Final Progress Report

Project title:	**Occupational hearing loss in Washington State**
Grant number:	CDC/NIOSH 5 R01 OH 03894-03
Date:	January 10, 2005

Principal investigator:	William E Daniell, MD MPH
Affiliation/institution:	Associate Professor Department of Occupational and Environmental Health Sciences University of Washington, Box 357234 Seattle, WA 98195-7234
Telephone:	206-685-3160
Email:	bdaniell@u.washington.edu

Co-investigators:	Susan S Swan, MS CIH Janice Camp, MN MSPH CIH Mary M McDaniel, MS CCCA [1] Martin Cohen, ScD CIH [2] John Stebbins, MS CIH [3] Robert Leo, MS [4]

Affiliations:

1 Pacific Hearing Conservation, Inc.
Seattle, WA

2 Department of Labor & Industries [former affiliation]
Olympia, WA

3 Department of Labor & Industries [current affiliation]
Olympia, WA

4 Department of Labor & Industries [current affiliation]
Seattle, WA

This report was prepared by William Daniell before complete review by the co-investigators.

Abstract

Washington State experienced a large increase in workers' compensation claims for occupational hearing loss (OHL) during the 1990s, continuing to the present. The findings of studies of these claims, and studies elsewhere, indicate that a substantial segment of the contemporary work force still faces a significant risk for developing OHL. There is a need for actions to address the underlying problems. There is also a critical need for information to guide any actions in a constructive and efficient manner.

This study included two main projects: 1) a telephone survey of people with recent OHL claims, and 2) field evaluation of noise exposures and hearing loss prevention practices at 76 companies in eight industries with higher than average rates of OHL claims. The study also analyzed previously collected pilot data from field evaluations in ten foundries, and incidentally yielded a descriptive study of OHL claims filed during 1984-1998. The overall study had four specific aims.

Aim 1: *To identify the major pathways and influential factors by which individuals with OHL are identified and reported to the workers' compensation system*.

The telephone survey found that the decision by a current or former worker to file an OHL claim is commonly influenced by a number of factors. The most important influence on decisions to file an OHL claim was social contacts, especially family members, but also friends and coworkers.

Several types of health care providers were identified as important or very important influences on decisions to file a claim. Most subjects said a screening program conducted outside of work had an important influence on their decision to file an OHL claim, but they generally described this as less important than other influences, particularly family members and friends.

Only about a quarter of subjects said an advertisement or other media source of information was an important influence, and most did not say it was a very important influence.

There was a relative lack of influence by workplace representatives on decisions to file an OHL claim. This raises concern about the completeness or adequacy with which audiometry findings are communicated to workers when they are tested in workplace annual monitoring programs.

Aim 2: *To identify factors that may have contributed to the increased reporting of OHL in Washington State*.

The telephone survey of did not identify any factors – "smoking guns" – that clearly accounted for why so many more current and former workers chose to file an OHL claim in recent years, than in the past. As noted, most of the surveyed claimants said that a screening program conducted outside of work had an important influence on their decision to file an OHL claim, but they generally described this as less important than other influences, particularly family and friends. It is possible, however, this study underestimated the direct or indirect influence of screening programs, advertisements, and media information on decisions to file a claim.

Aim 3: *To determine whether there is any substantial work-related risk at the present time for OHL in industries with high numbers and/or rates of OHL claims*.

The information provided by the telephone survey subjects about conditions at their most recent noisy job – most of which occurred since OSHA/WISHA hearing conservation regulations were implemented – suggested that many employers are not optimally compliant with regulations. Based on the subject reports, employers in some industries, particularly construction and other non-manufacturing industries, are generally less compliant than employers in other industries.

The evaluation of work sites in selected industries found that excessive noise exposure was common in all of the study industries. Nearly all companies had employee exposures that required a hearing loss prevention program, and more than half had employee exposures that required the employer to consider possible noise controls. In general, the possibility of new noise controls received no or low priority in all of the study industries.

Most of the evaluated companies had substantial shortcomings in their hearing loss prevention programs. In general, there was little difference between industries in the use of noise measurements or consideration of noise controls. However, policies and practices related to employee training, hearing protection, and audiometric testing were generally more complete in some industries than others. Within each industry, there were substantial differences between companies in the completeness of hearing loss prevention policies and practices. Every industry included some companies with relatively complete policies and practices and some companies where policies and practices were substantially incomplete.

Hearing protection was commonly underused. Reported use was highest at companies with relatively complete hearing conservation programs, and in industries where excessive noise exposure was most prevalent and least intermittent. Many employees had difficulty estimating how often, and presumably when, their noise exposure was excessive. This can pose a problem in situations where exposure is intermittent and hearing protection is used only during exposure.

Aim 4: *To assess the effectiveness of using workers' compensation claims information to "target" or identify industries and worksites with remediable risk factors for a chronic occupational health problem, using OHL as a case in point*.

The evaluation of work sites in selected industries found little evidence that claims statistics for OHL – and conceivably for other occupational illnesses that manifest many years after first exposure to a hazard – are useful for identifying industries where there is a high risk for developing that condition and where additional preventive measures are most needed.

In general, the reports by OHL claimants in the telephone survey about their most recent noisy workplace also were not an effective source of information for identifying industries that were substantially more in need of intervention than other industries, nor companies that were more in need of intervention than other companies within the same industry.

It is conceivable that claims statistics or claimants' reports could be useful for targeting specific industries, if supplemented with other information about candidate target industries.

The OHL claims statistics for the study industries showed a significant correlation with the average prevalence of hearing loss on audiometry records in each industry. In industries where OHL claims were more common, monitored employees were more likely to have hearing loss. Claims statistics for OHL – and conceivably other occupational illnesses – may be useful for targeting initiatives to identify workers who have that condition and who may not be aware they have the condition.

Information about the usual extent of noise in an industry is probably a better source of information for targeting interventions to reduce risk for developing OHL, than is information about hearing loss claims, although the two may be useful when considered together. In general, the average completeness of hearing loss prevention policies and practices at work sites in a study industry was strongly associated with the extent of noise overexposure in that industry. Furthermore, the intuitive response to information about noise levels would not necessarily be the best response. The industries with greatest margin for improving hearing loss prevention efforts are not necessarily the noisiest industries, but may be industries where noise exposure is more moderate or intermittent.

Significant Findings

Washington State experienced a large increase in workers' compensation claims for occupational hearing loss (OHL) during the 1990s, continuing to the present. Almost half of these claims involved persons beyond the usual retirement age, indicating at least part of the increase represents hearing loss caused by noise exposures that occurred many years or decades ago. However, the findings of studies of these claims, and studies elsewhere, indicate that a substantial segment of the contemporary work force still faces a significant risk for developing OHL. There is a need for actions to address and remediate the underlying problems. There is also a critical need for information to guide any actions in a constructive and efficient manner.

This study had four specific aims:

- **Aim 1:** To identify the major pathways and influential factors by which individuals with OHL are identified and reported to the workers' compensation system.
- **Aim 2:** To identify factors that may have contributed to the increased reporting of OHL in Washington State.
- **Aim 3:** To determine whether there is any substantial work-related risk at the present time for OHL in industries with high numbers and/or rates of OHL claims.
- **Aim 4:** To assess the relative effectiveness of using workers' compensation claims information to "target" (i.e., appropriately identify) industries and worksites with remediable risk factors for a chronic occupational health problem, using OHL as a case in point.

This study consisted of three related projects:

- **Project 1** involved analysis of data collected by the pilot project, in which noise exposures and hearing conservation practices were evaluated at ten foundries.
- **Project 2** was a cross-sectional study – using telephone interviews – of individuals with workers' compensation claims that were filed during 1997-1998 and accepted for OHL. In addition, the claims data obtained for this project were combined with OHL claims data from a separate project (1984-1996) to conduct a descriptive analysis of OHL claims.
- **Project 3** was a cross-sectional study – evaluating noise exposures and hearing loss prevention activities – at a representative sample of worksites in each of nine industries with relatively high industry-specific rates of OHL claims.

Aim 1: To identify the major pathways and influential factors by which individuals with OHL are identified and reported to the workers' compensation system.

Project 2 originally planned to characterize the "awareness-healthcare-claim pathways," or sequences of events, by which persons become aware of their hearing condition, receive a diagnosis, and enter the workers' compensation system. However, the pilot telephone survey found that many subjects did not know or recall which provider had filed their claim, or the sequence of provider contacts before and after claim filing. In addition, many subjects did not know or understand differences between different types of hearing professionals. Consequently, characterization of the healthcare pathway focused on: the health care provider who was involved in filing the claim; any referral made by that provider; and the referral source for any non-usual provider who was "important" in the decision to file a claim.

*The **Project 2** telephone survey of OHL claimants found that the decision by a current or former worker to file an OHL claim is commonly influenced by a number of factors. The most important influence on individuals' decisions to file an OHL claim was social contacts, especially family members, but also friends and coworkers.*

Several types of health care providers were identified as important or very important influences on decisions to file a claim. Most subjects said a screening program conducted outside of work had an important influence on their decision to file an OHL claim, but they generally described this as less important than other influences, particularly family members and friends.

Only about a quarter of subjects said an advertisement or other media source of information was an important influence, and most did not say it was a very important influence. It is possible, however, that this study underestimated the direct or indirect influence of screening programs, advertisements, and media information on decisions to file a claim.

There was a relative lack of influence by workplace representatives on decisions to file an OHL claim. This raises concern about the completeness or adequacy with which audiometry findings are communicated to workers when they are tested in workplace annual monitoring programs.

- For the majority of individuals with an OHL claim, the decision to file a claim was not triggered by recent awareness of hearing loss or its possible relationship to noise at work, nor by progressive worsening of hearing loss. However, recent information from a health care provider about their hearing loss, and its possible relationship to noise at work, probably had an important influence on a near majority of the subjects. The survey did not attempt to distinguish which provider, or type of provider, communicated this information.
- Several types of health care providers were identified as important or very important influences on many subjects' decisions to file a claim. About two-thirds of subjects said a hearing tester in a screening program outside of work played an important role in their decision to file an OHL claim, although that role was rarely considered very important. In contrast, one-quarter of subjects said their usual health care provider played an important role; however, more often than not, they considered that role to be very important.
- About one-quarter of subjects said a health care provider other than their usual provider played an important, and often very important role, in their decision to file an OHL claim. Most of those providers were otolaryngologists, audiologists, or other hearing-related professionals. Subjects came under the care of those important other providers through a variety of routes, but most often by self-referral. The next most common route was by referral from the subject's usual health care provider.
- Most of the providers who helped subjects file their OHL claim or evaluated them before they filed their claim were otolaryngologists or a type of hearing specialist the subject could not identify. Subjects' usual providers served this role in less than 20% of claims, but generally also referred subjects to a hearing professional.

Since this survey, the State of Washington implemented a requirement that OHL claims be filed within two years after diagnosis of OHL or cessation of occupational noise exposure (i.e., the "date of injury"), to be fully eligible for potential benefits. Claims filed after two years are still eligible for coverage of medical expenses, including hearing aids, but not disability compensation.

In the absence of such a requirement, about half of the subjects, including about one-third of those who were younger than 65 years of age when they filed their claim, did not file their claim in what would now be considered a timely manner.

- In the absence of a two-year filing requirement, there were some identifiable differences between individuals who filed their claim sooner or later than two years after the "date of injury." However, many of those differences were explainable by the difference in age.
- Among subjects who were younger than usual retirement age, those who filed more than two years after the date of injury were, on average, identical in age to those who filed in more timely manner but had ended their last noisy job about five years earlier. It is possible that age – or age-related phenomena such as retirement or impending retirement, onset of concomitant non-occupational hearing loss, particularly presbycusis, or the development of other health problems – may be a more important stimulus than the recency of final noise exposure for filing an OHL claim, at least in the absence of a two-year filing requirement.

Aim 2: To identify factors that may have contributed to the increased reporting of OHL in Washington State.

*The **Project 2** telephone survey of OHL claimants did not identify any factors – "smoking guns" – that clearly accounted for why so many more current and former workers chose to file an OHL claim in recent years, than in the past. As noted, most of the surveyed claimants said that a screening program conducted outside of work had an important influence on their decision to file an OHL claim, but they generally described this as less important than other influences, particularly family and friends. It is possible, however, this study underestimated the direct or indirect influence of screening programs, advertisements, and media information on decisions to file a claim.*

- A majority of survey subjects said hearing screening programs conducted outside of work were important, but not very important, in their decision to file a claim, and a substantial minority said advertisements and media sources of information were important. Most subjects attributed greater importance to family members and other social contacts, whose presence would not be expected to vary substantially from one period of time to another. Of note, subjects who said a screening program was an important influence were even more likely than those who did not say so, to report that family members and friends were important, and even very important, influences on their decision to file a claim.
- This study could have underestimated the influence of advertisements, media information, and screening programs on subjects' decisions to file an OHL claim. It is possible that publicly disseminated information, including intermediate person-to-person communication of that information, could have had a greater indirect than direct influence on subjects' decisions, by stimulating the people whom subjects considered to be important or more important influences. Similarly, it is plausible that the relative importance of publicly disseminated information and screening programs was under-appreciated by subjects.

Aim 3: To determine whether there is any substantial work-related risk at the present time for OHL in industries with high numbers and/or rates of OHL claims.

*The information provided by **Project 2** telephone survey subjects about conditions at their most recent noisy job – most of which occurred when OSHA/WISHA hearing conservation regulations were in force – suggested that many employers are not optimally compliant with those regulations. Based on the subject reports, employers in some industries, particularly construction and other non-manufacturing industries, are generally less compliant with regulations than employers in other industries.*

***Project 3**, the evaluation of work sites in selected industries, found that excessive noise exposure was common in all of the study industries. Nearly all companies had employee*

exposures that required a hearing loss prevention program, and more than half had employee exposures that required the employer to consider possible noise controls. In general, the possibility of new noise controls received no or low priority in all of the study industries.

- The percent of employees with excessive noise exposure differed significantly between the study industries. However, excessive exposure was common in all industries. In addition, the percent of employees with excessive noise exposure differed widely between companies within most of the study industries.
- Excessive employee noise exposure would have been 1.5 to 3 times more common if the NIOSH-recommended L_{eq} was used to characterize full-shift noise exposures, rather than the OSHA-specified L_{ave}.
- Employee noise exposures were relatively continuous at lumber mills. However, In all other industries, employee exposures generally were intermittent, and most employees spent at least several hours daily in areas where noise levels were under 85 dBA.
- In general, the possibility of new noise controls received no or low priority in all of the study industries. The study team judged that it would have been feasible for all or nearly all of the participant companies to implement one or more effective noise controls, at reasonable cost, to achieve a meaningful reduction in noise exposures for one or more employees. However, most companies had insufficient information about noise exposures in their workplace, and most had no plans to consider or implement any new noise controls.

Most of the evaluated companies had substantial shortcomings in their hearing loss prevention programs. In general, there was little difference between industries in the use of noise measurements or consideration of noise controls. However, policies and practices related to employee training, hearing protection, and audiometric testing were generally more complete in some industries than others. Within each industry, there were substantial differences between companies in the completeness of hearing loss prevention policies and practices. Every industry included some companies with relatively complete policies and practices and some companies where policies and practices were substantially incomplete.

- Employers are required to provide hearing loss prevention training upon first assignment of a new or relocated employee to a noise exposed position, and at least annually thereafter for all exposed employees. Annual training was not conducted by more than one-third of companies, and training had shortcomings at many other companies. Many employees who had annual training at their present company did not recall ever having such training.
- Employers are required to provide at least two different types of hearing protection for noise exposed employees. At most companies, all or nearly all employees reported that hearing protectors were readily available for them at no personal cost, although this was often limited to only one type of protector. However, at 25% of companies, between 11% and 48% of employees said that no hearing protectors were readily available for them.
- Employers are required to ensure that employees use appropriate hearing protection when noise exposure is excessive. Most company representatives reported no formal company policy or enforcement practices requiring use of hearing protection, either in the entire production area or in specific noisy areas. According to employees, however, hearing protector use policies were more common than reported by company representatives. The findings suggest a need for more enforcement at many companies and improved coordination of enforcement policies at other companies.

Hearing protection was commonly underused. Reported use was highest at companies with

relatively complete hearing conservation programs, and in industries where excessive noise exposure was most prevalent and least intermittent. Many employees had difficulty estimating how often, and presumably when, their noise exposure was excessive. This can pose a problem in situations where exposure is intermittent and hearing protection is used only during exposure.

- Overall, only 62% of interviewed employees said they always or almost always used hearing protection when they were exposed to loud noise. The reported use of hearing protection differed significantly between industries and, in general, was highest in industries where excessive noise exposure was most prevalent and least intermittent. The reported use of hearing protection was also generally highest at companies with relatively complete hearing conservation programs, particularly companies with actively enforced requirements to wear hearing protection. This suggests that greater company effort to ensure hearing protection can, on average, result in better employee hearing protective behavior.
- Overall, 25% of employees said they sometimes used hearing protection when they were exposed to loud noise, and another 13% said they either never (or almost never) used protection or were never exposed. It may be appropriate to consider these distinctions in endeavors to increase the use of hearing protection.
- Employees were often incorrect in estimating how often – and presumably when – they were exposed to loud noise. A commonly taught rule-of-thumb guideline for estimating noise levels was found to have limited reliability. This inaccuracy of employee perception could pose an important problem in industries where noise levels are intermittent and hearing protection may not be needed continuously, unless employees are given more than subjective guidelines for when and when not to wear hearing protection.

Hearing loss was common on existing audiometry for current and recent employees.

- Overall, 15% had enough hearing loss to meet American Medical Association criteria for impairment, and another 11% had moderate or worse high frequency loss without impairment. Among employees 55 years or older, 53% had evidence of impairment, and another 21% had moderate or worse high frequency hearing loss.
- Hearing loss was significantly more common in some industries than others. The difference between industries in the extent of hearing loss was seen in all except the youngest age group of employees, suggesting that the risk of hearing loss continues to the present, in at least six of the study industries.
- Employers are required to inform employees about abnormal findings on audiometry, and such findings can provide an important teaching opportunity, to inspire an employee to improve personal efforts to protect his/her hearing. However, the majority of workers whose audiometry revealed a clinically significant amount of hearing loss had not been informed – or did not recall being informed – that their audiometry showed an abnormality. More than a third had no tell-tale symptoms of hearing loss and were unaware of their hearing loss.
- Employers are required to provide written notification and training to individual employees who have a specified amount of hearing change over time, known as a standard threshold shift (STS). This important early indicator of possible noise effects on hearing was not being used effectively. Most employees whose audiometry showed an STS while they were employed at the present company did not recall ever being informed of that finding, and only about half of those who thought they had an STS had truly experienced one. Employee recollection of this important indicator was essentially no better than a random guess.

Aim 4: To assess the relative effectiveness of using workers' compensation claims information to "target" (i.e., appropriately identify) industries and worksites with remediable risk factors for a chronic occupational health problem, using OHL as a case in point.

***Project 3**, the evaluation of work sites in selected industries, found little evidence that claims statistics for OHL – and conceivably for other occupational illnesses that manifest many years after first exposure to a hazard – are useful for identifying industries where there is a high risk for developing that condition and where additional preventive measures are most needed.*

*In general, the reports by OHL claimants in the **Project 2** telephone survey about their most recent noisy workplace also were not an effective source of information for identifying industries that were substantially more in need of intervention than other industries, nor companies that were more in need of intervention than other companies within the same industry.*

It is conceivable that claims statistics or claimants' reports could be useful for targeting specific industries, if supplemented with other information about candidate target industries.

- This study evaluated companies in a limited number of industries, mostly in manufacturing, and included only one primary production industry, one construction industry, and no industries within the broad sector of "other" industries. Therefore, the study findings may have limited generalizability, particularly for the industries outside manufacturing sectors.
- The OHL claims statistics for the study industries showed no consistent relationship with either the average extent of employee overexposure to noise or the average completeness of hearing loss prevention policies and practices, at companies evaluated in those industries.
- One study industry, road construction, was an exception to this general conclusion. This industry had a very high incidence rate of OHL claims, and the companies evaluated in this industry tended to have substantially incomplete hearing loss prevention policies and practices. However, the average extent of employee overexposure to noise and completeness of hearing loss prevention policies and practices in this industry were comparable to what this study found in other industries with much lower rates or absolute numbers of OHL claims.
- Information about OHL claims may have limited or no usefulness for identifying specific companies where there is a relatively high need for additional preventive measures. Individual companies were no more likely to have incomplete hearing loss prevention policies or practices, if they had been assigned liability for one or more OHL claims or if an OHL claimant described them as a recent noisy workplace, compared to other companies that were not linked to an OHL claim, in the same industry.

The OHL claims statistics for the study industries showed a significant correlation with the average prevalence of hearing loss on audiometry records in each industry. In industries where OHL claims were more common, monitored employees were more likely to have hearing loss. Claims statistics for OHL – and conceivably other occupational illnesses – may be useful for targeting initiatives to identify workers who have that condition and who may not be aware they have the condition.

Information about the usual extent of noise in an industry is probably a better source of information for targeting interventions to reduce risk for developing OHL, than is information about hearing loss claims, although the two may be useful when considered together. In general, the average completeness of hearing loss prevention policies and practices at work sites in a study industry was strongly associated with the extent of noise overexposure in that industry. Furthermore, the intuitive response to information about noise levels would not necessarily be the best response. The industries with greatest margin for improving hearing loss prevention efforts are not necessarily the noisiest industries, but may be industries where noise exposure is more moderate or intermittent.

Table of Contents

List of Tables

List of Figures