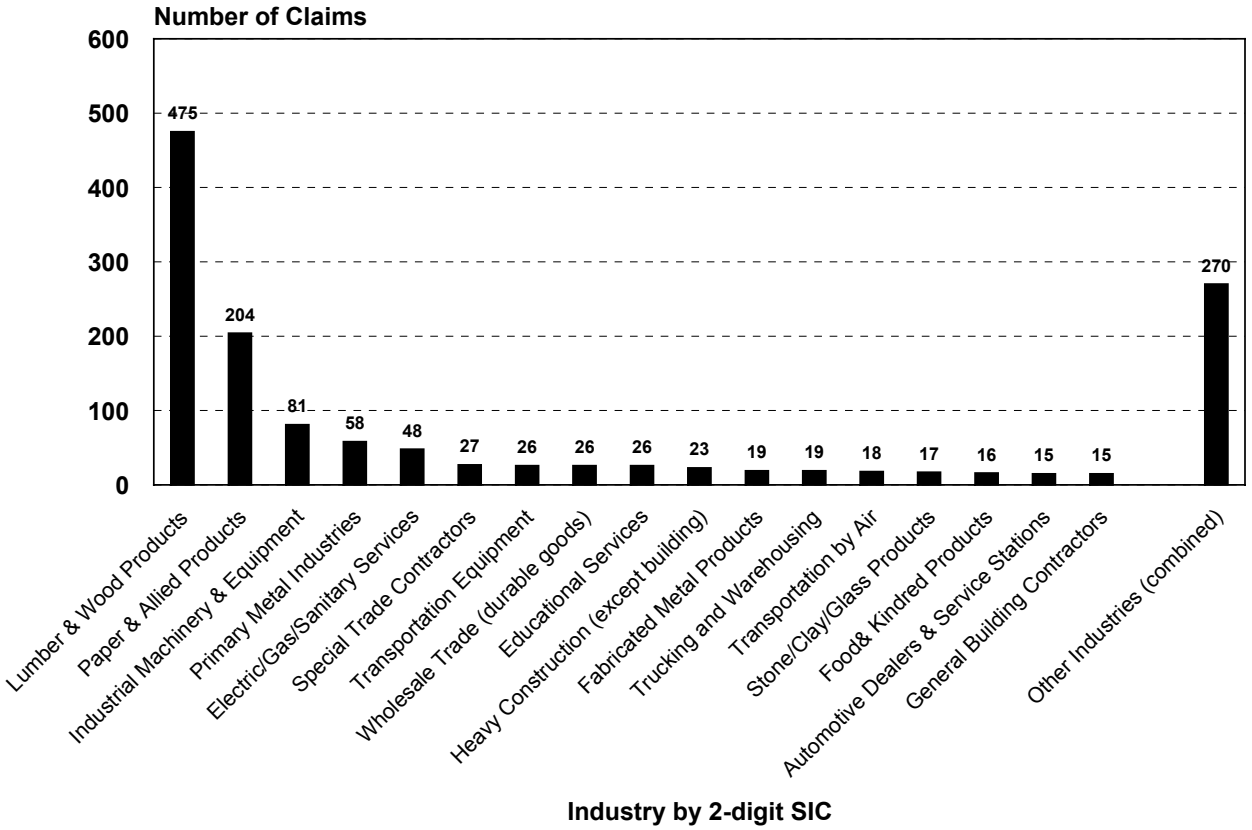

Figure 3

Average Annual Hearing Loss Claim Rate 1984-1998

Figure 4

Average Cost Breakdown of Claims: 1984-1989 versus 1990-1998