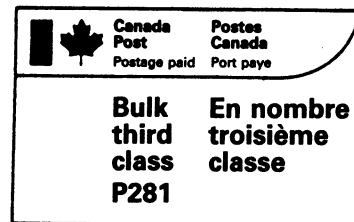
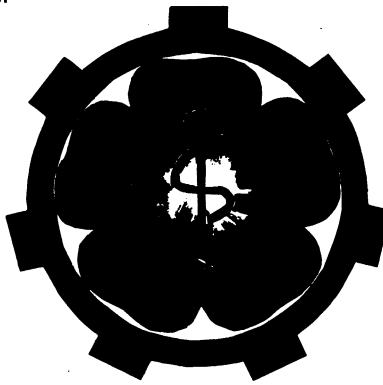


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Vol. V, No. 4

March 1988

ALBERTA OCCUPATIONAL MEDICINE NEWSLETTER

EDITORIAL COMMENTS

This issue brings to a close another volume of the Newsletter. During the past year, we have been fortunate to present a wide range of articles. In our shorter articles, we have covered a range from case reports to proceedings of meetings of interest to occupational health professionals. Our feature articles have ranged from practical concerns of dealing with occupational clinical syndromes to overviews of the meaning of evaluation and legislation specific to occupational health. Comments and requests for reprints received this year have indicated an interest in all types of topics presented thus far.

This issue brings a slightly different perspective to your attention. Both articles represent the results of Alberta research in occupational medicine. The first article derives from work done through the Alberta Occupational Health and Safety Heritage Research Grants Program, and focusses on risk factors for injury amongst an occupational group that is both common in Alberta, and frequently overlooked in occupational data — the farmers. In the second article, we are presented with an analysis of some of the vast amount of data collated by the Workers' Compensation Board each year. This article is the second part of a two-part series on hearing loss, a ubiquitous occupational concern.

We regret that, due to space limitations, we are unable to publish the second part of Bill Csokonay's article on health concerns of overseas employees; we hope to be able to present this to you in an upcoming issue. In the meantime, the staff of the Newsletter hopes that you enjoy the upcoming warmer weather, and that you are able to enjoy a break from

your own occupational settings in the months to follow.

Heather Bryant, MD, PhD, FRCPC

* * *

UPCOMING CONFERENCES

OCCUPATIONAL MEDICAL ASSOCIATION OF CANADA (OMAC)

The 1988 Annual OMAC Conference will be held in Quebec City from September 24 to 28. Although announcements and registration forms have not yet been sent out to OMAC members, the following facts can be used for planning purposes:

Location:	The Chateau Frontenac, Quebec City
September 24	Canadian Board of Occupational Medicine (CBOM) examinations
September 25	Seminar/workshops on occupational dermatology and on management skills for physicians
September 26/27	Scientific papers
September 28	OMAC/CBOM General Business Meetings

Physicians who are not currently members of OMAC and who are interested in joining the organization or in receiving more information about the conference, are invited to contact Dr. G. G. Jamieson in Calgary at (403) 288-5371. OMAC is the Canadian national organization which represents physicians who practice occupational medicine in any capacity, full-time or part-time.

UPCOMING CONFERENCES

CUMULATIVE TRAUMA DISORDER SYMPOSIUM

"Repetitive Motion Injuries of the Upper Extremity"
 Workers' Compensation Board of B.C.
 Auditorium, 6951 Westminister Highway,
 Richmond, British Columbia, April 22 & 23, 1988.

Contact:

Dr. Bob Brubaker
 Department of Health Care and Epidemiology
 Mather Building
 University of British Columbia
 Vancouver, British Columbia
 V6T 1W5

* * *

UPCOMING CONFERENCES

CANADIAN OCCUPATIONAL HEALTH ASSOCIATION

"Applying What We Know"
 Ottawa, Ontario, November 8-10, 1988.

Contact:

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 Occupational Health Unit
 Medical Services Branch
 Health and Welfare Canada
 du Chardon Street
 Tunney's Pasture
 Ottawa, Ontario

Prepared in the Department of Community Health Sciences, Faculty of Medicine,
 The University of Calgary, through funding by Alberta Community and Occupational Health.

VARIABLES INFLUENCING SELF-REPORTED SAFETY PRACTICES IN FARMERS

W. Andrew Harrell, B.A., M.A., Ph.D.*

INTRODUCTION

A recent study which examined the causes of farming-related accidents (Harrell, 1987) observed that farmers who routinely operated equipment, such as tractors, combines and hand tools, in a safe fashion had significantly lower risks of being seriously injured. Another factor highly predictive of accidents was whether or not farmers believed that risks must be taken to insure that a profit is made in one's business. Farmers who believed that higher profits justified health-endangering risks, indeed, showed both higher rates of personal-injury accidents and poorer safety habits in operating machinery.

This study also investigated the role that traditional masculinity plays in farm safety and risk of accidents. Other researchers have speculated that certain features of masculinity, notably an emphasis on personal risk taking and a generally careless attitude towards health, might be major contributors to sex differentials in mortality. This proved to be the case in the study of farm safety, with traditional men adopting a lifestyle which increased their risk of injury. Specifically, traditional men were more likely to take a variety of risks while at work and play, from driving automobiles recklessly to gambling. Risk-oriented farmers regarded profits gained from work-associated risks to far outweigh the costs. As a consequence, risk-oriented farmers worked longer hours, were exposed to more hazards at work and had higher accident rates; however, they did gain from their risk taking by acquiring larger, more profitable farming operations.

A second dimension of masculinity affecting accidents was the tendency for traditional men to suppress emotional expression. Such men minimized the perceived consequences and discomfort of accidents and illness. Farmers who kept their emotions in check felt that their chances of injury in the future were slight, in spite of having, in many cases, extensive histories of farming-related accidents. At the same time, they had a stoic acceptance of accidents as something inevitable, especially if one worked hard to get ahead in life.

Two surprising findings in this study were that neither a farmer's age nor the amount of his exposure to hazards had significant predictive effects on accident rates. Previous research had indicated that both variables were strong contributors to interindividual variations in accidents.

The data which I would like to present in this article examines more fully these

variables and their influence on specific safety practices.

METHOD

The Sample

In 1983 a lengthy self-administered questionnaire on farm safety and accident involvement was sent to 1,300 male members of an Alberta based farmer's association. A total of 683 questionnaires, or 52.5 percent, were returned.

The Variables

Predictors of safety practices include: farmer's age, exposure to hazards, prior accident history and three dimensions of traditional masculinity. Age of farmers varied from 21 years to 85 years, with a median of 49 years. Exposure to hazard was measured by the number of self-reported eight hour or longer days spent at farming activities. Prior accident history was measured in two ways. First, respondents reported how many previous farming-related accidents requiring medical attention had been experienced over a career. Secondly, they reported whether a farming accident had permanently injured or disabled them, such as the loss of a limb.

A number of survey items dealt with various aspects of traditional masculinity. Three dimensions — risk taking, impulsivity and inexpressiveness — are analyzed here.

A factor analysis of 20 items dealing with a range of farm safety practices revealed four major factors or clusterings of items. Representative items comprising these four factors are shown in Table 1.

The first two factors concern precautionary activities which farmers might take to avoid accidents or to minimize their risks. The first factor, termed precautionary operation of equipment, concerns the measures that a farmer takes to insure that he and those who work with him operate machinery with due care. The second factor concerns anticipation of accidents and efforts to prevent them. Measures include posting signs designed to prompt safety, and providing first aid kits.

The next two factors deal with actual safety behaviors. Factor three contains items describing how a farmer might behave to minimize his personal risk when using hand tools or when applying chemicals. The fourth factor deals with safety in operating machinery and equipment.

Analysis

In the original analysis, a series of multiple regressions was carried out. To better communicate the findings in this article, bivariate cross-tabular results are reported.

RESULTS AND DISCUSSION

Factor 1: Precautionary Equipment Operation

Two of the masculinity scales, risk taking and impulsiveness, were significantly related to this factor. Farmers who scored above the median on risk taking were significantly less likely (46.0 percent) than farmers below the median (60.0 percent) to score high on this scale of safety. Farmers above the median on impulsiveness (51.0 percent) were less likely than those below the median (61.0 percent) to have high scores.

Age was positively related to safety, with farmers 41 years or younger less likely (47.9 percent) than farmers 42-56 years (61.4 percent) or farmers older than 56 years (59.0 percent) to take precautions.

Prior accident history was also significantly related to precautions. Farmers reporting at least one accident in the past were less likely to take precautions (50.8 percent) than were accident-free farmers (64.3 percent).

Factor 2: General Precautionary Behaviors

Once again, impulsiveness was related to safety. Highly impulsive farmers were less likely (43.5 percent) than non-impulsive farmers (54.0 percent) to act safely. Farmers with a permanent injury from an accident were more likely (67.0 percent) than farmers lacking such an injury (46.5 percent) to observe these precautions. It appears then that prior accidents seem to "teach a lesson", resulting in safer behaviors only when a serious, disabling injury has occurred.

Factor 3: Safety Device Use

The only significant predictor was the number of prior farming-related accidents. Accident-free farmers (61.5 percent) were more likely to use these devices than were farmers with one prior accident (55.0 percent) or two or more accidents (50.0 percent).

Factor 4: Safe Equipment Operation

All three of the masculinity scales were significantly related to this factor. Inexpressive farmers were less likely (50.3 percent) than expressive farmers (59.3 percent) to operate equipment safely. High risk takers (50.8 percent) were less likely than low risk takers (59.6 percent) to behave safely. Impulsive farmers behaved less safely (50.8 percent) than less impulsive farmers (58.5 percent).

Age showed a nonlinear relationship to this safety factor. Middle-aged farmers, 42-56 years, were the safest (60.4 percent), followed by farmers 41 years or younger (55.8 percent). Farmers older than 56 years were the least safe (47.5 percent).

Table 1

Representative Items from Safety Practices Factors

1. Factor 1: Precautionary Equipment Operation

- (a) I am careful when operating farm equipment for the first time.
- (b) Before using a new piece of equipment I carefully read the operator's manual.

2. Factor 2: General Precautionary Behaviors

- (a) Signs are posted around the farm reminding myself and others to observe safe work habits.
- (b) A first aid kit is available where work is carried out.

3. Factor 3: Safety Device Use

- (a) When I am using hand tools, I wear safety gloves.
- (b) When I am applying any chemicals, I wear protective devices such as gloves or masks.

4. Factor 4: Safe Equipment Operation

- (a) When repairing or unclogging farm machinery, I turn off the equipment before working on it.
- (b) When operating farm machinery, I keep all safety shields and guards in place.

While the amount of time spent actively involved in farm work (exposure) did not directly predict any of the farm safety factors, it did increase the impact of the masculinity scales and prior accident history. Thus, the predictive power of impulsiveness, risk taking and expressiveness was greater for farmers who were above average in hours spent at work during a week. Predictive power was much diminished for farmers with low activity levels. Because of their overall low rates, a tendency toward risk taking or impulsivity had little opportunity for expression. With higher activity levels, farmers who were risk takers or impulsive tended to cut corners in their work lives by placing less importance on safety.

Exposure levels also affected the predictive power of prior accident history.

The strength of the association between accident history and safety was considerably higher when activity levels were high. Farmers who had one or more previous accidents were more likely to display poor safety practices when a high level of farming activity allowed for their expression. Low activity farmers with prior accident histories might have in fact been predisposed to carelessness in their safety practices, but their low activity levels precluded its expression.

References available on request.

**Professor, Centre for Experimental Sociology, The University of Alberta, Edmonton, Alberta*

* * * * *

NOISE INDUCED HEARING LOSS: PART II

CHARACTERISTICS AND COSTS OF CLAIMS SUBMITTED TO THE ALBERTA WORKERS COMPENSATION BOARD FOR HEARING LOSS

Ronald M. Dufresne, M.D., C.C.B.O.M.*
 Brian C. Alleyne, F.I.M.L.S., M.Sc.**
 Michael R. Reesal, M.B., Ph.D.,
 F.R.C.P.(C).***

Claims for noise induced hearing loss (NIHL) submitted to the Workers' Compensation Board (WCB), Alberta, for the ten year period 1976-1985, have increased by 240 percent (Table 1). This trend is being accompanied by an even greater relative increase in costs. The NIHL claims received during 1987 will commit the WCB to pension payments in excess of \$4 million, up from \$0.32 million in 1976. Similar increases are being observed in most jurisdictions in North America and it has been estimated that by the year 2000, hearing loss in Canada would reach an annual commitment of \$1.2 billion

(U.S.). The cutting irony of this observation of rising claims and costs is that while the nature and cause of this disease have long been fully understood, prevention has been ineffective.

In this survey we attempt to determine some of the characteristics and costs of occupationally related noise induced hearing loss in Alberta by analyzing information from WCB claim files.

PROCEDURES

A. Analysis of Characteristics

From each claim file in a cohort of 664 claims (1979-1983), 21 variables were extracted and coded for computer analysis. Variables included age, sex, employer, occupation, hearing thresholds at 250, 500, 1000, 2000, 3000, 4000, 6000 and 8000 Hz for each audiogram, the claim number and the date each claim was filed.

B. Criteria for Evaluating Pension Levels, Using Audiograms

According to current Workers' Compensation Board (Alberta) policy, an aver-

age noise induced hearing loss in excess of 35 dB, assessed at 0.5, 1, 2, 3 kHz is entitled to an amount of pension according to the degree of hearing impairment. Acceptable NIHL claims which have not attained the 35 dB average are entitled to rehabilitation, if necessary, and prescribed hearing aids. Loss of hearing in excess of an average loss of 80 dB is given a "whole body impairment" assessment of 5 percent for a single ear, and 30 percent for both ears. A graduated scale, in accordance with methods proposed in the American Medical Association guidelines (1) for combining hearing loss in both ears, provides the basis for interval calculations.

C. Years of Potential Hearing Loss

Since hearing loss has its greatest impact in morbidity among those who live longer, we calculated a "Years of Potential Hearing Loss (YPHL)" to express the impact of hearing loss on the working population. This indicator followed precedents adopted for calculating the "Years of Potential Life Loss (YPLL)", as proposed by Romeder and McWhinnie (2). The age at which the worker filed a valid claim was taken as the initial point and the 70th birthday, the end point. Among the 664 claimants, 207 who received a pension were between the age of 18 and 70. We calculated a YPHL on these 207 workers.

D. Estimating Compensation Costs

The final decision concerning acceptance or denial of any claim submitted to the Compensation Board is reached without delay, as required by Statute, or may be delayed for several years. Therefore, the cost of claims received during any year may be spread out over several years. For this reason, fiscal procedures were employed to correct for delays in settlement.

E. Noise Assessment

We asked a University Engineering student, who has an interest in acoustics, to assign the noise exposure level which best represented the average work experience using the claimant's work history alone as the basis for this estimate. This data was submitted for analysis and a correlation with the number of pensioned workers is illustrated in Figure 1.

RESULTS

A composite audiogram made up of averages derived from the first audiogram of each acceptable claim (Figure 2) shows the characteristic 4-6 kHz depression observed in noise induced hearing loss.

The worker's first job seems to exert considerable (probably the greatest) influence on whether a worker will sustain NIHL. Claimants with information on the length of time spent in their first job revealed that 9 percent (54) stayed in their first job for less than 1 year, 23 percent (137) stayed 1-5 years, 11 percent (64) 6-10 years and, 25 percent (148) more than 10

Table 1
Disposition of Hearing Loss Claims
(1976-1985)

YEAR	Status at end of December 1985			
	N	NF	R	A
1976	86	0	15	71
1977	80	0	12	68
1978	64	0	14	50
1979	87	0	18	69
1980	122	0	31	91
1981	118	0	12	106
1982	134	0	30	104
1983	203	0	47	156
1984	265	10	53	202
1985	292	37	64	191

N = total number of claims received during that year

NF = not finalized by December 1986

R = rejected

A = accepted

years. As indicated in Figure 1, 80 percent of workers with NIHL had first-job experiences with excessive noise. (The 77-85 dB group comprised 20 percent of the pensioned workers.)

In addition to noise induced hearing loss, some 13 percent of hearing loss claims originated from traumatic injury, such as burns to the middle ear from molten slag during welding, and head injuries. This may account partly for the higher than expected numbers of pensioned claims awarded to workers exposed to less than 85 dB of noise in first jobs (Figure 1).

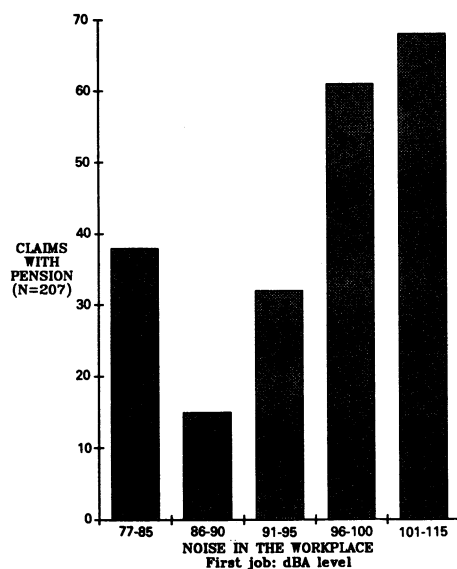


Figure 1

Pensioned workers (PW) were 15 years older than non-pensioned workers (NPW); an average age of 58.6 years, with a range of 23-85 years for PW, compared with 43 years and a range of 21-86 years for NPW (Table 2).

Industries that employed workers who received pensions are shown in Figure 3. As frequently reported in other countries, construction and manufacturing account for the greatest proportion of workers with claims for hearing loss.

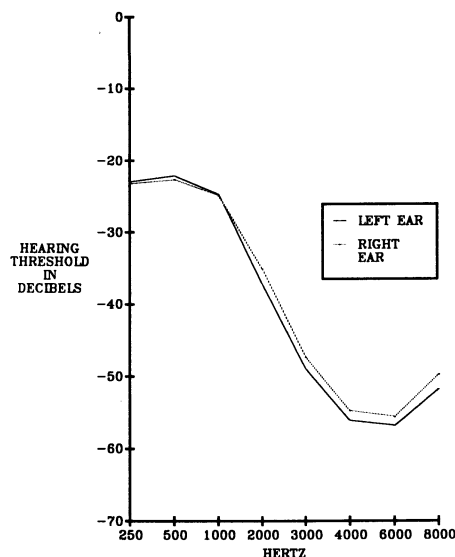


Figure 2

Approximately 50 percent of PW received awards of between 1-5 percent (Figure 4). An overall average of 5.7 percent disability was awarded for hearing loss (Table 2). More than 40 percent of PW received pensions in excess of 5 percent, the award assigned to complete deafness in one ear (Figure 4).

Our analysis of symptoms, injury and related illnesses, emphasizes the importance of tinnitus in relation to work related hearing loss (WRHL). More than half of workers with acceptable claims complained of persistent tinnitus, and 13 percent complained of dizziness (Figure 5), both of which are related to neurosensory inner ear injury.

For the five year period, 1979-1983, among 664 claims, we calculated a total YPHL of 2529 for 207 PW between age 18 and 70 years. More than one-third of the morbidity caused by WRHL is inflicted on workers 56 years of age or younger (Figure 6).

In addition to measuring the personal and social impact of WRHL on the working population, we wanted to determine the dollar cost of this disability to a compensation system. We chose to examine the cost of processing all WRHL claims received during 1983, and last year we had accessible financial data for settled claims. (By the end of 1986, all 1983 claims had been settled.)

Table 2
Characteristics and Disposition of Claims (1979-1983)*

Sex/Age	Number	Percent
Male	564	93.7
Female	38	6.3
Mean Age	48.6	(21-86)
With Pension	58.6	(23-85)
Without Pension	43	(21-86)
Hearing/Pension Status	Number	Percent
WRHL with Pension	218	36
(Hearing Aid prescribed)	(148)	(68)
WRHL without Pension	384	64
(Hearing Aid prescribed)	(42)	(11)
Trauma Related Hearing Loss Claims	78	13
Noise Induced Hearing Loss Claims	524	
Total Claims*	602	

Average permanent disability awards was 5.7 yrs (range 1.4 - 23 years)

WRHL = Work Related Hearing Loss

*62 claims were excluded from the cohort because their "stated dates of occurrence" of the work accident dated before 1979.

Of 203 claims received during 1983, 47 were rejected. The disposition of these claims and their costs are shown in Table 3. The cost in each of the four years (1983-1986) outlines the components of costs: compensation (COMP), for days off work; medical aid (M/A), for medical consultations and treatments; and, pensions (PENS), for permanent disability payments. The average cost per accepted claim for those received during 1983 was \$14,106. The administrative costs and the costs of tangible real assets required to operate the physical plant of the WCB Alberta amounted to an estimated \$642 per claim received during 1983. Adding

these costs of operation to the average cost for compensation of a claim in 1983 yields \$14,748. Pension payments account for the major portion of the capital costs committed for hearing loss claims. The 47 claims rejected incurred a total cost of \$3,298 or \$70/claim.

We also examined costs by following the cost-distribution for the cohort of 664 claims received during 1979-1983, as shown in Figure 7. The average cost per accepted claim over this period was \$9,241. Adding the administrative and operating costs, an average of \$527/claim yields \$9,768/claim.

Table 3
Cost of Claims
Entered in 1983 (N = 203)

	1983	1984	1985	1986	Total
Acc	22	81	24	29	156
Rej	22	24	1	-	47
Total	44	105	25	29	203
Comp \$	2256	4161	442	18574	25433
M/A \$	3333	38242	17858	24426	84859
Pens \$	158508	976793	405390	550526	2091217
Total\$	164097	1019196	423690	593526	2200509

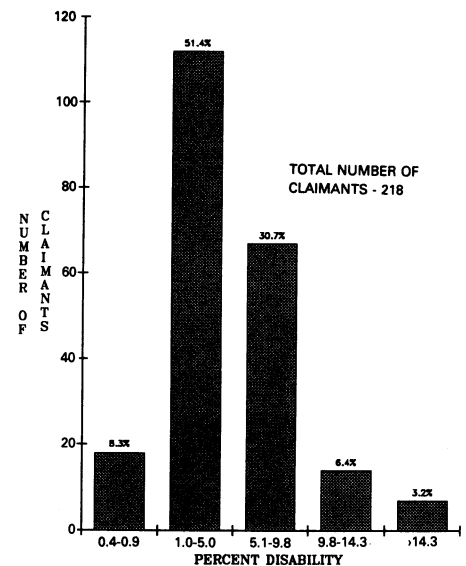
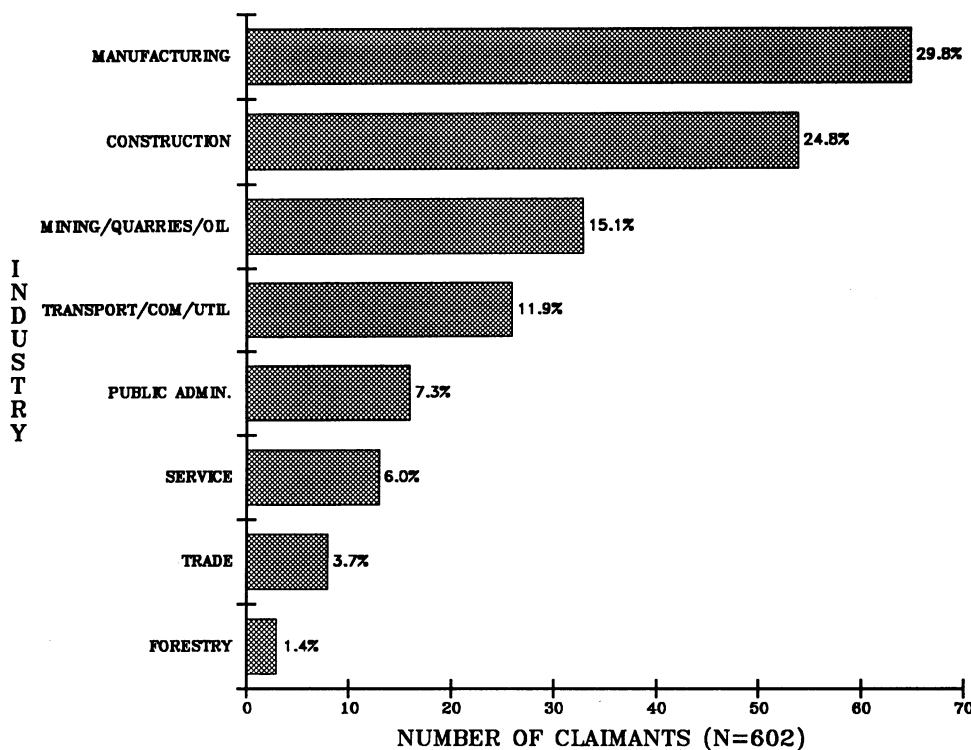
Acc = accepted claims

Rej = rejected claims

Comp \$ = money received in compensation for days off work

M/A \$\$ = money paid for medical costs — physician report audiogram, consultation, hearing aid

Pens \$ = money paid as disability pension



DISCUSSION

In our examination of both the characteristics and costs of hearing loss claims submitted to the Workers Compensation Board of Alberta, we reviewed experiences mainly for the years from 1979-1983, from which we calculated predictable costs.

Our study revealed little that is new, or unexpected, in the characteristics we chose to analyze: Most claims submitted by Alberta workers are valid; audiograms demonstrate the typical 4-6 kHz depression. Claimants are mainly male workers in the manufacturing and construction industries, and their hearing loss is frequently associated with tinnitus.

The cost analysis, however, yields information on costs that are unexpectedly high and, we believe, raises issues which need to be seriously addressed because both the social and monetary costs are accelerating beyond control.

The average loss of hearing among workers who submit valid claims shows a 6 percent impairment. This represents a considerable sensory disruption, viewed in the context that a five percent impairment represents complete loss of hearing in one ear. Moreover, since a substantial proportion (40 percent) of workers who qualify for NIHL pensions are under 55, this form of sensory deprivation is being inflicted on a relatively young age group and is currently costing society some four million dollars per year in pensions.

This trend is disturbing when one considers that:

1. large numbers of workers are at risk,
2. it is impossible during disability assessment of any worker to determine the out-of-work contribution, the proportion of NIHL which originates from sources outside the noisy workplace,
3. noise induced hearing loss is preventable, and

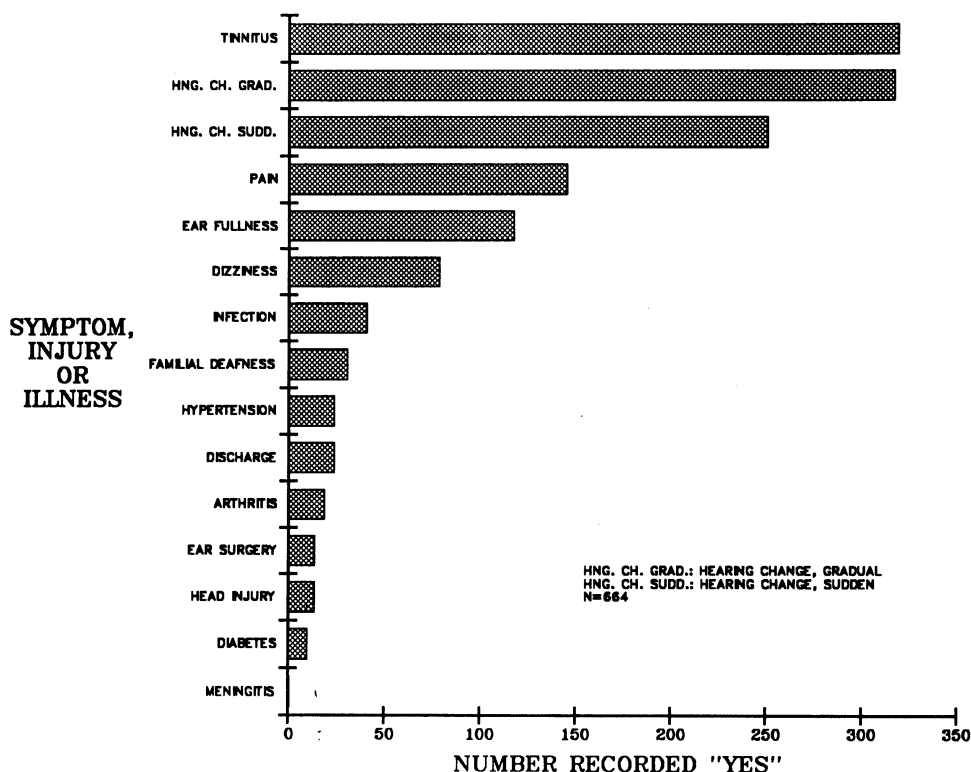


Figure 5

4. criteria on which current payments are based may not fully compensate for the disability experienced.

Current assessment based on audiogram readings alone ignore the extent to which hearing loss affects peoples' lives. We do not attempt to assess the extent to which NIHL disrupts normal activities of daily living and working. In this society audible communications are necessary for appreciating both the ordinary and the finer forms of recreation and culture. We do not measure the "gap" when we fail to translate impairment into the social impact of disability on the working population. Can we convert functional impairment of a sense organ into a fairer award of disability? Atherley and Noble (3) have brought attention to problems which surface when disturbances in workers' social and personal enjoyment are ignored.

To provide an insight into social morbidity, we adopted a new approach by expressing morbidity from industrial hearing loss as an index, the YPHL. We estimated the YPHL from the age at which a compensable hearing loss was attained, to the age of 70. For the 207 pensioners studied over a five year period, we calculated a YPHL of 2529. This amounts to 12.2 YPHL for each worker receiving a pension, more than a third of whom are less than 56 years of age and 15 percent are less than 48. These observations indicate that a considerable hearing impairment is sustained by relatively young people. Since pensions are paid over the working lifetime, approximately 2500 YPHL in 200 pensioners, and the number of affected younger workers, reflect both

the current costs and future burden of hearing loss on society.

We realize this survey does not encompass the full extent of work-related hearing loss in Alberta. Our assessment was technically biased by studying only workers who chose to submit a claim to the WCB.

We have no comparable information on the characteristics of individuals (20 percent) not insured by the WCB Alberta. These include workers employed in agriculture, general office workers, and employees of professions, consulting and financial institutions.

However, since we planned to determine the characteristics and costs for work-related hearing loss reported to a compensation system, we accepted the limitations imposed by this selection. We are aware that our findings do not achieve the ideal in which everyone who could have suffered work related hearing loss has been compensated. Of the 20 percent uninsured, at least one industry, agriculture, which makes up seven percent of the total working population, is likely to contain workers who sustain noise induced hearing loss, without WCB compensation.

This bias does not however detract from our main objective: to demonstrate that NIHL incurs a relatively heavy and increasing cost to compensation systems and to workers. These costs can be expressed both in dollar amounts committed by a compensation system and in the Years of Potential Hearing Loss.

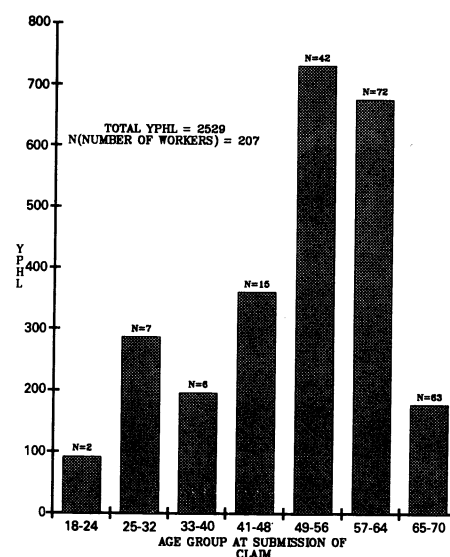


Figure 6

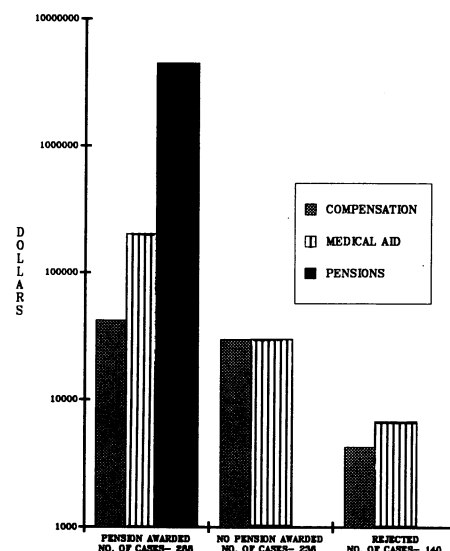


Figure 7

Acknowledgement:

The authors are grateful to Donna Suggett, R.N., Winona Northrup and Nasim Kanji for invaluable assistance during preparation of this manuscript and to Jim Meyer for preparation of the illustrations.

References available on request.

(This article has been accepted in similar format by the Journal of Occupational Medicine.)

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