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FINAL PROJECT REPORT

PATTERNS OF HEALTH AND HEALTH SERVICE USE IN CONSTRUCTION

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Abbreviations

ANSI	American National Standards Institute
ASRD	Alcohol or Substance Abuse Related Disorders
BLS	Bureau of Labor Statistics
CPS	Current Population Survey
CPT	Current Procedural Terminology
CPWR	The Center to Protect Workers' Rights
CTWW	Carpenters' Trusts of Western Washington
DRG	Diagnostic Related Group
H&W	Health and Welfare
HCFA	Health Care Financial Administration
ICD-9-CM	International Classification of Diseases Clinical Modification
ICP-9	International Classification of Diseases
L&I	Washington State Department of Labor and Industries
MMWR	Morbidity and Mortality Weekly Report
NAMCS	National Ambulatory Medical Care Survey
NEISS	National Electronic Injury Surveillance System
NHDS	National Hospital Discharge Survey
NIOSH	National Institution for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
SEER	Surveillance, Epidemiology and End Results
SIR	Standardized Incidence Ratio
US	United States
WC	Workers' Compensation

I. SIGNIFICANT FINDINGS

General

Through combining data from a number of administrative data sources (union records, health insurance claims, workers' compensation records) we were able to clearly define two occupational cohorts, i.e., carpenters and laborers, as well as their health care received through their union insurance coverage, their work-related injuries (and illnesses) and the health care received for these injuries. Personal identifiers allowed us to link these data on an individual basis. This provided the unique opportunity to look comprehensively at the health care received by these two occupational groups and the costs for care per month of insurance eligibility or per hours worked as most appropriate for the given analyses. The individually linked data allowed us to address several issues using longitudinal analyses.

The methods we have used provide data that are particularly useful for analyses of work-related injuries and illnesses reported through the workers' compensation system. By using actual reports of hours worked from union records, we are able to calculate rates of injury and identify high risk sub-groups within the cohorts. Our findings for both the carpenters and the laborers document rates of injury much higher than reported through the Bureau of Labor Statistics. The discrepancies are greatest for less serious events, which did not result in paid lost time, but still exist for lost time injuries as well. We had previously reported similar findings based on analyses of the carpenters for a shorter period of time (Lipscomb, Kalat, Dement, 1996). This finding remains consistent using a longer follow up period for the carpenters and among the laborers cohort as well.

While these data are very useful for making comparisons of groups within the cohorts, we found it very difficult to identify appropriate sources of national data on health care utilization with which to compare our cohorts' experiences. Although national survey data exist, such as the National Ambulatory Medical Care Survey (NAMCS) and the National Hospital Discharge Survey (NHDS), after stratifying these national data by age, sex and disease groups that would be useful for epidemiologic purposes, the estimates of utilization rates were often based on very small numbers with standard errors too large to be considered reliable. We also encountered difficulty in identifying doctors' office visits in our data that could be used for comparison with the national doctors' office visits data from NAMCS. Little national data are available for comparison of care received through workers' compensation and for treatments for alcohol and substance abuse -- both of which are important in understanding how these construction workers differ from the general United States population with respect to these factors.

The rates of health care utilization for carpenters and laborers were overall quite comparable through the workers' compensation system. However, the laborers consistently have much higher utilization through their union insurance coverage than do the carpenters, despite very comparable coverage between the two union insurance plans. This difference remained even after taking into account differences between the cohorts in age and sex distribution. The strikingly high rate of care for injuries and poisonings through their union insurance for both carpenters and laborers raises the question of whether some of their work-related care might actually be delivered through their union insurance. Both carpenters and laborers also had very high rates of utilization usculoskeletal disorders, respiratory diseases, and mental health disorders, particularly those :d to substance abuse.

A very significant proportion of health care was delivered for these construction workers gh the workers' compensation system. Carpenters incurred 55.7% of all of their charges for itient care through workers' compensation and 22.9% of charges for hospital care; the ers incurred 34% of outpatient charges and 21.2% of hospital charges.

le Specific

Carpenters

Among carpenters, the most common mechanisms of work-related injuries were struck by, exertion, struck against, abraded, falls from elevations and falls from same level in that order. exertion injuries were responsible for the greatest medical costs ($20,304 per 100 person- or 200,000 hours worked). Although falls from elevations were the fifth most common ianism of injury among carpenters, they ranked second in costs for medical care per 100,000 on-years of hours worked ($10,725). These results demonstrate that injuries from falls are of re serious nature and should be targets for intervention.

Among carpenters whose predominant type of work involved drywall installation, :rock was associated with over 40% of their work-related injuries. Struck by injuries eased steadily with increasing age and experience in the union, likely reflections of training and rience or possibly different job exposures. These injuries most often involve cuts to the upper :mity. In contrast, there was a steady increase in the rate of falls with increasing age, and falls ted in injuries to the knee, back, and multiple sites. The rate of overexertion injuries varied by age or time in the union, perhaps due to the consistently heavy nature of this work. 'exertion injuries were responsible for the greatest proportion of costs for medical care, ianent impairment, and paid lost days, and they most often involved sprains or strains to the . Overexertion injuries will likely become an even more significant issue as the industry moves rger, and consequently heavier and bulkier, sheets of drywall.

Eye injuries were responsible for 12% of workers' compensation claims with claims filed at stimated rate of 6.1 per 100 person-years of hours (200,000 hours) worked. Individuals with ious work-related eye injuries had 1.6 times higher rates of injury than individuals without ious eye injuries. Although very common, eye injuries rarely were severe enough to require time off from work. At least 10% of all medical costs for eye injuries and 35.5% of medical s for eye injuries which resulted in paid lost time were associated with injuries sustained while nering – a very common carpenter exposure. These findings raise questions about factors h might influence the failure to use appropriate protection including availability and ptability of eye protection, use of protection by peers, and perception of risk.

The overall claim rate for upper extremity musculoskeletal injuries was 5.3 per 100 person- s of work (200,000 hours). One third of these upper extremity claims resulted in paid lost time ı work. Carpenters with less than one year of experience had nearly a two-fold risk of injury pared to carpenters with 15 or more years of experience. The least experienced workers were

2.5 times more likely to have an injury resulting in paid lost time from work, had longer periods of time away from work, and were twice as likely to have a second injury. The impact of these findings related to inexperienced carpenters is substantial since they make up a very large proportion of the cohort. Women carpenters were twice as likely as men to have an upper extremity injury and nearly three times as likely to require paid lost time. The increase in risk for paid lost time injuries among women was mostly due to injuries to the lower arm.

Questionnaires completed by injured carpenters and interviews with a small group of carpenters who experienced work-related injuries document that, for some individuals at least, there are serious repercussions of work injury across several domains including financial and health care needs, social support, and career and life changes. Interviewed workers made recommendations including the appointment of a union representative for injured workers, peer support opportunities, mentors for women in the trade, changes in the benefit structure to address gaps in coverage, learning opportunities and avenues for moving up within the construction industry or into new careers, improvements in health and safety, and education and political advocacy for policies which protect and assist injured workers.

Mental disorders were the second leading reason for outpatient medical care for carpenters. These visits were predominantly related to alcohol or substance abuse. Individuals who had diagnoses of alcohol or substance abuse had significantly higher injury-related health care utilization through their union insurance coverage (RR=2 for outpatient care and RR=4.3 for inpatient care). The cost ratios for injury care through their union insurance were greater than the utilization ratios – a likely indication that those with these diagnoses sustained more serious injuries as well. Through workers' compensation we did not find significant evidence of higher injury rates, higher utilization or greater costs for those with alcohol or substance abuse related diagnoses. One possible, or partial, explanation for the different patterns in private and workers' compensation insurance is cost-shifting with individuals with substance abuse problems being more likely to seek injury related care through their "no fault" private insurance. However, our analyses of the more rare serious events which resulted in hospitalization, in which the individual would be less able to exercise an option for payment are not consistent with this explanation. Individuals with diagnoses of alcohol or substance abuse problems may not be likely to use substances on the job.

Laborers

The cohort of construction laborers was involved in many different types of work and data were not available to accurately characterize the work of individual workers. Therefore, we are not able to relate medical care, and more specifically, medical care for the treatment of injuries to exposures that might have occurred in the workplace. However, the distribution of medical care contacts and of charges for medical care by diagnosis raise some interesting questions that warrant further investigation.

As expected, the proportion of outpatient visits among male laborers covered by workers' compensation is highest for injuries and poisonings (68%) and next highest of musculoskeletal disorders (19%). For outpatient visits covered by the union health insurance, on the other hand, musculoskeletal disorders accounted for 32% and injuries and poisonings for 12%. More detailed analyses are needed to determine whether the presumed non-work-related musculoskeletal disorders and injuries have any relationship to the corresponding work-related conditions. Particularly for the musculoskeletal disorders, the condition may have been present in some instances before it was recognized as work-related or it may have continued to be a problem after coverage by workers' compensation ceased.

When we examine medical care by type of injury, overexertion accounts for 45% of the time-loss injuries and falls account for 18%. By nature of injury, sprains account for half of the time-loss injuries, and the back is the part of the body most often affected, accounting for 29% of the time-loss injuries. This shows fairly clearly that these construction laborers are at considerable risk of ergonomic injuries and suggests that the type of work they do should be studied to determine the necessary interventions to reduce the risk for these kinds of injuries.

Although females represented only 11% of the laborer cohort, their rates of outpatient visits under the union health insurance were considerably higher than those for males. Overall, the visit rate was 50% higher and the rates for females were higher in every age group. About one-third of the female outpatient visits under the union health insurance were for the treatment of musculoskeletal disorders. The proportion of outpatient visits under workers compensation that were due to musculoskeletal disorders for females was only 17% compared with 32% for males. The reasons for these differences represent a target for further investigation.

Analysis of charges for medical care covered by the union health insurance by selected disease groups reveals that injuries and poisonings account for 14% of the charges, and heart disease, mental disorders, and musculoskeletal disorders each account for 10%. For medical care covered by workers' compensation, on the other hand, injuries and poisonings account for 47% of the charges and musculoskeletal disorders for 25%.

As noted above, mental disorders account for 10% of the charges for medical care under the union health insurance. Most of this expenditure is due to substance abuse treatment and, more specifically, to treatment of alcohol dependence (ICD-9 code 303) which accounts for 8% of total outpatient visits under the union health insurance. This has been a consistent problem over the years (Pollack and Ringen, 1993) and has been shown to increase the risk of injury on the job (Pollack et al., 1998). While the union health insurance covers the treatment for alcohol dependence for these laborers only if they enroll in a membership assistance program, more attention needs to be given to ways of preventing substance abuse problems from occurring.

II. USEFULNESS OF FINDINGS

Perhaps the most useful aspect of the findings of this study is that they point toward specific directions for opportunities for intervention to improve the health of both the carpenters and the laborers. For example, one of the striking findings in this study is that the two diagnostic categories with the highest charges for medical care under both the union health and welfare insurance and workers' compensation and for both carpenters and laborers were musculoskeletal disorders and injuries and poisonings. About half of the workers' compensation charges are for the treatment of injuries and poisonings, and a quarter of those charges are due to musculoskeletal disorders. These findings lead us to focus on more specific details of these problems and efforts to find ways to deal more directly to eliminate hazards in the workplace.

While these data do not identify the etiology of the musculoskeletal disorders, the disorders themselves likely influence construction workers' abilities to do heavy work regardless of their etiology. Another possibility may be that these conditions, particularly the musculoskeletal disorders, may be a continuation of the effects of the workplace, or vice versa. For the most part, prevention efforts have focused on the workplace. However, these findings suggest that we should examine the injuries and musculoskeletal disorders that were treated under the health and welfare insurance to determine what kind of intervention outside the workplace might be in order, such as, determining possible work limitations. A survey of construction workers seen in the emergency room of an urban general hospital for treatment of musculoskeletal disorders found that two-thirds of those interviewed had musculoskeletal problems that persisted several months after initial contact (Welch et al., 1999). Intervention in that situation might involve a rehabilitation program that focuses on those disorders.

As far as the effects of life style are concerned, data from elsewhere have shown that both the carpenters and laborers have among the highest rates of current smokers and high rates of alcohol dependence. This becomes apparent by the high rates of substance abuse that have been diagnosed through the union health insurance. These insurance plans already have provisions that require the use of approved treatment programs, and it appears that a substantial number of members have been diagnosed with such disorders. There are undoubtedly a number of workers who have alcohol problems that have not been diagnosed and who could benefit from a program aimed at prevention. We have documented that carpenters with substance abuse diagnoses have higher injury care utilization covered by the union health insurance. These findings clearly indicate the continued need for substance abuse services through their union insurance (one of the services with a $10,000 cap on lifetime services) and also evaluation of the effectiveness of these services. They also raise questions about the long term effects of these problems in other areas – including possible effects on the heath care utilization of the family unit.

It is more difficult to identify the effects of smoking from data of this kind from working populations, primarily because the diseases that are caused by smoking, such as lung cancer, appear with greater frequency in later life. Therefore, disease outcomes that result from smoking are less likely to appear in a working population than, for example, in a retired population. However, the relatively high rate of treatment for heart disease and for respiratory diseases may be partially due to cigarette smoking over a long period of time. This suggests further study that would obtain information on smoking from workers that could be linked with their medical care

This may lead to better evidence that could form the basis for a focused prevention program.

Although follow up time was a limiting factor in the analyses, our findings were not stent with shifting of costs from one health care payment system to the other. Overall, we did at carpenters and laborers who experienced work-related injuries utilized more health es through their union plans than those without work injuries. After injuries carpenters had rates of utilization through their union insurance than before, but laborers had slightly ised rates. These findings seem to suggest that those who use services in one system are to use services in the other system.

III. ABSTRACT

Purpose

In the United States, the cost of health care delivery for individuals working in the construction trades is theoretically covered by two different insurance systems – private insurance through an employer or union and workers compensation. Although in theory these two systems are separate, and in combination they should provide comprehensive coverage, there are potential gaps and overlaps between them. Chronic diseases and ailments that arise gradually from exposures in the workplace are much less likely to be recognized through workers' compensation than events which are the result of acute injury. Little is known about the delivery of health services to construction workers. Union construction workers, who receive their health insurance coverage through jointly trusteed health and welfare trusts, may have lapses of coverage during periods of unemployment – which is not uncommon in the construction trades due to the very nature of the work. The purposes of this work included the study of overall rates and patterns of health care utilization among construction carpenters and laborers including health conditions of possible occupational origin; the magnitude of costs associated with their care; and the identification of sequellae of serious occupational illness or injury on health care coverage, utilization, occupational status and personal and family status. The goal was to compare patterns of care within subgroups of each of the cohorts and to compare care received under workers' compensation and private health insurance.

Methods

By combining data from a number of administrative sources, we were able to clearly define occupational cohorts of union carpenters and laborers, the health care they received through their union health insurance coverage, their work-related injuries and illnesses and the care received for these through workers' compensation. We were also able to identify periods of eligibility for health insurance coverage and hours worked thus providing measures of time at risk. These data together provided the unique opportunity to look comprehensively at the health care received by these two occupational groups, the costs of care for different conditions per month of insurance eligibility or hours worked as most appropriate for the given analyses, and defined occupational illness and injury rates. Through the use of personal identifiers we were able to link data on an individual basis across the union health insurance and workers' compensation systems. This allowed us to explore a number of issues using longitudinal analyses.

Analyses were conducted of injury and illness rates defined through workers' compensation using hours worked as a measure of time at risk. Crude and stratified rates were generated for all injuries and injuries resulting in paid lost time from work. Rates were also calculated by body part injured, nature of injury, and type of injury. More specific analyses of work injuries among carpenters were done for eye injuries, injuries to the upper extremity, and injuries among drywall installers. Outpatient and inpatient utilization rates were calculated per month of insurance eligibility for different diagnoses and costs of care. Attempts were made to compare these data on construction workers to other sources of national data on health care utilization. Utilization rates were compared through union health insurance before and after work-related injuries of varying severity. Health care utilization for injury related care was compared among carpenters with and without diagnoses of alcohol or substance abuse. Lastly, in an attempt to gather qualitative

information about repercussions of work-related injuries, a group of injured carpenters were sent questionnaires asking about specific repercussions of their injuries and a small group of volunteers participated in structured interviews.

Results

Cohorts of 12,958 carpenters and 11,652 laborers, and their health insurance claims and time at risk for the periods 1989-1995 and 1990-1994 respectively, were identified. Our findings of work-related injuries for both carpenters and laborers document rates of injury much higher than those reported by the Bureau of Labor Statistics. The discrepancies are greatest for less serious events, which did not result in paid lost time, but exist for lost time injuries as well. Musculoskeletal injuries and disorders are significant problems for both of these groups of construction workers and the need for evaluation of exposures which contribute to these, as well as interventions, are clearly indicated. There are serious repercussions of work injury, at least for some construction workers, across several domains including financial and health care needs, social support, and career and life changes.

The rates of health care utilization for carpenters and laborers were overall quite comparable through workers' compensation; however, laborers consistently have much higher utilization through their union insurance coverage than do carpenters despite comparable coverage plans. Both carpenters and laborers had very high rates of utilization for injuries, musculoskeletal disorders, respiratory diseases, and mental health disorders – largely related to substance abuse. Carpenters with diagnoses of substance abuse had higher rates of injury-related health care utilization through their union health insurance but not through workers' compensation.

In understanding health care delivery for these working cohorts, a very large proportion of their care would be missed without including the care received through workers' compensation. Carpenters incurred 56% of all outpatient charges and 23% of inpatient charges through workers' compensation; the laborers incurred 34% of outpatient charges and 21% of inpatient charges. About half of the workers' compensation charges are for injuries and poisonings and a quarter are for musculoskeletal conditions. While these data do not allow definition of etiology of these complaints, the complaints likely influence construction workers' abilities to do heavy work regardless of their etiology.

Although follow up time was a limiting factor in the analyses in which we attempted to address this issue, our findings were not consistent with shifting of costs from one health care payment system to the other. We did see that, overall, carpenters and laborers who experienced work-related injuries utilized more health services through their union plans than those without work injuries, suggesting that those who use services in one system are likely to use services in the other system.

IV. BACKGROUND

In the United States the cost of health care delivery for individuals working in the construction trades is theoretically covered by two different insurance systems – private insurance through an employer or union and workers' compensation. While the latter is designed to provide health care for work-related injuries and illnesses, the former covers only medical problems that are not work-related.

Members of construction trade unions have health insurance coverage, in most cases, through participation in jointly trusteed health and welfare funds. Approximately 1,250 such funds provide health insurance coverage to approximately 10 million construction workers and their dependents. These funds developed through the collective bargaining process over a period of years in different local areas and in different industries and trades. While the funds differ in many respects, they all have several things in common:

- they are trusts, and have to comply with the federal Taft-Hartley Act;
- they all have a board of trustees consisting of an equal number of representatives for the workers and the employers;
- the board defines the benefits to be provided to the workers covered by the trust;
- the employers pay a contribution sufficient to cover the benefits and the administration of the trusts;
- the contribution is defined and enforced contractually by being included in the collective bargaining agreements; and
- the trusts then either provide the benefits directly or through contract with a health insurance company.

These health funds have traditionally had close alliances with the populations they serve. They tend to be more involved with their clients and more responsive to the worker's needs than might be the case with more impersonal, large insurance companies. These trusts, which provide coverage for workers in industries that are highly mobile and often without health insurance are not limited to the construction trades. Overall they have over $33 billion in annual expenditures, and they represent approximately 25% of the total private employment-related health care market in the U.S. (Ringen, 1998).

Although in theory these two systems are separate, and in combination they should provide comprehensive coverage, there appear to be gaps and overlaps between them. First, construction workers have one of the highest proportions of individuals without health insurance. Most non-union construction workers do not have private medical insurance coverage and even union construction workers' coverage may lapse during periods of unemployment – which is not uncommon in the construction trades due to the very nature of the work. Eligibility for benefits is typically based on having worked a required number of hours, with workers being allowed to "bank" hours to cover eligibility requirements during periods of time when they are unable to work due to lack of available work, illness, or disability, and union workers may have periods of time when their coverage lapses due to lack of steady work.

If a worker is injured on the job or has a work related condition, he or she must submit a claim through their employer or workers' compensation agency. If the claim is approved, medical care will be paid for by the compensation carrier until it is determined that the person requires no additional care or they have reached a point of maximum medical improvement. Workers' compensation also provides partial salary reimbursement when loss of time from work is required and payment for permanent impairment which may result from the work-related injury or illness. Chronic diseases and ailments that arise gradually are much less likely to be recognized through the compensation system than events which are the result of acute injury (Blessman, 1991). In these cases the demarcation between work-related and non work-related is not clear -- and can result in contentious situations. Coverage for medical care for a disputed condition may also be excluded from payment by a private carrier, leaving the patient uninsured for some services (Ramsey and Rosenstock, 1994).

Little is known about the delivery of health services to construction workers in the United States. Thirty years ago the Tennessee Valley Authority developed mobile health centers to provide occupational and preventive medicine to construction workers engaged in building its power plants, dams, etc. The papers published to describe these programs did not include any evaluation of process or outcome (Craig, 1968; Craig, 1974). In 1993, the Center to Protect Workers' Rights (CPWR) with NIOSH and other federal agencies, union and employer associations and public health organizations organized the *National Conference on Ergonomics, Safety and Health in Construction*. Among the summary recommendations provided by the conference rapporteur, Professor John T. Dunlop of Harvard University, were the following (CPWR, 1993):

- A call for more research on the economics of safety and health practices among construction workers.
- Efforts to change workers' compensation should be encouraged with collective bargaining among union work forces being a cost-effective and viable process.
- The inability to clearly differentiate work-related from other health problems necessitates combining medical coverage under workers' compensation with general health insurance – and developing broadly defined health promotion programs for workers.
- The present decentralized programs that administer health insurance for construction workers and their families provide a basis for enhancing safety and health and for placing added emphasis on preventive services and primary care.

While, from a public health standpoint, there may be good reason to consider merging workers' compensation and general health insurance benefits, there are numerous political considerations which make the enactment of this type of legislation unlikely in the near future. However, an understanding of how the two systems work is essential in the development of strategies which will improve the health and safety of workers and their families.

Health care utilization is a function of many societal and individual factors. Anderson and Newman (1973) described a conceptual model of health care utilization in which health services use can be viewed as a type of individual behavior. Their model includes societal determinants and characteristics which interact with individual determinants to predict health services use. Societal factors include technology and treatment norms including volume and distribution of health care resources and access and structure of those resources. Individual use of health care services is dependent on the predisposition of the individual to use services, the ability to secure services, as well as age, sex, past illness, occupation/skill, and illness severity.

This conceptual model does not specifically address the potential interplay between the two systems. It cannot be assumed that all work-related illnesses, or even injuries, will be captured in workers' compensation data. Even after a person chooses to seek medical care, there appear to be factors which influence whether they choose to seek care through the compensation system. Fingar (1992) has reported that there are propensities among some workers to use different types of services; younger workers were more likely to seek emergency room care than older workers, but they were less likely to file a compensation claim. There also is conflicting literature on the potential significance of cost-shifting practices on the part of providers and insurers (Ducatman, 1986; Zwerling, 1991; Butler et al., 1997) related to the diagnosis of conditions as occupationally related and to the per capita costs associated with conditions labeled work-related.

Although very little is known specifically about health services use among construction workers, they have known exposures to a number of risk factors for work-related injuries and illnesses. Occupational injury rates in the construction trades are high compared to those in the general workforce in the United States. Fatal and lost work time injuries in the construction trades continue to rank among the highest in the U.S. (U.S. Dept. of Labor, BLS, 1995; Kisner, 1994; Sorock, 1993; Stone, 1993; MMWR 98-04-02). The Bureau of Labor Statistics (BLS) (U.S. Dept of Labor, 1998) reported an overall rate of work-related injuries or illnesses of 7.1 per 100 full-time workers in 1997. During the same year a rate of 9.5 per 100 full-time workers was reported for the construction industry. The BLS data, the primary source of data on the construction trades, are based on reports from OSHA logs from a probability sample of employers. The BLS sample survey also obtains the number of hours worked by employees of the establishments in the survey. These are used to estimate the number of full-time equivalent workers. A cohort approach, using individual person-hours of work time as the denominator, revealed rates of medical cost or lost-time compensation claims for construction carpenters much higher than the BLS estimates (Lipscomb, 1996). Construction workers are at much higher risk for injuries resulting from being struck, falls, and electrocutions.

Construction workers not only have higher rates of work-related injuries than other trade groups, but they are also among the most likely workers to experience serious occupational injuries (Salminen, 1994). National rates of disabling injuries have risen in the construction trades in recent decades (Robinson, 1988), which is of great concern from human and economic perspectives. Very little is known about the long term repercussions of these serious occupational injuries on the workers themselves, their families, and their use of health services; although there are data to suggest that persistent problems are not uncommon (Larsson, 1995; Cheadle, 1994). Return to work, often used as a marker of recovery, may in fact only mark the end of the first of several episodes of work disability caused by the original injury (Baldwin, 1996).

In addition to work exposures which place them at risk for fatal and non-fatal injuries, construction workers are exposed to a wide variety of substances and work conditions which may contribute to the development of chronic diseases and disorders. A number of ergonomic risk factors which place them at risk for overexertion type disorders have been described in the construction trades (Schneider and Susie, 1994) including, but not limited to heavy work, materials handling, pushing, pulling, twisting, frequent lifting over 25 pounds, and awkward postures. Construction workers have exposures to a number of substances which may place them at risk for lung disorders (Lipscomb and Dement, 1998). These substances include asbestos, silica, wood, cement, dusts from drywall finishing and other mineral dusts. These workers are also exposed to man-made mineral fibers, solvents, paints, coatings, glues, fillers, and cutting and welding fumes. Workers involved in renovations may have exposures to molds, dust mites, and other organic dusts. Construction workers may also have occupational exposures not commonly associated with construction, which may be present in industries in which they are working on construction (Courteau, 1994). Many construction workers are exposed to high levels of lead in bridge reconstruction and lead paint abatement. They also have the potential for exposures to other neurotoxic solvents and chemicals. Injuries to the eyes (BLS, 1997; Lipscomb, 1999) and noise induced hearing loss are prevalent among construction workers (Waitzman, 1998).

Occupation likely reflects many complex factors that represent education, social status, and life-style factors among other things. These factors can have a profound effect on health and use of health care services. Proportionate mortality studies of construction workers in the U.S. reveal excess deaths from injuries as well as diseases of the respiratory system, certain cancers in sub-groups of construction workers and specific diagnoses associated with tobacco use and alcohol abuse (Wang, Dement and Lipscomb, 1999; Robinson, 1995). Construction workers have higher rates of tobacco use and their use has failed to decline in recent years at the same rate as the general population (Nelson, 1994). Recent national survey data in the U.S. report high rates of alcohol and substance abuse among individuals in the construction trades (Hoffman et al, 1996), and construction workers have been reported to have a large proportion of individuals who drink heavily (Trice, 1990). In addition, alcohol-related use of health services, both inpatient and outpatient, has been reported to be among the highest in males who do construction work (Olkinuora, 1984). Health care utilization is an important outcome measure for population based research related to the assessment of the magnitude of substance abuse problems, including tobacco addiction. Smoking and excess alcohol use are recognized risk factors for a number of chronic diseases. By example, cirrhosis of the liver has long been used as marker of excessive drinking in populations and lung cancer has been a similar marker for tobacco use. In addition, surveys of the population for smoking habits show many of the construction trades to be at the top of the list of occupations having a high proportion of current smokers (Nelson et al., 1994).

There is no single comprehensive database available for surveillance purposes which provides information about occupational disorders and injuries, much less the health care delivery to occupational groups. A number of avenues have been explored including the use of administrative data such as workers' compensation files (Mathias, 1990; Franklin, 1991; Tanaka, 1988). These data alone do not necessarily define a population from which the claims arose. Health insurance claims have also been used for surveillance purposes (Bernacki, 1986 and 1989; van Peenen, 1986; Blose, 1991; Pell, 1985 and 1986; Bond, 1983; Pollack, 1993), and there are examples of the use of combined data from work related health care delivery and private insurance coverage to address specific research questions (Park, 1992; Lipscomb, 1998; Pollack, 1998).

These types of data were not developed for research purposes, and there are problems associated with their use for other than administrative purposes. However, they are a potentially rich source of information about the health problems and care associated with the treatment of those problems for occupational groups. The practical problems which make the study of construction workers difficult including frequently changing employers, irregular and temporary employment, and often small and dispersed work sites make the possible use of existing data sources particularly appealing for these workers. The fact that union construction workers obtain health care benefits through the health care trusts allows not only the potential enumeration of populations for study but also the ability to capture their health care claims experience. By combining these data with workers' compensation data a comprehensive picture of the health care delivery of these individuals can be obtained.

V. SPECIFIC AIMS

The major objective of this research was to investigate work related morbidity among construction workers and the patterns of health services use associated with these work related conditions as they are covered under workers' compensation insurance and under general health insurance, and to determine how these systems coexist. The following are specific aims:

A) To study the overall rates and patterns of health care utilization among construction workers as well as utilization rates and patterns for health conditions of possible occupational etiology.

B) To assess health care utilization rates and patterns for construction workers defined by prior health conditions, age, gender, and occupation/skill.

C) To study the magnitude of costs associated with occupational injuries and illnesses among construction workers and the distribution of these costs between workers' compensation insurance and private medical insurance.

D) To determine health care use patterns by type of provider, length of stay and cost of treatment for selected morbidity conditions and to compare patterns for workers' compensation versus private medical coverage.

E) To identify long term sequelae of serious occupational illness or injury on health coverage, health care utilization, occupational status and personal and family status.

F) To identify the causes of select morbidity patterns and propose ways to improve the prevention of such patterns.

VI. RESEARCH DESIGN AND METHODS

Descriptions of Populations Studied and Data Sources

Combined administrative data sources were used to identify cohorts of union carpenters and laborers and their health insurance claims filed through private insurance and workers' compensation. Descriptions of the data sources, the populations studied, the respective periods of follow up, and the analytical methods are described below for each of the two trades. Although the data on carpenters and laborers are very similar, some differences do exist requiring the procedures used to create the data sets and the analytical methods to differ somewhat between the two groups. Because of these differences the two groups are described separately, and the effect of differences in methods and procedures are taken into account when comparing and interpreting the results.

Methods for Creating Data Sets

Carpenters

Data Sources

Combined administrative data sources were used to identify a cohort of union carpenters and to identify their health insurance claims filed for care delivered between January 1989 and December 1995 through private health insurance coverage and workers' compensation. Health insurance eligibility files from the Carpenters' Trusts of Western Washington (CTWW) were used to identify union carpenters who had worked in the State of Washington. These files also provided the union hours worked each month and a marker indicating whether each individual had health insurance eligibility each month from January 1989 through December 1995 for members of the United Brotherhood of Carpenters and Joiners of Western Washington.

The trust also provided demographic information including date of birth, sex, and the union local with which each carpenter was affiliated. This information was supplemented with data from national union membership files to identify demographic variables and to define the union initiation date. These files provided information on the Washington union local affiliation of individuals who were no longer living in Washington State at the time that the data were extracted.

The Carpenters' Trusts of Western Washington also provided health insurance claims filed for care delivered between 1989 and 1995 for these individuals. For a given medical encounter, charges may be generated for multiple services with each representing a 'line item,' e.g., physician examination, x-ray, laboratory work, physical therapy visit, etc. Thus, for a given medical encounter, multiple lines of data can be generated in the claims system. The claims data provided the actual line items for medical care including the date of service, the primary ICD-9 code and CPT code attached to each item, the provider rendering care, the place of treatment, and the cost associated with each item.

To become eligible for insurance coverage through the trust, a carpenter must have worked at least 275 hours in a three month period. After this initial requirement is met, the individual must work 1200 hours per year or 300 hours per quarter to maintain coverage. However, extra hours worked above the required amount to maintain coverage are 'banked' and are used to maintain coverage in months in which the individual may not have worked enough hours to cover his or her eligibility requirement.

Data on workers' compensation claims were provided for cohort members by the Washington State Department of Labor and Industries (L&I). These compensation claims data included the date of the event for which the claim was filed, the amount of lost work time associated with the event, and the ANSI codes describing the event by body part involved, the nature of injury, the type of event causing the injury and the source of injury as recorded on the first report of injury. The Department of Labor and Industries also provided data on claims for medical care for these events. Elements of these data are similar to those from the Carpenters' Trusts of Western Washington and include the date of service, ICD-9 and procedure codes, the place of treatment, the provider type rendering care, and the cost associated with treatment. However, Washington State L&I does not consistently maintain electronic records of injuries that do not result in paid lost time that occur among workers who were hired by self-insured contractors, and they do not maintain records of medical care received for any injuries from self-insured employers, regardless of whether the injury was serious enough to result in lost time. Our inability to capture these events and associated claims will result in an underestimation workers' compensation claim rates for less serious injuries, as well as underestimation of health care utilization for both less serious and paid lost time claims.

Matching of Records

The CTWW generated a list of all individuals in their files for the time period of interest -- 1989-1995. This list, with a unique assigned identifier for each person and personal identifiers of name, date of birth and social security number was forwarded to L&I. L&I identified records in their files for these individuals using a matching algorithm requiring social security number and last name or social security number and date of birth. Similar matching was done by the union to collect demographic data from their national records. All records were purged of personal identifiers and provided for analyses with the unique identifier attached. This allowed records to be linked on an individual basis for analyses.

Definition of the cohort

Using the eligibility file of the CTWW, an historical cohort of approximately 13,000 carpenters was identified each of whom had worked at least three months of union time and had at least one month of health insurance eligibility between 1989 and 1995. No restriction was placed on a minimum number of hours of work per month, and the three months did not have to be consecutive. For each carpenter in the cohort, the date of entry into the cohort was defined as the first month when both eligibility and hour requirements were met. The date of exit was defined as the last month in which the individual had either hours worked or health insurance eligibility.

To collect as much demographic information (date of birth, gender, union initiation date and local affiliation) on the cohort as possible, information was obtained from several sources including the Carpenters' Trusts of Western Washington, national union membership files, and national union history files. Information on gender was also collected from the Washington State Department of Labor and Industries records for individuals who had filed workers' compensation claims.

Data Editing of Medical Claims

The data for these carpenters contained each line item for medical care that was received during the seven year observation period, resulting in some cases in multiple records per person -- sometimes on the same day. Claims for medical care for work injuries were not restricted to those associated with illnesses or injuries that occurred in months of union work and included claims for medical care for injuries sustained before 1989 for which these individuals were still under care through workers' compensation during the follow up period.

Each data source was searched for exactly duplicate claims (line items). These few items (<25) from the CTWW files were reviewed at the trust for whether they should be considered true duplicates or not. The duplicate items were unit categories (doses of insulin, minutes of physical therapy) used for billing purposes and were not dropped from the total line items. In addition, the combined files were searched for duplicate line items filed through both workers' compensation and private health care insurance. Duplicate claims found in both private insurance files and workers' compensation files were assigned to the file in which the claim was paid. There were 127 encounters in which the same individual was seen for the same three digit ICD-9 code on the same date in both systems with the claim being paid in both systems. These claims were left in both systems. No more than ten line items were in any given ICD-9 major disease group, with the exception of endocrine disorders (n=23), diseases of the respiratory system (n=22), and diseases of the musculoskeletal system (n=29).

Claims (actual line items) filed through the health and welfare trust and through workers' compensation were separated into three categories which included outpatient care, inpatient care, and miscellaneous charges. In the health and welfare trusts, the miscellaneous category included durable medical equipment, vision care, transportation, nursing home, hospice care, and medications. In workers' compensation, the miscellaneous category included services such as vocational rehabilitation and travel reimbursement. No medication information was provided for the carpenters through workers' compensation.

Inpatient care included inpatient visits for substance abuse in both hospitals and in substance abuse treatment centers. The trust only pays for substance abuse treatment in authorized facilities. The places substance abuse inpatient treatments were received were reviewed by a representative from the trust to differentiate substance abuse treatment centers from hospitals.

For calculation of health care utilization rates, one outpatient visit per person per ICD-9 code per provider per day was allowed. For analyses of cost all appropriate line items were utilized. Each hospitalization through the workers' compensation system was assigned a primary ICD-9 diagnosis. Through the health and welfare system each line item for a given hospitalization did not necessarily have the same ICD-9 code. The line items for each hospitalization were assigned the ICD-9 code attached to hospital room and board charges.

Laborers

Data Sources

Each year since 1989, Zenith Administrators, who manage the health insurance plan for the Northwest Laborers' Health and Security Trust, has supplied the Center to Protect Workers' Rights (CPWR) with three types of computer files containing information on the non-work-related medical care experience of construction laborers in the State of Washington - a file of records for all members of the Northwest Laborers who were eligible for the union health insurance with an indication of whether or not eligible for each month, a file of claims for medical care during the year, and a file of the number of union hours each laborer worked each month of the year.

"Eligibility" for the union health insurance means that the worker is covered by that insurance. A worker attains eligibility for health insurance at the beginning of the second month following his or her accrual of 200 union hours of work. Each subsequent month, the number of hours worked is added and 120 hours are deducted from the worker's hour bank, but the worker remains covered by the health insurance as long as the number of hours in the bank remains above 120. When the number of hours drops below 120, the worker may lose the coverage altogether or may elect to continue coverage by paying the premium out of pocket (COBRA). Any hours in the worker's hour bank remain there for a period of up to ten months. Within that time period, if the worker builds up the hours back to 120 or more, his or her eligibility is reinstated.

Data on injuries on the job covered by workers' compensation and on the medical care for the treatment of these injuries were provided by the Washington State Department of Labor and Industries. The details are presented below.

Matching of Records

Using name, social security number, and date of birth, the union health insurance eligibility records for the laborers cohort were matched against the workers' compensation claims file in the Washington State Department of Labor and Industries (L&I), the principal insurer in the state for work-related injuries. CPWR received the matching claims records that contain detailed information on the injury as well as all of the corresponding records containing all of the information on the medical care received by the worker and covered by the workers' compensation insurance. No medical care information was available on those who worked for employers who were self-insured for workers' compensation. The CPWR and the Northwest Laborers' Health and Security Trust signed a confidentiality agreement that indicated that CPWR would maintain the names in a secure file and not include them in the computer records used for statistical analysis.

All claims that had been rejected as not appropriate for coverage by workers' compensation were excluded from the file. Also excluded were claims that pertained to injuries which occurred either before or after the worker's tenure in the cohort. The workers' compensation claims file also included claims for injuries that occurred during months in which the worker recorded no union hours. These workers must have been working for non-union employers when those injuries occurred. These non-union work-related injury claims (a total of 585 claims) were excluded from the calculations of injury rates since there was no information on the number of hours that these laborers worked on such jobs and therefore no measure of their exposure to the risk of injury. However, these injury claims and their corresponding medical information were included in all of the analyses on the use and cost of medical care. The information available on each member of the cohort, therefore, included all of the medical diagnoses from their claims under the union health insurance plan, and for those who had matching claims in the workers' compensation files, information on the number and characteristics of their work-related injuries, as well as information on all the medical care provided for these injuries that was covered by the state workers' compensation agency.

Definition of the cohort

We defined a cohort of construction laborers as those who were eligible for the union health insurance for at least one month during the five-year period 1990 to 1994, who showed union hours worked for at least one month during that period and who were residents of the State of Washington. The use of one month in the definition was arbitrary. For each laborer in the cohort, the date of entry into the cohort was defined as the first month when both the eligibility and the hour requirements were met, and the date of exit was defined as the last month during the 1990-1994 observation period in which the worker was observed to have either health insurance eligibility or union hours worked. Throughout the text that follows these dates will be referred to as "entry month" and "exit month," respectively.

Data Editing of Medical Claims

As indicated above, this study is limited to the period 1990-1994, and the observations on each individual in the cohort are further limited to the interval between entry and exit dates as defined above. The matching data from the Department of Labor and Industries on the laborers cohort included some claims for injuries that occurred from the 1980s through early 1996, the time when the extracting of the matching data was carried out. For this study, only claims for injuries that occurred within the interval between entry and exit months as defined above were included. Medical care records reflecting the treatment of these injuries were included only if the service dates were between the dates of entry and exit. Data on medical care provided during the study interval were excluded only if they pertained to an injury that occurred prior to the entry date. Such data were included for the carpenters.

For many analyses, medical care is classified according to the International Classification of Diseases (ICD-9) categories. Since many of the ICD-9 codes were missing in the workers' compensation medical data, the following describes the procedures we used to assign ICD-9 codes to these records. Different procedures were used depending upon whether the record with a missing diagnosis pertained to inpatient care or to other than inpatient care.

For hospital inpatient care, there were multiple records pertaining to a single admission. Each record pertained to a specific service or charge. Many of these records showed no diagnosis code but most had a Diagnostic Related Group (DRG) code. In general, the DRG system organizes ICD-9 diagnoses and procedure codes in a way so as to enable providers to recover the appropriate payment for services rendered. Among the multiple records pertaining to each hospital admission, we identified an ICD-9 code which was almost always associated with the first bill-item and considered that to be the principal diagnosis. This code was used as the diagnosis for the records that did not already have an ICD-9 code for that admission, after making sure that this code was consistent with the DRG that had been assigned to that admission. This procedure resulted in the assignment of an ICD-9 code to every inpatient record that did not initially have one.

The remaining records in the medical file pertained to hospital outpatient care, pharmacy, and office visits. A large number of the records, mostly from the outpatient and pharmacy files, did not have diagnosis codes. Records without a diagnosis were identified and grouped with all of the medical care records related to the same specific workers' compensation claim. In all but a few instances, at least one ICD-9 diagnosis code could be found among the records for a specific claim. That diagnosis was considered the "assigned" code for all the records that did not have a diagnosis code pertaining to the same injury claim. If multiple ICD-9 codes were found, then the one associated with the largest amount of money paid was selected as the "assigned" diagnosis. This procedure permitted the assignment of ICD-9 codes to all but 384 records out of over 60,000 records without diagnosis codes.

A significant portion of the union health insurance claims file contained records for claims with substance abuse diagnoses. The vast majority of these claims (over 70%) were for services received at chemical dependency treatment agencies. For many of the claims, it was ambiguous whether the services were provided on an outpatient or inpatient basis, according to the usual definiton of such care. However, since the associated costs and the treatment plans resembled outpatient care more than inpatient, these were grouped with outpatient service claims.

There was a large number of outpatient visits made by laborers to chiropractors for which the ICD-9 diagnoses codes were not assigned. Since insurance benefits cover chiropractor visits only for spinal treatments, all of the records pertaining to these claims were assumed to be related to musculoskeletal system diseases and were characterized as such.

For inpatient union health insurance claims, some claims for services provided - within a single period of hospitalization - had overlapping service dates. The information on those records was combined with all of the other information on that period of hospitalization so that the medical care associated with each hospitalization episode could be identified.

Analytical Methods

Carpenters

Analyses of Workers' Compensation Injury/Illness Rates

The descriptive analyses of workers' compensation claims represent an update of analyses of the injury experience of the carpenters covering 1989-1992, and they have been completed using methods previously described (Lipscomb, Kalat and Dement; 1996). For these analyses of injuries (and illnesses) covered by workers' compensation (not utilization of medical care for those injuries), events were restricted to those in which the injury date was in a month the individual worked union hours, in an attempt to evaluate only injuries that occurred while working as a union carpenter. Events were also restricted to those approved for coverage through workers' compensation. Person hours of union work was used as the measure of time at risk in an attempt to define numerators and denominators in a similar fashion. Specifically, the denominator for these rates is the number of person-years of exposure, where the number of person years was calculated by dividing the total number of hours worked by 2,000. For age specific rates and rates stratified by time in the union, hours were allowed to accumulate in the appropriate strata.

No exposure information on each carpenter was available. We used the predominant work of each local as a gross surrogate for work exposure. Through interviews with the field representative for each local, the predominant type of work of each local was assigned for the study period. In addition, a measure of time in the union was estimated by identifying the earliest date each individual could be identified in national union files or trust pension data. The locals were grouped according to the predominant work of the local during this time period including heavy and light commercial work, residential, drywall, lumber/sawmill, millwrighting, piledriving, and a mixed category. Categories were determined based on interviews with the field representative for each local. Only one local (2127) changed predominant type of work during this seven year period. The time at risk and events for this local were allowed to vary appropriately over time.

Crude and stratified rates were generated for all injuries, injuries resulting in paid lost time, or medical costs and injuries resulting in paid lost time from work (which is on the fourth missed day in Washington State). Rates were calculated for all injuries and for injuries resulting in paid lost time by body part injured, nature of injury, and type of injury.

Employers who self-insure for workers' compensation in Washington are not required to report work related injuries and illnesses to the Department of Labor and Industries until after the claim is closed. L&I does not consistently maintain electronic records on claims from self-insured employers that do not result in paid lost time. ANSI coding and medical cost data are not consistently available for claims from self-insured employers and are listed as missing in these analyses. The data for the carpenters were extracted in December of 1996. There is the possibility that we would have missed some serious self-insured claims that had not closed at the time of the data extraction. Our inability to accurately identify claims which did not result in paid lost time from self-insured employers would result in an underestimation of the true injury rates for less serious injuries. However, we estimate that our rates are low by only approximately 10% for all injuries.

Health Care Utilization Rates

Definition of periods of eligibility for health care utilization

Observed person time did not start to accumulate until the month in which each individual had met all cohort entry criteria (three months of work hours and one month of insurance eligibility for carpenters). Individuals were considered to be eligible for health care utilization through their union health insurance in any month in which they had health insurance eligibility through their health and welfare trust. Individuals were considered eligible for health care utilization through the workers' compensation system beginning in the month in which the individual first met all cohort entry criteria. Eligibility for workers' compensation utilization ended when they were last observed having either hours worked or union health insurance eligibility. The assumption was made that these individuals would be eligible for medical care through workers' compensation by virtue of working in the State of Washington and that they are eligible to receive care for a work-related injury even when out of work.

Definition of events of interest

Unique outpatient visits and hospitalizations of interest were defined in a manner comparable to periods of eligibility. These events of interest from union health insurance files included claims for medical care provided in months of insurance eligibility. Medical care services covered by workers' compensation included those that were provided in any month from cohort entry to last observation. Employers who self-insure for workers' compensation in Washington are not required to report medical care to the Department of Labor and Industries. Our inability to accurately identify medical care for claims from self-insured employers would result in an underestimation of medical care utilization (outpatient visits, hospitalizations, and charges) associated with workers' compensation claims.

Visits were initially categorized using broad ICD-9 code groupings. Later analyses were done separating these very broad categories using a modified version of the NIOSH Lifetable groupings (U.S. DHHS, 1996). The modifications grouped relevant injury codes not included in the standard NIOSH Lifetable (See Appendix 1).

Calculation of Utilization Rates

Outpatient utilization rates were based on the number of unique health care visits, which was defined as one encounter per day per provider for each individual. Inpatient rates were based on the number of hospital admissions. Overall and stratified rates were calculated for each three digit ICD-9 code grouping for outpatient visits and hospital admissions. Appropriate events of interest in either system were divided by the number of person years of eligibility in that system and multiplied by 1000 (expressing utilization as a rate per 1000 person-years of insurance eligibility).

Utilization rates in the health and welfare system and the workers' compensation system were calculated separately.

Age and sex specific rates were generated in a similar manner. For these rates, age was treated as a time varying variable with months of eligibility allowed to accumulate in the appropriate strata over time. Utilization rates were also compared by predominant type of work of the local with which each carpenter was affiliated as described earlier in the analyses of work-related injuries.

Laborers

Analyses of Workers' Compensation Injury Rates

Injury rates for the laborers' cohort were computed by using the number of union hours worked during the worker's tenure in the cohort to measure the amount of time of exposure to risk of injury. Specifically, the denominator for these rates is the number of person-years of exposure, where the number of person years was calculated by dividing the total number of hours worked by 2,000 hours. A person-year was defined as constituting 2,000 hours. As indicated earlier, the 585 injuries that occurred during months when the laborer recorded no union hours worked were excluded from the numerator.

Data are presented as rates per 100 person-years. Overall rates and rates stratified by type of injury, nature of injury, and part of body are presented using total number of injuries and number of time-loss injuries as numerators. Time-loss injuries are the more serious injuries, involving loss of four or more days away from work. For any tabulations involving age groups, age was calculated as of the date of entry into the cohort.

Health Care Utilization Rates

Definition of periods of eligibility for health care utilization

For union health care, the total number of months of health insurance eligibility during each individual's observation period - aggregated for all cohort members - was used since that represented the amount of time "at risk" of receiving medical care. For the workers' compensation system, the total number of months from entry into the cohort until exit for each cohort member, aggregated for all members, was used as the denominator. The reason for including all months during a worker's tenure in this denominator is that, even if the worker was not working union hours or not working at all, he or she was still eligible to receive medical care for work-related injuries and illnesses under workers' compensation.

Definition of events of interest

The definition of a medical contact - the numerator - depends on the type of care received such as inpatient or outpatient. For the union health care system, only medical care provided in months with insurance eligibility during the individual's observation period are included. On the other hand, for workers' compensation, medical care provided in any month during the worker's observation period in the cohort are included. Moreover, this medical care pertained only to injuries that occurred during the observation period of the worker.

General hospital inpatient care included various aspects of care such as intensive care, room and board, and other miscellaneous care, all related to the period between hospital admission and discharge. Regardless of the number of claims that pertained to a hospitalization episode, a single admission was considered as one medical contact and was assumed to involve only one principal diagnosis.

Outpatient care included all services received at a hospital on an outpatient basis, as well as services such as diagnostic x-ray and laboratory, and visits to physician's office. A medical contact was defined as a service provided to an individual by a single provider on a given day for a specific diagnosis within a major ICD-9 disease grouping.

Calculation of Utilization Rates

Because of the difference in the definition of a medical contact, utilization rates were calculated separately for inpatient and outpatient care. These rates were expressed as the number of contacts per 1,000 person-years of eligibility, where a person-year of eligibility represents 12 months of eligibility for medical care. Utilization rates were computed by age and gender for inpatient and for outpatient care. Due to very small numbers, inpatient utilization rates were not computed for females.

We calculated gender specific utilization rates across each major ICD-9 disease grouping. This was done for both inpatient and outpatient care, although no inpatient utilization rates were computed for females for the same reason mentioned above.

Under the union health care system, laborers were also treated at certified substance abuse treatment centers. At these centers, a patient sometimes receives treatment on a daily, weekly, or even monthly basis for a period of time, while at other times a patient stayed overnight while receiving care. Often, the treatment patterns appeared to be a combination of the two, and were clearly different from the usual definition of inpatient or outpatient care. However, these services resembled outpatient care more than inpatient, and hence were categorized as such. A medical contact was defined as a service provided to an individual by a single provider on a given day for a specific diagnosis. If a service covered a time period between two dates with no indication as to whether or not the person stayed overnight, it was counted as a single contact.

Additional Analytical Methods Applied to Both Cohorts

<u>Health Care Costs</u>

In analyzing costs of health care, cost was defined in terms of amounts charged rather than by amounts paid. Because amounts paid are affected by deductibles, co-payments and amounts allowed by the insurance, they are probably less representative of the cost of care than amounts charged. For each selected ICD-9 diagnostic grouping, medical care costs were analyzed by type of insurance (union health insurance vs. workers' compensation) and by place of contact (inpatient vs. outpatient). In the case of care covered by workers' compensation, costs were also analyzed by injury characteristics (body part injured, nature of injury, and type of injury).

Costs per 1000 person years of insurance eligibility were calculated only for males because of the small number of females in each group. To allow comparisons of carpenters and laborers, these analyses did not include miscellaneous charges because the ICD-9 code was frequently missing on miscellaneous charges in the laborers' files.

Charges for medical care under workers' compensation per 100 person-years of work were calculated by ANSI codes for body part, injury nature, and injury type. These costs were limited to charges for care during the observation period for injuries that occurred in months of union work during the observation period.

Generation of National Data for Comparison of Utilization Rates for Both Cohorts

Comparisons with national data are useful in determining if populations under study have excesses of disease or injury, or in this case medical care, that might be obscured through internal comparisons using the study data alone. The observed numbers of hospitalizations for any given diagnosis in our two cohorts were too small to permit meaningful comparisons. The number of ambulatory care visits was large enough, on the other hand, to make comparisons feasible.

For comparisons to outpatient utilization received through each of the two health care trusts, we used data from the National Ambulatory Medical Care Survey (NAMCS) and the Current Population Survey (CPS; Bureau of the Census). NAMCS includes visits to offices of non-federally employed physicians (excluding anesthesiologists, radiologists, and pathologists). The scope of the survey does not include physicians who treat outpatients through hospital practices. NAMCS for the five years 1990-1994 was used to obtain national estimates of age and sex specific visits by major ICD-9 groups. We used the NAMCS visits that were covered by commercial insurance or an HMO which compared most closely with the visit data in our study. Appropriate weights were assigned to each stratum, and an average number of weighted visits per year per stratum was calculated. Marginal data were not available that would have allowed pooling of data across years to improve reliability of stratum specific estimates. In addition, data from NAMCS did not provide population estimates by type of insurance coverage. A denominator was estimated using age and sex specific population estimates of the number of individuals covered by health insurance from the Current Population Survey. These estimates, appropriately weighted for the survey design of each sample, were used to calculate age and sex specific rates for each of the ICD-9 code grouping of interest. These rates were then applied to our person-time at risk, in this case person-years of eligibility for health care utilization, to calculate numbers of events that would have been expected if our population had utilization rates identical to the national rates. Observed to expected ratios were calculated for each stratum. Our observed visits were limited to one visit per day per person per provider. Hospital outpatient encounters were not included nor were visits that were only for laboratory work. Visits to providers that were known to be out of scope of NAMCS were excluded.

For over 25% of the carpenter outpatient visits, the provider type was missing, making this precise match with 'in-scope' visits impossible. To adjust for this, we calculated the percentage of visits for each diagnostic grouping that were 'in-scope' using the visits for which we had all the needed data to define appropriate visits. We then used this percentage to allocate visits in each category that were missing a provider type.

An overall summary measure was calculated for each ICD-9 code grouping. The statistical significance of the summary measure was assessed with a chi-square statistic with one degree of freedom. Due to the differing demographic distributions for the two groups, the comparisons for carpenters with NAMCS data were limited to the white population while those for laborers pertained to the total population.

In stratifying the data into age, sex and disease specific categories that were considered to be useful units for epidemiologic analyses, the estimates of visits from the national data sources were often based on very small numbers with large standard errors indicating that the estimates were not reliable. To provide more stable estimates, average number of weighted visits from NAMCS were collapsed into the major ICD-9 categories and proportions were calculated. These were then compared to the proportion of visits in each major ICD-9 category, which were felt to be in scope for NAMCS among our worker populations.

Effects and Sequela of Serious Injuries

Utilization in Health and Welfare Funds By Work Injury Experiences

Initially the utilization rates in the Health and Welfare funds were compared among individuals with different work injury experiences with no attempt to compare rates before and after work injuries. Utilization rates were compared among: 1) individuals with no work injury, 2) individuals who experienced a work injury but had no paid lost time, and 3) individuals who had serious work injuries which resulted in greater than three months of paid lost time. Utilization rates and rate ratios were calculated overall and by major ICD-9 groupings for inpatient and outpatient care. Those with no work injury were used as the referent group.

Health Care Utilization and Resulting Costs Before and After Work Injuries

Utilization rates were compared through health and welfare coverage before and after work-related injuries. Three gradients of injury severity were compared including: 1) those with a workers' compensation injury with time away from work of one to two months (18-37 paid days), 2) greater than two and up to three months (38-57 paid days), and 3) greater than three months (58 days or more). Overall outpatient and inpatient utilization before and after injury were compared separately and then stratified by ICD-9 groups. Initial analyses were limited to individuals who only had one work injury during the follow up period. For carpenters, later analyses allowed each person to remain at risk after their first injury in any given category of severity if he/she had not had a more serious event first. The individual was censored at the time of the second event or at the time of a more serious injury, defined by the above categories of paid lost time.

Costs per month of insurance eligibility before and after work injuries were compared among individuals who experienced a work injury which resulted in more than three months of paid lost time. These analyses were limited to individuals with one serious injury in the follow up period. Based on analyses of work related injuries these serious injuries (>58 paid days) make up less than 15% (10% for carpenters; 13% for laborers) of injuries and approximately 40% of the paid lost time injuries (39.3% for carpenters; 43.3% for laborers). Workers' compensation claims for these serious injuries were filed by 8.3% of the carpenter cohort and 7.3% of the laborer cohort. However, they are responsible for over 90% of the paid lost time and the vast majority of medical costs.

Supplementary Analyses of Carpenters

Additional analyses of the carpenter cohort were conducted to explore several more specific topics. These analyses are described below.

Survey of Injured Workers

In an attempt to gather descriptive information about the effects of work-related injuries, a sample of injured carpenters was asked to complete a questionnaire designed to gather information about injuries that resulted in at least a week of time away from work and the perceived consequences of that injury. Six hundred twenty three (623) different carpenters were identified who had filed workers' compensation claims for injuries which resulted in paid lost time from work in 1993 or 1994. Forty-six percent (n=285) had experienced injuries which resulted in at least three months of paid lost time from work. This ensured us of a population of workers who had actually experienced injuries and allowed a reasonable period of time for individuals to have experienced long term sequelae. These individuals were sent a mailed questionnaire initially in December of 1997. Four additional mailings were sent in an attempt to increase the response rates.

Individuals who had experienced a work injury while doing carpentry in the last ten years which resulted in at least a week of time away from work were asked to complete the questionnaire. Individuals who had experienced more than one injury in this time period were asked to report on the injury they considered the most severe. The survey asked specific questions about time away from work initially and later, potential effects of the injury on health insurance benefits for the carpenter and dependents, loss of income, changes in ability to work, satisfaction with medical care, and general health and well-being. In addition, workers were asked to describe their injuries and any significant effects the event had on them or their families.

Interviews with Injured Workers

Individuals who responded to the survey were invited to participate in structured interviews and/or focus groups to explore further some of the issues that had been raised in the survey. Individuals who chose to participate were instructed to contact the union representative coordinating these activities in the Seattle area by a provided postcard or phone call. Most participants were drawn from those carpenters who participated in the mail survey. Two additional participants were welcomed into the ongoing discussions because of the relevance of their input. These included the wife of an injured carpenter and a carpenter who had experienced a work injury and expressed interest in participating. It is recognized that the methods of selection tends to favor those who had the greatest negative impact from their injuries. However, the objective was to develop in-depth understanding of repercussions of work-related injuries and not to necessarily collect generalizable data.

The original plan had been to conduct several focus groups to identify general concerns and then develop questions for more in-depth interviews. Because it was so difficult to arrange logistics of the focus groups for participants living in a fairly wide geographic area, one-on-one interviews were used instead. Two men and one woman did meet together at a local union hall using the same general format as the interviews. A total of twenty individuals participated in this process with interviews taking place in homes, restaurants, workplaces, or the local union hall. The interviews and small group discussion were conducted by staff of the Center for Working Life, a non-profit organization based in Portland, Oregon. The resulting qualitative data were analyzed by the same group.

The interviews and small group discussion covered four general areas: availability and cost of medical care, the direct and indirect economic impact of injuries, the effects of injuries on family and community activities, and the impact of injuries on sense of self. Interviewers attempted to elicit responses in these areas through open-ended questions which allowed those being interviewed to address issues most important to them. For example, some carpenters focused more on the frustrating experiences of getting compensation from Labor and Industries, while others quickly moved the discussion towards the economic or emotional impact on the family. Some, especially those whose injuries resulted from a specific event, described the events surrounding their injury and the immediate aftermath in great detail.

Identification of Incident Cases of Cancer from Health Insurance Claims Data

Health insurance claims data from multi-employer health funds, such as the CTWW, are potentially rich sources of epidemiologic data for cancer research. These funds offer several advantages for cancer research including: 1) accurate enumeration and demographic data for the population at risk including coverage of highly mobile populations, 2) the ability to conduct longitudinal studies with cohort follow-up provided through union membership files and health fund eligibility records, 3) the ability to study populations at higher risk than the general population as a result of occupational exposures and lifestyle factors such as smoking, and 4) the ability to identify deaths and causes of death among cohort members using pension fund death benefit information.

While Surveillance, Epidemiology and End Results (SEER) data from the National Cancer Institute will remain the gold standard for cancer incidence studies, SEER data provide limited geographic coverage of cancer incidence. McBean et al. (1993) recommended the use of health claims data such as HCFA to complement the SEER data system. Health claims data have the potential to provide for much broader and timely coverage of incident cancer cases, as well as greater ability for analyses of medical treatment costs, screening effectiveness, and the effectiveness of cancer treatments. However, it is a challenge to identify incident cases of cancer from the mix of incident and prevalent cases represented in claims data.

In earlier studies using these same data sources for a cohort of 11,232 active carpenters who were followed between the years 1989 and 1992, we had focused on respiratory diseases

(Lipscomb and Dement, 1998). SEER data were used to estimate expected lung cancer cases in our cohort, revealing an elevated Standardized Incidence Ratio (SIR) among male carpenters between the ages of 45-54. For these analyses, all first diagnoses of cancer of the lung or bronchus were identified from claims data (no cases identified in workers' compensation). Person-months of insurance eligibility were stratified by age categories used in the SEER data and then converted to person-years of observation. National SEER incidence rates were then applied to the carpenters' time at risk to calculate expected numbers of cases. The observed cases were then compared to expected for each age category, and the overall SIR and confidence interval were calculated for the entire population (SIR=Observed/Expected).

In identifying cancer cases from health insurance claims, we knew that some of our cases were prevalent rather than incident cases. To more closely approximate incidence, the same analyses were performed after discounting the first three months of person-time observed for each cohort member. This ignored both time at risk and cases that occurred in the first three months of insurance eligibility. Anyone who became a case during this period of time was excluded from further analyses entirely. This was done with the assumption that it would be unlikely for an individual diagnosed with lung cancer to go longer than three months without medical care.

Subsequently, we have explored further preliminary analyses focused on the identification of incident cases of cancer from health insurance claims data. For these analyses, we used an expanded cohort definition, including retirees as well as active workers providing a cohort of over 16,000. Our earlier analyses of lung cancer cases, which required observation for at least three months before diagnosis to be called an incident case, was done somewhat empirically based on high case fatality of lung cancer and the likelihood of fairly intensive treatment and follow-up. Other investigators (Cooper et al., 1998) have also used similar techniques which required some period of disease free observation before calling a case of cancer incident. The appropriate period to observe someone without treatment before one would label them an incident case is likely to be quite different for different types of cancer. By example, prostate cancer with its low case fatality rate is not infrequently treated with 'watchful waiting.'. Patients very likely could go for long periods of time between visits for a prevalent case.

To assess this, we examined the distribution of time between medical encounters for different types of cancer. We next explored how our SIR type analyses would be affected by different lagging schemes designed to capture different proportions of cases based on the distribution of time between visits.

Work-related Eye Injuries Among Union Carpenters

Union administrative records were combined with workers' compensation data to identify a cohort of 12,958 active union carpenters, their person-time at risk, and their documented work-related eye injuries between 1989 and 1995 in the State of Washington. The injuries were described using ANSI codes for injury nature, type (mechanism), and source or object associated with the event. Injuries which resulted in paid lost time from work were also described based on the ICD-9 codes attached to claims for their medical treatment. Overall rates of filing compensation claims for eye injuries as well as age, gender, and union local specific rates were calculated. To identify high risk subgroups and explore incident and recurrent events, the person-time and events were stratified by age, sex, time in the union, claim status, and predominant type of work of the union local with which each carpenter was affiliated for multivariate analyses with Poisson regression.

Work Injuries and Associated Costs In Drywall Installation

Combined administrative data sources were used to describe the work-related injuries of drywall carpenters, to calculate rates of occurrence, and to explore high risk sub-groups. Health insurance eligibility files were used to identify a cohort of active union carpenters affiliated with a union local whose predominant work involved drywall installation in the State of Washington. These files contained the hours worked by each individual for each month between January 1989 and December 1995, providing person-hours at risk as a union carpenter. The Washington Department of Labor and Industries (L&I) provided records of workers' compensation claims filed by these individuals, including medical only claims as well as those which resulted in lost work time.

To identify high risk subgroups for the most common types of injures experienced by carpenters performing drywall installation, the person-time and events (overexertion and struck by injuries and falls) were stratified by age, sex, and time in the union for multivariate analyses with Poisson regression. The number of paid lost days and the costs associated with these injuries for medical care, paid lost time, and permanent impairment were described for overall claims filed by the three most common mechanisms of injury. Costs associated with the claims for which the injury source was coded as sheetrock were calculated separately.

Injury Related Health Care Utilization Among Carpenters with Alcohol or Substance Abuse Related Diagnoses

We assessed whether union carpenters with substance abuse or alcohol related diagnoses had increased rates of health care utilization for injuries. Administrative data were used to identify a cohort of 12,958 working union carpenters and their health insurance claims filed through private health insurance coverage and through workers' compensation (WC) between 1989 and 1995. Individuals were identified who were treated during this period of time for alcohol or substance abuse related disorders (ASRD) including codes for alcoholic psychoses (291), drug psychoses (292), alcohol dependence syndrome (303), drug dependence (304), non-dependent abuse of drugs (305), toxic effects of alcohol (980), alcoholic cardiomyopathy (425.5), alcoholic gastritis (535.3), alcoholic fatty liver (571.1), acute alcoholic hepatitis 9571.1), alcoholic cirrhosis of the liver (571.2), and unspecified alcoholic liver damage (571.3). Crude and stratified rates of health care utilization for injury care (ICD9 codes 800-999, excluding 980) were calculated for those with and without ASRD. Private health care utilization and WC were considered independently of one another. Using methods of indirect standardization, age and sex specific rates of injury care utilization among those without alcohol or drug related diagnoses were applied to the time at risk of those with one of these diagnoses to calculate expected numbers of events. Observed to expected ratios were compared for each stratum, and a summary measure was computed to separately compare utilization through workers' compensation and private insurance systems.

Work-Related Upper Extremity Musculoskeletal Injuries Among Union Carpenters

(student dissertation)

Union administrative data were combined with workers' compensation injury data to describe the occurrence and explore risk factors associated with upper extremity musculoskeletal injuries among a cohort of 12,725 carpenters in western Washington. Because of the lack of personal exposure data, the predominant type of work of the local was used as a surrogate for work exposure for its members. Person-hours of work as a union carpenter were used as the measurement of time at risk. Crude injury claim rates were calculated and Poisson regression analyses were used to explore associations between predominant type of work and the risk of filing a claim. Finally, survival analyses were used to assess the effect of injury- and individual-level factors on the length of time away from union carpentry work after a paid lost time upper extremity musculoskeletal injury.

VII. RESULTS

Carpenters

Description of the cohort

From the union eligibility file 12,958 carpenters were identified who worked at least three months of union time and had at least one month of insurance eligibility through the CTWW between 1989 and 1995. Individuals who were not currently working carpenters were excluded including business agents and administrative personnel. Time in the cohort varied from one to 82 months with a mean of 43 months and a median of 45 months. There were 1,044 individuals who did not show any hours worked after they met all cohort entry criteria (having met the work criteria in months before they ever had insurance eligibility).

Date of birth was identified for 99% of the cohort, sex for 98%. Mean age at first observation was 35.3 years and median age was 34 years. The cohort was predominantly male with only 323 women (2.5%) who contributed just under 2% of the hours worked. The distribution of age by gender for cohort members is presented in **Table 1**.

There are 18 union locals included in the Carpenters' Trusts of Western Washington. In addition, the trust maintains records for individuals with a local assignment of '99.' These individuals are members of a local outside of Western Washington, but are working in Washington. The distribution of individuals by predominant task of the local with which they were affiliated is presented in **Table 2**. For 253 individuals, we were unable to identify a union local that is covered through the Carpenters Trusts of Western Washington. These included 15 individuals assigned '99' and 238 individuals for whom a Washington State local was identified in the years of interest but not a local in Western Washington. These individuals made up 2% of the cohort and contributed 0.83% of the hours worked during this seven year period. For 987 individuals we were unable to identify a union local in Washington State during this time period. These individuals made up 7.6% of the cohort but contributed only 0.89% of the hours worked. The union local affiliation is the only surrogate available for type of work these carpenters perform. The local assignment was the current local of each individual when the data were extracted in 1996. Comparisons were made of current and past local assignments for individuals who were in the original 189-1992 cohort (Lipscomb et al., 1997) and remained in the extended cohort. Only 5.4% of these 9,523 individuals had a change in their local assignment during the time since the cohort was originally defined.

Union initiation date was the most frequently missing piece of demographic information. This variable was only available through the national union records and was missing for 24% of the cohort. The CTWW provided the year in which they first knew of any union activity for each individual. This included not only the year they first appeared in Washington but the earliest year they had a record of pension contributions for that individual in any trust. Year of entry in the union carpentry trade was defined as the earliest year of noted activity in the national or Washington files. For 245 individuals, the first record of activity was the date they first appeared in the trust eligibility files between 1989 and 1995. Mean time in the union at first observation in this cohort was 7.8 years and the median was 2.7 years.

Patterns of Work

Over the seven year period, the cohort worked 65,188,000 hours or 32,594 person-years of hours worked. The sum of months with hours worked was 410,453. The range varied from none to 82 with a mean of 32 months and a median of 24 months. The distribution of the number of months with hours worked is presented by six month intervals in **Table 3**. Nineteen percent (19%) of the cohort had six months or less of hours worked. Only 0.2% of the cohort, or 30 individuals worked all 82 months of our observation period.

Patterns of Eligibility for Health Care Coverage

Eligibility for private health insurance totaled 476,409 months, ranging from zero to 82 months. The mean coverage was 37 months and the median was 30 months. From entry into the cohort until last observation, individuals averaged six months without private health insurance coverage (median two months). From entry until exit average months without union work was 11 (median six months). Individuals averaged coverage for private insurance five months more than they had hours worked due to the system of 'banking hours' to assure more continuous health insurance coverage. Patterns of continuous insurance eligibility by length of time in the cohort are presented in **Table 4**. There was a general tendency for individuals to be less likely to have continuous coverage with increasing observation time, as might be expected. Time at risk for workers' compensation coverage totaled 556,089 months.

Workers' Compensation Injury/Illness Claims

During the seven year period of observation 13,865 workers' compensation injuries or illnesses were sustained among this group of 12,958 carpenters. The overall rate of injury (or illness) was 42.5 per 100 person-years of hours worked. Lost-time injuries occurred at a rate of 9.3 per 100 person-years of work. Age-specific overall injury rates and numbers of persons injured are presented in **Table 5**. Injury rates decline steadily with increasing age, with the highest rates seen among the youngest group of carpenters (79.2 per 100 person-years) and the lowest rates among those 65 years of age and older (23.3 per 100 person-years). Age-specific time-loss injury rates are presented in **Table 6**. Again the youngest group of workers had the highest rates of injury (15 per 100 person-years), and the oldest workers had the lowest rates (2.7 per 100 person-years). However, the pattern of decline is not as marked when only looking at events which resulted in paid lost time from work (after three days away in Washington State).

In **Table 7**, the distribution of hours worked and the frequency and rate of injuries, overall and for those that resulted in paid time loss, are presented by predominant type of work. Carpenters affiliated with locals whose predominant work involved residential carpentry and drywall had the highest rates of both overall and time-loss claims, with the exception of the group for whom no Washington State local could be identified. These individuals had markedly higher

rates of injury than the rest of the cohort, with overall claim rates and paid lost time rates that were nearly three times higher than any other group.

The frequency and rates of overall and time-loss injuries are presented by type of injury in **Tables 8a and 8b**, respectively. Struck by injuries were most common followed by overexertion and struck against injuries. Falls from elevations ranked fifth, occurring at a rate of 2.8 per 100 person-years. Time loss injuries were more likely to have been the result of overexertion, followed by struck by injuries, falls from elevations and falls to the same level.

Similar frequencies and rates are presented by nature of injury in **Tables 9a and 9b**. Sprains were the most common injuries followed closely by cuts. Time-loss injuries most often were described as sprains or cuts, followed by fractures and ill-defined conditions. The body parts most frequently injured were fingers, followed by the back, eyes, hands and knees. Time loss injuries most often were the result of an injury to the back, followed by the knee, finger and shoulder. Eye injuries rarely resulted in paid lost time from work (**Tables 10a and 10b**).

Health Care Utilization

Utilization Patterns Among the Cohort

During the seven years of observation 6,328 individuals received outpatient care through their union health insurance, and 6,064 individuals received outpatient care through workers' compensation. There were 614 individuals hospitalized through union insurance and 307 individuals hospitalized through workers' compensation. Overall, 32.9% of the carpenter cohort (n=4,273) did not use any health care through either insurance system during the observation period.

The cohort had 112,514 outpatient visits (2,834.1 per 1000 person-years) and 824 hospitalizations (20.8 per 1000 person-years) through their union insurance coverage. Through workers' compensation, these carpenters had 115,354 outpatient visits (2,489.3 per 1000 person-years) and 391 hospitalizations (8.4 per 1000 person-years). Over half of the outpatient care and approximately one third (32%) of the hospitalizations for this working age cohort were covered through the workers' compensation system.

Age-specific utilization rates by type of insurance coverage for males are presented separately for outpatient and inpatient care in **Tables 11 and 12**, respectively. Rates of outpatient utilization through union insurance gradually increase with increasing age, with the exception of those 65 years of age and older. Through workers' compensation those 60 years old and older have the lowest rates of outpatient utilization, but there is not a definite pattern in outpatient utilization by age. Through union insurance there is a fairly steady increase in the rate of hospitalization with aging. Through workers' compensation the lowest rates of hospitalizations were among the oldest and the youngest age groups with some evidence of increased rates of hospitalization with aging up to the age of 60 years. However, the age-specific rates for hospitalizations, particularly through workers' compensation, are based on small numbers.

Age-specific outpatient utilization rates for female carpenters are presented in **Table 13**. Due to very small numbers, age-specific hospitalization rates are not presented for women.

Women for each age group utilized outpatient services through their union insurance at higher rates than male carpenters. The age related utilization pattern seen for men is not obvious for these women carpenters. Through workers' compensation, the highest outpatient utilization rates were among those 30-34 years of age. These utilization rates are based on much smaller numbers than for men making the rates more unstable.

Outpatient and inpatient utilization rates by type of insurance are presented by predominant type of carpentry work in **Tables 14 and 15**, respectively. As might be expected based on the work-related injury findings, those carpenters affiliated with locals doing drywall and residential carpentry and those with no Washington union local affiliation have the highest rates of outpatient utilization through workers' compensation. Hospitalization rates through compensation were highest for those with no Washington local, followed by those doing drywall and light commercial work. The same patterns by type of work were not seen through union health insurance coverage. Those without a Washington local affiliation had the lowest outpatient and inpatient utilization rates through the union insurance coverage.

Outpatient utilization rates are presented for male and female carpenters by major ICD-9 diagnostic groups in **Tables 16 and 17**, respectively. For males the highest rates of outpatient utilization through the union insurance was for diseases of the musculoskeletal system and connective tissue (855.7 per 1000 person-years), followed by mental disorders (397.9 per 1000 person-years) and injury and poisoning (387.5 per 1000 person-years). Through workers' compensation the utilization rates were largely for injury and poisonings (1,765.6 per 1000 person-years) and musculoskeletal disorders (460.3 per 1000 person-years). Diseases of the nervous system was the next most frequent diagnosis but these visits occurred at a much lower rate (72.3 per 1000 person-years).

Outpatient utilization rates for women were considerably higher than those for men, but the three highest rates of utilization through the union insurance were for musculoskeletal disorders (1,266.3 per 1000 person years), mental disorders (858.6 per 1000 person-years), and injury and poisonings (631.7 per 1000 person-years) just as they had been for male carpenters. Through workers' compensation similar patterns were seen for the women carpenters as well. The highest rates of utilization were for injury and poisoning (2,884 per 1000 person years), musculoskeletal disorders (533.0 per 1000 person years), and diseases of the nervous system (138.2 per 1000 person years). Disease specific rates for women are based on relatively few observations, particularly for some categories of disease.

Inpatient utilization rates for male carpenters are presented in **Table 18** by major diagnostic groups and type of insurance coverage. Rates in each category are based on small numbers, even for males, and rates are not presented for women due to very small numbers. Through union insurance coverage the highest hospitalization rates were for mental disorders (4.5 per 1000 peron-years), followed by diseases of the circulatory system (4.1 per 1000 person-years), neoplasms (2.6 per 1000 person-years) and injury (2.5 per 1000 person-years). Through workers' compensation patterns were very similar to those seen for outpatient utilization with the vast majority of hospitalizations being due to musculoskeletal disorders (4.1 per 1000 person-years) and injury (3.6 per 1000 person-years).

Overall, mental disorders by far were responsible for the greatest number of inpatient days among these working carpenters. This is true even though there was no inpatient utilization for mental disorders through workers' compensation. Injuries were the next most common reason for inpatient days, followed by circulatory problems, musculoskeletal disorders, and neoplasms.

Comparison to U.S. Population

Rates of utilization in the general population (and standard errors) were calculated for each disease specific group by ten year age groups. Analyses were limited at the outset to males due to the small number of events for women carpenters with which to work. In an effort to reduce the standard errors, and thus the reliability of the external rates, analyses were further limited to individuals over the age of 35 years. Despite these efforts the vast majority of external estimates of the number of visits generated from the National Ambulatory Care Survey were not considered reliable (the standard errors exceeded the reliable level based on the survey design). Because of this problem and the difficulties encountered in identifying visits from our data that would be considered in scope for the survey, we did not feel these analyses provided valid comparisons of outpatient health care utilization of carpenters and the general population with similar health insurance coverage.

Health Care Costs

Charges for inpatient and outpatient medical care totaled $40,541,073. Charges through union health insurance totaled $21,871,201 (53.9% of all charges), and charges through workers' compensation totaled $18,669,872 (46.1% of all charges). However, charges through workers' compensation accounted for 55.7% of outpatient charges and 22.9% of inpatient charges. Charges for inpatient and outpatient care (but not miscellaneous charges) are presented for selected disease groupings by type of insurance coverage in **Table 19**. Charges per 1000 person-years for male carpenters by selected disease groupings are presented in **Table 20**. Through union insurance the greatest charges were incurred for musculoskeletal conditions, diseases of the heart, and mental disorders. Through workers' compensation the greatest charges were for diseases of the musculoskeletal system, sprains and strains, fractures, and dislocations.

Charges for work-related medical care per 100 person-years of work are presented by type of injury, nature of injury and body part injured in **Tables 21a, 21b, and 21c**, respectively. These analyses were limited to injuries that occurred in months of union work and medical care received for these injuries during the observation period. The greatest charges per person year of work was for overexertion injuries, followed by falls from elevations, and struck by injuries. Falls from elevation appear to result in more serious injuries with a disproportionate share of charges compared to the number of injuries. Sprains, fractures, and ill-defined symptoms were responsible for the greatest costs for medical care. As with falls from elevations, fractures and ill-defined symptoms account for a disproportionate share of charges incurred. When looking at charges by body parts injured, back injuries are by far the most costly injuries and are responsible for $13,868 per 100 person-years of work. This figure is more than twice the charge for any other body part

injured. This is followed by injuries to the knee and the shoulder which account for $5,295 and

$4,660 per 100 person-years of work, respectively.

Effects and Sequellae of Serious Work-related Injuries

Utilization through Union Insurance by Work-related Injury Experience

Union outpatient utilization by broad ICD-9 groups are presented by categories of work-related injury experience in **Table 22**. Rates of utilization and rate ratios are presented comparing those with no work injury, those with a work injury that did not result in paid lost time from work, and those with work injuries that resulted in greater than three months of paid lost time from work. Similar analyses are presented for inpatient utilization in **Table 23**. Overall, those with work injuries that did not result in paid lost time from work had 1.1 times the rate of outpatient utilization through their union insurance compared to those who did not experience a work injury. Those with a serious time-loss injury (>3 months) had a 40% higher outpatient utilization rates through their union health insurance benefits with higher rates seen for most categories of illness and injury compared to those with no work injury. Overall, those with a work injury which did not result in paid lost time from work had a 24% lower rate of hospitalization through their union insurance than those without any work injury. Those with a serious time-loss injury had the same rate of hospitalization through union insurance as those with no work injury. As in all our analyses of hospitalizations the comparisons are based on relatively small numbers of events.

Utilization through Union Insurance Before and After Work-related Injury

In **Table 24**, the results of analyses of utilization before and after work-related injury are presented by categories of time-loss. These analyses were limited to individuals who only experienced one work-related injury during the follow up period. For all three categories of severity of work-related injuries, outpatient and inpatient utilization through union insurance decreased after a work-related injury. The overall charge ratio for care through union insurance after serious work injury (ie requiring three months or more of time away from work) compared to before was 1.1 (**Table 25**). Charges per month of insurance eligibility for outpatient utilization through union insurance decreased slightly after serious work related injury but increased 50% for inpatient related care. The increase in inpatient charges was due to high charges related to admissions for circulatory diagnoses and neoplasms after the work-related injury. Although not presented here, we found the same relationship when we examined utilization before and after serious back injury as well and when allowing a six month lag after the work injury.

Laborers

Description of Cohort

Based on the entry criteria of at least one month of union health insurance coverage and at least one month of union hours during the five-year period 1990 to 1994, we were able to identify a cohort of 11,652 laborers. Almost 26% of the members (2,973 individuals) entered the cohort in January of 1990. The length of time between entry into and exit from the cohort varied between one and 60 months with a median value of 31 months. There were 1,013 laborers who met their hours requirement before the eligibility requirement, but after entry into the cohort, they had no more union hours worked. On the other hand, there were 15 individuals who met the eligibility requirement prior to meeting the hours requirement, but who, once in the cohort, had no more insurance coverage.

Information on date of birth was available for 96% of the cohort, but information on gender was available for only 84%. Among those with known age, the average age of a laborer at the time of entry into the cohort was 35.6 years, while the median age was 35.2 years. Of those with gender given, 89% were males and 11% were females. Details of the age by gender distribution are shown in **Table 26**.

Patterns of Work

The total number of union hours worked, aggregated for all cohort members during their observation periods between 1990-1994, amounts to 39,069,380. This translates to 19,535 person-years, where one person-year is defined as 2,000 hours. The distribution of the number of months with hours worked is shown in **Table 27**. The median number of months with hours is 18 months. About 3% of the laborers cohort worked all 60 months.

Patterns of Eligibility for Health Care Coverage

For an individual, the number of months of union health insurance coverage ranged anywhere from zero to 60 months with a median value of 21 months. About 12% of the cohort members were eligible for the entire 60-month period. The observation period for medical care for occupational injuries or illnesses under workers' compensation for each individual is the same as that individual's tenure in the cohort. Hence, the median number of months of eligibility for workers' compensation coverage is 31 months which also is the median length of time in the cohort.

Table 28 shows the cohort's distribution of continuous eligibility (for union health insurance coverage) by the length of time in the cohort. As may be expected, individuals with longer tenure in the cohort tend to have less continuous insurance coverage. However, it is notable here that the relatively large number of the laborers (18% of the cohort) that were in the cohort for the entire 60 months, also had a high percentage (over 65%) with continuous coverage.

Workers' Compensation Injury Claims

Of the 11,652 cohort members, 4,316 had work-related injuries identified in the workers' compensation system during their observation periods between 1990 and 1994. These laborers sustained a total of 7,503 injuries. Among these records were claims for 1,287 injuries among 896 workers who were employed by self-insured employers. As already indicated earlier, the workers' compensation claims file also included a total of 585 claims for injuries that occurred during months in which there were no union hours recorded for the worker. Although the injury claims among those with self-insured employers were included in all the rate calculations, the injuries occurring during non-union hours were not because of the absence of any measure of their exposure to the risk of injury.

Age-specific injury rates for all injuries is shown in **Table 29**, while those for time-loss injuries are shown in **Table 30**. For all injuries, the rate seems to be higher among the younger age groups (under 35 years), although the small number of workers in the under 20 age-group makes the rate somewhat unstable. For the more serious time-loss injuries, the rates tend to be higher among the older age-groups between 25 and 50 years.

Injury rates according to the type of injury are presented **in Tables 31a** and **31b**. The rate is highest when the injury stemmed from overexertion. The second highest rate appears to be for injuries in which the worker was struck by some object. This finding holds true for all injuries as well as time-loss injuries. **Tables 32a** and **32b** show that according to the nature of injury; rates are by far the highest for sprains. When considering all injuries, the rate for cuts ranks second. However, for time-loss injuries, the rate for fractures ranks second. **Tables 33a** and **33b** show that rates are among the highest for injuries involving the back. In **Tables 32** and **33**, the "Other" category includes all injuries for which the nature or body part is not listed in the table. Since this category does not represent a particular nature of injury or part of body, even though the rates are quite high for this group, no meaningful conclusions can be drawn.

Health Care Utilization Patterns Among the Cohort

During their period of observation between 1990 and 1994, there was a total of 7,048 laborers who received outpatient care under the union health care system, a rate of 273 per 1,000 person-years of eligibility. They made a total of 106,286 outpatient visits (4,120 visits per 1,000 person-years) to health care providers. Also, under the union insurance system there were 798 laborers who received hospital inpatient care at a rate of 30.9 per 1,000 person years. They accounted for a total of 1,083 hospital admissions (i.e., 42 per 1,000 person-years).

Under the workers' compensation system, a total of 3,634 laborers received outpatient care (117 per 1,000 person-years) through 73,580 outpatient visits (2,368 per 1,000 person-years) to medical providers. One hundred and eighty laborers received inpatient care (at a rate of 5.8 per 1,000 person-years). They accounted for 204 hospital admissions (6.6 per 1,000 person-years). (These results are presented in **Table 48** compared to carpenters).

Overall, 33.2% of the laborers cohort, i.e., 3,870 individuals, never received any medical care from either of the insurance systems during the observation period.

Tables 34 and **35** compare the age-specific utilization rates for male laborers under the two health care systems, for outpatient and inpatient care, respectively. In the union health insurance system, the outpatient utilization rates tend to be higher for older age groups. In the workers' compensation system, the rates are lower under 25 and over 59 and are highest between the ages of 25 and 39. For inpatient care in the union insurance system, there is an increase in the rate of hospitalization with increasing age. Under workers' compensation, although the higher hospitalization rates do pertain to the older groups, the actual number of hospitalizations is too small to establish a meaningful trend.

Table 36 presents the age-specific outpatient utilization rates for females. Under the union health care system, the highest rate is among the 55-59 age-group. The rates, however, do not show any specific trend. It is notable that the rates for the female laborers are much higher than those for males. The highest rate of outpatient utilization for females under workers' compensation was in the 25-29 age-group. Again, there does not seem to be any overall trend in the rates. The age-specific inpatient rates for female laborers were based on very small numbers and as such are not presented here.

Outpatient visit rates by major diagnostic groups are presented in **Table 37** for males and **Table 38** for females. For males in the union health care system, the highest rates were for musculoskeletal system diseases, mental disorders, and injury and poisoning, in that order. A large percentage of the visits under the musculoskeletal disorders category were made to chiropractors for spinal treatments. An in-depth look at the mental disorders category revealed that visits for substance abuse treatments accounted for a significant portion of the total number of contacts under this category. Alcohol Dependence Syndrome (ICD-9 code=303) was the most frequent diagnosis, followed by non-dependent abuse of drugs (ICD-9 code=305) and drug dependence (ICD-9 code=304). Although the utilization rate was also relatively high for respiratory system diseases in the union insurance system, it was not so under workers' compensation. Under the latter system, injury and poisoning and musculoskeletal system diseases rank at the top. Among females, under the union health care system, the higher rates are in musculoskeletal system diseases and diseases of the genitourinary system, whereas under workers' compensation, injury and poisoning is by far the leading category, followed by musculoskeletal system diseases. **Table 39** shows the hospitalization rates for males by major diagnostic groups. Under the union health care system, diseases of circulatory system rank at the top (8.3 per 1,000 person-years), followed by mental disorders (6.2 per 1,000 person-years). Under workers' compensation, musculoskeletal system diseases and injury and poisoning are the only categories with any appreciable numbers. The number of inpatient admissions among females was too small for any meaningful interpretation.

Health Care Costs

Total charges for inpatient and outpatient medical care combined for both systems amounted to $41,591,528. Of that, $29,435,697 (i.e. 70.8%) was in the union health care system and $12,155,831 (29.2%) was in the workers' compensation system. Inpatient and outpatient components of the medical care costs also follow the same pattern. In inpatient care, the bulk of the cost (78.8%) was in the union health care system. Outpatient care in this system accounted for 67.4% of the total outpatient charges. The detailed breakdown of inpatient and outpatient charges in the two systems by selected disease groupings is presented in **Table 40.** Total (inpatient and outpatient combined) charges per 1,000 person-years for male laborers by selected disease groupings is shown in **Table 41**. In the union health insurance system, total charges are highest for musculoskeletal system diseases, then for mental disorders, followed by heart disease. For charges per 1,000 person-years of eligibility, heart disease ranks at the top, followed by mental disorders and musculoskeletal system diseases. Under workers' compensation, musculoskeletal system diseases rank at the top. Injuries involving sprains and strains are the second costliest category, followed by fractures. This holds true for both total charges and charges per 1,000 person-years for male laborers. A similar presentation for female laborers was omitted due to the small numbers involved.

Tables 42a, 42b, and **42c** show the charges for medical care in the workers' compensation system per 100 person-years of work, according to the classifications by type of injury, nature of injury and the body part injured, respectively. Unlike the other cost-related-analyses, here the focus was on injuries sustained while working on union jobs only. The results show that overexertion is the leading type of injury, sprains the leading nature of injury, and back the leading part of body injured. In all three classifications, the costs (per 100 person-years) for the leading categories were more than twice that for any other categories for that injury characteristic.

Effects and Sequelae of Serious Work-Related Injuries

Utilization of H&W fund by work-related injury experience

Table 43 presents the rates of utilization and rate ratios by major ICD-9 groups for outpatient health care among the laborers according to their occupational injury experience. **Table 44** presents these for inpatient care. The first group, consisting of those with no work injury, is the referent group. Overall those with a work injury, but no time-loss injury, seem to have a 20% higher outpatient utilization rate than the referent group. However, **Table 44** shows that they also have a 20% lower overall inpatient utilization rate. For the group with more than three months away from work, the overall outpatient utilization rate was 30% higher, while the inpatient utilization rate was 10% lower than the referent group. Again, since the inpatient rates are based on rather small numbers, the results may not be very meaningful.

Utilization and cost in H&W fund before and after work-related injury experience

There were 2,469 laborers in the cohort who experienced only one work-related injury. For the analyses that follow, we focused on this group. **Table 45** presents the union health care utilization rates for these cohort members, before and after their work-related injuries. The 2,469 injuries were graded according to their severity, as determined by the length of paid time away from work. For the group with one to two months away from work, the utilization rate after the injury increased 30% for outpatient care and 120% for inpatient care. For injuries involving two to three months away from work, the utilization of care dropped after the injury with an "after to before" rate ratio of 0.8 for outpatient services and 0.9 for inpatient services. Finally, for the group with the most severe injuries (i.e., more than three months away from work), the utilization rate for outpatient care dropped by 10% after the injury, while that for inpatient care increased by 120%. Again, the inpatient rates are based on very small numbers.

Table 46 presents the ratio of charges to the union insurance system for care received after and before serious work-related injuries for the above mentioned group of individuals. In this analysis, we narrowed our focus further to those 357 persons (with single injuries) whose injuries involved more than three months of lost time. Overall, or by a specific type of care such as outpatient or inpatient, the charges per months of eligibility were always found to be at least twice as high after the injury.

Comparisons of Findings for Carpenters and Laborers

This work was carried out as two separate projects with the analyses for carpenters (Duke) and laborers (CPWR) done by separate groups. However, the work was carried out using the same procedures to the extent possible to allow the comparison of findings. There were some differences in the definition of the cohorts, follow up periods and methods utilized due to differences in the data available for the two cohorts. A summary of differences are presented in **Table 47** to help in interpretation and understanding of our findings. These are referenced below in comparing results between the two groups.

Contrast of two cohorts

The study cohorts consisted of 12,958 carpenters and 11,652 laborers. The age distributions of these cohorts for each gender are given in **Figure 1**. The distributions for males for the two cohorts were quite similar, with the carpenters slightly younger. The median ages were 34.2 years for carpenters and 35.2 years for laborers. Of those with gender given, females represented 2.6% of the carpenters and 10.9% of the laborers. The numbers of females, particularly in the carpenter cohort, were too small to permit any definitive comparison. Gender identification was not given for 15.7% of the laborers. This group has been excluded from any of the analyses in this report that involve gender.

The distribution of each cohort by number of months with union hours worked is shown in **Figure 2**. The distributions are quite similar, after allowing for the fact that the cohort period for the carpenters is two years longer than that for the laborers. Both are U-shaped. Those with zero months with union hours are the workers who had met the hours requirement earlier during the study period but, after meeting the eligibility requirement, had no further months with union hours worked.

As described earlier, a worker remained under observation during the study period until he/she no longer has a month with either union hours worked or health insurance eligibility. **Figure 3** shows the distribution by length of time in the cohort of the percent in each category who had continuous health insurance eligibility. Among those who were under observation for the entire study period, over 60% of the laborers had health insurance eligibility continuously for the laborers compared with slightly less than 40% for the carpenters. For periods of observation up to four and one-half years, carpenters had the higher proportion of workers with continuous health insurance eligibility.

Work-related Injury Rates

Comparisons of work-related injury rates are presented in **Table 48**. For all injuries, carpenters had the higher rate, but the rates for time-loss injuries were slightly higher for the laborers. Age-specific injury rates for all injuries are shown in **Figure 4**. The rates were higher for carpenters in the younger age groups and for laborers from age 60 and beyond. For lost time injuries (**Figure 5**) on the other hand, the rates tend to be higher among the laborers for almost all age groups except for those under 30.

Rates for specific types of injury are shown in **Figure 6**. For most types of injury, the rates for all injuries tended to be higher among the carpenters, but for lost time injuries, the rates for laborers were much closer, and for some categories, such as overexertion, the rates for laborers exceeded those for carpenters. The rates according to nature of injury (**Figure 7**) tend to show the same general picture as those for type of injury. The rate of injury due to sprains, the leading category, was higher among the carpenters, but for the more serious injuries (lost time injuries), the rate was higher among the laborers.

When injury rates by part of body injured are examined (**Figure 8**), the injury rate for backs was higher among the carpenters but higher for laborers for lost time injuries. This is the same picture shown for overexertion in **Figure 6** and for sprains in **Figure 7**. The highest rate overall was for fingers for carpenters (more than double the rate for laborers) and for backs for laborers, but for lost time injuries, the part of body with the highest rate was the back for each of these two trades.

Comparison of Medical Care Utilization Rates

Both the carpenters and the laborers have health insurance coverage through their respective unions delivered through health care trusts. Both of these plans provide major medical coverage including outpatient and inpatient medical coverage, mental health and pharmacy benefits. The plans are very similar in terms of benefit structure, with major elements contrasted in **Table 49**.

Rates of utilization of medical care by inpatient/outpatient status are presented in **Table 50** for carpenters and laborers separately. The rates for both inpatient and outpatient care under the union health insurance were considerably higher for the laborers, but the reverse was true for medical care under workers' compensation.

The age-specific outpatient utilization rates for union health insurance and for workers' compensation are presented in **Figure 9**. For contacts covered by the union health insurance, the rates are higher for the laborers for every age group with the exception of those under 20 years of age. The large differences between carpenters and laborers occur at the older age groups. Workers' compensation rates are more comparable. For contacts covered by workers' compensation, the rates were somewhat higher for the carpenters for the age groups under 25 and for the 40-44, 50-54 and 65 and over age groups. For the remainder of the age groups, the rates for the two groups of workers were virtually equal. Since the number of female carpenters was so small and since females represented only 11% of the laborers cohort, comparison data on health care utilization will not be presented for females.

Data from the Department of Labor and Industries for the carpenters included claims for health care utilization that occurred during our seven year period of observation for work injuries that occurred before our observation period (or before the individual met all entry criteria). In contrast, for the laborers, data were only extracted for utilization associated with injuries that occurred during the follow up period. In the carpenters' data these claims for care for injuries that occurred before our period of observation accounted for 10% of workers' compensation charges. Since the follow up period was shorter for the laborers, the proportion of charges (and visits) that the cohort incurred that were not identified may very well have been greater than 10%.

In **Table 51** the proportion of outpatient visits by broad ICD-9 groups are presented for each trade with the relevant comparisons to the average weighted estimates from the National Ambulatory Care Survey 1991-1994 (carpenters: white male population, age 35-64; laborers: no race or gender exclusions, age 18-64). The proportion of visits for the carpenters and laborers are not dissimilar. As might be expected in working populations, both carpenters and laborers had lower proportions of outpatient visits for circulatory disorders. The very low proportion of visits for laborers for mental health disorders is a reflection of the fact that the vast majority of these visits were made to chemical dependency treatment centers which were considered out of scope for this analysis. In contrast, the carpenters had a greater proportion of mental health outpatient visits than reflected in NAMCS. The laborers had a much higher proportion of visits for injury and poisoning compared to the carpenters and compared to NAMCS proportions. Both of our worker groups had higher proportions of visits than the relevant NAMCS comparison group for respiratory disorders as well as symptoms and ill-defined conditions. Musculoskeletal disorders were somewhat higher for both groups, especially for the laborers (**Figure 10**). The latter is of particular interest in light of the fact that very high use of chiropractic services for musculoskeletal disorders among both of these worker groups were not even included in these comparisons. (NAMCS does not include chiropractor visits in scope, and no other comparative data are available for chiropractor visits.)

Hospital inpatient admission rates for males for the two cohorts are given in **Figure 11**. Except for the age group under 20, the hospital admission rates covered by the union health insurance for the laborers are much higher than those for the carpenters. For inpatient admissions covered by workers' compensation, the rates are generally higher for the carpenters, but the numbers in several age groups are too small to yield reliable rates.

The outpatient utilization rates for males by type of insurance and major ICD-9 diagnostic groups are presented in **Figure 12**. In the union health insurance system, the rates for laborers are much higher in almost all categories except for neoplasms. In that case, the carpenters have the higher rate. In workers' compensation, however, the utilization rates for the two groups are quite comparable.

Inpatient utilization rates by major ICD-9 categories are presented in **Figure 13**. Because of the relatively small numbers of admissions, we cannot attach much significance to the differences we note between the two trades. The relatively large rates for injuries and poisonings covered by the union health insurance, particularly among the laborers, raises the question as to whether some of these might have been work-related.

Medical Care Costs

In **Table 19** (carpenters) and **Table 40** (laborers), we had previously shown costs according to selected ICD-9 disease groupings, classified by the type of care such as inpatient, outpatient, and total, under the two health care systems (union insurance and workers' compensation). However, for the laborers, the grand total also includes the charges that are mentioned in the footnote to the table. These were charges that could not be allocated to any specific diagnostic category. Under the union health care system, heart disease ranks at the top in terms of the amount charged for general hospital inpatient care for both the carpenters and the laborers. For outpatient care, the highest charges were for diseases of the musculoskeletal system, followed by "Symptoms and Ill-Defined Conditions" for the carpenters and mental disorders for the laborers. Under workers' compensation, diseases of the musculoskeletal system ranked at the top for both groups for both inpatient and outpatient care.

Similarly in **Tables 20** (carpenters) and **41** (laborers), we have previously shown charges to the two health care systems per 1,000 person-years of eligibility for male workers. Given the small proportion of female members in both cohorts, similar analyses for them were omitted. Only inpatient and outpatient charges were included in these analyses. For the carpenters, diseases of musculoskeletal system rank highest in terms of charges to union health insurance per 1,000 person-years of eligibility, with heart disease a close second. For the laborers, heart disease ranks at the top. Under workers' compensation, for both the carpenters and the laborers, diseases of musculoskeletal system rank highest in charges per 1,000 person-years. A comparison of the two groups for the remaining diagnostic groups shows them to be remarkably similar.

Table 52 shows the percentages that musculoskeletal disorders and injuries represent of total charges in each insurance system. The findings are very similar for these two populations of active construction workers. About half of the workers' compensation charges are for the treatment of injuries and poisonings (52% for carpenters and 47% for laborers), and a quarter of the charges are for musculoskeletal disorders – neither of which is surprising. Through union insurance, musculoskeletal disorders account for 12% of charges for carpenters and 10% of charges for laborers; injuries account for 17% of charges for carpenters and 14% for laborers.

Finally, charges to the workers' compensation system per 100 person-years of union hours worked were computed according to the type of injury, nature of injury, and the body part injured. For this particular analysis, medical care for injuries was defined identically for both cohorts. Specifically, it was care received during our follow up period for injuries sustained in the follow up period. The results obtained are also very similar. **Figure 14** shows that for both the carpenters and the laborers, overexertion was the leading type of injury, costing the most per 100 person-years of work. **Figure 15** shows that sprains were the leading nature of injury for both groups, and **Figure 16** shows that the back was the leading part of body injured for both groups, in terms of charges per 100 person-years of work. In all three cases, the charges for the laborers (for the top category) exceeded that for the carpenters.

Additional Trade Specific Results

More detailed descriptions of methods and findings for some of these results, in the form of draft manuscripts or reports, are attached in the Appendices (see notations following headers).

Descriptive Results from Survey of Injured Carpenters

From 583 carpenters who were sent questionnaires, 39 questionnaires were returned because of inaccurate addresses. Of those we were able to contact (n=544), 188 responded to the questionnaire for a response rate of 35%. Of the 188 who responded, 149 had experienced an injury while working as a carpenter in the last ten years that had required at least a week of time away from work. The responses of those 149 individuals are summarized below.

The ages of these individuals ranged from 27 to 65 years, with a mean and median of 44 years. They were almost exclusively white (95%). Fifty-one percent (51%) had more than a high school education, 40% were high school graduates and 9% had less than a high school degree. The majority were married (72%), with 12% being single and 11% divorced. The length of time since injury, time out of work immediately following the injury, years in the construction trade and time in the union when injured, and current work and union status are presented in **Table 53**. Over half of these injuries had occurred over five years previously, 45% had occurred between two and five years previously, and only one had occurred within the last year. The distribution of time out of work initially was quite skewed. Sixteen individuals were not out of work a full week immediately following their injury. The others were out from 1-259 weeks (mean 32 weeks, median 8 weeks). Thirty percent were out of work at least a month at the time of injury and 37% were out of work for 3 months or more. These individuals had worked in construction from less than a year to 44 years at the time of their injuries (mean 16 years, median 15 years) and had been in the union from less than a year to 42 years (mean 11.5 years, median 8 years). Only 54% acknowledged still working in construction, either full-time (n=80) or part-time (n=1) although several others (n=7) reported working in construction related jobs, such as, superintendents, inspectors, or non-union construction "odd jobs."

The frequency of several effects of work-related injuries are presented in **Table 54**. Over 90% of these individuals had received workers' compensation benefits in the form of medical care or wages for paid lost time. Three individuals reported that they chose not to report a workers' compensation injury, and one additional person explained that he felt he would be laid off from his job if he filed. One filed a claim that was rejected for coverage. One individual was injured while working on a Habitat for Humanity House and was not covered by workers' compensation. Over 10% never returned to work after their injury and 56 (37.8%) reported having to miss work again after their initial return. Twenty percent (n=30) reported they were less able to handle stress than before their injury.

A variety of financial consequences were associated with these work injuries. Forty-five percent (n=67) reported losing their union insurance benefits at some time because of failure to work enough hours to maintain coverage. Twenty-four percent (24%) reported having additional insurance coverage through a spouse at the time of the injury that they could use, and 8.7% (n=13) reported that they actually utilized this coverage. Forty-eight (32%) individuals had failed to see a doctor due to concerns about insurance coverage or out-of-pocket expenses. This figure compared to 38 individuals, or 25.5%, who had this problem prior to their work injury.

Just over 25% reported having had a family member take time off work or school to provide assistance. The majority (n=109, 73.2%) reported having a significant loss of income due to their injury, with 24% reporting losses of over $50,000. Thirty-five percent reported an inability to pay bills and 30% reported the need to defer purchases. Twenty individuals (13.4%) had to change their place of residence because of financial concerns.

A number of work-related changes were also reported including changes in the type of work accepted (41.7%), changes in the speed with which work could be done (49.7%) and the inability to do certain tasks (53%).

In addition to specific items that respondents were asked about, a number of additional financial impacts were reported. These are described in **Table 55**. Some relate to specific direct losses and others to the effects of the financial losses such as need to move, sell items, failure to save for kid's education, and divorce.

As might be expected, individuals who were out of work for three months or more initially following their work injury were significantly more likely to have lost their health insurance benefits at some time (81.8%), to have reported a significant loss of income (92.7%), and were more likely to have never returned to work (20%). No relationship was found between satisfaction with medical care and length of time out of work following injury ($p=0.52$).

Responses to health related quality of life questions are presented in **Table 56** contrasting those who returned to work in less than three months with those who were out of work three months or more. Overall appraisal of health, ability to accomplish tasks due to emotional distress, and report of feeling calm and peaceful all or most of the time were not associated with time off work. A variety of activity limitations were significantly associated with time off work as were reports of pain interfering with activity, feelings of downheartedness and lack of energy.

In addition to specific questions to which these workers were asked to respond, they were asked to tell us about anything else they thought was important for us to know about the effects of having had a work-related injury. Ninety-seven individuals (51.6% of respondents) provided additional descriptions of problems they had encountered. Their concerns largely centered around problems related to financial security, physical impairment, job security and stress in the workplace and at home.

Financial problems were not limited to individuals who described serious injuries or long term loss of work. Several carpenters expressed concern over immediate financial problems following what they described as 'short term injuries.' Some of these problems were caused by delayed payment from Labor and Industries for approved compensation claims. Others expressed concerns over maintaining their union health insurance during periods of time when they were unable to work due to injury and the high cost of COBRA payments, as well as medical bills that were not covered under compensation.

A number of carpenters raised concerns about long term job security. They expressed concerns over "not measuring up" anymore, loss of self-confidence and discrimination against carpenters who have experienced injuries in getting jobs. Physical impairments that were specifically mentioned were most often of a musculoskeletal nature but also included eye injuries and hearing loss. Carpentry was described as physically taxing work that pays well, and several concerns were raised over the inability to make the same level of salary in other jobs. This was described as necessitating a carpenter to plan for his/her future including provision of a "nest egg," disability insurance, and the development of other skills that will allow one to work outside the trade. Concerns were raised about unrealistic expectations of counselors involved in retraining skilled workers who have commanded relatively high wages.

A number of mental health repercussions of injuries were expressed including depression, panic attacks, alcohol abuse, loss of self-esteem and self-confidence, and guilt over not working and providing for the family. Effects were not limited to the worker but included family members as well as the injured worker. Social outlets were lost with the inability to do usual hobbies and tasks at home as well as ones at work. Complaints were raised over lack of concern for the worker and family both from employers and the union. Workers felt a lack of recognition that older workers, particularly, often work with pain and discomfort and that many work-related injuries go unreported to avoid the problems that filing a claim creates.

Results from Interviews with Injured Carpenters
(Complete detailed report of interviews with injured carpenters included in appendices.)

The purpose of this investigation was to gain an in-depth understanding of the social, emotional and economic impacts of workplace injuries on carpenters. As part of this study, 20 carpenters living in western Washington State participated in interviews or small group discussions during the summer and fall of 1998. Participants included 17 men and three women ranging in age from 31 to 59. The interviews and focus groups were conducted by staff of the Center for Working Life, a non-profit organization based in Portland, Oregon. This qualitative study following the survey described above, provided in-depth discussions with injured carpenters to more fully reveal the effects that work injuries have on the lives of carpenters and their families.

Because of difficulty in arranging focus groups of carpenters who did not live close to one another, one-on-one interviews were conducted using open-ended questions. Fifteen men and two women participated in these interviews, and two men and one woman took part in a group discussion at a union hall. These discussions covered four general areas: availability and cost of medical care, direct and indirect economic impact of injuries, effects on the family and community activities, and impact on sense of self.

Examination of the challenges that carpenters face, the changes they experience in work and other areas, their coping strategies, and their self-identified needs highlight the importance of the following critical issues:

- Understanding and addressing not only the financial and health care needs of injured carpenters, but also the emotional and mental health effects of injury and subsequent life changes.
- Addressing the need that injured carpenters have for receiving clear information and social support from those who understand and empathize with their circumstances.
- Understanding the diverse career and life changes that can occur with aging or following an injury and developing benefits, retraining and career mobility systems that take such changes into account.

Participants made suggestions for ways in which their needs could be addressed which included the following.

1. **A Union Representative for Injured Workers.** Create a position for a union representative/advocate for injured carpenters or for peer counselors who would provide the following either directly or by referral to individuals with abilities relevant to union carpenters:

contact with the union; information on workers' compensation, health care, and union benefits; guidance in assessing training and career options; advocacy with L&I, medical professionals, vocational rehabilitation, and therapists.

2. **Peer Support.** Provide opportunities for injured workers to meet one another to share experiences, information and strategies for coping and making changes.

3. **Mentors for Women Apprentices.** Train and provide mentors for women to alert them to potential safety and health hazards that arise from harassment or from work pressures they face as women.

4. **Change the Benefits Structure.** Make changes in union benefits to address gaps in coverage when injured and the loss of pension when disabilities make the carpenter unable to continue carpentry work.

5. **Learning Opportunities.** Expand the scope and accessibility of learning opportunities to improve opportunities within and outside of carpentry.

6. **Mobility.** Provide more information about and more avenues for moving up within the construction industry or moving into new careers.

7. **Improve Health and Safety.** Find ways to improve health and safety to decrease accidents and cumulative injuries.

8. **Education and Political Advocacy.** Increase union involvement in educating the public about what carpenters do and advocating for policies which protect and assist injured workers.

Identification of Incident Cases of Cancer in Claims Data

The distributions of time between medical visits vary dramatically by type of cancer. The range of time between visits was greatest for Hodgkins disease, non-melanotic skin cancers, bladder cancer and prostate cancer and shortest for pleural, pancreatic and nasal cancers. The distribution of time between visits for these diagnoses are presented below.

DISTRIBUTION OF TIME (in days) BETWEEN MEDICAL ENCOUNTERS FOR SELECTED TYPES OF CANCER

Cancer Type	Range	Mean	Median
Skin (non-melanotic)	1-1,984	141.1	17
Hodgkins Disease	1-2,141	35.4	7
Bladder	1-2,078	61.9	8
Prostate	1-2,444	44.0	6
Pleural	1-56	17.7	14
Pancreatic	1-44	4.3	2
Nasal	1-92	3.9	2

We next explored how our SIR type analyses were affected by requiring different disease free periods of time before diagnosis designed to capture different proportions of cases. The SIR for colon cancer was 2.56 if you assume (falsely) that all cases identified in the claims data are incident. By requiring a period of 24 months of disease free observation, which allows a lag accounting for 95% of the distribution of time between encounters, the SIR was 1.92. With an extremely restrictive definition of incidence, requiring at least four years of disease-free observation before a case was considered incident, the SIR was 1.51. Excess lagging, as in the latter case, no doubt results in fewer observed cases (less sensitivity) and significantly less person-time of observation upon which to base the analyses. While these results are suggestive of an excess of colon cancer among carpenters, the true magnitude of risk has not been determined by our preliminary studies although the relative risk likely ranges from 1.5 to 2.5. The analyses with no lagging and lagging 24 months are shown below.

COLON CANCER STANDARDIZED INCIDENCE RATIO ANALYSES --- no lag
Among Male Carpenters in Western Washington

	Observed	Expected	Ratio
Total	91	35.58	2.56

COLON CANCER STANDARDIZED INCIDENCE RATIO ANALYSES -- lagged 24 months
Among Male Carpenters in Western Washington

	Observed	Expected	Ratio
Total	48.00	24.96	1.92

In an effort to separate incident cancer cases from prevalent cases, we identified the number of cancer cases for which we could identify the presence of a surgical pathology CPT (Current Procedural Terminology) code along with the presence of an ICD-9-CM code for carcinoma. It was assumed that new cases of cancer would be diagnosed by a pathology report and that the diagnosis and treatment course would follow from that report. When this criterion was added to define incidence, the number of cancer cases (all sites) decreased from 1318 to 561. In the table below these changes in frequencies are demonstrated for cancers with 15 or greater cases. The proportion of cases in the elderly age groups demonstrated the most drop-off. This decrease may indicate that some of the cases with only an ICD-9CM diagnosis were prevalent cases; however, the reduction also excludes many true incident cases. An accurate assessment can not be determined without a gold standard such as medical record review for case validation or the use of SEER data linked on an individual basis which is available for some areas of the country, including Western Washington.

MAJOR CANCER SITES AMONG MALE CARPENTERS 1989-1995

Cancer sites with ≥15 cases

Cancer	ICD-9-CM Code	Frequency by ICD-9-CM diagnosis	Frequency by ICD-9-CM diagnosis and surgical pathology CPT code
Prostate	185	314	127
Skin (non-melanoma)	173	292	215
Trachea/bronchus/lung	162	117	35
Colon/rectum	153-154	92	37
Bladder	188	63	30
Non-Hodgkins lymphoma	200, 202	46	16
Oral cavity and pharynx	140-149	36	7
Melanoma	172	29	16
Kidney, ureter	189	27	8
Brain/nervous	191-192	26	4
Leukemia	204-208	25	7
Stomach	151	23	10
Breast	174-175	22	2
Esophagus	150	21	6
Larynx	161	21	10
Hodgkins lymphoma	201	17	6

Further development and validation of methods for identifying incident cases is needed for more reliable risk estimates.

Work-related Eye Injuries Among Union Carpenters
(Manuscript with detailed methods and findings attached in appendices; Published: *Applied Occupational and Environmental Hygiene*, October 1999)

Eye injuries were responsible for 12% (n=1730) of the workers' compensation claims during this time period, exceeded only by back and finger injuries. Thirty-one claims resulted in paid lost time from work and these cases accounted for one third of all costs for medical care for eye injuries. At least 10% of all medical costs for eye injuries and 35.5% of medical costs for eye injuries which resulted in paid lost time were associated with injuries sustained while hammering -- a very common carpenter exposure. Claims were filed at an estimated rate of 6.1 per 200,000 hours worked.

Individuals with previous compensation claims for eye injuries had rates of injury 1.6 times higher than individuals without previous eye injuries. Rates decreased significantly with age and time in the union. Eye injuries among these union carpenters were very common, but the rate of injuries severe enough to require paid time off work was quite low. These findings raise questions about factors which might influence the failure to use appropriate protection including availability and acceptability of eye protection, use by peers, and perception of risk.

Work Injuries and Associated Costs In Drywall Installation
(Manuscript with detailed methods and findings attached in appendices; In review: *Applied Occupational and Environmental Hygiene*, July 1999).

Between 1989 and 1995 1,773 drywall carpenters filed 2,567 workers' compensation claims representing an overall rate of 53.3 per 200,000 hours worked. These claims were filed by 1,046 different individuals, or 59.0% of the cohort. Claims resulting in paid lost time from work were filed at a rate of 12.5 per 200,000 hours worked (n=609). The paid lost time claims were filed by 445 (25.1%) different individuals. The most common mechanism of injury involved being struck (38.3%), overexertion (28.1%) and falls (13.2%). Struck by injuries most commonly involved cuts to the upper extremity. Overexertion injuries were most commonly described as sprains or strains involving the back. Sheetrock was associated with over 40% of these injuries. Falls most commonly involved injuries to the knee followed by the back and multiple injuries. Struck by injuries decreased steadily with increasing age and increasing time in the union. There was a steady increase in the rate of falls with increasing age. Overexertion injuries were responsible for the greatest proportion of costs for medical care, permanent impairment, and paid lost days.

The high rates of overexertion injuries among these workers is not surprising based on knowledge of known ergonomic stresses on drywall jobs. However, these workers are also at high risk of acute traumatic injuries.

Injury Related Health Care Utilization Among Carpenters with Alcohol or Substance Abuse Related Diagnoses
(Manuscript with detailed methods and findings attached in appendices; In review: *American Journal of Public Health*, August, 1999)

During this seven year period of time 491 people (3.8% of the cohort) filed insurance claims for an alcohol or substance abuse related (ASRD). Those treated for ASRD had significantly higher injury related utilization rates through their union insurance coverage (RR=2 for outpatient care and RR=4.3 for inpatient care). This pattern was consistent for all age groups under the age of 60. The cost ratios for injury care through private insurance among these two groups were greater than the utilization ratios - a likely indication that those with ASRD sustained more serious injuries. Individuals treated for substance abuse did not have higher utilization rates for injury related care through workers' compensation, with the exception of males under the age of 20 years old. These young men with ASRD had higher rates of outpatient injury utilization in workers' compensation (RR=2.9).

The results in the private insurance system are consistent with reports of others associating injury and substance abuse, while a quite different picture is seen when evaluating that association in the workers' compensation system. Through workers' compensation we did not find significant evidence of higher injury rates, higher utilization rates for injury care or greater cost among those with ASRD. One possible, or partial, explanation for these different patterns in private and workers' compensation insurance is cost shifting with individuals with substance abuse problems being more likely to file injury related care through their "no fault" private insurance. However, our analyses of the more rare serious events, in which the individual would be less able to exercise an option for payment, are not consistent with this explanation.

Work-related Upper Extremity Musculoskeletal Injuries Among Union Carpenters
(Copy of dissertation is attached in appendices.)

Over this seven year period 1,720 approved workers' compensation claims for upper extremity musculoskeletal injuries were filed by 1,482 cohort members; one third of all claims involved paid lost time. The average annual cost to workers' compensation for these injuries totaled nearly $2 million. The average cost per hour worked was $0.21. The overall claim rate for upper extremity musculoskeletal injuries was 5.3 per 200,000 hours worked.

Inexperience as a union carpenter appeared to be the most consistent risk factor for filing upper extremity musculoskeletal injury claims. Carpenters with less than one year of union experience had nearly a two-fold risk of filing a claim compared to carpenters with 15 or more years of experience. The least experienced carpenters were 2.5 times as likely as the most experienced to file a paid lost time claim. Once injured, the least experienced carpenters were about twice as likely as their most experienced counterparts to file a second claim. And, among carpenters who were disabled and missed at least one month of work, the least experienced carpenters had longer periods of time away from work than their more experienced counterparts. The impact of musculoskeletal injuries among inexperienced carpenters was substantial because 43 percent of the carpenters entering the cohort were new recruits. These findings speak to the need for enhanced primary, secondary, and tertiary prevention of musculoskeletal injuries among new recruits and apprentice carpenters.

Women were about twice as likely as men to file a claim and nearly three times as likely to require paid lost time. The increase in risk for paid lost time claims among women was mostly due to lower arm injuries. Women were about 50 percent more likely than men to file a second claim, although the estimate was imprecise. The reasons for the increased risk among women carpenters are not well understood. Research to identify tools and work tasks associated with upper extremity musculoskeletal disorders among female carpenters is needed. The course of recovery from these disorders may also differ by sex. Answers to these questions may help women gain a foothold in the construction trade and in other physically demanding, male-dominated trades.

VIII. DISCUSSION

We used combined administrative data to identify cohorts of carpenters and laborers, their health insurance claims through both workers' compensation and their union health insurance coverage, and appropriate periods of eligibility for coverage, providing a measurement of time at risk. Our goals were to explore how these administrative data might be used to better understand the health care delivery to workers – in this case union carpenters and laborers – and how claims data might be utilized more fully for epidemiologic research. We were interested in ways in which we might better understand the potential interplay across these two different payment systems, and we were particularly interested in how serious work-related injuries might influence this interaction.

Analyses of utilization are often limited to self-report or analyses of care through either private insurance coverage or medicare. Utilization data through workers' compensation is more difficult to obtain. The State of Washington is one of six state administered workers' compensation funds. As such, they were able to provide us with not only the work injury records but also the claims for medical care for those injuries. These combined data sources provided a unique opportunity to look at the overall health care utilization for two large groups of active construction workers. Comparable analyses were completed allowing us to make internal comparisons of patterns and rates of care for each trade and to make comparisons between trades. In addition, attempts were made to identify appropriate sources of data for external comparisons to allow us to assess how the amount of medical care for specific diagnoses observed among these cohorts of construction workers compare with the amount of care expected based on relevant comparison groups in the U.S.

Our findings for both carpenters and laborers document rates of work-related injuries that are much higher than reported by the Bureau of Labor Statistics. The discrepancies are greater for less serious events but still exist for lost time injuries as well. These findings are consistent with our earlier findings with a more limited time period (Lipscomb, Kalat, and Dement, 1996), and with findings of others (Glazner et al.,1998) which suggest that data sources such as the Bureau of Labor Statistics may provide sizable underestimates of the burden of injury in construction.

A very significant proportion of health care was delivered for these construction workers through the workers' compensation system. In seeking to understand the health care delivery for these workers a very large proportion of their overall health care would be missed without including the care received through workers' compensation. The rates of utilization for carpenters and laborers through the workers' compensation system were quite comparable. However, laborers consistently have higher utilization through their union insurance for reasons that are difficult to understand in light of the very similar benefit structures.

Chronic work related diseases are less likely to be identified in compensation data (e.g. lung cancer). Previous studies have demonstrated increased risks but cases do not show up in compensation records.

A number of factors could potentially influence the interplay between these two health care delivery systems. Workers with serious work-related injury might experience increased numbers of visits through their union insurance following injury or, in contrast, their usual health care needs might be met through their visits to care providers covered under workers' compensation. These analyses were constrained somewhat by lack of observation after closure of a work-related injury claim, but we found no consistent evidence of cost shifting. With longer periods of follow up, we might be able to address these issues more adequately.

Our analyses of carpenters with diagnoses of alcohol or substance abuse revealed very different patterns of injury-related care through workers' compensation and union insurance. This demonstrates the importance of being able to include care delivered through both systems in understanding health care delivery more completely for these workers. We did see that overall carpenters and laborers who experienced work-related injuries utilized more health services through their union plans than those without work injuries. After injuries, carpenters had lower rates of utilization through their union insurance than before, but laborers had slightly increased utilization. These findings seem to suggest that those who use services in one system are likely to use services in the other system. Follow up time was a limiting factor in these analyses, however.

To make valid comparisons to the general population it is important to have an appropriate population to use for comparison. Our populations of carpenters and laborers included individuals of working age, who had health insurance coverage by virtue of working. We wanted to compare the amount of medical care these construction populations received for specific diagnoses with the amount of care that would have been expected based on an appropriate comparison group -- specifically other workers who also had health insurance coverage that was obtained by working. The identification of an appropriate population for comparison of utilization was challenging.

The data used for population comparisons to the carpenters, due to their demographic make-up, was only the white male insured U.S. population. The weighted number of visits from NAMCS were often based on very few encounters resulting in unreliable estimates for most strata. To decrease this problem somewhat, we limited the analyses to individuals 35 years and older. For laborers, the data included men and women of all races aged 18 to 64. Our estimates of encounters that were within the scope of survey were also not without error. Provider type was often missing and approximations had to be made for these claims. We dropped all laboratory visits, which could be in scope if a person went to a physician's office just for lab work.

We had no comparison data for workers' compensation utilization since those visits were included with Medicaid, Champus, etc. in the NAMCS surveys. No data were available to compare utilization of care provided by chiropractors - a group of providers responsible for a large number of visits for both of these worker groups. Substance abuse inpatient visits are mostly not standard hospital visits but more likely at substance abuse treatment facilities, but there is not a good source of comparison data for this type of utilization. Appropriate data that can be used to make meaningful comparisons of health care utilization, across a wide range of services, to the general population or other worker groups remains a great need and should be a focus of future health services research.

We also used these data to identify a group of carpenters who had experienced work injuries that resulted in paid lost time. A group of these workers were subsequently surveyed by mail to gather descriptive information on the repercussions of work related injuries. These survey findings from the injured carpenters cannot be assumed to be representative of all construction work. Although it does not appear that respondents were more likely to have had prolonged time off work based on time off work of the initial sample, the respondents were older and had more time in the union than the overall cohort. However, the data do demonstrate several important points. A significant number of workers have significant sequellae of work related injuries, including financial losses, loss of insurance benefits, loss of ability to compete as well in the construction labor market, and the ability to cope with stress. Individuals who were out of work for three months or more reported more sequella of injury including financial loss, loss of insurance benefits and decreased measures of health related quality of life. However, they did not report significantly lower appraisal of their overall health. Workers do miss work after initial return following injury (in this sample of injured carpenters >37%) as described by Baldwin (1996), documenting the limitation in the use of the initial return to work as a useful outcome measure. Only 54% of those responding to the survey were still working in construction when they were surveyed, raising significant questions about the "natural history" of work among individuals in the construction trades.

We attempted to evaluate whether individuals who experienced work related injuries, particularly of a more serious nature, had higher health care utilization following these injuries through their union health insurance. We did not find any consistent evidence of long term carry over of care into the union insurance system and, in fact, there was some decrease in health care utilization through the union insurance after a serious work-related injury. However, these analyses were limited by follow up time to some extent with the majority of serious cases taking months to close through workers' compensation leaving relatively short periods of observation after case closure.

Social, emotional and economic consequences of injury are difficult to study. The more detailed interviews with a small convenience sample of injured workers provided a greater depth of information about difficulties encountered and needs of injured workers in several domains, including financial and health care needs, social support, and career and life changes.

In interpreting our findings, it must be kept in mind that when relying on health insurance claims - either private coverage or workers' compensation - a claim must be filed in order for a case to be recognized (Park, 1992; Van Peenen, 1986). When using such data, it is important to recognize that health events of interest are identified by the filing of an administrative instrument for payments. With any insurance data, it is important to recognize that it is health insurance claims that are being studied and not the incidence or prevalence of health events. Workers' compensation can be used to pay for medical care for events attributed to the workplace, as a method of income support for time away from work due to the event or both. There are a number of factors which could affect whether a person reports a work-related injury for either of these reasons.

"Seeking health care depends on the person's perception and interpretation of the significance of the symptoms, on availability and expectation of treatment, and on learned and cultural patterns of illness behavior" (Waddell, 1987). Filing of insurance claims may be influenced by the severity of the event. More minor illnesses and injuries may not require medical attention or the individual may seek care but not consider that the cost justified the filing of a claim with their health insurance provider (Tsai, 1991). It cannot be assumed that all work-related illnesses, or even injuries, will be captured in workers' compensation data. Even after a person decides to seek medical care, there appear to be factors which influence whether they chose to seek care through the compensation system. A comparison of National Electronic Injury Surveillance System (NEISS) data from emergency rooms concerning occupational injury with workers' compensation data revealed that the differences in reporting between these two databases was not random (Fingar, 1992). Younger workers were more likely to seek emergency room care than older workers, but they were less likely to file a compensation claim. This made younger workers' injuries more likely to be reflected in the NEISS data but missing in compensation files. If this same phenomenon occurs among construction workers on the West coast, then the already very high rates of occupational injuries we see among these workers may not fully represent the magnitude of the problem.

There were other limitations to these analyses as well. We had no information on the work done by members of our cohorts on non-union jobs, as indicated by injuries in months when there were no union hours worked. We had only crude categorizations of the type of work of the carpenters based on the predominant work of the local with which the carpenter was affiliated; we had no information on the type of work of the laborers. We had no information on medical care, and resulting charges, for treatment of work-related injuries where the employer was self-insured. This means that we underestimated the magnitude of care through workers' compensation. A good deal of descriptive information on these injuries also was unavailable. Other data were also missing. Specifically, gender was unknown for 16% of the laborers. In many cases assignment of ICD-9 diagnosis codes for the laborers' medical care required some assumptions.

When looking at the cost of medical care, we chose to look consistently at charges for medical care and not at payments. We recognize problems inherent in either method. In workers' compensation, payments are based on a determined fee schedule and the remaining unpaid charges do not become the responsibility of any person or institution. Through union insurance, payment is also based on a determined benefit structure, but the remaining charges do become the responsibility of the worker. Our intent in the majority of these analyses was to look at overall patterns of health care utilization. To this end, we wanted to compare costs across the workers' compensation system and the union insurance program, and we felt the most appropriate comparisons were to charges -- not to amounts paid under two different benefit structures. However, we acknowledge that the latter raises a series of important economic questions. In addition, charges for care were used at some level to address severity of illness or injury that cannot be addressed purely through utilization data.

Despite the limitations to the use of these administrative data there are advantages. There are practical problems that make the study of construction workers difficult including frequently changing employers, irregular and temporary employment, and often small and dispersed work sites. These factors make it difficult to enumerate cohorts of workers for study. By combining data sources we were able to define cohorts for study, identify their work-related injury claims, and their claims for health care for those events and for conditions treated under their union provided health insurance. This is not possible using each system separately. The combined data provide both numerators and denominators for computing medical care utilization rates and injury rates. Although we encountered great difficulty in finding sources of data for comparison to the general population, by making the data as comparable as possible between the carpenters and the laborers we could at least make reasonable comparisons between these two groups of construction workers. Linkage on an individual basis also makes it possible to study the relationship between injuries on the job and non-work-related medical care.

Combining these data provides relatively quick access to large amounts of data at a moderate expense. The information is collected by a third party, avoiding the introduction of bias by the researcher (Nelson, 1992; Ray, 1989). Potential bias in recalling medical care is avoided (Van Peenen, 1986). This could be a big advantage in studying details of events for which the individual may have difficulty recalling. The study of claims is not dependent upon the cooperation of subjects for full ascertainment of data. There are economic incentives to file a claim, which may help capture more information, although the potential for bias introduced by this incentive must, of course, be considered as well. Insurance claims allow the study of morbidity data in contrast to much occupational epidemiology, which focuses on mortality, leaving gaps in information about non-fatal conditions (Pell, 1989).

IX. CONCLUSIONS

These types of administrative data can be useful for epidemiologic research including a better understanding of heath services use by defined cohorts of workers. They provide information about morbidity which is difficult to capture for occupational groups. In the medical care findings among carpenters with alcohol and substance abuse related diagnoses, the importance of capturing a comprehensive picture of health care utilization is demonstrated. The results of these particular analyses document the need to look across insurance systems in fully understanding the health care delivery for this group of workers.

From our perspective, these data are most useful for comparisons within the cohorts allowing the identification of high risk sub-groups. There is a great challenge in identifying appropriate sources of data for comparisons to the general population. The data from national sources based on survey sampling techniques, such as NAMCS, when stratified into units that would be useful for epidemiologic work (by age, sex, and specific disease for instance) are often too thin to be reliable. There are not good sources of data for comparison of utilization through workers' compensation and there are problems identifying appropriate comparison data for care delivered through the rapidly evolving mental health/substance abuse systems. There is a need for identification, or possibly development, of other sources of data that can be used for comparison purposes.

We continue to find these data useful in analyses of workers' compensation injury data to more accurately define rates of injury, identify high risk groups within the cohorts, to describe injuries, and document associated costs. The greatest shortcoming is the lack of individual exposure information for members of the cohort and more detailed information about tasks in proximity to injury or illness among those who are hurt or become ill because of their workplace. For the carpenters we have been able to define a very crude surrogate based on predominant work of the union local. Work type is not always organized by local in other areas of the country and was not useful in our analyses involving the laborers. Since only two diagnostic categories (injuries / poisonings and musculoskeletal disorders) appear with any appreciable frequency for contacts covered by workers' compensation, it is quite clear that using workers' compensation data for the study of occupational diseases is not adequate.

The methods of identifying well-defined cohorts of construction workers and their health care experiences potentially allow for the identification of individuals with conditions of interest who could be contacted for more detailed questioning using a nested case-control design. We have previously used this technique to study asthma among carpenters (Lipscomb and Dement, 1998). However, the analyses of claims data in the manner we have used them involve a considerable lag between diagnoses or treatment for a condition and the actual analyses of events. These data could be much more useful if relationships were developed that would allow individuals with conditions of interest to be identified as soon as a claim for a particular condition was filed, as well as a pool of appropriate controls, from these claims data. This modified case-control design with prospective data collection shortly after an event of interest would facilitate rapid follow back with workers to ask appropriate exposure questions and could be very useful for etiologic research.

The relatively unique aspects of the Washington State workers' compensation system allowed these particular analyses. Most state based workers' compensation records do not contain records of medical care. Care delivered under the umbrella of workers' compensation is typically through a variety of insurance carriers. However, the same combinations of data could be collected through other state administered funds and through a variety of large industries which self-insure for health insurance and workers' compensation.

X. RECOMMENDATIONS FOR FURTHER STUDY

Our analyses and findings provide information that point to needs for additional information, as well as new research methods. For some of these issues we have already begun additional actions. Our recommendations, and actions when taken, are enumerated below.

- Among carpenters, work-related injury rates were highest among individuals who did drywall or residential work. To identify the etiology of these injuries and to make specific prevention recommendations, investigation beyond the level of analyses of coded injury data collected for administrative purposes is warranted. Towards this need funding has been secured from NIOSH (RO1), based in part on these analyses as preliminary data, to do prospective injury reporting and investigations with a large cohort of union carpenters in St. Louis who do residential and/or drywall carpentry.

- Our exploratory attempts at defining incident cancer cases show possibly higher than expected incidence for several cancers. Alternatively, this could represent access to treatment with increased survival and, thus, more prevalent cases. There is a need to evaluate methods that allow the use claims data for cancer epidemiology; specifically, there is a need to be able to discriminate incident from prevalent cases with reasonable accuracy. A grant (RO1) application has been submitted to NCI/AHCPR to develop methods to utilize health claims data for cancer surveillance including validation methods. The initial review is complete and consideration is being given to resubmission based on comments of the review panel.

- Further evaluation of problems of alcohol/substance abuse seem warranted. Our analyses indicate the potential for cost savings from injury related care among individuals with these diagnoses, particularly through the health and welfare system. Little is known about substance abuse among dependents of construction workers. To address in more detail health care utilization among carpenters with diagnoses of alcohol or substance abuse and their dependents, we have secured funding through the Robert Wood Johnson Foundation Substance Abuse Policy Research program.

- Cost data analyses of work injuries provide a very reasonable method to set priority needs for prevention. By example, we saw very high cost per hour worked for falls from elevations among carpenters. Methods should be developed that incorporate both cost per injury, or cost per hour worked, as well as frequency of events and long term sequellae in establishing priority needs.

- The use of these types of data should be explored for hybrid nested-case control studies in which cases are identified in proximity to first diagnosis so pertinent exposure information can be gathered and compared to controls. This seems appropriate for study of respiratory disease, incident cases and aggravation of existing diseases; skin disorders; injuries and potentially risk factors for their sequellae.

- These data also have potential uses for case ascertainment of conditions such as disorders among family members from possible parental exposures if data on dependents were incorporated into analyses.

- Survey data which allowed the linkage of individual smoking histories with claims data could be very useful in understanding smoking related illness among construction workers and in planning and evaluating targeted intervention efforts.

- Women make up an increasing proportion of the construction workforce and yet our ability to analyze their experiences was limited by small numbers, even in these relatively large cohorts. Alternative methods of study are needed to adequately address the needs of women in the construction workforce and the repercussions of their employment. In our analyses of work-related injuries to the upper extremity, we found higher rates of injuries among women with the greatest burden due to lost time injuries to the lower arm -- but not the shoulder area. Research to identify tools and work tasks associated with upper extremity musculoskeletal disorders among female carpenters is needed. The course of recovery from these disorders may also differ by gender. Answers to these questions may help women not only gain a foothold in the construction trades and other physically demanding, male-dominated trades, but may also improve their longevity in the trades.

- Additional analyses are warranted in light of our consistent findings of higher injury risk, for a number of injuries and conditions, among those with the least amount of time in the union. These findings are often not explained by age differences. The findings may represent differences in training or experience, and in some cases they appear to; but they may also represent differences in exposure. Not recognizing, and addressing, the potential assignment of inexperienced workers to more dangerous or physically taxing tasks, may result in continued attribution of risk to inexperience alone and the failure to recognize high risk exposures which could be modified.

- Appropriate population based health care utilization data for specific diagnoses are needed for comparison with worker data. Current methods of collecting data on health care utilization do not meet epidemiologic study needs. Data need to be available that allow comparisons of chiropractic care and substance abuse treatment, along with other traditional inpatient and outpatient services. We recognize that this becomes quite a challenge in the changing face of health care delivery in the United States in recent years. Development of other linked databases on worker groups with more diverse exposures would be very useful, and this is potentially possible using data from other health care trusts. The importance of capturing health care delivery - not just injury events - through workers' compensation cannot be over-emphasized based on our findings in these two construction cohorts.

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XIII. Tables

Table 1

Distribution of Age by Gender
Washington Carpenters Cohort 1989-1995

	Gender		
Age Groups	Male	Female	Unknown
16-19 years	380	8	0
20-24 years	1,612	55	1
25-29 years	2,195	87	2
30-34 years	2,499	81	1
35-39 years	2,141	58	3
40-44 years	1,322	20	1
45-49 years	896	11	0
50-54 years	676	1	2
55-59 years	510	0	0
60-64 years	223	0	0
65 and over	37	0	0
Unknown	103	2	31
TOTAL	12,594	323	41

Table 2

Distribution of Predominant Type of Work Defined by Union Local Affiliation Washington Carpenters 1989-1995

Predominant Task of Local	**Individuals**
Light commercial	1,251
Heavy commercial	1,894
Mixed	5,679
Residential	345
Drywall	1,773
Millwrights	205
Piledrivers	632
Lumber/Sawmill	70
Local Outside W. Washington Trust	253 (2.0% of cohort)
No Washington State Local Identified	987 (7.6% of cohort)
TOTAL	12,958

Table 3

Distribution of Number of Months With Hours Worked
Washington Carpenters Cohort 1989-1995

Months with Hours after Cohort Entry	Number of Persons	Percent
0	1,044	8.1
1 to 6 months	2,489	19.2
7 to 12 months	1,306	16.1
13 to 18 months	949	7.3
19 to 24 months	772	6.0
25 to 30 months	656	5.1
31 to 36 months	650	5.0
37 to 42 months	582	4.5
43 to 48 months	615	4.7
49 to 54 months	504	3.9
55 to 60 months	516	4.0
61 to 66 months	498	3.8
67 to 72 months	576	4.4
73 to 78 months	761	5.9
79 to 81 months	1,010	8.0
All 82 months	30	0.2
TOTAL	12,958	100.0

Table 4

Continuous Insurance Eligibility by Length of Time in Cohort
Washington Carpenters Cohort 1989-1995

Months in Cohort	Number of Persons (Percent of Cohort)	Number with Continuous Eligibility (Row Percent)
1 to 6 months	2,163 (16.7)	2,017 (93.3)
7 to 12 months	1,047 (8.1)	729 (69.6)
13 to 18 months	969 (7.5)	604 (62.3)
19 to 24 months	703 (5.4)	376 (53.5)
25 to 30 months	703 (5.4)	346 (49.2)
31 to 36 months	476 (3.7)	220 (46.2)
37 to 42 months	586 (4.5)	191 (32.6)
43 to 48 months	563 (4.3)	217 (38.5)
49 to 54 months	536 (4.1)	185 (34.5)
55 to 60 months	386 (3.0)	54 (14.0)
61 to 65 months	397 (3.1)	65 (16.4)
66 to 71 months	382 (2.9)	52 (13.6)
72 to 77 months	724 (5.6)	106 (14.6)
78 to 81 months	2,683 (20.7)	243 (9.1)
All 82 months	640 (4.9)	248 (38.8)
TOTAL	12,958 (100%)	5,653 (43.6)

Table 5

Injury Rates by Age Groups
All Injuries
Washington Carpenters 1989-1995

Age Group	Person-years of hours	Persons[1] injured	Injuries	
			Number	Rate per 100 person-years
<20 years	240	141	190	79.2
20-24 years	2,049	801	1,330	64.8
25-29 years	4,184	1,373	2,317	55.4
30-34 years	6,260	1,741	2,951	47.1
35-39 years	6,672	1,601	2,742	41.1
40-44 years	5,036	1,141	1,830	36.3
45-49 years	3,103	647	1,017	32.7
50-54 years	2,345	468	723	30.8
55-59 years	1,782	347	503	28.3
60-64 years	813	176	238	29.2
65 and over	73	10	17	23.3
unknown	37	5	7	9.4
TOTAL	32,594	6,784	13,865	42.5

1 Each injured carpenter only counted once in any given category regardless of the number of injuries sustained. Total figure does not represent sum of column since the same carpenter can be represented in more than one age category.

Table 6

Injury Rates by Age Groups
Time-Loss[1] Injuries
Washington Carpenters 1989-1995

Age Group	Person-years of hours	Number of persons[2] injured	Injuries	
			Number	Rate per 100 person-years
< 20 years	240	33	36	15.0
20-24 years	2,049	182	199	9.7
25-29 years	4,184	427	482	11.5
30-34 years	6,260	541	628	10.0
35-39 years	6,672	524	607	9.1
40-44 years	5,036	381	443	8.8
45-49 years	3,103	211	235	7.6
50-54 years	2,345	172	193	8.2
55-59 years	1,782	108	122	6.8
60-64 years	813	60	66	8.1
65 and over	73	2	2	2.7
Unknown	37	2	3	9.3
TOTAL	32,594	2,451	3,016	9.3

1 Time-loss or compensable injuries required four or more days away from work.

2 Each injured carpenter only counted once in any given category regardless of the number of injuries sustained. Total figure does not represent sum of column since the same carpenter can be represented in more than one age category.

Table 7

Distribution of Hours Worked and Frequency and Rate of Work Related Injuries by Predominant Type of Work of Union Local Washington Carpenters 1989-1995

Predominant Task of Local	Person-years of hours 1989-95	Injuries: Overall Number	Injuries: Overall Rate[1]	Injuries: Time-Loss Number	Injuries: Time-Loss Rate[1]
Light commercial	2,589	1,000	38.7	208	8.0
Heavy commercial	5,589	2,070	40.2	412	8.0
Mixed	15,797	6,039	38.2	1,288	8.2
Residential	448	283	62.9	71	15.8
Drywall	4,816	2,567	53.3	609	12.6
Millwrights	626	280	44.8	50	8.0
Piledrivers	2,173	607	27.9	108	5.0
Lumber/Sawmill	207	31	15.1	5	2.4
Local Outside W. Washington Trust	305 (<1% of hrs)	133	43.6	35	11.5
No Washington State Local Identified	481 (1.5% of hrs)	855	178.1	230	47.9
TOTAL	32,594	13,865	42.5	3,016	9.3

[1] Rates are per 200,000 hours worked or 100 person-years of work.

Table 8a

Injury Rates by Type of Injury
All Injuries
Washington Carpenters Cohort 1989-1995

Type of Injury	Number of persons[1] injured	Injuries	
		Number	Rate of injury per 100 person-years
Struck by[2]	3,066	3,348	10.3
Overexertion	2,816	3,061	9.4
Struck against	1,619	1,740	5.3
Abraded	1,181	1,375	4.2
Fall from elevation	896	913	2.8
Fall same level	618	644	2.0
Bodily Reaction	496	518	1.6
Contact with toxin	213	217	0.7
Caught in, under, between	199	201	0.6
Temperature extremes	64	66	0.2
Electricity	21	21	0.1
Motor vehicle, highway	19	19	0.1
Motor vehicle, non-highway	8	8	<0.1
Explosions	4	4	<0.1
Missing Code	1,269	1,730	5.3
TOTAL	6,784	13,865	42.5

1 Each injured carpenter only counted once in any given category regardless of the number of injuries sustained.

2 This category includes 123 injuries in 122 individuals from 'continuous noise' (injury rate and rate of persons injured= 0.4 per 100 person-years).

Table 8b

Injury Rates by Type of Injury
Time-Loss[1] Injuries
Washington Carpenters Cohort 1989-1995

Type of Injury	Number of persons[2] injured	Injuries	
		Number	Rate of Injury per 100 person-years
Overexertion	1,262	1,311	4.0
Struck by	472	662	2.0
Fall from elevation	374	380	1.2
Fall same level	229	234	0.7
Bodily Reaction	205	207	0.6
Caught in, under, between	50	50	0.2
Abraded	33	33	0.1
Contact with toxin	24	24	0.1
Motor vehicle, highway	7	7	<0.1
Temperature extremes	8	8	<0.1
Electricity	2	2	<0.1
Motor vehicle, non-highway	2	2	<0.1
Missing Code	95	96	0.3
TOTAL	2,451	3,016	9.3

1 Time-loss or compensable injuries required four or more days away from work.

2 Each injured carpenter only counted once in each category regardless of the number of injuries sustained. Total figure does not represent sum of column since the same carpenter can be represented in more than one type of injury category.

Table 9a

Injury Rates by Nature of Injury
All Injuries
Washington Carpenters 1989-1995

Nature of Injury	Number of persons[1] injured	Injuries	
		Frequency	Rate of injury per 100 person-years
Sprains	2,864	3,929	12.1
Cut	2,584	3,278	10.1
Scratches	1,252	1,489	4.6
Contusion	1,036	1,172	3.6
Ill-defined symptoms	531	561	1.7
Fracture	544	555	1.7
Multiple injuries	197	203	0.6
Nerve Conditions	133	136	0.4
Dislocation	137	139	0.4
Hearing loss	119	120	0.4
Hernia	94	98	0.3
Bursitis	90	90	0.3
Other [2]		511	1.6
Not classified	1,121	1,584	4.9
TOTAL	6,784	13,865	42.5

1 Each injured carpenter only counted once in each category regardless of the number of injuries sustained. Total figure does not represent sum of column since the same carpenter can be represented in more than one nature of injury category.

2 All others, each contributed < 80 injuries with rates < 0.25

Table 9b

Injury Rates by Nature of Injury
Time-Loss[1] Injuries
Washington Carpenters Cohort 1989-1995

Nature of Injury	Number of persons[2] injured	Injuries	
		Frequency	Rate of injury per 100 person-years
Sprains	1,270	1,468	4.5
Cuts	278	284	0.9
Fractures	280	283	0.9
Ill-defined	242	245	0.8
Contusion	190	192	0.6
Nerve Conditions	93	94	0.3
Dislocation	88	88	0.3
Hernia	80	83	0.3
Multiple Injuries	75	76	0.2
Other[3]		120	0.4
Missing Code	76	83	0.3
TOTAL	2,451	3,016	9.3

1 Time-loss or compensable injuries required four or more days away from work.

2 Each injured carpenter only counted once in each category regardless of the number of injuries sustained. Total figure does not represent sum of column since the same carpenter can be represented in more than one nature of injury category.

3 All other injuries not listed. Each contributed to < 30 events and rates < than 0.09.

Table 10a

Injury Rates by Part of Body Injured
All Injuries
Washington Carpenters 1989-1995

Body Part Injured	Number of persons[1] injured	Injuries	
		Frequency	Rate of injury per 100 person-years
Back	1,623	1,941	6.0
Eye(s)	1,428	1,730	5.3
Hand	769	837	2.6
Knee	671	711	2.2
Wrist	517	541	1.7
Foot	449	462	1.4
Shoulder	397	413	1.3
Back/Neck	343	381	1.2
Multiple	338	356	1.1
Elbow	304	320	1.0
Ankle	296	306	0.9
Forearm	240	246	0.8
Neck	192	198	0.6
Other [2]		1,877	5.8
Unclassified	1,053	1,483	4.5
TOTAL	6,784	13,865	42.5

1 Each injured carpenter only counted once in each category regardless of the number of injuries sustained. Total figure does not represent sum of column since the same carpenter can be represented in more than one part of body category.

2 Other includes all others; each < 180 injuries and rates < 0.5.

Table 10b

Injury Rates by Body Part Injured
Time-Loss[1] Injuries
Washington Carpenters 1989-1995

Body Part Injured	**Number of persons[2] injured**	**Injuries**	
		Frequency	**Rate of injury per 100 person-years**
Back	760	831	2.5
Knee	308	317	1.0
Finger	250	256	0.8
Shoulder	179	187	0.6
Wrist	177	182	0.6
Multiple	139	144	0.4
Back/Neck	120	124	0.4
Foot	109	109	0.3
Abdomen	99	102	0.3
Ankle	97	100	0.3
Hand	91	91	0.3
Elbow	87	88	0.3
Neck	64	64	0.2
Other [3]		399	
Missing	22	22	0.1
TOTAL	2,451	3,016	9.3

1 Time-loss or compensable injuries required four or more days away from work.

2 Each injured carpenter only counted once in each category regardless of the number of injuries sustained. Total figure does not represent sum of column since the same carpenter can be represented in more than one part of body category.

3 All others contributed < 40 injuries with rates of < 0.13

Table 11

Age Specific Utilization Rates by Type of Insurance
Washington Carpenters 1989-1995

Males, Outpatient

	Union Health Insurance			Workers' Compensation		
Age Category	**Number of persons[1]**	**Number of Visits**	**Rate of visits per 1000 person-years**	**Number of persons[1]**	**Number of Visits**	**Rate of visits per 1000 person-years**
< 20 years	68	475	1,914.7	91	3,414	2,277.7
20-24 years	487	4,708	2,092.1	640	32,638	2,153.1
25-29 years	1,073	11,542	2,516.2	1,173	15,482	2,825.0
30-34 years	1,603	18,699	2,694.3	1,538	22,664	2,782.2
35-39 years	1,624	20,902	2,778.7	1,471	25,370	2,862.0
40-44 years	1,234	16,705	2,835.3	1,053	19,337	2,780.2
45-49 years	785	10,773	2,980.3	610	11,109	2,628.7
50-54 years	587	9,009	3,135.8	445	9,102	2,723.8
55-59 years	517	7,559	3,098.3	358	6,533	2,415.6
60-64 years	323	6,415	3,452.0	186	3,221	1,641.5
65 and over	100	2,206	2,891.9	40	333	424.2
OVERALL	8,401	108,993	2,795.5	7605	119,655	2631.5

[1]Individuals may be represented in more than one age category over the seven year follow up period.

Table 12

Age Specific Utilization Rates by Type of Insurance
Washington Carpenters 1989-1995

Males, Inpatient

	Union Health Insurance			Workers' Compensation		
Age Category	Number of persons	Number of admissions	Rate of admissions per 1000 person-years	Number of persons	Number of admissions	Rate of admissions per 1000 person-years
< 20 years	8	9	36.3	1	1	3.5
20-24 years	25	29	12.9	10	11	4.0
25-29 years	66	87	19.0	34	44	8.0
30-34 years	110	135	19.5	51	62	7.6
35-39 years	100	118	15.7	64	80	9.0
40-44 years	79	100	17.0	60	69	9.9
45-49 years	59	86	23.8	34	42	9.9
50-54 years	62	91	31.7	23	28	8.4
55-59 years	45	57	23.4	28	36	13.3
60-64 years	51	79	42.5	11	141	7.1
65 and over	22	33	43.3	1	1	1.3
OVERALL	627	824	21.1	317	388	8.5

1 Individuals may be represented in more than one age category over the seven year follow up period.

Table 13

Age Specific Utilization Rates by Type of Insurance
Washington Carpenters 1989-1995

Females, Outpatient

	Union Health Insurance			Workers' Compensation		
Age Category	Number of persons	Number of Visits	Rate of visits per 1000 person-years	Number of persons	Number of Visits	Rate of visits per 1000 Person-years
< 20 years	1	26	5,200.0	2	8	1,548.4
20-24 years	17	393	6,093.0	17	144	1,822.8
25-29 years	49	466	3875.3	34	421	2,865.6
30-34 years	58	1,019	5818.8	50	1,431	5,819.0
35-39 years	49	798	4608.3	37	594	2,859.2
40-44 years	20	561	6,250.7	22	590	5,518.3
45-49 years	9	216	5,562.2	8	185	4,065.9
50-54 years	3	4	3,761.2	1	15	1.052.6
55-59 years	--	--	--	--	--	--
60-64 years	--	--	--	--	--	--
65 and over	--	--	--	--	--	--
OVERALL	206	3,521	5,055.3	171	3,388	3,968.8

1 Individuals may be represented in more than one age category over the seven year follow up period.

Table 14

Utilization Rates by Type of Insurance
By Predominant Type of Work
Washington Carpenters 1989-1995

Outpatient

	Union Health Insurance			Workers' Compensation		
Predominant Type of Work	Number of persons	Number of Visits	Rate of visits per 1000 Person-years	Number of persons	Number of Visits	Rate of visits per 1000 Person-years
Heavy Commercial	949	17,810	2,916.5	916	17,810	2,504.1
Light Commercial	547	8,174	2,499.1	552	8,418	2,174.3
Mixed Commercial	3,071	55,758	2,877.8	2,763	53,528	2,400.3
Residential	94	1,186	2,110.3	134	2,365	3,465.4
Drywall	960	17,304	2,963.2	1,081	29,578	4,244.6
Millwright	107	2,226	3,012.2	107	2,518	2,748.4
Piledriving	360	6,130	2,454.2	205	4,050	1,425.9
Lumber Sawmill	38	1,093	4,237.8	11	124	429.4
Local Outside Western Washington	108	1,686	4,110.5	107	1,777	3,305.5
No Washington Local Identified	115	1,147	1,788.2	206	2,875	3,512.9

Table 15

Utilization Rates by Type of Insurance
By Predominant Type of Work
Washington Carpenters 1989-1995

Inpatient

	Union Health Insurance			Workers' Compensation		
Predominant Type of Work	Number of persons	Number of Visits	Rate of visits per 1000 Person-years	Number of persons	Number of Visits	Rate of visits per 1000 Person-years
Heavy Commercial	110	157	25.7	44	53	7.5
Light Commercial	50	63	19.3	31	38	9.8
Mixed Commercial	285	383	19.8	144	184	8.3
Residential	6	12	21.4	4	5	7.3
Drywall	100	147	25.2	52	68	9.8
Millwright	12	14	18.9	7	7	7.6
Piledriving	27	47	18.8	12	14	4.9
Lumber Sawmill	8	12	46.5	0	0	--
Local Outside W. Washington	8	10	24.4	6	15	27.9
No Washington Local Identified	9	9	14.0	7	7	8.6

Table 16

Utilization Rates by Type of Insurance and Major ICD-9 Disease Groups
Carpenters Washington State 1989-1995
Males, Outpatient

	Union Health Insurance			Workers' Compensation		
ICD9 codes	**Number of persons**	**Visits**	**Rate of visits per 1,000 person-years**	**Number of persons**	**Visits****	**Rate of visits per 1,000 person-years**
Infectious Diseases (001-139)	1,107	1,804	46.3	36	83	1.8
Neoplasms (140-239)	831	5,072	130.1	30	49	1.1
Endocrine, Nutritional, and Metabolic Diseases (240-279)	652	2,216	56.8	19	61	1.1
Diseases of the Blood (280-289)	109	241	6.2	4	5	0.1
Mental Disorders (290-319)	1,071	15,512	397.9	59	353	7.8
Diseases of the Nervous System (320-389)	2,293	4,039	103.6	847	3,289	72.3
Diseases of the Circulatory System (390-459)	1,468	5,005	128.4	91	263	5.8
Diseases of the Respiratory System (460-519)	4,237	8,637	221.5	128	366	8.1
Diseases of the Digestive System (520-579)	1,566	3,336	85.6	159	541	11.9
Diseases of Genitourinary System (580-629)	1,442	3,345	85.8	37	89	2.0
Diseases of the Skin (680-709)	1,868	3,158	81.0	292	666	14.7
Diseases of the Musculoskeletal System and Connective Tissue (710-739)+	5,501	33,361	855.7	3,525	20,931	460.3
Congenital Anomalies (740-759)	72	173	4.4	43	226	5.0
Symptoms and Ill-defined Conditions (780-799)	3,719	7,805	200.2	678	1,072	23.6
Injury and Poisoning (800-999)	4,410	15,118	387.5	12,532	80,280	1,765.6
V-codes	78	90	2.31	2,134	3,961	87.1
Missing	44	50	1.3	1,859	7,405	162.9
TOTAL^	30,494	108,993	2,795.5	22,480	119,655	2,631.52

***Excludes utilization associated with compensation claims that occurred while these carpenters were working for employers who were self-insured for workers' compensation. No medical Information available for those events.*
+ Includes chiropractic care.
^ Totals include 26 persons and 31 visits for pregnancy complications/prenatal conditions; likely represent visits for dependents in Health and Welfare fund.

Table 17

Utilization Rates by Type of Insurance and Major ICD-9 Disease Groups
Carpenters Washington State 1989-1995

Females, Outpatient

	Union Health Insurance			Workers' Compensation		
ICD9 codes	**Number of persons**	**Visits**	**Rate of visits per 1,000 person-years**	**Number of persons**	**Visits****	**Rate of visits per 1,000 person-years**
Infectious Diseases (001-139)	47	71	101.9	2	2	2.3
Neoplasms (140-239)	15	29	41.6			
Endocrine, Nutritional, and Metabolic Diseases (240-279)	20	72	103.4			
Diseases of the Blood (280-289)	2	3	4.3			
Mental Disorders (290-319)	46	598	858.6	1	1	1.2
Diseases of the Nervous System (320-389)	59	107	153.6	21	118	138.2
Diseases of the Circulatory System (390-459)	13	19	27.3	1	1	1.2
Diseases of the Respiratory System (460-519)	130	306	439.3	2	2	2.3
Diseases of the Digestive System (520-579)	33	62	89.0	4	10	11.7
Diseases of Genitourinary System (580-629)	169	395	567.1			
Complications of Pregnancy (630-676)	43	108	155.1			
Diseases of the Skin (680-709)	55	107	153.6	4	5	5.9
Diseases of the Musculoskeletal System and Connective Tissue (710-739)	148	882	1,266.3	107	455	533.0
Congenital Anomalies (740-759)	5	5	7.2			
Conditions in Perinatal Period (760-779)	1	1	1.4			
Symptoms and Ill-defined Conditions (780-799)	136	305	437.9	13	21	24.6
Injury and Poisoning (800-999)	112	440	631.7	282	2,462	2,884
V-codes	9	11	15.8			
Missing						
TOTAL	1,043	3,521	5,055.3	538	3,388	3,968.8

***Excludes utilization associated with compensation claims that occurred while these carpenters were working for employers who were self-insured for workers' compensation. No medical Information available for those events.*

Table 18
Utilization Rates by Type of Insurance and Major ICD-9 Disease Groups
Carpenters Washington State 1989-1995

Males, Inpatient

	Union Health Insurance			Workers' Compensation		
Major Diagnostic Groups	**Number of persons**	**Admissions**	**Rate of admissions per 1,000 person-years**	**Number of persons**	**Admissions ****	**Rate of admissions per 1,000 person-years**
Infectious Diseases (001-139)	9	9	0.23			
Neoplasms (140-239)	67	100	2.6			
Endocrine, Nutritional, and Metabolic Diseases (240-279)	7	7	0.2			
Diseases of the Blood (280-289)	7	7	0.2			
Mental Disorders (290-319)	162	^ 177	4.5			
Diseases of the Nervous System (320-389)	6	6	0.2	3	3	0.1
Diseases of the Circulatory System (390-459)	144	160	4.1	7	9	0.2
Diseases of the Respiratory System (460-519)	23	25	0.6	5	6	0.1
Diseases of the Digestive System (520-579)	72	76	1.9	3	3	0.1
Diseases of Genitourinary System (580-629)	44	44	1.2	1	1	0.02
Diseases of the Skin (680-709)	13	13	0.3	5	5	0.1
Diseases of the Musculoskeletal System and Connective Tissue (710-739)	48	48	1.2	164	185	4.1
Congenital Anomalies (740-759)	3	4	0.1			
Conditions in Perinatal Period (760-779)						
Symptoms and Ill-defined Conditions (780-799)	46	47	1.2	6	8	0.2
Injury and Poisoning (800-999)	99	99	2.5	156	162	3.6
V-codes	1	1	0.3	6	6	0.1
TOTAL	722*	824	21.1	356	388	8.5

** Includes one admission coded as 'Complication of pregnancy'- either a miscode or admission of a spouse.*
***Excludes utilization associated with compensation claims that occurred while these carpenters were working for employers who were self-insured for workers' compensation. No medical Information available for those events.*

^ 143 in substance abuse treatment centers; all coded as inpatient by Carpenters' Trust.

Table 19
Amounts Charged by Type of Insurance and Selected ICD-9 Disease Groupings
Washington State Carpenters 1989-1995

	Union Health Insurance			Workers' Compensation*		
Selected Disease Groupings	Outpatient	Inpatient **	Total Charges	Outpatient	Inpatient **	Total Charges
(001-139) Infectious/parasitic diseases	$171,537	$51,075	$222,613	$6,046	.	$6,046
(140-149) Malignant neoplasms of buccal cavity & pharynx	3,489	.	3,489	.	.	0
(150-159) MN of digestive organs & peritoneum	143,205	139,422	282,627	100	.	100
(160-165) MN of respiratory system	405,187	209,210	614,397	.	.	0
(170-173,190-199)MN of other & unspecified sites	222,024	255,210	477,234	.	.	0
(174-175) MN of breast	12,484	8,304	20,788	.	.	0
(179-184) MN of female genital organs	3,401	.	3,401	.	.	0
(185-187) MN of male genital organs	114,660	130,546	245,206	.	.	0
(188-189) MN of urinary organs	56,061	46,427	102,488	.	.	0
(200-208) Neoplasms of lymphatic and hematopoetic tissue	281,904	340,640	622,544	138	.	138
(210-229) Benign neoplasms	201,008	42,756	243,764	7,674	.	7,674
(230-234) Cancer in Situ	11,172	4,295	15,467	.	.	0
(235-239) Neoplasms of uncertain behavior	66,309	16,577	82,886	2,178	.	2,178
(240-246,250-279) Endocrine, metabolic, immune disorders	177,684	59,578	237,262	4,925	.	4,925
(280-289) Diseases of the blood and blood forming organs	28,522	75,257	103,779	436	.	436
(290-319) Mental, psychoneurotic and personality disorders	1,029,904	1,016,933 ^	2,046,837	56,929	.	56,929
(340,320-337,341-389) Disorders of the nervous system and sense organs	703,616	30,599	734,215	824,990	20,750	845,740
(390-398,402,404,410-414,420-429) Diseases of the heart	494,669	2,108,241	2,602,910	16,800	37,470	54,270

	Union Health Insurance			Workers' Compensation*		
Selected Disease Groupings	**Outpatient**	**Inpatient ** **	**Total Charges**	**Outpatient**	**Inpatient ** **	**Total Charges**
(401,403,405,415-417,430-438, 440-459) Other diseases of the circulatory system	373,486	793,629	1,167,115	30,851	69,060	99,911
(460-466,480-487,490-493,470-478, 494-519) Diseases of the respiratory system	995,025	302,244	1,297,269	50,104	18,980	69,084
(520-537,550-553,540-543, 555-558,560,562-579) Diseases of the digestive system	724,518	694,475	1,418,993	321,242	12,584	333,826
(580-608,610-629) Diseases of the genitourinary system	758,047	245,420	1,003,467	11,985	4,819	16,804
(630-676) Complications of pregnancy, childbirth, and puerperium	32,327	44,004	76,331	369	.	369
(680-686,690-709)Diseases of the skin and subcutaneous tissue	296,990	60,989	357,979	98,429	23,816	122,245
(710-739) Diseases of the musculoskeletal system and connective tissue	2,243,100	458,993	2,702,093	3,751,795	1,002,484	4,754,279
(740-759) Congenital anomalies	28,820	33,865	62,685	34,863	.	34,863
(760-779) Conditions arising in the perinatal period	2,878	.	2,878	696	.	696
(780-796,798,799) Symptoms and ill-defined conditions	1,218,723	166,495	1,385,218	171,111	43,907	215,018
(800-829) Fractures	376,843	901,741	1,278,584	1,191,338	972,491	2,163,829
(830-839) Dislocation	434,750	16,059	450,809	1,816,049	44,081	1,860,130
(840-848) Sprains and strains of joints and adjacent muscles	410,845	376,327	787,172	2,885,275	125,029	3,010,304
(850-854) Intracranial injury excluding those with skull fracture	32,500	22,906	55,406	124,418	42,933	167,351
(860-869) Internal Injury of chest, abdomen, pelvis	13,932	218,501	232,433	20,857	55,964	76,821
(870-897) Open wound	287,047	51,096	338,143	1,251,570	57,333	1,308,903
(900-904) Injury to blood vessels	2,262	.	2,262	11,264	.	11,264
(905-909) Late effects of injuries, poisonings, toxic effects, etc.	8,723	68,214	76,937	33,147	.	33,147
(910-919) Superficial injury	36,246	.	36,246	130,013	4,620	134,633

	Union Health Insurance			Workers' Compensation*		
Selected Disease Groupings	**Outpatient**	**Inpatient ****	**Total Charges**	**Outpatient**	**Inpatient ****	**Total Charges**
(920-924) Contusion	75,483	58,773	134,256	411,325	3,783	415,108
(925-929) Crushing Injury	2,732	.	2,732	46,425	.	46,425
(930-939) Foreign body	38,698	.	38,698	165,064	.	165,064
(940-949) Burns	15,462	.	15,462	27,385	2,476	29,861
(950-957) Injury to nerves/spinal cord	13,276	.	13,276	46,910	.	46,910
(958-959) Traumatic complications	32,634	3,657	36,291	79,729	.	79,729
(960-979) Poisoning by drugs, etc	9,867	24,127	33,994	440	.	440
(980-989) Toxic effects, nonmedical	10,172	7,661	17,833	14,017	534	14,551
(990-995) Other, unspecified effects of external causes	10,707	2,433	13,140	11,805	.	11,805
(996-999) Complications of surgical/medical care, NEC	39,956	109,307	149,263	40,019	90,291	130,310
(V01-V82) V-codes	10,287	2,675	12,962	649,743	100,159	749,902
Missing ICD9 codes	9,367	.	9,367	1,587,855	.	1,587,855
TOTALS	$12,672,536	$9,198,661	$21,871,201	$15,936,308	$2,733,564	$18,669,872

* *Excludes those who worked for employers who were self-insured for workers' compensation. No medical Information available on them.*

** *For inpatient charges the charges were assigned to the primary admission ICD9 code not the code assigned to each line item.*

^ *$ 371,156 in substance abuse treatment centers.*

Table 20
Charges per 1000 Person-years of Eligibility by Selected ICD9 Groupings and Type of Insurance Coverage
Washington Carpenters 1989-95

Males

	Union Health Insurance		Workers' Compensation*	
ICD9 code groupings	Total Charges (In & Outpt) **	Charges per 1000 person-years of eligibility	Total Charges (In & Outpt) **	Charges per 1000 person-years of eligibility
(001-139) Infectious and Parasitic Diseases	$206,568	$5,298	$5,713	$126
(140-149) Malignant Neoplasms of buccal cavity & pharynx	3,465	89	.	.
(150-159) MN of digestive organs & Peritoneum	287,842	7,383	100	2
(160-165) MN of respiratory system	618,394	15,861	.	.
(170-173,190-199) MN of other & unspecified sites	452,919	11,617	.	.
(174-175) MN of breast	20,788	533	.	.
(185-187) MN of male genital organs	247,055	6,337	.	.
(188-189) MN of urinary organs	94,565	2,425	.	.
(200-208) Neoplasms of lymphatic and hematopoetic tissue	617,914	15,849	138	3
(210-229) Benign neoplasms	221,773	5,688	7,674	169
(230-234) Cancer in situ	14,669	376	.	.
(235-239) Neoplasms of uncertain behavior	97,178	2,492	2,178	48
(240-246,250-279) Endocrine, metabolic, immune disorders	224,759	5,765	4,925	108
(280-289) Diseases of blood and blood forming organs	97,330	2,496	436	10
(290-319) Mental, Psychoneurotic and personality disorders	1,654,838	50,139	56,869	1,252
(340,320-337,341-389) Disorders of the nervous system and sense organs	838,223	21,499	822,620	18,107
(390-398,402,404,410-414 420-429) Diseases of the heart	2,560,878	65,683	54,253	1,194
(401,403,405,415-417,430-438,440-459) Other diseases of the circulatory system	1,064,835	27,311	99,910	2,199
(460-466,480-487, 490-493,470-478, 494-519) Diseases of the respiratory system	1,185,714	30,412	68,976	1,515

	Union Health Insurance		Workers' Compensation*	
ICD9 code groupings	**Total Charges (In & Outpt) ****	**Charges per 1000 person-years of eligibility**	**Total Charges (In & Outpt) ****	**Charges per 1000 person-years of eligibility**
(520-537,550-553,540-543,555-558,560,562-579) Diseases of the digestive system	1,377,733	35,337	324,520	7,143
(580-608,610-629) Diseases of the genito-urinary system	992,693	25,461	16,804	370
(680-686,690-709) Diseases of skin and subcutaneous tissue	338,651	8,686	121,928	2,684
(710-739) Diseases of the musculoskeletal system and connective tissue	2,608,792	66,912	4,672,530	102,848
(740-759) Congenital anomalies	143,312	3,676	34,863	767
(760-779) Conditions arising in perinatal period	2,811	72	696	15
(780-796,798,799) Symptoms and ill-defined conditions	1,414,791	36,288	211,802	4,662
(800-829) Fractures	1,077,850	27,645	2,131,553	46,918
(830-839)Dislocation	448,949	11,515	1,818,280	40,022
(840-848) Sprains and strains	616,285	15,807	2,923,384	64,347
(850-854) Intracranial injury excluding skull fracture	54,083	1,387	166,974	3,675
(860-869) Internal injury of chest, abdomen, and pelvis	223,798	5,740	76,529	1,684
(870-897)Open wound	342,460	8,784	1,288,318	28,357
(900-904) Injury to blood vessels	33,419	857	11,264	248
(905-909) Late effects of injuries and other external causes	85,997	2,206	33,147	730
(910-919) Superficial injury	36,328	932	132,443	2,915
(920-924) Contusion with intact skin surface	131,885	3,383	406,461	8,947
(925-929) Crushing injury	2,629	67	44,956	990
(930-939) Foreign body	37,762	969	163,858	3,607
(940-949) Burns	16,071	412	27,100	597
(950-957) Injury to nerves/cord	20,217	519	46,910	1,033
(958-959) Traumatic complications and unspecified injuries	38,402	985	76,328	1680
(960-979) Poisoning by drugs/ medicinals	33,112	849	440	10

ICD9 code groupings	Union Health Insurance		Workers' Compensation*	
	Total Charges (In & Outpt) **	Charges per 1000 person-years of eligibility	Total Charges (In & Outpt) **	Charges per 1000 person-years of eligibility
(980-989) Toxic effects, non-medical	17,525	450	14,551	320
(990-995)Other external causes	13,027	334	11,560	254
(996-999) Complications, surgical and medical	150,920	3,871	130,159	2,865
(V01-V82) V-codes	11,716	300	738,446	16,254
Missing ICD9 codes	11,053	284	1,554,778	34,222
TOTALS	$21,102,643	$541,255	$18,304,743	$402,908

* *Excludes those who worked for employers who were self-insured for workers' compensation. No medical Information available on them.*

** *For inpatient charges the charges were assigned to the primary admission ICD9 code not the code assigned to each line item.*

Note: The number of person-years is 38,990 for union health insurance and 45,432 for workers' compensation..

Table 21a

Charges for Work Related Medical Care[1] per 100 Person-years of Work by Type of Injury (ANSI) Washington Carpenters 1989-1995

Type of Injury	Number of injuries	Total Charges	Charge per 100 Person-years of Work
Overexertion	3,061	$6,618,190	$20,304
Fall from elevation	913	3,495,818	10,725
Struck by	3,348	3,224,745	9,893
Fall same level	644	1,273,596	3,907
Bodily reaction	518	961,779	2,950
Struck against	1,740	796,446	2,443
Caught	201	310,283	952
Abraded	1,375	295,732	907
MVA high way	19	276,223	847
Contact w toxin	217	122,821	376
Temperature extremes	66	18,776	57
Electricity	21	17,885	54
MVA non highway	8	27,680	85
Explosions	4	501	2
Missing /unknown	1,730	688,171	2,111
TOTAL	13,865	$18,128,646	$55,620

1 Based on medical care delivered in observation period for each person. All care is for injuries that occurred in months of union work. Does not include care for injuries which occurred while working for self-insured employers.

Table 21b

Charges for Work Related Medical Care[1] per 100 Person-years of Work
by Nature of Injury (ANSI)
Washington Carpenters 1989-1995

Nature of injury	Number of injuries	Total Charges	Charge per 100 Person-years of Work
Sprains	3,929	$7,623,280	$23,388
Fracture	561	2,746,765	8,427
Ill Defined Symptoms	555	1,463,816	4,491
Cut	3,278	1,436,830	4,408
Contusion	1,172	1,133,027	3,476
Dislocation	139	754,858	2,316
Multiple Injuries	203	621,734	1,907
Nerve Condition	136	496,090	1,522
Scratches	1,489	281,635	864
Hearing Loss	120	263,677	809
Hernia	98	260,134	798
Bursitis	90	198,861	610
Concussion	32	147,245	452
Amputation	20	130,996	402
Teeth	61	55,595	171
Poisoning	4	49,431	152
Nervous System	4	39,753	122
Heart Conditions	1	36,884	113
Influenza	7	27,298	84
Other[2]	385	175,621	478
Unknown	1,581	185,104	568
TOTAL	13,865	$18,128,634	$55,620

1 Based on medical care delivered in observation period for each person. All care is for injuries that occurred in months of union work.

2 This category includes all injuries for which nature is not listed in the table. Each individual "nature" group under this category contributed <$25,000 in the amount charged.

Table 21c
Charges for Work Related Medical Care[1] per 100 Person-years of Work
by Body Part Injured (ANSI)
Washington Carpenters 1989-1995

Body Part Injured	Number of injuries	Total Charges	Charge per 100 Person-years of Work
Back	1,941	$4,520,301	$13,868
Knee	711	1,725,899	5,295
Shoulder	413	1,518,871	4,660
Multiple	356	1,455,017	4,464
Finger(s)	2,063	1,052,834	3,230
Wrist	541	853,893	2,620
Back/Neck	381	827,679	2,539
Foot	462	539,125	1,654
Elbow	320	538,606	1,652
Neck	198	525,705	1,613
Eye(s)	1,730	438,250	1,345
Hand	837	422,378	1,296
Ankle	306	353,389	1,084
Abdomen	169	296,849	911
Head (unspecified)	24	269,286	826
Ear, internal	136	265,635	815
Forearm	246	233,387	716
Hips	60	232,798	714
Lower leg	105	206,169	6,32
Trunk Multiple	74	183,083	562
Arm(s) (unspecified)	106	175,299	538
Brain	32	147,245	452
Chest	179	143,619	441
Upper extremity	62	141,405	434
Thigh	87	134,698	413
Leg(s) (unspecified)	72	130,526	400
Lower extremity	38	123,191	378
Other[2]	733	620,469	1,905
Missing/ unknown	1,483	53,040	163
TOTAL	13,865	$18,128,646	$55,620

1 Based on medical care delivered in observation period for each person. All care is for injuries that occurred in months of union work.

2 This category includes all injuries for which nature is not listed in the table. Each individual "nature" group under this category contributed <$100,000 in the amount charged.

Table 22

Rates[1] and Rate Ratios Comparing Utilization in Union Health Insurance
by Work related Injury Experience
Washington Carpenters 1989-1995

Outpatient

ICD9 Groups	*Group with no work injury*		*Group with injury but no time-loss paid*		*Group with injury with > 3 months time-loss paid*	
	Rate	Rate Ratio	Rate	Rate Ratio	Rate	Rate Ratio
Infectious	34.3	1.0	47.4	1.4	73.7	2.1
Neoplasms	209.3	1.0	112.0	0.54	66.1	0.32
Endocrine	72.1	1.0	53.7	0.74	74.2	1.02
Blood	7.0	1.0	6.1	0.87	10.7	1.5
Mental	321.6	1.0	391.4	1.2	530.4	1.7
Nervous	94.6	1.0	101.1	1.1	137.4	1.5
Circulatory	158.0	1.0	120.4	0.76	160.7	1.0
Respiratory	190.0	1.0	250.2	1.3	291.4	1.5
Digestive	76.6	1.0	83.4	1.1	107.9	1.4
Genitourinary	112.8	1.0	89.6	0.79	131.2	1.2
Skin	89.6	1.0	79.2	0.88	99.6	1.1
MSD[2]	717.8	1.0	867.1	1.2	1,256.3	1.8
Congenital	6.6	1.0	3.7	0.56	6.3	0.94
Symptoms	204.6	1.0	195.9	0.96	269.1	1.3
Injury	309.7	1.0	424.9	1.4	425.7	1.4
V-codes	2.8	1.0	3.2	1.2	3.1	1.1
Overall	2,610.0	1.0	2,835.2	1.1	3,650.4	1.4

1 Visits per 1000 person-years of insurance coverage

2 MSD=Musculoskeletal Disorder

Table 23
Rates[1] and Rate Ratios Comparing Utilization in Union Health Insurance
by Work Related Injury Experience
Washington Carpenters 1989-1995

Inpatient

ICD9 Groups	*Group with no work injury*		*Group with injury but no time-loss paid*		*Group with injury with > 3 months time-loss paid*	
	Rate	Rate Ratio	Rate	Rate Ratio	Rate	Rate Ratio
Infectious	0.48	1.0	0.18	0.38	—	
Neoplasms	4.0	1.0	2.1	0.52	2.1	0.53
Endocrine	0.24	1.0	—	----	0.52	2.2
Blood	0.36	1.0	0.12	0.33	0.26	0.72
Mental	4.3	1.0	4.6	1.1	6.5	1.5
Nervous	0.24	1.0	0.30	1.3	0.26	1.1
Circulatory	5.9	1.0	4.3	0.73	7.1	1.2
Respiratory	1.1	1.0	0.54	0.50	1.3	1.2
Digestive	2.5	1.0	1.6	0.64	2.6	1.0
Genitourinary	1.6	1.0	0.90	0.57	0.78	0.50
Skin	0.24	1.0	0.36	1.5	1.3	5.5
MSD	1.7	1.0	0.78	0.46	1.6	0.93
Congenital	0.24	1.0			0.52	2.2
Symptoms	2.2	1.0	1.2	0.53	2.1	0.96
Injury	2.4	1.0	3.4	1.4	1.1	0.44
V-codes			0.06			
Overall	27.5	1.0	20.9	0.76	28.0	1.0
# encounters on which rates are based	(n = 228)		(n = 346)		(n = 107)	

[1] Visits per 1000 person-years of insurance coverage

Table 24

Rate[1] Ratios Comparing Utilization in Union Health Insurance System
After Work Related Injury to Utilization Before Injury
by Categories of Time-Loss Days Away From Work
Washington Carpenters 1989-1995

	1 to 2 months out			2+ to 3 months out			> 3 months out		
	Rate before injury	Rate after injury	Ratio	Rate before injury	Rate after injury	Ratio	Rate before injury	Rate after injury	Ratio
Outpatient	4,162.5	2,999.0	0.7	4,223.6	2,986.4	0.7	4,233.6	3,030.3	0.7
Inpatient[2]	27.2	23.8	0.9	27.0	25.4	0.9	30.1	26.2	0.9

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1 All data based on persons with a single work-related injury only. Rates are computed per 1,000 person years of eligibility.

2 Inpatient rates are based on very small numbers and maybe unstable.

Table 25

Charges in Health and Welfare
Before and After Serious Work-related Injury
Washington Carpenters 1989-1995

	Before Work Injury		After Work Injury		Charge Ratio
Place of service	Charges	Charge per Month of Eligibility	Charges	Charge per Month of Eligibility	After/ Before
Outpatient	$ 638,119	$ 36.00	$ 561,437	$ 31.73	0.88
Inpatient	$ 378,938	$ 20.00	$ 541,494	$ 30.60	1.5
Miscellaneous	$ 158,814	$ 8.37	$ 147,250	$ 8.32	0.98
TOTAL	$ 1,175,871	$ 61.98	$ 1,250,180	$ 70.66	1.1

Note: 'Serious' refers to injuries which resulted in 3 months or more of paid lost time.

Table 26

Distribution of Age and Gender
Northwest Laborers Cohort 1990-1994

	Gender		
Age Groups	Male	Female	Unknown
< 20 years	164	12	73
20-24 years	1,108	111	288
25-29 years	1,366	159	287
30-34 years	1,666	248	242
35-39 years	1,421	217	207
40-44 years	1,060	148	131
45-49 years	783	86	100
50-54 years	578	42	46
55-59 years	375	29	35
60-64 years	172	6	14
65 years and over	20	4	5
Unknown	44	8	397
TOTAL	8,757	1,070	1,825

Table 27

Distribution of Number of Months With Hours Worked
Northwest Laborers Cohort 1990-1994

Months with Hours after Cohort Entry	Number of Persons	Percent of Total
0	1,013	8.7
1 to 6 months	2,554	21.9
7 to 12 months	1,354	11.6
13 to 18 months	961	8.2
19 to 24 months	862	7.4
25 to 30 months	731	6.3
31 to 36 months	711	6.1
37 to 42 months	645	5.5
43 to 48 months	704	6.0
49 to 54 months	729	6.3
55 to 59 months	1,056	9.1
All 60 months	332	2.8
TOTAL	11,652	100.0

Table 28
Continuous Insurance Eligibility by Length of Time in Cohort
Northwest Laborers Cohort 1990-1994

Months in Cohort	Number of Persons (Percent of Cohort)		Number with Continuous Eligibility (Row Percent)	
1 to 6 months	2,412	(20.7)	2,143	(88.8)
7 to 12 months	1,033	(8.9)	536	(51.9)
13 to 18 months	935	(8.0)	377	(40.3)
19 to 24 months	599	(5.1)	194	(32.4)
25 to 30 months	760	(6.5)	241	(31.7)
31 to 36 months	637	(5.5)	194	(30.5)
37 to 42 months	671	(5.8)	183	(27.3)
43 to 48 months	501	(4.3)	134	(26.7)
49 to 54 months	663	(5.7)	156	(23.5)
55 to 59 months	1,313	(11.3)	437	(33.3)
All 60 months	2,128	(18.3)	1,397	(65.6)
TOTAL	11,652	(100.0)	5,992	(51.4)

Table 29

Injury Rates by Age Groups
All Injuries
Northwest Laborers 1990-1994

Age Group	Person-years of hours	Number of persons injured*	Injuries	
			Number	Rate per 100 person-years
< 20 years	157	47	69	43.9
20-24 years	1,560	391	634	40.6
25-29 years	2,617	639	1,118	42.7
30-34 years	3,936	893	1,602	40.7
35-39 years	3,658	758	1,308	35.8
40-44 years	2,763	492	843	30.5
45-49 years	2,130	362	634	29.8
50-54 years	1,534	238	386	25.2
55-59 years	877	154	241	27.5
60-64 years	251	54	77	30.7
65 years and over	19	3	6	31.4
Unknown	32	0	0	0.0
TOTAL	19,535	4,031	6,918	35.4

*Each injured laborer only counted once regardless of the number of injuries sustained

Table 30

Injury Rates by Age Groups
Time-Loss[3] Injuries
Northwest Laborers 1990-1994

Age Group	Person-years of hours	Number of persons injured*	Injuries	
			Number	Rate per 100 person-years
< 20 years	157	10	11	7.0
20-24 years	1,560	113	130	8.3
25-29 years	2,617	235	294	11.2
30-34 years	3,936	367	441	11.2
35-39 years	3,658	333	395	10.8
40-44 years	2,763	216	261	9.4
45-49 years	2,130	169	212	10.0
50-54 years	1,534	108	131	8.5
55-59 years	877	66	73	8.3
60-64 years	251	24	26	10.4
65 years and over	19	0	0	0.0
Unknown	32	0	0	0.0
TOTAL	19,535	1,641	1,974	10.1

[3]Time-loss injuries required four or more days away from work
*Each injured laborer only counted once regardless of the number of injuries sustained

Table 31a

Injury Rates by Type of Injury
All Injuries
Northwest Laborers 1990-1994

Type of Injury	Number of persons injured*	Injuries	
		Number	Rate per 100 person-years
Overexertion	1,444	1,733	8.9
Struck by	1,304	1,538	7.9
Struck against	516	552	2.8
Rubbed or abraded	430	470	2.4
Fall from elevation	364	388	2.0
Fall on same level	360	379	1.9
Bodily reaction	256	261	1.3
Contact w/ radiations, caustics, etc	244	259	1.3
Caught in, under, between	160	163	0.8
Unknown	124	126	0.6
Contact w/ temp extremes	64	65	0.3
Highway motor vehicle accidents	36	36	0.2
Non highway motor vehicle accidents	32	33	0.2
Contact w/ electric current	21	21	0.1
Explosions	3	3	0.0
Accident type, not elsewhere classified	2	2	0.0
Missing codes	650	889	4.6
TOTAL		6,918	35.4

*Each injured laborer only counted once in any given category regardless of the number of injuries sustained.

Table 31b

Injury Rates by Type of Injury
Time-Loss Injuries[4]
Northwest Laborers 1990-1994

Type of Injury	Number of persons injured*	Injuries	
		Number	Rate per 100 person-years
Overexertion	797	881	4.5
Struck by	307	316	1.6
Fall from elevation	188	196	1.0
Fall on same level	160	163	0.8
Bodily reaction	130	131	0.7
Struck against	82	83	0.4
Unknown	54	54	0.3
Caught in, under, between	51	53	0.3
Contact w/ radiations, caustics, etc	25	26	0.1
Highway motor vehicle accidents	20	20	0.1
Non highway motor vehicle accidents	15	16	0.1
Rubbed or abraded	15	15	0.1
Contact w/ temp extremes	11	11	0.1
Contact w/ electric current	4	4	0.0
Explosions	1	1	0.0
Missing codes	4	4	0.0
TOTAL		1,974	10.1

[4]Time-loss injuries required four or more days away from work
*Each injured laborer only counted once in any given category regardless of the number of injuries sustained.

Table 32a

Injury Rates by Nature of Injury
All Injuries
Northwest Laborers 1990-1994

Nature of Injury	Number of persons injured [1]	Injuries	
		Number	Rate per 100 person-years
Sprains	1,723	2,165	11.1
Cut	841	954	4.9
Contusion	646	714	3.7
Scratches	474	518	2.7
Fractures	342	357	1.8
Ill-Defined Symptoms	293	306	1.6
Multiple Injuries	141	145	0.7
Nerve Conditions	106	106	0.5
Dislocation	86	86	0.4
Burn-chemical	74	74	0.4
Inguinal Single	68	68	0.3
Conjunctivitis	58	60	0.3
Burn-heat	58	59	0.3
Hearing Loss	57	57	0.3
Other[2]	270	280	1.4
Missing	650	889	4.6
Unknown	78	80	0.4
TOTAL		6,918	35.4

1 Each injured laborer only counted once in any given category regardless of the number of injuries sustained.

2 This category includes all injuries for which nature is not listed on the table. Each individual "nature" group under this category contributed < 50 injuries with rates < 0.25.

Table 32b

Injury Rates by Nature of Injury
Time-Loss[1] Injuries
Northwest Laborers 1990-1994

Nature of Injury	Number of persons injured[2]	Injuries	
		Number	Rate per 100 person-years
Sprains	882	991	5.1
Fractures	187	191	1.0
Ill-Defined Symptoms	166	168	0.9
Contusion	134	137	0.7
Cut	91	93	0.5
Multiple Injuries	70	71	0.4
Nerve Conditions	70	70	0.4
Dislocation	61	61	0.3
Inguinal Single	53	53	0.3
Scratches	16	16	0.1
Dermatitis-contact	10	10	0.1
Other[3]	64	65	0.3
Missing	4	4	0.0
Unknown	44	44	0.2
TOTAL		1,974	10.1

1 Time-loss injuries required four or more days away from work.

2 Each injured laborer only counted once in any given category regardless of the number of injuries sustained.

3 This category includes all injuries for which nature is not listed on this table. Each individual group under this category contributed < 10 injuries with rates < 0.05.

Table 33a

Injury Rates by Part of Body Injured
All Injuries
Northwest Laborers 1990-1994

Part of Body Injured	Number of persons injured[1]	Injuries	
		Number	Rate per 100 person-years
Back	949	1,074	5.5
Eye(s)	591	658	3.4
Finger(s)	547	592	3.0
Knee	362	381	2.0
Foot	301	311	1.6
Wrist	266	281	1.4
Hand	265	271	1.4
Multiple Body Parts	227	234	1.2
Shoulder	208	219	1.1
Back/Neck	199	211	1.1
Ankle	160	164	0.8
Elbow	143	146	0.7
Forearm	131	133	0.7
Abdomen	127	131	0.7
Chest	114	118	0.6
Toe(s)	108	109	0.6
Neck	102	104	0.5
Other[2]	787	880	4.5
Missing	650	889	4.6
Unknown	12	12	0.1
TOTAL		6,918	35.4

1 Each injured laborer only counted once in any given category regardless of the number of injuries sustained.

2 This category includes all injuries for which the body part is not listed on this table. Each individual "body Part" group under this category contributed < 100 injuries with rates < 0.5.

Table 33b

Injury Rates by Part of Body Injured
Time-Loss[1] Injuries
Northwest Laborers 1990-1994

Part of Body Injured	Number of persons injured[2]	Injuries	
		Number	Rate per 100 person-years
Back	522	565	2.9
Knee	194	200	1.0
Wrist	123	125	0.6
Shoulder	116	118	0.6
Multiple Body Parts	103	105	0.5
Finger(s)	97	103	0.5
Foot	88	88	0.5
Back/Neck	83	86	0.4
Abdomen	76	76	0.4
Ankle	73	73	0.4
Toe(s)	46	46	0.2
Hand	45	46	0.2
Elbow	39	39	0.2
Neck	39	39	0.2
Chest	37	38	0.2
Forearm	24	24	0.1
Other[3]	187	192	1.0
Missing	4	4	0.0
Unknown	7	7	0.0
TOTAL		1,974	10.1

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1 Time-loss injuries required four or more days away from work.
2 Each injured laborer only counted once in any given category regardless of the number of injuries sustained.
3 This category includes all injuries for which the body part is not listed on this table. Each individual "body part" group under this category contributed <35 injuries with rates <0.18.

Table 34

Age Specific Utilization Rates by Type of Insurance
Northwest Laborers 1990-1994

Males, Outpatient

	Union Health Insurance			Workers' Compensation		
Age Category	Number of persons	Number of visits	Rate of visits per 1,000 person-years	Number of persons	Number of visits	Rate of visits per 1,000 person-years
< 20 years	71	358	1,828.1	42	193	617.1
20-24 years	539	5,252	2,904.3	345	3,893	1,725.7
25-29 years	839	10,706	3,695.2	568	9,860	2,852.9
30-34 years	1,132	17,951	4,139.0	755	14,515	2,837.3
35-39 years	1,025	15,613	3,908.1	610	13,549	2,865.5
40-44 years	779	12,339	3,988.6	400	8,273	2,259.8
45-49 years	591	10,443	4,289.3	279	7,995	2,768.0
50-54 years	435	7,933	4,272.3	202	4,674	2,191.2
55-59 years	301	6,987	5,438.8	141	3,538	2,435.7
60-64 years	146	3,317	5,391.3	40	1,000	1,468.4
65 years and over	10	172	4,007.8	3	12	230.4
Unknown	3	4	274.3	0	0	
TOTAL	5,871	91,075	4,034.2	3,385	67,502	2,522.9

Table 35

Age Specific Utilization Rates by Type of Insurance
Northwest Laborers 1990-1994

Males, Inpatient

	Union Health Insurance			Workers' Compensation		
Age Category	Number of persons	Number of admissions	Rate of admissions per 1,000 person-years	Number of persons	Number of admissions	Rate of admissions per 1,000 person-years
< 20 yrs	2	2	10.2	1	1	3.2
20-24 yrs	44	48	26.5	10	10	4.4
25-29 yrs	78	99	34.2	21	26	7.5
30-34 yrs	69	90	20.8	38	40	7.8
35-39 yrs	90	114	28.5	26	31	6.6
40-44 yrs	98	148	47.8	24	27	7.4
45-49 yrs	86	114	46.8	17	20	6.9
50-54 yrs	62	97	52.2	13	14	6.6
55-59 yrs	72	119	92.6	14	17	11.7
60-64 yrs	39	59	95.9	7	7	10.3
65 yrs and over	4	6	139.8	0	0	
Unknown	0	0		0	0	
TOTAL	644	896	39.7	171	193	7.2

Table 36

Age Specific Utilization Rates by Type of Insurance
Northwest Laborers 1990-1994

Females, Outpatient

	Union Health Insurance			Workers' Compensation		
Age Category	Number of persons	Number of visits	Rate of visits per 1,000 person-years	Number of persons	Number of visits	Rate of visits per 1,000 person-years
< 20 years	6	52	4,105.3	1	1	59.7
20-24 years	66	987	6,454.5	11	42	194.3
25-29 years	107	1,404	5,498.7	41	956	2,739.9
30-34 years	174	2,647	5,766.9	74	1,283	2,082.8
35-39 years	160	2,347	5,559.4	63	1,425	2,504.0
40-44 years	107	1,881	6,469.5	33	904	2,344.5
45-49 years	67	1,371	7,109.8	15	309	1,220.5
50-54 years	31	548	6,044.1	8	221	1,848.1
55-59 years	22	613	8,948.9	2	11	124.2
60-64 years	6	123	7,165.1	1	10	558.1
65 years and over	3	29	4,350.0	0	0	
Unknown	0	0		0	0	
TOTAL	749	12,002	6,092.4	249	5,162	1954.6

Table 37

Utilization Rates by Types of Insurance and Major ICD-9 Disease Groupings
Northwest Laborers 1990-1994

Males, Outpatient

	Union Health Insurance			Workers' Compensation		
Major Diagnostic Groups	Number of persons	Visits	Rate of visits per 1,000 person-years	Number of persons	Visits	Rate of visits per 1,000 person-years
Infectious Diseases (001-139)	721	1,558	69.0	29	53	2.0
Neoplasms (140-239)	442	2,146	95.1	17	32	1.2
Endocrine, Nutritional, & Metabolic Diseases (240-279)	490	1,780	78.8	13	101	3.8
Diseases of Blood & Blood Forming Organs (280-289)	48	92	4.1	5	17	0.6
Mental Disorders (290-319)	1,126	13,239	586.4	33	176	6.6
Diseases of Nervous System & Sense Organs (320-389)	1,461	3,585	158.8	422	2,657	99.3
Diseases of Circulatory System (390-459)	803	4,604	203.9	33	180	6.7
Diseases of Respiratory System (460-519)	2,218	7,338	325.0	41	261	9.8
Diseases of Digestive System (520-579)	981	3,013	133.5	88	477	17.8
Diseases of the Genitourinary System (580-629)	693	2,349	104.1	16	65	2.4
Diseases of Skin & Subcutaneous System (680-709)	1,199	3,168	140.3	158	539	20.2
Diseases of Musculoskeletal System (710-739)	2,622	29,462	1,305.0	1,099	12,932	483.3
Congenital Anomalies (740-759)	51	94	4.2	28	101	3.8
Conditions Originating in Perinatal Period (760-779)	4	6	0.3	4	4	0.2
Symptoms & Ill-defined Conditions (780-799)	1,716	5,070	224.6	403	895	33.5
Injury & poisoning (800-999)	2,537	10,630	470.9	3,085	45,777	1,710.9
V-codes (V01-V82)	1,135	1,986	88.0	1,090	3,066	114.6
Unknown	501	955	42.0	95	169	4.9
TOTAL	5,871	91,075	4,034.2	3,385	67,502	2,522.9

Note: The number of person-years is 22,576 for union health insurance, and 26,756 for workers' compensation.

Table 38

Utilization Rates by Types of Insurance and Major ICD-9 Disease Groupings
Northwest Laborers 1990-1994

Females, Outpatient

	Union Health Insurance			Workers' Compensation		
Major Diagnostic Groups	Number of persons	Visits	Rate of visits per 1,000 person-years	Number of persons	Visits	Rate of visits per 1,000 person-years
Infectious Diseases (001-139)	89	174	88.3	1	1	0.4
Neoplasms (140-239)	81	412	209.1	4	28	10.6
Endocrine, Nutritional, & Metabolic Diseases (240-279)	65	169	85.8	3	66	25.0
Diseases of Blood & Blood Forming Organs (280-289)	17	38	19.3	0	0	
Mental Disorders (290-319)	126	839	425.9	8	44	16.7
Diseases of Nervous System & Sense Organs (320-389)	186	446	226.4	35	280	106.0
Diseases of Circulatory System (390-459)	64	203	103.1	4	4	1.5
Diseases of Respiratory System (460-519)	323	1,000	507.6	4	7	2.7
Diseases of Digestive System (520-579)	106	349	177.2	4	60	22.7
Diseases of the Genitourinary System (580-629)	384	1,381	701.0	1	1	0.4
Complications of Pregnancy (630-676)	29	128	65.0	1	1	0.4
Diseases of Skin & Subcutaneous System (680-709)	173	376	190.9	5	6	2.3
Diseases of Musculoskeletal System (710-739)	348	3,943	2,001.5	97	899	340.4
Congenital Anomalies (740-759)	8	10	5.1	1	1	0.4
Symptoms & Ill-Defined Conditions (780-799)	263	802	407.1	44	143	54.2
Injury & Poisoning (800-999)	264	1,054	534.0	226	3,432	1,299.5
V-codes (V01-V82)	227	584	296.5	79	181	68.5
Unknown	47	94	47.7	5	8	1.5
TOTAL	749	12,002	6,092.4	249	5,162	1,954.6

Note: The number of person-years is 1,970 for Union health insurance, and 2,641 for workers' compensation.

Table 39

Utilization Rates by Types of Insurance and Major ICD-9 Disease Groupings
Northwest Laborers 1990-1994

Males, Inpatient

	Union Health Insurance			Workers' Compensation		
Major Diagnostic Groups	Number of persons	Admissions	Rate of admissions per 1,000 person-years	Number of persons	Admissions	Rate of admissions per 1,000 person-years
Infectious Diseases (001-139)	13	13	0.6	0		
Neoplasms (140-239)	37	53	2.4	1	1	0.0
Endocrine, Nutritional, & Metabolic Diseases (240-279)	13	13	0.6	0		
Mental Disorders (290-319)	115	139	6.2	2	2	0.1
Diseases of Nervous System & Sense Organs (320-389)	8	8	0.4	0		
Diseases of Circulatory System (390-459)	114	187	8.3	4	4	0.2
Diseases of Respiratory System (460-519)	41	49	2.2	0		
Diseases of Digestive System (520-579)	89	116	5.1	3	3	0.1
Diseases of the Genitourinary System (580-629)	39	44	2.0	0		
Diseases of Skin & Subcutaneous System (680-709)	14	14	0.6	8	8	0.3
Diseases of Musculoskeletal System (710-739)	48	50	2.2	81	88	3.3
Congenital Anomalies (740-759)	1	1	0.0	1	1	0.0
Conditions Originating in Perinatal Period (760-799)	1	1	0.0	0		
Symptoms & Ill-defined Conditions (780-799)	71	79	3.5	3	3	0.1
Injury & Poisoning (800-999)	109	119	5.3	78	82	3.1
V-codes (V01-V82)	5	5	0.2	1	1	0.0
Unknown	5	5	0.1	0		
TOTAL	644	896	39.7	171	193	7.2

Note: The number of person-years is 22,576 for Union Health Insurance, and 26,756 for workers' compensation.

Table 40

Amounts Charged by Type of Insurance and Selected ICD-9 Disease Groupings
Northwest Laborers 1990-1994

	Union Health Insurance			Workers' Compensation		
Selected Disease Groupings	Inpatient	Outpatient	Total Charges	Inpatient	Outpatient	Total Charges
(001-139) Infectious diseases	$130,291	$203,877	$334,168	$0	$4,411	$4,411
(140-149) MN of buccal cavity/pharynx	13,140	25,838	38,978			
(150-159) MN of digestive organs	84,488	101,926	186,414		197	197
(160-165) MN of respiratory system	117,356	98,750	216,105		1,529	1,529
(170-173, 190-199) MN of other and unspecified sites	131,953	289,754	421,707		17	17
(174-175) MN of breast	27,996	88,280	116,276			
(179-184) MN of female genital organs		702	702			
(185-187) MN of male genital system	112,683	137,661	250,345	3,079	8,686	11,765
(188-189) MN of urinary organs	93,536	86,993	180,530			
(200-208) Neoplasms of lymphatic and hematopoetic tissue	15,151	63,563	78,714			
(210-229) Benign neoplasms	72,653	286,928	359,581		8,417	8,417
(230-234) Cancer in situ		23,199	23,199			
(235-239) Neoplasms of uncertain behavior	29,727	118,974	148,701		6,513	6,513
(240-246, 250-279) Endocrine, nutritional, & metabolic diseases	78,013	299,322	377,335		26,382	26,382
(280-289) Diseases of blood and blood forming organs	5,088	27,517	32,605		1,029	1,029
(290-319) Mental & psychoneurotic disorders	788,687	2,538,992	3,327,680	8,908	44,885	53,793
(340, 320-337, 341-389) Disorders of the nervous system & sense organs	54,933	855,046	909,979		710,940	710,940
(390-398, 402, 404, 410-414, 420-429) Diseases of the heart	2,201,814	1,125,205	3,327,020		1,447	1,447
(401,403, 405, 415-417, 430-438, 440-459) Other diseases of circulatory system	644,945	689,283	1,334,228	195,236	14,820	210,056
(460-466, 480-487, 490-493, 470-478, 494-519) Diseases of respiratory system	443,186	1,222,269	1,665,455		42,464	42,464
(520-537, 550-553, 540-543, 555-558, 560, 562-579) Diseases of digestive system	937,314	1,270,023	2,207,337	24,436	258,001	282,437

	Union Health Insurance			Workers' Compensation		
Selected Disease Groupings	Inpatient	Outpatient	Total Charges	Inpatient	Outpatient	Total Charges
(580-608, 610-629) Diseases of genitourinary system	394,769	1,353,726	1,748,495		7,791	7,791
(630-676) Complications of pregnancy	63,918	85,568	149,485		218	218
(680-686, 690-709) Diseases of skin & subcutaneous system	67,830	411,779	479,609	62,020	71,923	133,943
(710-739) Diseases of musculoskeletal system	536,913	2,817,287	3,354,172	868,194	2,505,555	3,373,749
(740-759) Congenital anomalies	9,452	32,544	41,996	4,890	12,569	17,459
(760-779) Certain conditions originating in perinatal period	1,835	1,193	3,028		957	957
(780-796, 798, 799) Symptoms & ill-defined conditions	633,248	1,844,495	2,477,743	11,891	205,475	217,365
(800-829) Fractures	1,003,440	721,861	1,725,301	494,893	837,643	1,332,537
(830-839) Dislocations	21,686	315,873	337,559	36,427	1,088,630	1,125,057
(840-848) Sprains & strains	109,262	635,621	744,883	234,120	1,906,839	2,140,959
(850-854) Intracranial injury, excluding skull fracture	46,222	96,003	142,225	6,692	35,100	41,792
(860-869) Internal injury of chest, abdomen, & pelvis	285,861	17,475	303,336	70,951	24,925	95,876
(870-897) Open wound	147,852	464,587	612,439	156,160	452,860	609,020
(900-904) Injury to blood vessels	38,406	16,747	55,153		4,734	4,734
(905-909) Late effects of injuries, poisonings, etc.		1,938	1,938		10,486	10,486
(910-919) Superficial injury		42,984	42,984	1,798	69,612	71,409
(920-924) Contusion with skin surface intact	3,079	151,353	154,432	2,739	320,874	323,613
(925-939) Crushing injury		7,081	7,081	8,975	70,821	79,796
(930-939) Effects of foreign body		41,035	41,035		75,504	75,504
(940-949) Burns	6,091	33,548	39,639	9,575	51,639	61,213
(950-957) Injury to nerves & spinal cord		16,471	16,471		55,435	55,435
(958-959) Certain traumatic complications	47,522	114,159	161,681	18,891	78,589	97,480
(960-979) Poisonings by drugs	13,334	8,640	21,974		349	349
(980-989) Toxic effects of substances of non-medical source	12,093	15,613	27,707	1,146	20,743	21,889
(990-995) Other/Unspecified effects of external causes		16,184	16,184	19,208	16,683	35,891
(996-999) Complications of surgery/medical care, NEC.	56,594	23,220	79,813	137,337	14,590	151,926

	Union Health Insurance			Workers' Compensation		
Selected Disease Groupings	Inpatient	Outpatient	Total Charges	Inpatient	Outpatient	Total Charges
V codes (V01-V49)	122,899	336,009	458,908		1,980	1,980
Other V codes (V50-V82)	31,613	294,517	326,130	248,872	412,189	661,062
E codes	131,931	25,265	157,196		3,260	3,260
ICD9 code missing		170,014	170,014		41,684	41,684
TOTAL	$9,768,804	$19,666,893	$40,270,981[1]	$2,626,436	$9,529,395	$13,456,705[2]

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1 Includes the following amounts not allocated to diagnoses: Pharmacy ($989,291); Dental ($6,916,181); Vision ($1,027,818); Miscellaneous ($1,901,994). Without these included total is $29,435,697.

2 Includes the following amounts not allocated to diagnoses: Pharmacy ($232,024); Miscellaneous such as ancillary and vocational services ($1,068,850). Without these included total is $12,155,831.

Table 41

Charges per 1,000 Person-Years of Eligibility
by Selected ICD-9 Disease Groupings and Type of Insurance Coverage
Northwest Laborers 1990-1994

Males

	Union Health Insurance		Workers' Compensation	
Selected Disease Groupings	Total charges (Inpatient & Outpatient)	Charges per 1,000 person-years	Total charges (Inpatient & Outpatient)	Charges per 1,000 person-years
(001-139) Infectious diseases	$289,298	$12,814	$4,292	$160
(140-149) MN of buccal cavity/pharynx	38,978	1,727		
(150-159) MN of digestive organs	186,414	8,257	197	7
(160-165) MN of respiratory system	212,954	9,433	1,529	57
(170-173, 190-199) MN of other and unspecified sites	397,798	17,620	17	1
(174-175) MN of breast	272	12		
(185-187) MN of male genital system	250,345	11,089	11,765	440
(188-189) MN of urinary organs	180,530	7,997		
(200-208) Neoplasms of lymphatic and hematopoetic tissue	78,530	3,478		
(210-229) Benign neoplasms	261,559	11,586	2,177	81
(230-234) Cancer in situ	11,926	528		
(235-239) Neoplasms of uncertain behavior	136,050	6,026	320	12
(240-246, 250-279) Endocrine, nutritional, & metabolic diseases	339,312	15,030	21,772	814
(280-289) Diseases of blood and blood forming organs	17,001	753	1,029	38
(290-319) Mental & psychoneurotic disorders	2,967,922	131,464	47,104	1,760
(340, 320-337, 341-389) Disorders of the nervous system & sense organs	770,076	34,110	622,120	23,252
(390-398, 402, 404, 410-414, 420-429) Diseases of the heart	3,234,296	143,263	1,392	52
(401,403, 405, 415-417, 430-438, 440-459) Other diseases of circulatory system	1,281,685	56,772	209,964	7,847
(460-466, 480-487, 490-493, 470-478, 494-519) Diseases of respiratory system	1,488,832	65,948	41,661	1,557
(520-537, 550-553, 540-543, 555-558, 560, 562-579) Diseases of digestive system	1,869,170	82,795	260,497	9,736
(580-608, 610-629) Diseases of genitourinary system	1,140,661	50,525	7,690	287

	Union Health Insurance		Workers' Compensation	
Selected Disease Groupings	Total charges (Inpatient & Outpatient)	Charges per 1,000 person-years	Total charges (Inpatient & Outpatient)	Charges per 1,000 person-years
(680-686, 690-709) Diseases of skin & subcutaneous system	413,022	18,295	133,087	4,974
(710-739) Diseases of musculoskeletal system	2,840,704	125,828	3,226,585	120,593
(740-759) Congenital anomalies	36,702	1,626	17,417	651
(760-779) Certain conditions originating in perinatal period	3,028	134	957	36
(780-796, 798, 799) Symptoms & ill-defined conditions	2,179,561	96,543	195,820	7,319
(800-829) Fractures	1,550,741	68,690	1,214,681	45,398
(830-839) Dislocations	275,748	12,214	1,053,596	39,378
(840-848) Sprains & strains	645,426	28,589	1,960,314	73,266
(850-854) Intracranial injury, excluding skull fracture	116,036	5,140	41,698	1,558
(860-869) Internal injury of chest, abdomen, & pelvis	267,543	11,851	85,747	3,205
(870-897) Open wound	581,834	25,772	600,702	22,451
(900-904) Injury to blood vessels	54,462	2,412	4,734	177
(905-909) Late effects of injuries, poisonings, etc.	1,938	86	10,486	392
(910-919) Superficial injury	38,481	1,704	66,778	2,496
(920-924) Contusion with skin surface intact	138,802	6,148	302,827	11,318
(925-939) Crushing injury	7,081	314	79,592	2,975
(930-939) Effects of foreign body	38,341	1,698	72,412	2,706
(940-949) Burns	33,577	1,487	59,053	2,207
(950-957) Injury to nerves & spinal cord	16,426	728	55,055	2,058
(958-959) Certain traumatic complications	155,413	6,884	95,001	3,551
(960-979) Poisonings by drugs	16,175	716	349	13
(980-989) Toxic effects of substances of non-medical source	14,573	646	19,050	712
(990-995) Other/Unspecified effects of external causes	14,494	642	33,865	1,266
(996-999) Complications of surgery/medical care, NEC.	48,752	2,159	150,853	5,638
V codes (V01-V49)	101,113	4,479	1,970	74
Other V codes (V50-V82)	277,565	12,295	608,264	22,734

	Union Health Insurance		Workers' Compensation	
Selected Disease Groupings	Total charges (Inpatient & Outpatient)	Charges per 1,000 person-years	Total charges (Inpatient & Outpatient)	Charges per 1,000 person-years
E codes	155,274	6,878	3,041	114
ICD-9 code missing	150,596	6,671	40,827	1,526
TOTAL	25,327,014	1,121,856	11,368,289	424,887

Note: The number of person-years is 22,576 for Union health insurance, and 26,756 for workers' compensation.

Table 42a

Charges for Work Related Medical Care
by Type of Injury (ANSI)
Northwest Laborers 1990-1994

Type of Injury	Number of injuries	Amount Charged	Charges per 100 person-years of work
Overexertion	1,562	$4,852,232	$24,839
Struck by	1,455	2,151,083	11,011
Fall from elevation	358	1,780,788	9,116
Fall on same level	342	1,056,794	5,410
Bodily reaction	239	1,017,541	5,209
Struck against	535	472,067	2,417
Caught in, under, between	156	258,612	1,324
Contact w/ radiations, caustics, etc	252	147,423	755
Rubbed or abraded	459	122,486	627
Highway motor vehicle accidents	29	95,687	490
Non highway motor vehicle accidents	30	86,706	444
Contact with electric current	21	57,410	294
Contact with temperature extremes	62	37,282	191
Explosions	3	9,634	49
Accident type, not elsewhere classified	2	290	1
Unknown[1]	103	425,811	2,180
TOTAL		$12,571,848	$64,356

[1] As contrasted with the carpenters' table, we did not include self-insured in "unknown."

Table 42b

Charges for Work Related Medical Care
by Nature of Injury (ANSI)
Northwest Laborers 1990-1994

Nature of Injury	Number of injuries	Amount charged	Charges per 100 person-years of work
Sprains	2,020	$5,560,991	$28,467
Fractures	331	1,470,992	7,530
Ill-Defined Symptoms	244	1,082,017	5,539
Contusion	688	1,049,507	5,372
Cut	941	825,429	4,225
Multiple Injuries	134	695,815	3,562
Dislocation	76	510,018	2,611
Nerve Conditions	87	424,242	2,172
Inguinal Single	55	226,208	1,158
Scratches	511	159,729	818
Hearing Loss	41	79,422	407
Nervous System	3	64,595	331
Electric Shock	19	52,142	267
Amputation	9	43,491	223
Burn-heat	57	37,991	194
Teeth	30	30,632	157
Toxic	44	27,228	139
Other[1]	290	181,789	931
Unknown	28	49,611	254
TOTAL		$12,571,849	$64,356

[1] This category includes all injuries for which nature is not listed on this table. Each individual "nature" group under this category contributed <$25,000 in the amount charged.

Table 42c

Charges for Work Related Medical Care
by Part of Body Injured (ANSI)
Northwest Laborers 1990-1994

Part of Body Injured	Number of injuries	Amount charged	Charges per 100 person-years of work
Back	973	$2,978,553	$15,247
Knee	342	1,389,067	7,111
Shoulder	198	994,781	5,092
Multiple Body Parts	208	876,314	4,486
Wrist	253	777,426	3,980
Finger(s)	567	504,163	2,581
Back/Neck	196	463,389	2,372
Ankle	153	398,068	2,038
Neck	98	344,726	1,765
Foot	295	342,519	1,753
Abdomen	114	342,360	1,753
Hips	37	331,636	1,698
Leg(s) Unspecified	50	309,237	1,583
Hand	260	292,306	1,496
Elbow	141	228,710	1,171
Chest	113	213,654	1,094
Eye(s)	646	206,853	1,059
Arm(s) Unspecified	51	187,654	961
Forearm	125	181,424	929
Lower Leg	83	180,912	926
Trunk Multiple	47	179,393	918
Toe(s)	99	130,346	667
Other[1]	553	708,550	3,627
Unknown	6	9,808	50
TOTAL		$12,571,849	$64,356

[1] This category includes all injuries for which the body part is not listed on this table. Each individual "body part" group under this category contributed <$100,000 in amount charged.

Table 43

Rates[1] and Rate Ratios Comparing Utilization in Union Health Insurance System
by Work Related Injury Experience
Northwest Laborers 1990-1994

Outpatient Care

Major Diagnostic Groups	*Group with no injury*		*Group with injury but no time-loss paid*		*Group with injury with > 3 months' time-loss paid*	
	Rate of visits	Rate ratio	Rate of visits	Rate ratio	Rate of visits	Rate ratio
Infectious diseases	56.6	1.0	77.5	1.4	95.3	1.7
Neoplasms	103.8	1.0	82.3	0.8	151.7	1.5
Endocrine, nutritional, & metabolic diseases	71.4	1.0	72.3	1.0	124.8	1.7
Diseases of blood & blood forming organs	5.3	1.0	5.1	1.0	7.3	1.4
Mental disorders	453.1	1.0	657.4	1.5	788.3	1.7
Diseases of nervous system & sense organs	149.3	1.0	165.5	1.1	203.4	1.4
Diseases of circulatory system	203.1	1.0	173.1	0.9	188.9	0.9
Diseases of respiratory system	286.1	1.0	391.8	1.4	385.0	1.3
Diseases of digestive system	128.6	1.0	138.8	1.1	146.6	1.1
Diseases of genitourinary system	157.0	1.0	135.6	0.9	171.3	1.1
Complications of pregnancy	6.5	1.0	4.0	0.6	9.8	1.5
Diseases of skin & subcutaneous system	129.4	1.0	132.6	1.0	164.5	1.3
Diseases of musculoskeletal system	1,138.5	1.0	1,584.3	1.4	1,458.7	1.3
Congenital anomalies	3.2	1.0	5.5	1.7	5.1	1.6
Conditions originating in perinatal period	0.1	1.0	0.2	2.5		0.0
Symptoms & ill-defined conditions	210.5	1.0	240.6	1.1	296.5	1.4
Injury & poisoning	414.0	1.0	509.5	1.2	559.3	1.4
V-codes	107.6	1.0	104.1	1.0	96.6	0.9
Overall	**3,661.9**	**1.0**	**4,520.6**	**1.2**	**4,906.4**	**1.3**

[1] Rates are computed per 1,000 person-years of eligibility.

Table 44

Rates[1] and Rate Ratios Comparing Utilization in Union Health Insurance System
by Work Related Injury Experience
Northwest Laborers 1990-1994

Inpatient Care

Major Diagnostic Groups	*Group with no injury*		*Group with injury but no time-loss paid*		*Group with injury with > 3 months' time-loss paid*	
	Rate of admissions	Rate ratio	Rate of admissions	Rate ratio	Rate of admissions	Rate ratio
Infectious diseases	0.7	1.0	0.4	0.6	0.4	0.7
Neoplasms	3.7	1.0	1.0	0.3	1.7	0.5
Endocrine, nutritional, & metabolic diseases	0.4	1.0	0.5	1.2	1.3	3.1
Diseases of blood & blood forming organs	0.1	1.0				
Mental disorders	7.1	1.0	5.4	0.8	8.1	1.1
Diseases of nervous system & sense organs	0.2	1.0	0.5	2.1	0.4	1.8
Diseases of circulatory system	8.3	1.0	6.3	0.8	7.7	0.9
Diseases of respiratory system	2.5	1.0	1.8	0.7	1.3	0.5
Diseases of digestive system	6.6	1.0	4.7	0.7	3.4	0.5
Diseases of genitourinary system	3.3	1.0	1.9	0.6	2.1	0.7
Complications of pregnancy	1.0	1.0	0.4	0.4	1.3	1.3
Diseases of skin & subcutaneous system	0.7	1.0	0.3	0.5	1.7	2.6
Diseases of musculoskeletal system	2.2	1.0	2.4	1.1	1.3	0.6
Congenital anomalies			0.1			
Conditions originating in perinatal period			0.1			
Symptoms & ill-defined conditions	2.8	1.0	3.7	1.4	5.1	1.9
Injury & poisoning	4.7	1.0	5.5	1.2	6.0	1.3
V-codes	2.1	1.0	1.2	0.6	0.9	0.4
Overall	46.4	1.0	36.4	0.8	42.7	0.9

1 Rates are computed per 1,000 person-years of eligibility

Table 45

Rate[1] Ratios Comparing Utilization in Union Health Insurance System
After Work Related Injury to Utilization Before Injury
by Categories of Time-Loss Days Away From Work
Northwest Laborers 1990-1994

	1 to 2 months out			2 to 3 months out			> 3 months out		
	Rate before injury	Rate after injury	Ratio	Rate before injury	Rate after injury	Ratio	Rate before injury	Rate after injury	Ratio
Outpatient	3,943.8	5,065.7	1.3	3,822.5	3,148.8	0.8	5,198.8	4,855.5	0.9
Inpatient[2]	16.8	36.5	2.2	56.0	49.2	0.9	33.1	74.2	2.2

1 All data based on persons with a single work-related injury only. Rates are computed per 1,000 person years of eligibility.

2 Inpatient rates are based on very small numbers and maybe unstable.

Table 46

Charges in Union Health Insurance System
Before and After Serious[1] Work-Related Injury
Northwest Laborers 1990-1994

	Before work-related injury		After work-related injury		Charge ratio
Place of service	Charges	Charge per month of eligibility	Charges	Charge per month of eligibility	After/Before
Outpatient	$288,460	$61	$589,752	$118	2
Inpatient	67,009	14	275,408	55	4
Miscellaneous	57,477	12	86,504	17	1
TOTAL	412,947	88	951,664	190	2

1 All data based on persons with a single work-related injury that involved 58 or more days away from work.

Table 47

Contrast of Cohorts, Data Structure, and Methods Used for Analyses

Condition	Carpenters	Laborers
Cohort • definition	Worked 3 months 1989-1995; 1 month of eligibility.	Worked 1 month 1990-1994; 1 month of eligibility
• size	n=12,958	n=11,652
• gender distribution	2.5% female of those with known gender	10.8% female of those with known gender
• age	Treated as time varying	Assigned at entry of study period
• missing information	Less than 1% missing age or gender information	15.7% missing gender information; 4% missing age information
Workers' compensation • data structure	No pharmacy charges	Total pharmacy charges were available but were excluded from any analyses
	Utilization data includes care delivered in observation periods even if injury occurred before 1989 (~10% of utilization and charges)	No utilization data for injuries that occurred outside observation period (1990-94)
	ICD-9 codes rarely missing on line items	ICD-9 codes often missing on line items. For inpatient assigned by DRG group and most common code; for outpatient, assigned by code with most amount paid.
Union health insurance • data structure	No dental utilization or charges	Total dental charges were available but were excluded from any analyses.
	Inpatient ICD9 code assigned based on room/board charge for hospitalization	Usually did not have to assign. Records pertaining to a single episode consistently showed a single ICD-9 code. On rare occasions, assigned based on room/board charge for hospitalization.
	Provider type missing for over 35% of encounters	Type of service (rather than provider type) was used for the purpose of identifying inpatient, outpatient, etc.

Condition	Carpenters	Laborers
Analytical issues • Mental health care utilization through union insurance	Inpatient/ outpatient status assigned by trust; identified inpatient visits and charges for care at substance abuse treatment centers	Only some cases could be identified as inpatient. The vast majority (mainly consisting of care at substance abuse treatment centers) were assigned as outpatient cases.
• Chiropractor visits	Chiropractor visits assigned ICD-9 codes	All approved chiropractor visits (with no ICD-9 codes) for spinal treatments were considered outpatient visits under broad ICD-9 group of Musculoskeletal System Disorders.

Table 48

Work-Related Injury Rates for All Ages and Genders Combined
Washington Carpenters 1989-1995 and
Northwest Laborers 1990-1994

Type of Injury	Person-years of hours	Number of persons injured[1]	Injuries	
			Frequency	Rate of Injury per 100 person-years
Carpenters				
All Injuries	32,594	6,874	13,865	42.5
Time-loss Injuries	32,594	2,451	3,016	9.3
Laborers				
All Injuries	19,535	4,031	6,918	35.4
Time-loss Injuries	19,535	1,641	1,974	10.1

1 *Each individual only counted once regardless of the number of injuries*

Table 49

Comparison of Features of Union Health Insurance Benefits
by Trade

Benefits Coverage Restrictions	Carpenters (1989-1995)	Laborers (1990-1994)
Eligibility for coverage	Must work 275 hours (250 before 1993) in a 3 month period to meet initial eligibility; afterwards must work 1200 hours per year or 300 hours per quarter to maintain coverage. Extra hours worked may be "banked" to extend coverage in periods when hours worked are not sufficient.	Must accumulate 200 hours in a 12 month period to meet eligibility requirement. Each month, 120 hours are deducted from the person's hour bank. Coverage continues as long as 120 hours or more are in the bank. If it drops below, eligibility is lost, but can be reinstated if, within 10 months, hours are built back up to 120 or more. Extra hours, a maximum of 1080, can be accumulated in the hours bank.
Major Medical Coverage includes:	Inpatient and outpatient care, including rehabilitation; prescription drugs; annual physical; chiropractic care.	Inpatient and outpatient care, including prescription drugs, annual physical, chiropractic care for spinal treatments.
Direct payment required by worker for coverage	None	None.
Deductibles	$100 annually; additional $10 per visit or $200 per admission if fails to use PPO.	$100 annually; for PPO providers, coverage is 90%; for non-PPO providers, coverage is 85%.
Co-payments	None	For PPO providers, 10%; for non-PPO providers, 15%; in either case, annual maximum is $1,000.
Rider for pre-existing condition	None allowed	None.
Mental health coverage	yes, but with cap (below)	50%, with cap (below)
Substance abuse coverage	Yes, but with cap (below)	Yes, with cap (below)
Caps on payment	Annual maximum $100,000, $150,000 since 1993; Inpatient rehab $5,000 per disability; Inpatient Psych $10,000 annual; Substance abuse lifetime maximum $10,000 but no more than $5,000 annually;	Annual maximum $100,000; lifetime maximum $1,000,000. Mental : $1,000 lifetime max. Substance abuse : $10,000 lifetime max, with no more than $5,000 in 24 consecutive months.
Exclusions	Care for work related problems; obesity treatment; if injured committing assault; acupuncture, hypnosis; reproductive or sexual disorders; private hospital room; speech therapy;	Care for work related problems; obesity treatment; if injured while violating criminal laws; hypnosis ; reproductive or sexual disorders; private hospital room;
Time-Loss Benefits		Weekly income of $134/week, beginning 1st day for accidents, and 8th day for sickness. Maximum of 13 weeks.

Table 50

Medical Care Utilization Rates by Type of Insurance
Washington Carpenters 1989-1995
Northwest Laborers 1990-1994

Place of care	Union Health Insurance			Workers' Compensation		
	Person-years of eligibility	Number of contacts	Rate per 1,000 person-years	Person-years of eligibility	Number of contacts	Rate per 1,000 person-years
Carpenters						
Outpatient	39,700	112,514	2,834.1	46,341	115,354	2,489.3
Inpatient	39,700	824	20.8	46,341	391	8.4
Laborers						
Outpatient	25,798	119,104	4,616.8	31,071	73,580	2,368.1
Inpatient	25,798	1,083	42.0	31,071	204	6.6

Table 51

Physician Office Visits
Comparison of Per cent Distribution of Visits by ICD-9 Group
Each Worker Group vs. NAMCS

	Proportion of Visits			
ICD9 codes	Carpenters[1]	NAMCS	Laborers[2]	NAMCS
Infectious Diseases (001-139)	2.3	2.4	3.5	3.5
Neoplasms (140-239)	5.3	4.8	3.6	3.9
Endocrine, Nutritional, and Metabolic Diseases (240-279)	4.3	5.7	3.8	4.2
Mental Disorders (290-319)	11.6	7.0	1.2	5.8
Diseases of the Nervous System (320-389)	7.0	9.1	7.3	7.4
Diseases of the Circulatory System (390-459)	9.4	12.6	7.6	7.1
Diseases of the Respiratory System (460-519)	14.5	11.8	15.1	13.5
Diseases of the Digestive System (520-579)	4.4	5.3	5.1	4.5
Diseases of Genitourinary System (580-629)	4.5	4.4	6.5	9.0
Diseases of the Skin (680-709)	5.6	7.0	6.4	6.3
Diseases of the Musculoskeletal System and Connective Tissue (710-739)	13.2	11.5	12.2	8.9
Symptoms and Ill-defined Conditions (780-799)	10.4	4.6	9.4	4.7
Injury and Poisoning (800-999)	6.8	10.3	16.4	8.7
Supplementary Classification (V01-V82)	0.1	3.1	1.4	11.4
All Other	0.5	0.4	0.6	1.5

1 Carpenters analyses limited to males 35-64 years old; NAMCS comparisons limited to average weighted visits for men 35-64 years old with private health insurance, 1990-1994.

2 Laborers analyses include men and women ages 18-64; NAMCS comparisons limited to average weighted visits men and women ages 18-64 with private health insurance coverage, 1990-1994..

Table 52

Amount Charged for Treatment of Musculoskeletal Disorders and Injuries and Poisonings Under Each Insurance System

	Carpenters		Laborers	
	Musculoskeletal Disorders	Injuries and Poisonings	Musculoskeletal Disorders	Injuries and Poisonings
Union Insurance				
Amount charged	$2,702,093	$3,712,937	$3,354,172	$4,531,835
Percent of total charge	12.4	17.0	10.4	14.0
Workers' Compensation				
Amount charged	$4,745,279	$9,706,585	$3,373,749	$6,3345966
Percent of total charge	25.5	52.0	25.1	47.1

Table 53
Survey Respondents With a Carpentry Injury
Resulting in at Least a Week of Lost Time in the Last 10 Years
Union Carpenters Washington State
(n=149)

	Frequency (%)
Time since injury	
Within last year	1 (0.7)
Within last 2 years	9 (6.2)
Within last 3 years	13 (9.0)
Within last 4 years	12 (8.3)
Within last 5 years	31 (21.5)
Greater than 5 years ago	78 (54.2)
Weeks out of work immediately after injury	
One week or less	30 (20.4)
More than one week but less than one month	17 (11.6)
1 month to less than 3 months	45 (30.6)
3 months or greater	55 (37.4)
At time of injury, years worked as a carpenter or in construction	
Less than 1 year	1 (0.7)
1-4 years	13 (8.8)
5-10 years	36 (24.5)
More than 10 years	97 (66.0)
At time of injury, years in the United Brotherhood of Carpenters	
Less than 1 year	9 (6.1)
1-4 years	29 (19.6)
5-10 years	56 (37.8)
More than 10 years	54 (36.5)
Current work status	
Full-time in construction	80 (53.7)
Part-time in construction	1 (0.7)
Full-time not in construction	10 (6.7)
Part-time not in construction	3 (2.0)
Retired	7 (4.7)
Not working due to lack of available work	16 (14.7)
Not working due to disability	21 (14.1)
Other	21 (14.1)
Currently a member of United Brotherhood of Carpenters	103 (69.1)

Table 54

Effects of Work-Related Injuries or Illnesses
Union Carpenters Washington State

Because of your injury, have you:	Frequency (%)
Ever received medical care or lost pay through workers' compensation?	139 (91.3)
Ever missed work after initial return? (16 (10.8%) never returned to work)	56 (37.8)
Ever lost union health insurance benefits?	67 (45.0)
Had to have family members take time off work or school to assist you?	38 (25.5)
Had a significant loss of income?	109 (73.2)
If yes, how much estimated income did you lose?	
Less than $5,000 — 28 (26.9%)	
$5,000-10,000 — 23 (22.1%)	
$10,000-20,000 — 14 (13.5%)	
$20,000-30,000 — 6 (5.8%)	
$30,000-40,000 — 3 (2.9%)	
$40,000-50,000 — 5 (4.8%)	
Over $50,000 — 25 (24.0%)	
Ever had inability to pay bills on time?	52 (34.9)
Deferred planned purchases?	45 (30.2)
Had a lower standard of living than planned?	59 (40.0)
Had to move your place of residence?	20 (13.4)
Changed the types of work you accept?	62 (41.6)
Had changes in the speed with which you can work?	74 (49.7)
Not been able to do certain tasks?	79 (53.0)
Often felt like you could not cope with stressful problems as well as you used to?	30 (20.5)
Ever failed to see a doctor because of concern over insurance coverage or out-of-pocket expenses?	48 (32.2)

Table 55

Volunteered Financial Impacts of Injury
Union Carpenters Washington State

- Age-related bias; people think older workers have more injuries.
- Laid off due to injuries.
- Hard to keep job because of back injury
- Cannot do construction anymore, now earn 50% of carpenter wages

- Had to file bankruptcy
- Loss of credit
- Borrowed money
- Wife had to go to work
- Fighting monthly to make ends meet
- Depleted savings
- Had to sell vehicle
- Plan to sell home
- Had to move in with parents; brother
- Had to seek work out of state
- Ran up credit card debt

- Loss of pension contributions
- Have to self pay medical insurance premiums
- Loss of future earnings
- Cannot save for kids college
- Lost dental benefits
- Took early retirement
- Wife lost wages to help care for me

- Divorce
- Nearly got divorced; changed everything

Table 56

Responses to Health Related Quality of Life Questions
by Time Out of Work After Injury
Washington State Union Carpenters

	Initially Out of Work: Less than 3 Months	3 Months or Greater	
• Appraisal of general health:			
Excellent	13.0% (12)	14.6% (8)	
Very good	45.7% (42)	25.5% (14)	
Good	34.8% (32)	45.5% (25)	
Fair	5.4% (5)	9.1% (5)	
Poor	1.1% (1)	5.5% (3)	p=0.10
• Moderate activities limited a lot	10.95 (10)	29.1% (16)	P=0.001
• Climbing stairs limited a lot	5.5% (5)	27.3% (15)	P=0.001

Last 4 weeks ...

• Due to physical health :			
accomplished less than like	25.0% (23)	63.6% (35)	P=0.001
limited in work or activity	28.3% (26)	63.6% (35)	P=0.001
• Due to emotional problems :			
accomplished less than like	24.2% (22)	29.6% (16)	p=0.47
• Pain interfered (quite a bit or extremely) with you work in home or outside	18.5% (17)	40.7% (22)	P=0.001
• Felt calm and peaceful all or most of the time	40.2% (37)	29.0% (16)	p=0.49
• Had a lot of energy all or most of the time	32.6% (30)	20.0% (11)	p=0.08
• Felt downhearted and blue all or most of the time	4.4% (4)	14.5% (8)	p=0.04
• Physical health or emotional problems interfered with social activities all or most of the time	5.6% (5)	20.3% (11)	P=0.005

XIV. Figures

Table 51

Physician Office Visits
Comparison of Per cent Distribution of Visits by ICD-9 Group
Each Worker Group vs. NAMCS

	Proportion of Visits			
ICD9 codes	Carpenters[1]	NAMCS	Laborers[2]	NAMCS
Infectious Diseases (001-139)	2.3	2.4	3.5	3.5
Neoplasms (140-239)	5.3	4.8	3.6	3.9
Endocrine, Nutritional, and Metabolic Diseases (240-279)	4.3	5.7	3.8	4.2
Mental Disorders (290-319)	11.6	7.0	1.2	5.8
Diseases of the Nervous System (320-389)	7.0	9.1	7.3	7.4
Diseases of the Circulatory System (390-459)	9.4	12.6	7.6	7.1
Diseases of the Respiratory System (460-519)	14.5	11.8	15.1	13.5
Diseases of the Digestive System (520-579)	4.4	5.3	5.1	4.5
Diseases of Genitourinary System (580-629)	4.5	4.4	6.5	9.0
Diseases of the Skin (680-709)	5.6	7.0	6.4	6.3
Diseases of the Musculoskeletal System and Connective Tissue (710-739)	13.2	11.5	12.2	8.9
Symptoms and Ill-defined Conditions (780-799)	10.4	4.6	9.4	4.7
Injury and Poisoning (800-999)	6.8	10.3	16.4	8.7
Supplementary Classification (V01-V82)	0.1	3.1	1.4	11.4
All Other	0.5	0.4	0.6	1.5

1 Carpenters analyses limited to males 35-64 years old; NAMCS comparisons limited to average weighted visits for men 35-64 years old with private health insurance, 1990-1994.

2 Laborers analyses include men and women ages 18-64; NAMCS comparisons limited to average weighted visits men and women ages 18-64 with private health insurance coverage, 1990-1994..

Table 52

Amount Charged for Treatment of Musculoskeletal Disorders and Injuries and Poisonings Under Each Insurance System

	Carpenters		Laborers	
	Musculoskeletal Disorders	Injuries and Poisonings	Musculoskeletal Disorders	Injuries and Poisonings
Union Insurance				
Amount charged	$2,702,093	$3,712,937	$3,354,172	$4,531,835
Percent of total charge	12.4	17.0	10.4	14.0
Workers' Compensation				
Amount charged	$4,745,279	$9,706,585	$3,373,749	$6,3345966
Percent of total charge	25.5	52.0	25.1	47.1

Table 53
Survey Respondents With a Carpentry Injury
Resulting in at Least a Week of Lost Time in the Last 10 Years
Union Carpenters Washington State
(n=149)

	Frequency (%)
Time since injury	
Within last year	1 (0.7)
Within last 2 years	9 (6.2)
Within last 3 years	13 (9.0)
Within last 4 years	12 (8.3)
Within last 5 years	31 (21.5)
Greater than 5 years ago	78 (54.2)
Weeks out of work immediately after injury	
One week or less	30 (20.4)
More than one week but less than one month	17 (11.6)
1 month to less than 3 months	45 (30.6)
3 months or greater	55 (37.4)
At time of injury, years worked as a carpenter or in construction	
Less than 1 year	1 (0.7)
1-4 years	13 (8.8)
5-10 years	36 (24.5)
More than 10 years	97 (66.0)
At time of injury, years in the United Brotherhood of Carpenters	
Less than 1 year	9 (6.1)
1-4 years	29 (19.6)
5-10 years	56 (37.8)
More than 10 years	54 (36.5)
Current work status	
Full-time in construction	80 (53.7)
Part-time in construction	1 (0.7)
Full-time not in construction	10 (6.7)
Part-time not in construction	3 (2.0)
Retired	7 (4.7)
Not working due to lack of available work	16 (14.7)
Not working due to disability	21 (14.1)
Other	21 (14.1)
Currently a member of United Brotherhood of Carpenters	103 (69.1)

Table 54

Effects of Work-Related Injuries or Illnesses
Union Carpenters Washington State

Because of your injury, have you:		Frequency (%)
Ever received medical care or lost pay through workers' compensation?		139 (91.3)
Ever missed work after initial return? (16 (10.8%) never returned to work)		56 (37.8)
Ever lost union health insurance benefits?		67 (45.0)
Had to have family members take time off work or school to assist you?		38 (25.5)
Had a significant loss of income?		109 (73.2)
If yes, how much estimated income did you lose?		
Less than $5,000	28 (26.9%)	
$5,000-10,000	23 (22.1%)	
$10,000-20,000	14 (13.5%)	
$20,000-30,000	6 (5.8%)	
$30,000-40,000	3 (2.9%)	
$40,000-50,000	5 (4.8%)	
Over $50,000	25 (24.0%)	
Ever had inability to pay bills on time?		52 (34.9)
Deferred planned purchases?		45 (30.2)
Had a lower standard of living than planned?		59 (40.0)
Had to move your place of residence?		20 (13.4)
Changed the types of work you accept?		62 (41.6)
Had changes in the speed with which you can work?		74 (49.7)
Not been able to do certain tasks?		79 (53.0)
Often felt like you could not cope with stressful problems as well as you used to?		30 (20.5)
Ever failed to see a doctor because of concern over insurance coverage or out-of-pocket expenses?		48 (32.2)

Table 55

Volunteered Financial Impacts of Injury
Union Carpenters Washington State

- Age-related bias; people think older workers have more injuries.
- Laid off due to injuries.
- Hard to keep job because of back injury
- Cannot do construction anymore, now earn 50% of carpenter wages

- Had to file bankruptcy
- Loss of credit
- Borrowed money
- Wife had to go to work
- Fighting monthly to make ends meet
- Depleted savings
- Had to sell vehicle
- Plan to sell home
- Had to move in with parents; brother
- Had to seek work out of state
- Ran up credit card debt

- Loss of pension contributions
- Have to self pay medical insurance premiums
- Loss of future earnings
- Cannot save for kids college
- Lost dental benefits
- Took early retirement
- Wife lost wages to help care for me

- Divorce
- Nearly got divorced; changed everything

Table 56

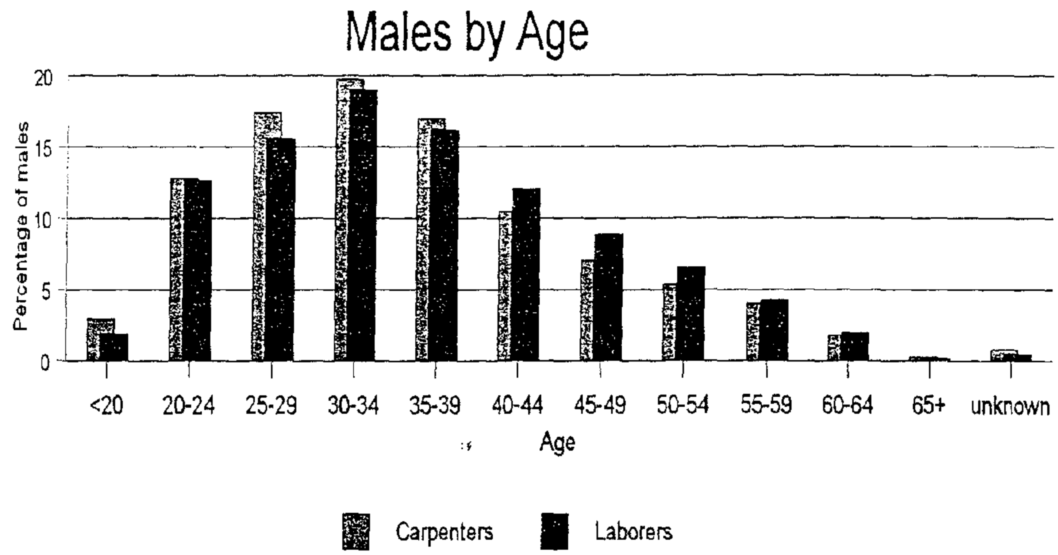
Responses to Health Related Quality of Life Questions
by Time Out of Work After Injury
Washington State Union Carpenters

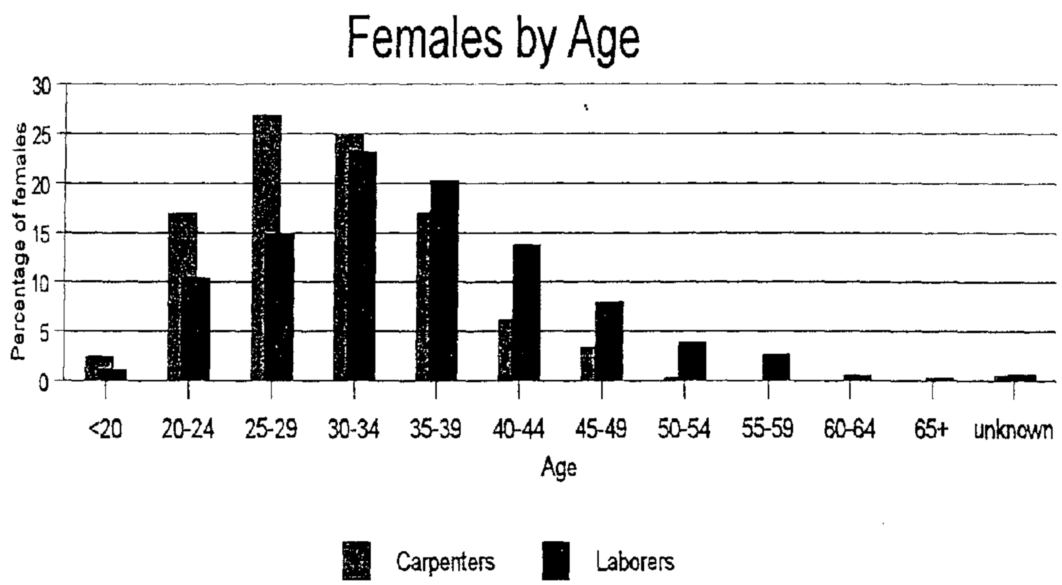
	Initially Out of Work: Less than 3 Months	Initially Out of Work: 3 Months or Greater	
• Appraisal of general health:			
Excellent	13.0% (12)	14.6% (8)	
Very good	45.7% (42)	25.5% (14)	
Good	34.8% (32)	45.5% (25)	
Fair	5.4% (5)	9.1% (5)	
Poor	1.1% (1)	5.5% (3)	p=0.10
• Moderate activities limited a lot	10.95 (10)	29.1% (16)	P=0.001
• Climbing stairs limited a lot	5.5% (5)	27.3% (15)	P=0.001
Last 4 weeks ...			
• Due to physical health :			
accomplished less than like	25.0% (23)	63.6% (35)	P=0.001
limited in work or activity	28.3% (26)	63.6% (35)	P=0.001
• Due to emotional problems :			
accomplished less than like	24.2% (22)	29.6% (16)	p=0.47
• Pain interfered (quite a bit or extremely) with you work in home or outside	18.5% (17)	40.7% (22)	P=0.001
• Felt calm and peaceful all or most of the time	40.2% (37)	29.0% (16)	p=0.49
• Had a lot of energy all or most of the time	32.6% (30)	20.0% (11)	p=0.08
• Felt downhearted and blue all or most of the time	4.4% (4)	14.5% (8)	p=0.04
• Physical health or emotional problems interfered with social activities all or most of the time	5.6% (5)	20.3% (11)	P=0.005

XIV. Figures

Figure 1

Comparisons of Age Distributions by Gender of Two Cohorts

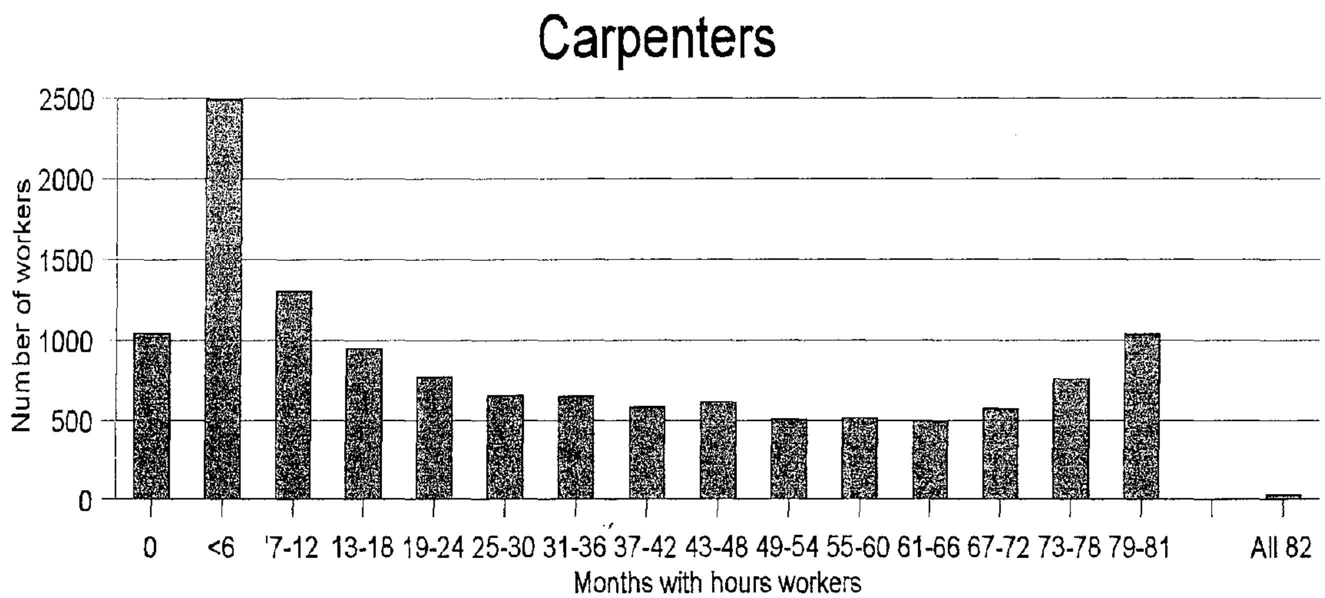


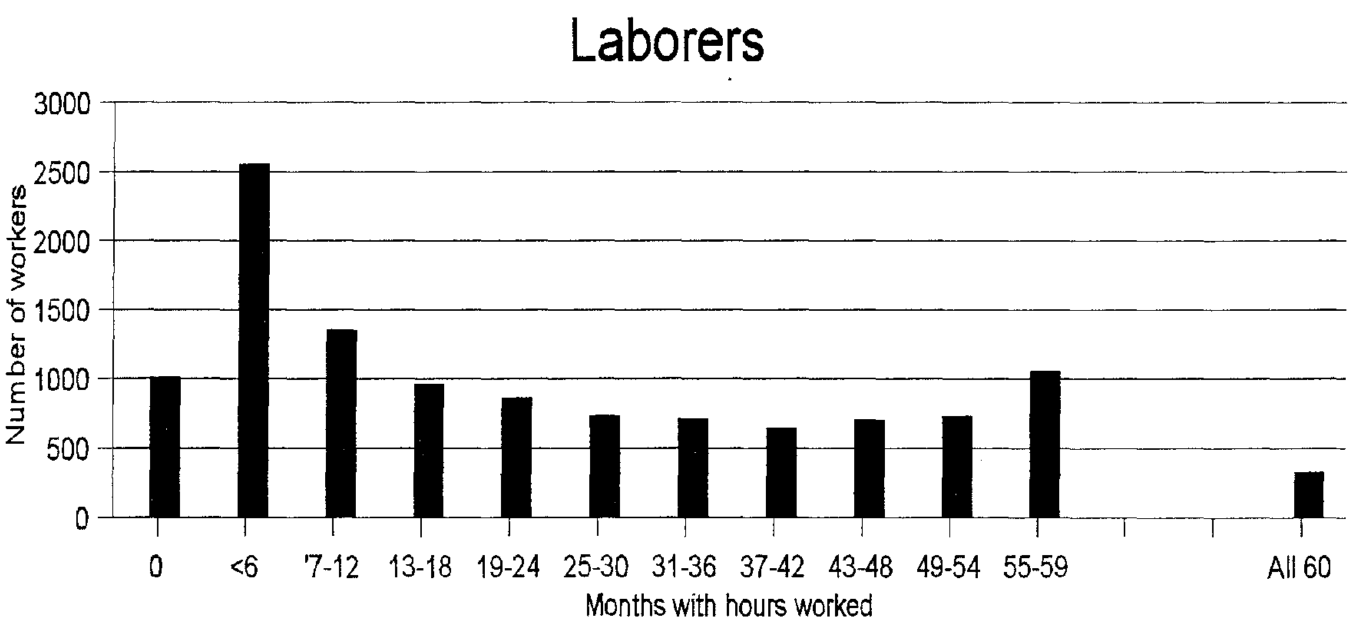


Note:
Percentages are of those with known gender (gender was unknown for <1% of carpenters and 16% of laborers)
Scale is different for males and females.

Figure 2

Distribution of Number of Months with Hours Worked for Two Cohorts

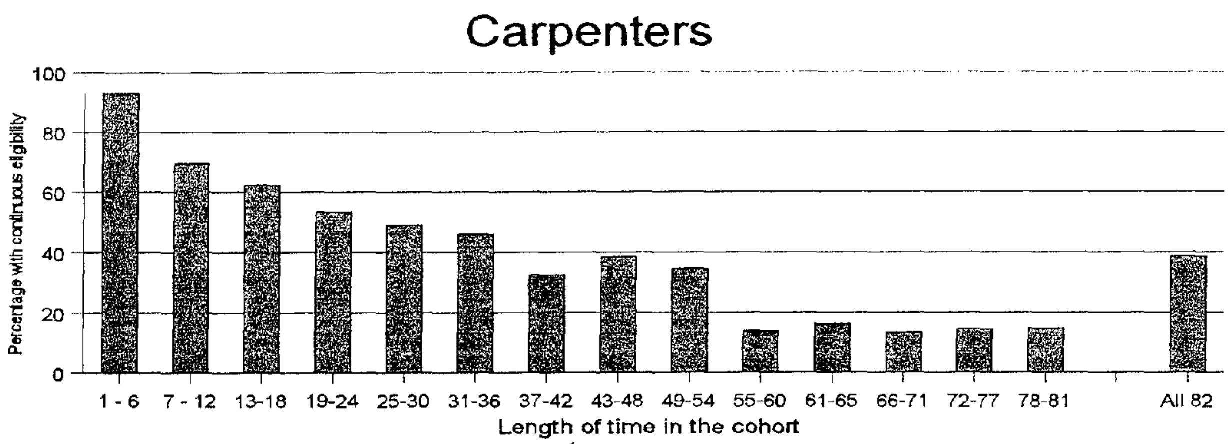


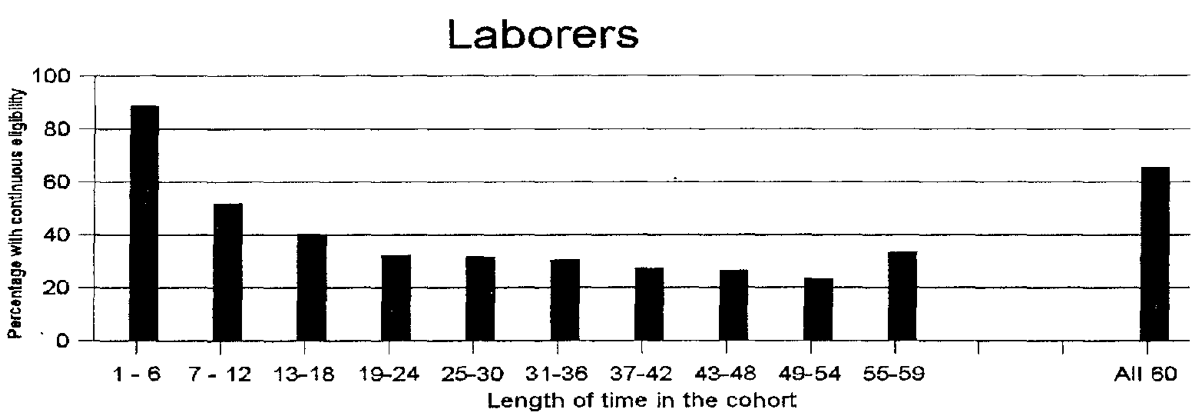


Note: Carpenters were observed for 84 months; laborers for 60 months.

Figure 3

Percent with Continuous Insurance Eligibility by Length of Time in Cohorts





Note: Carpenters were observed for 84 months but had to have worked at least 3 months to meet cohort requirements; laborers observed for 60 months.

Figure 4

Work Injury Rates per 100 Person-years
by Age Groups
All Injuries

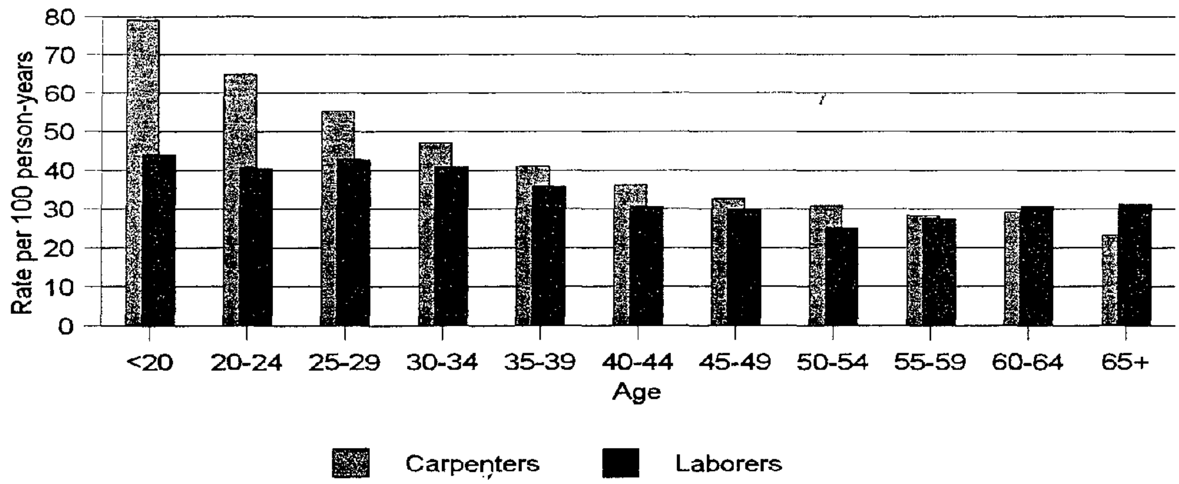


Figure 5

Work Injury Rates per 100 Person-years by Age Groups Lost Time Injuries

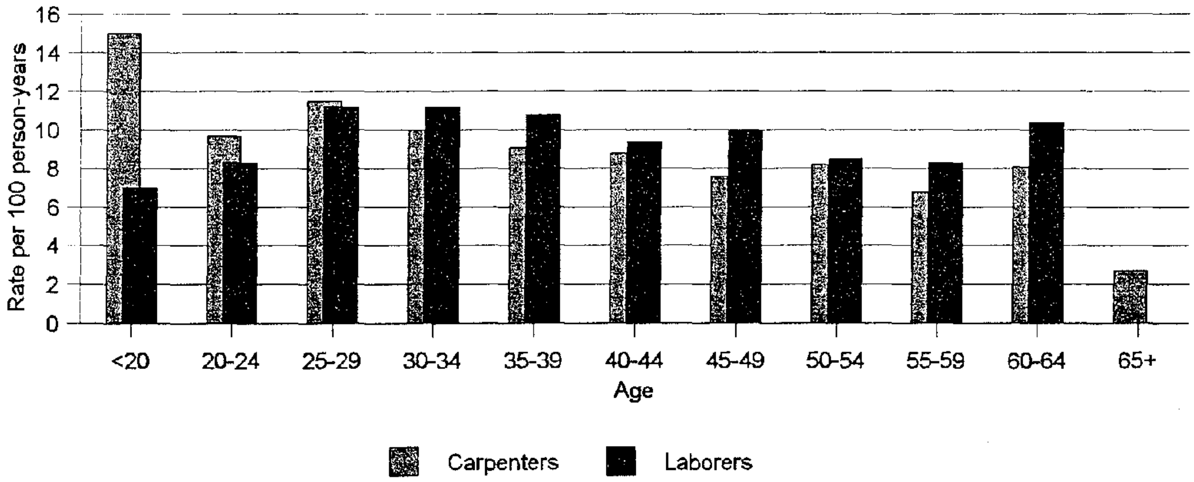
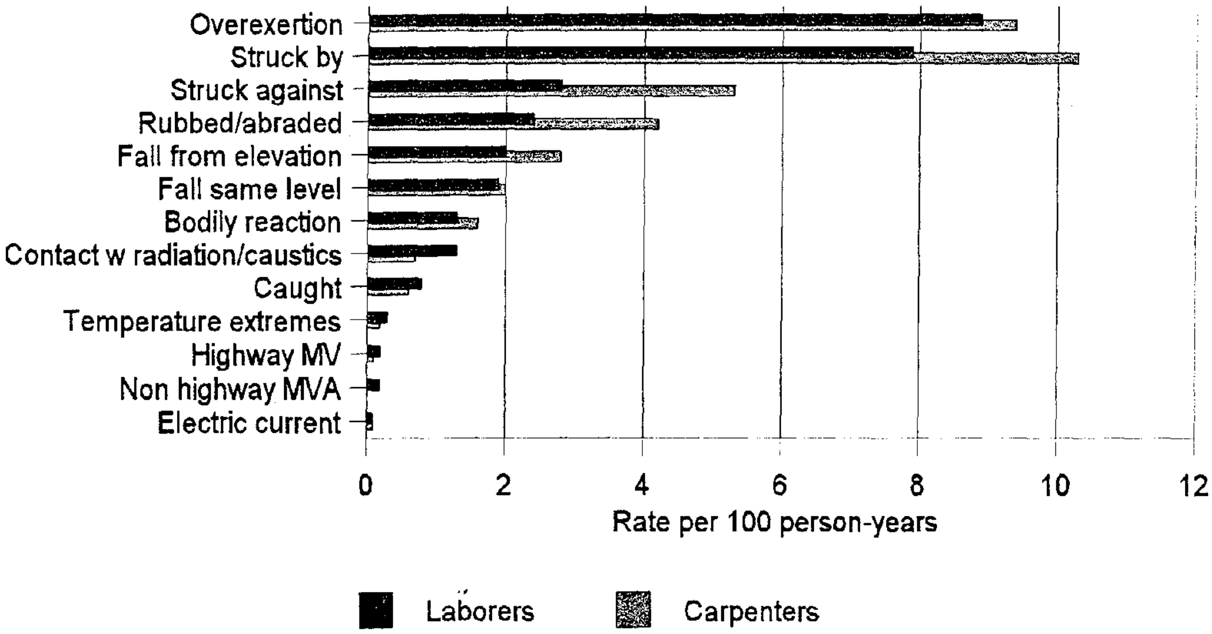


Figure 6
A. Injury Rates per 100 Person-years
by Type of Injury
All Injuries



B. Injury Rates per 100 Person-years
by Type of Injury
Lost Time Injuries

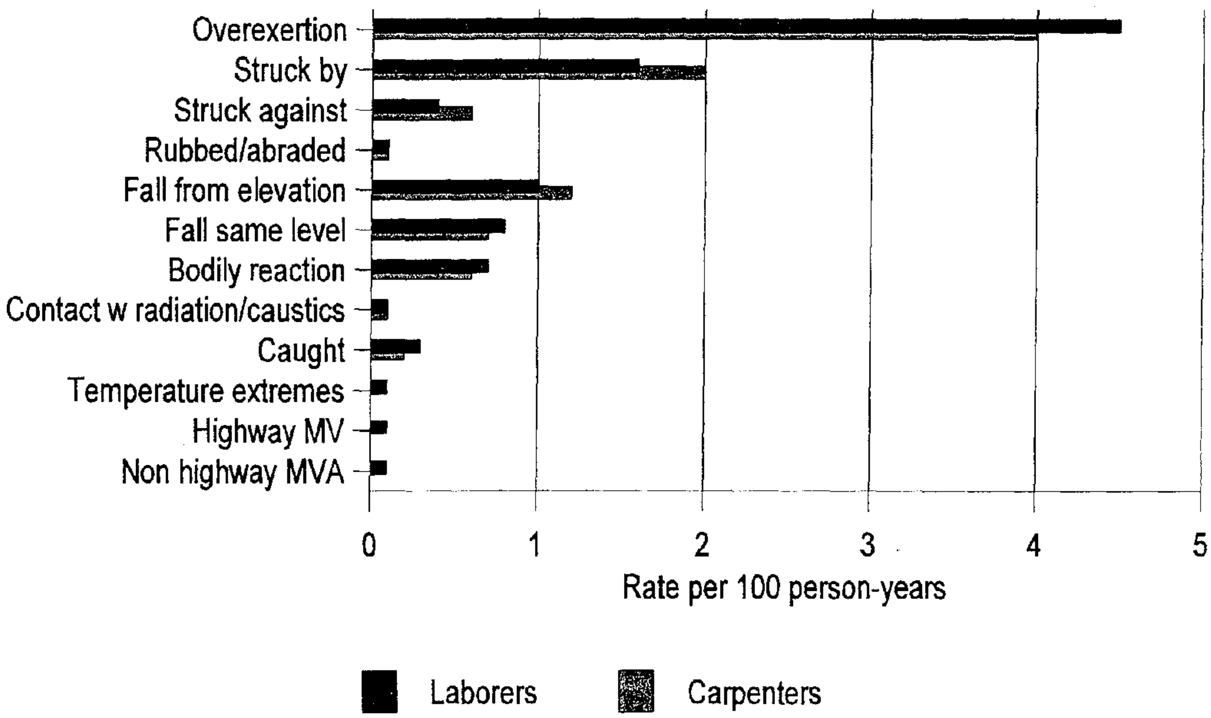
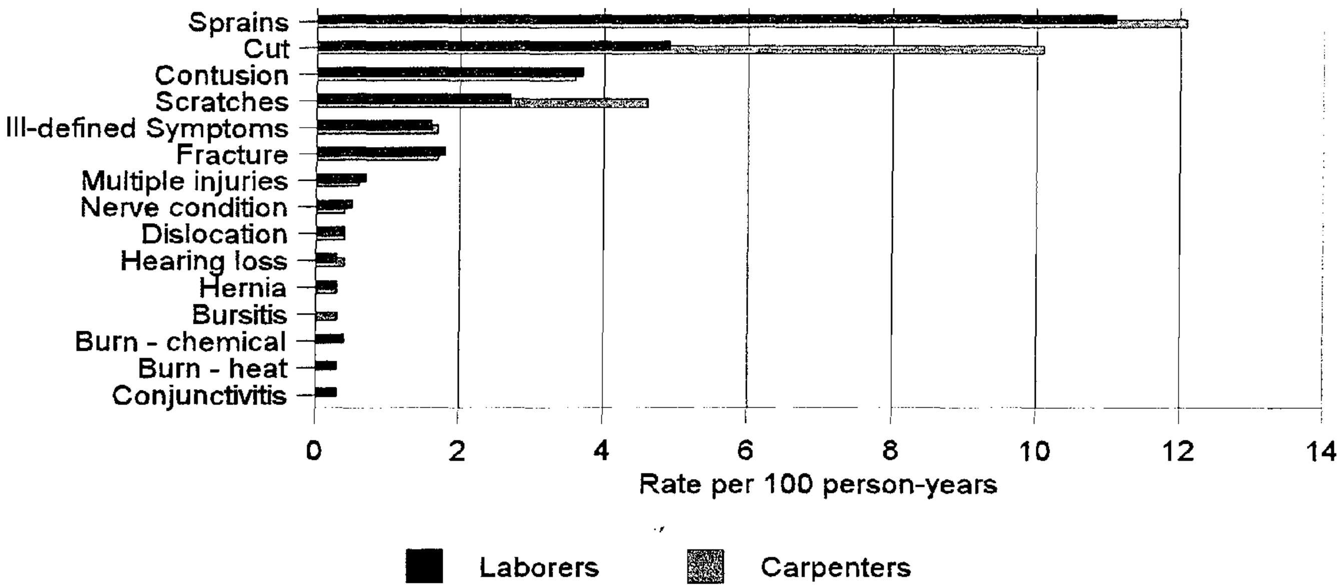


Figure 7
A. Injury Rates per 100 Person-years
by Nature of Injury
All injuries



B. Injury Rates per 100 person-years
by Nature of Injury
Lost time injuries

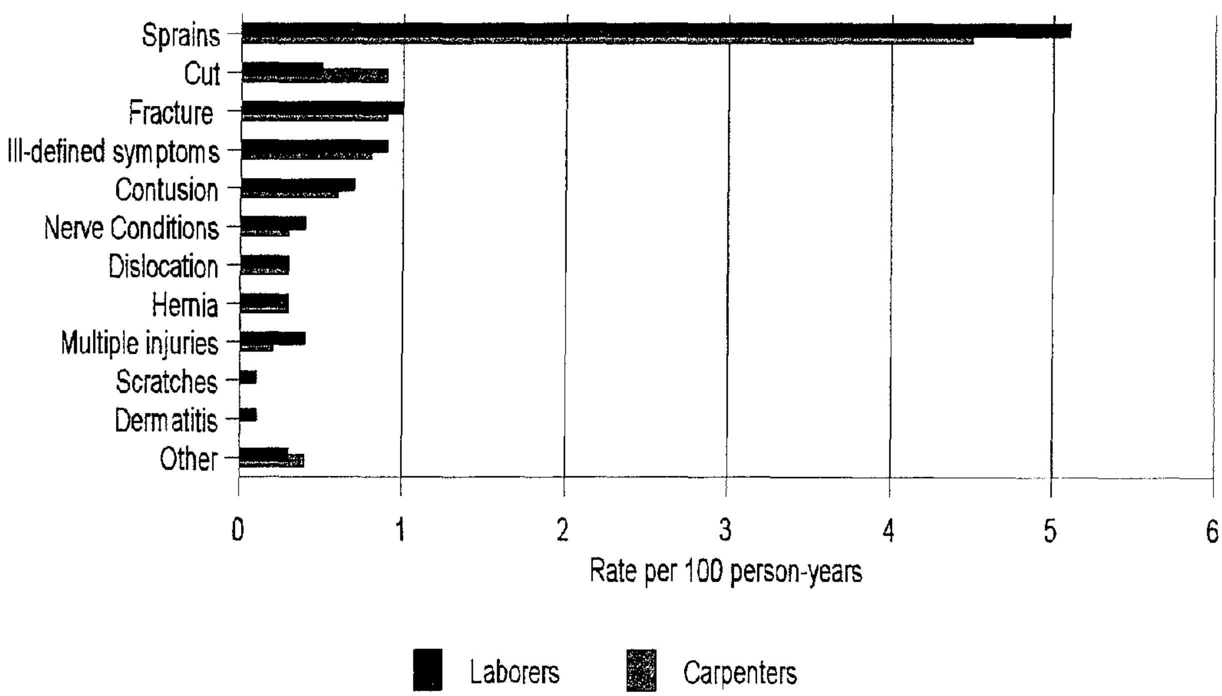
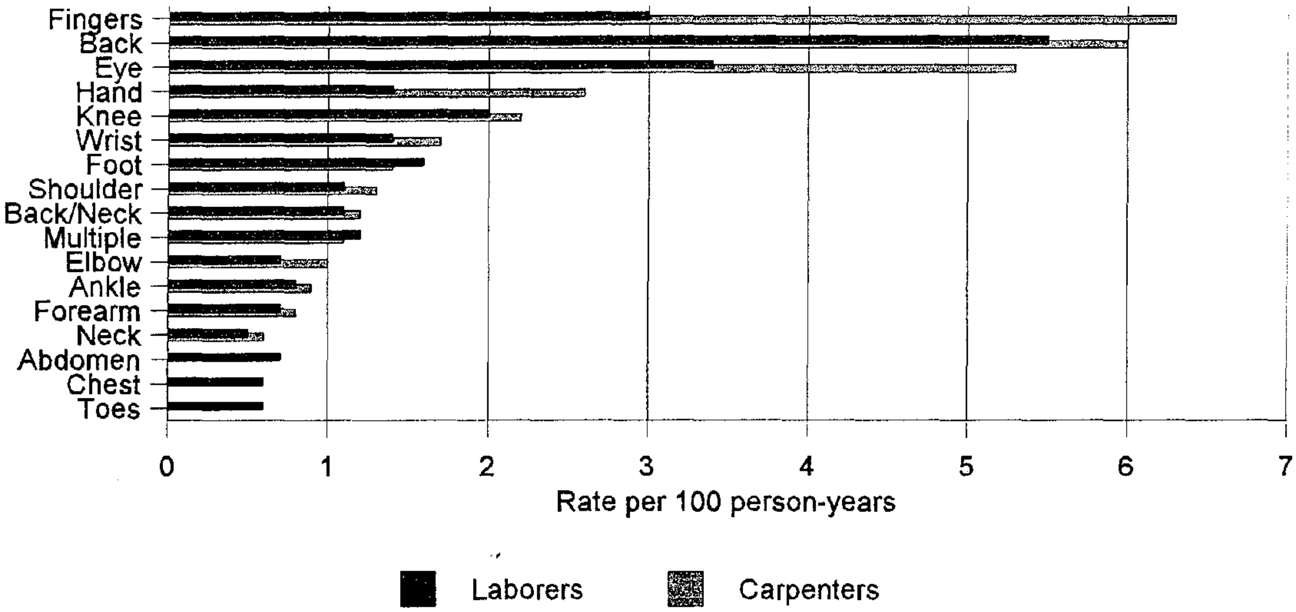


Figure 8

A. Injury Rates per 100 Person-years
by Body Part Injured
All Injuries



B. Injury Rates per 100 Person-years
by Part of Body Injured
Lost Time Injuries

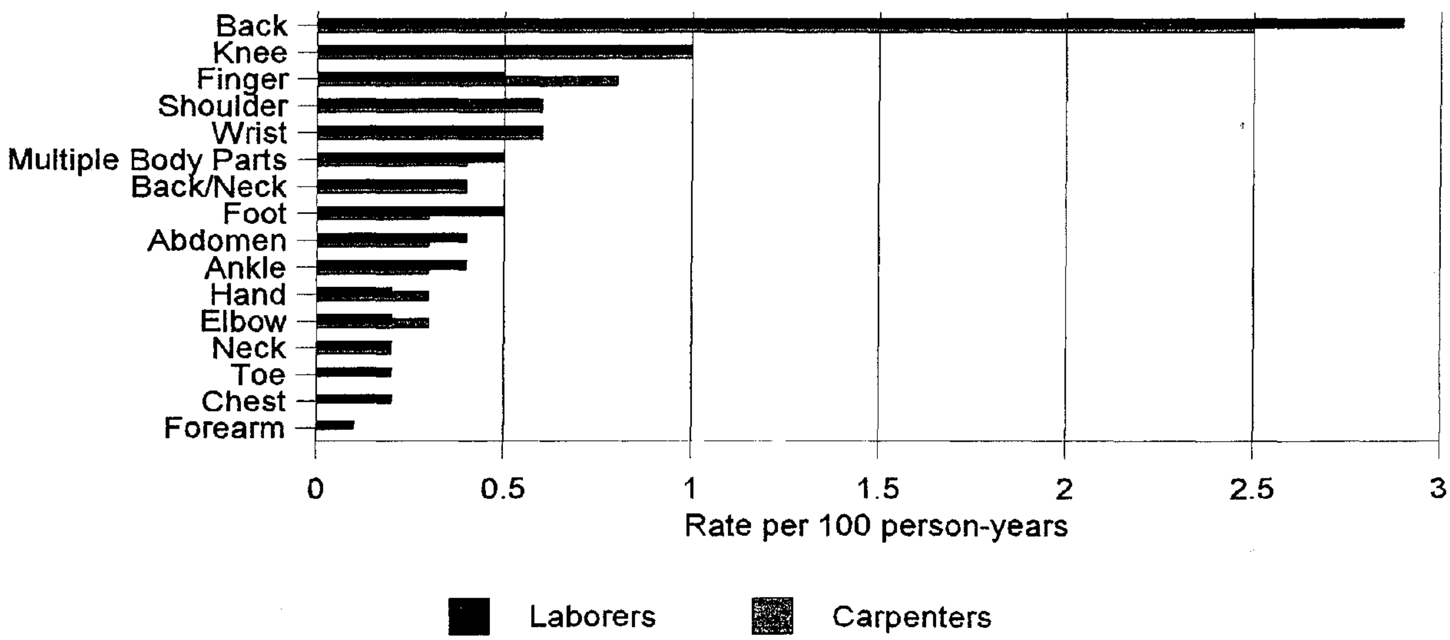
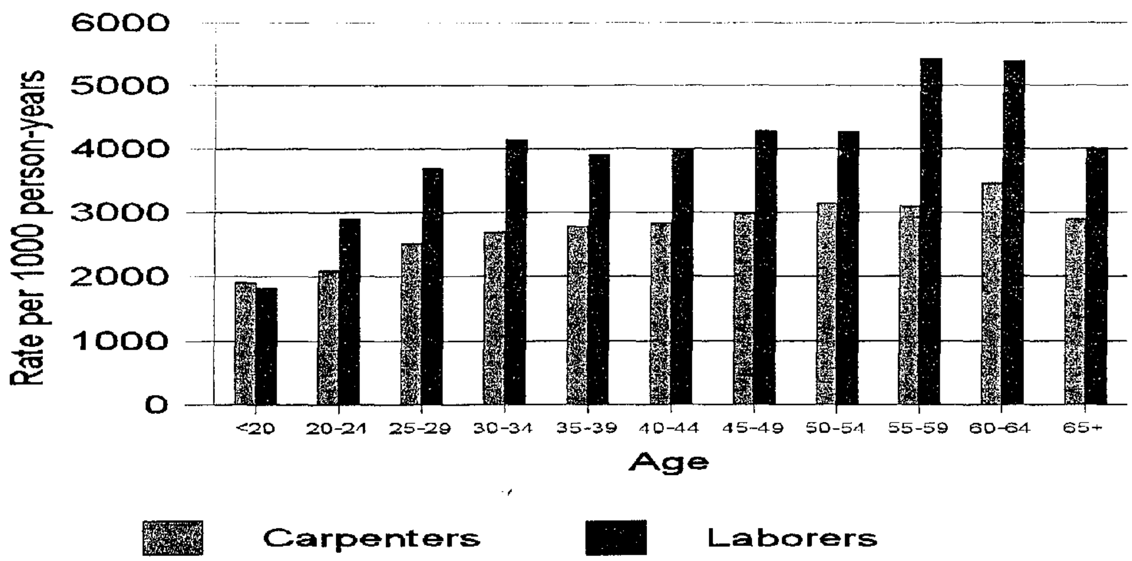


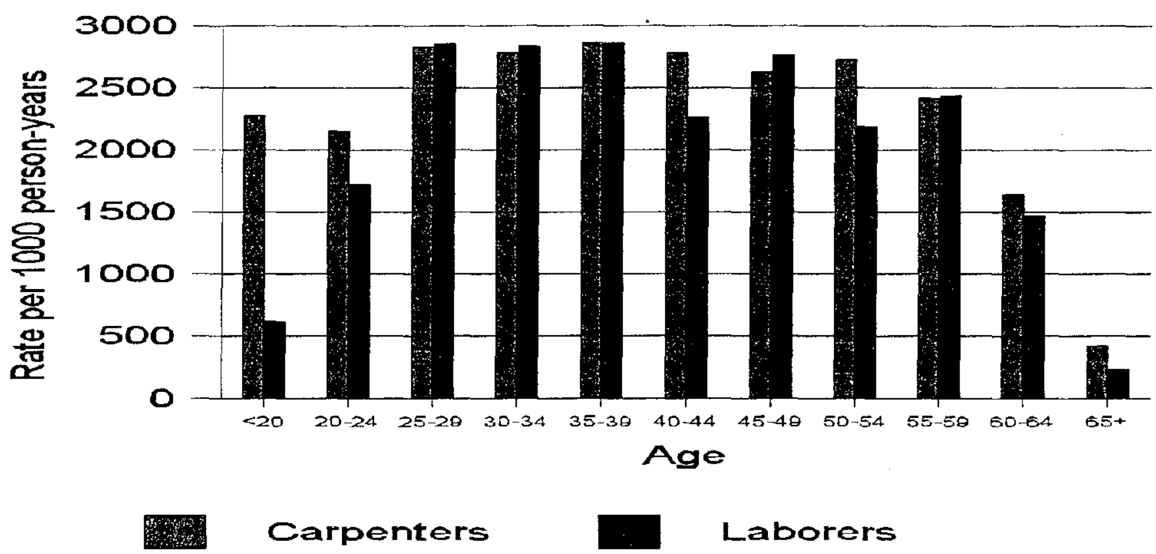
Figure 9

Age Specific Utilization Rates* by Type of Insurance
Carpenters and Laborers Washington State^

A. Union Health Insurance: Outpatient, Males



B. Workers' Compensation: Outpatient, Males



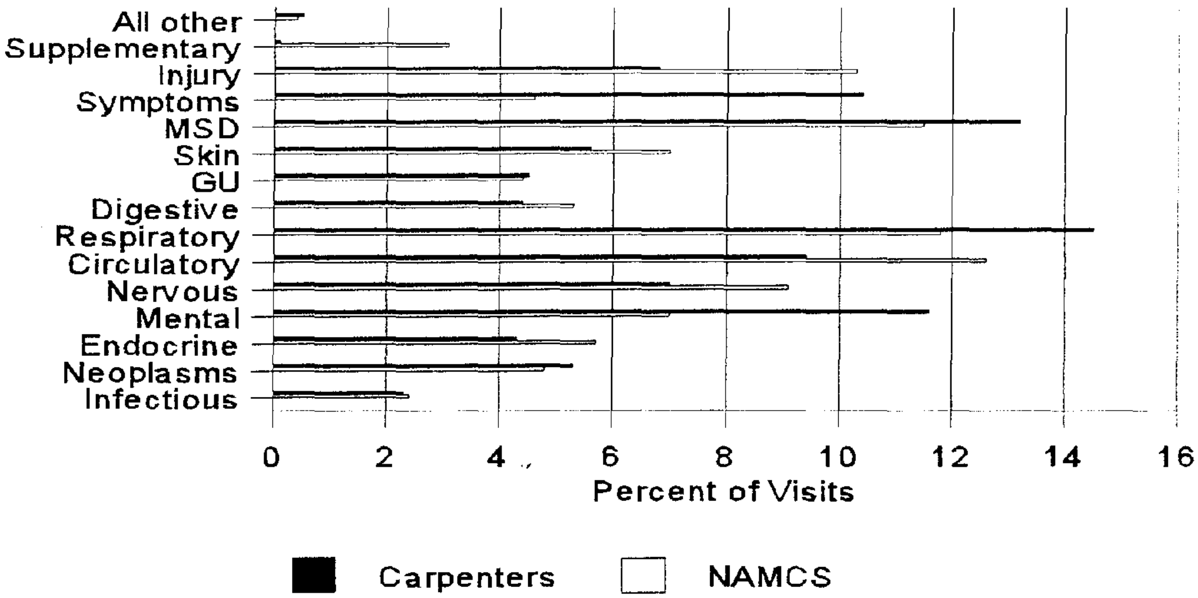
* Rates are per 1000 person-years of eligibility

^ Carpenters observed for seven years; laborers for 5 years.

Figure 10

Percent of physician Office Visits

A. Carpenters vs National Ambulatory Medical Care Survey (NAMCS)
(limited to males 35 years and older)



B. Laborers vs National Ambulatory Medical Care Survey (NAMCS)

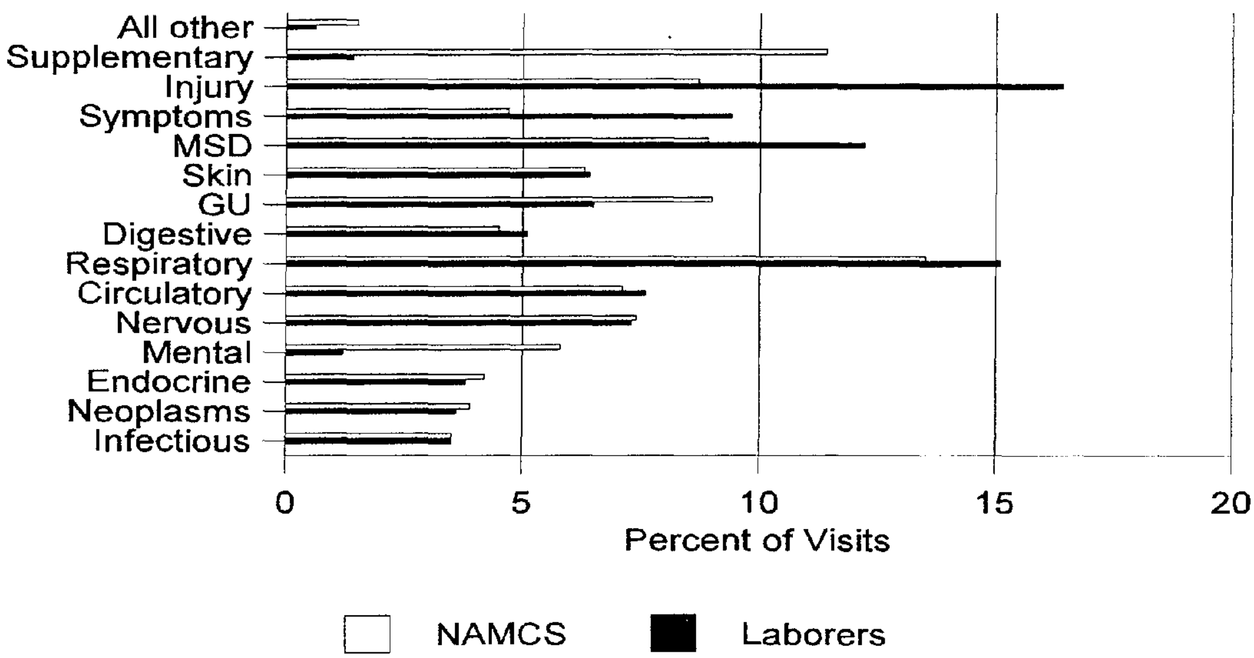
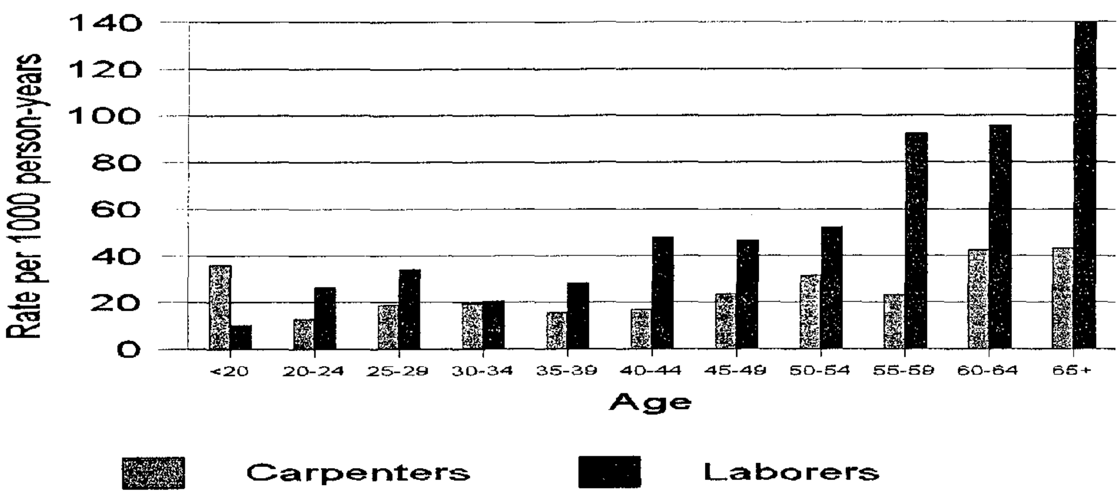


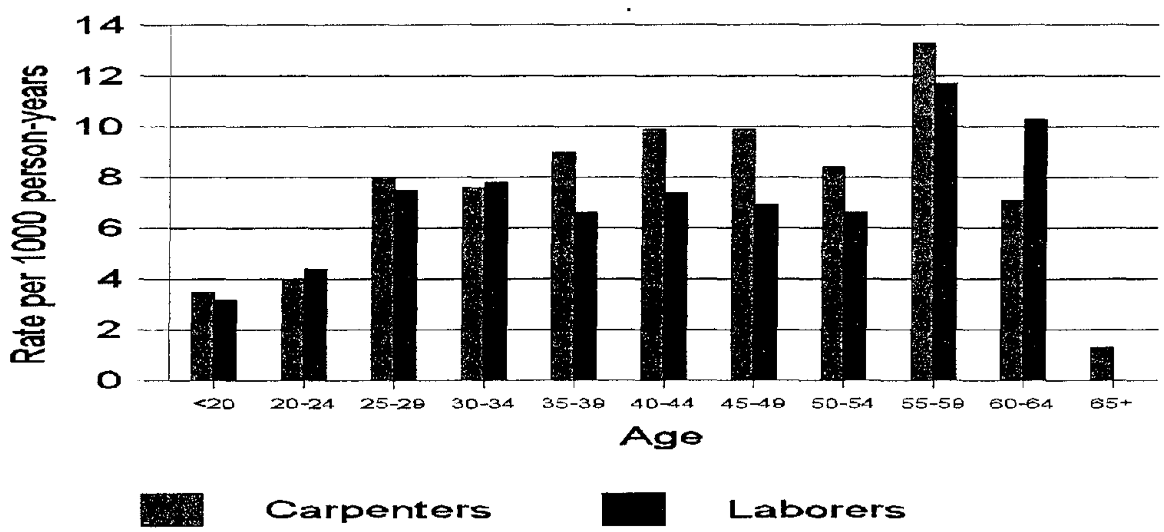
Figure 11

Age Specific Utilization Rates* by Type of Insurance
Carpenters and Laborers Washington State^

A. Union Health Insurance: Inpatient, Males



B. Workers' Compensation: Inpatient, Males

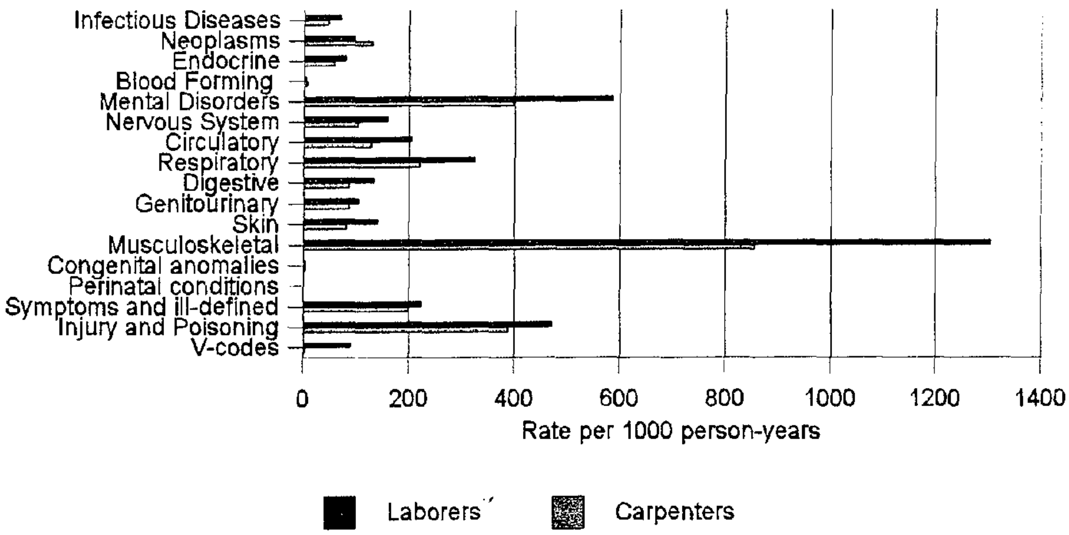


* Rates are per 1000 person-years of eligibility
^ Carpenters observed for seven years; laborers for 5 years.

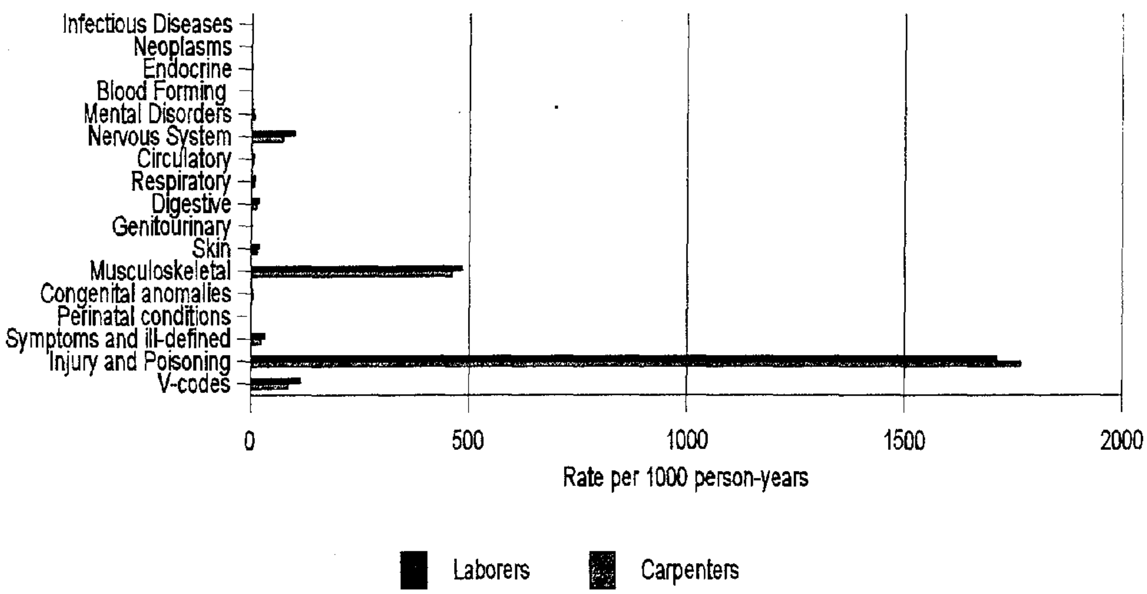
Figure 12

Utilization Rates by Type of Insurance and ICD-9 Groupings
Carpenters and Laborers

A. Union Insurance: Outpatient, Males



B. Workers' Compensation: Outpatient, Males



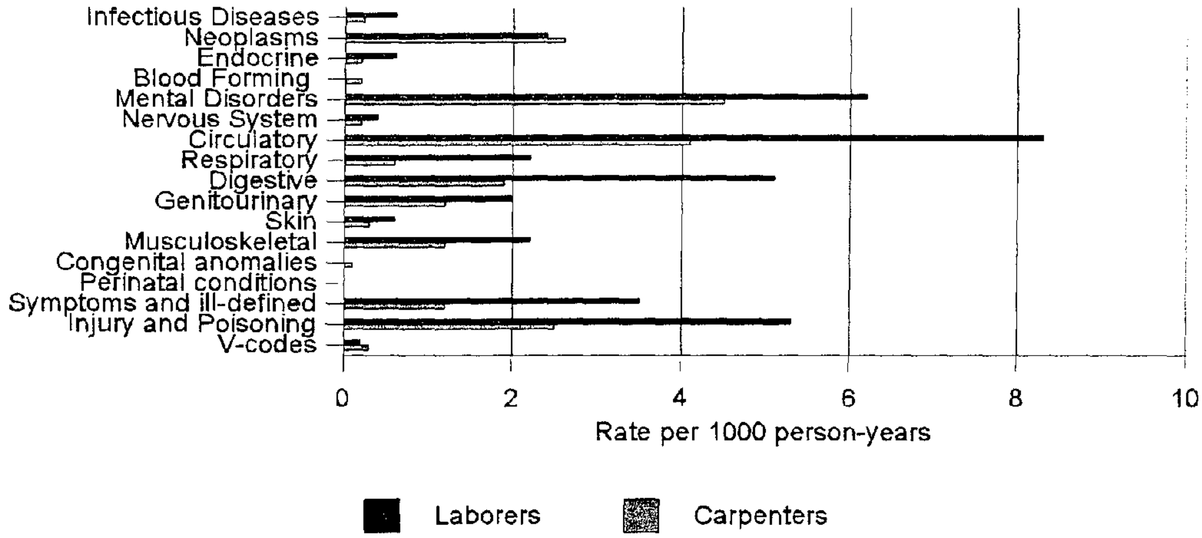
* Rates are per 1000 person-years of eligibility

^ Carpenters observed for seven years; laborers for 5 years.

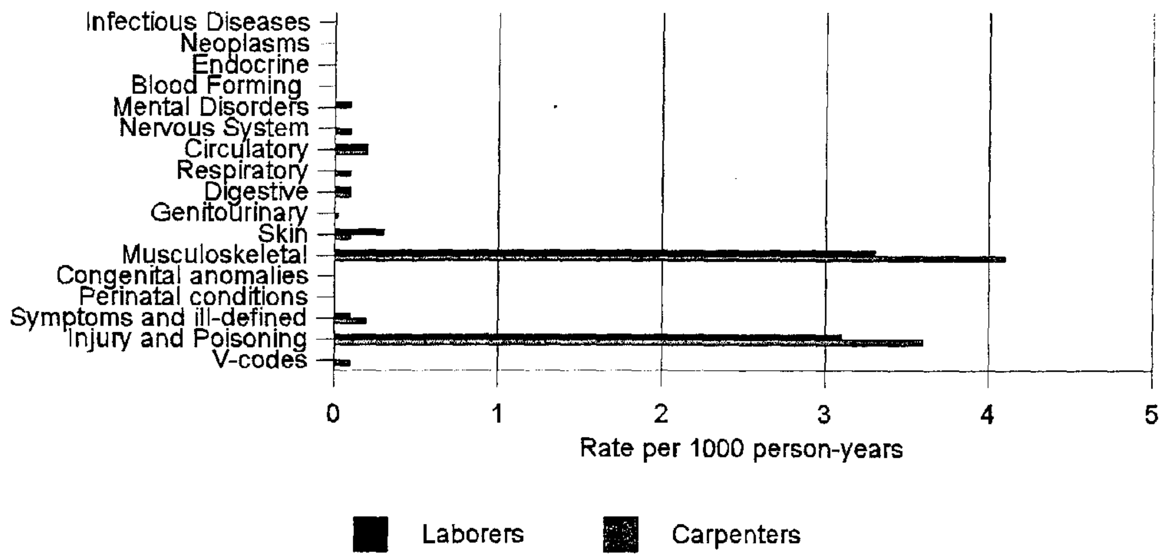
Figure 13

Utilization Rates by Type of Insurance
Carpenters and Laborers

A. Union Insurance: Inpatient, Males



B. Workers' Compensation: Inpatient, Males



* Rates are per 1000 person-years of eligibility

^ Carpenters observed for seven years; laborers for 5 years.

Figure 14

Charges for Work-Related Medical Care
per 100 Person-years of Work
by Type of Injury
Carpenters and Laborers Washington State

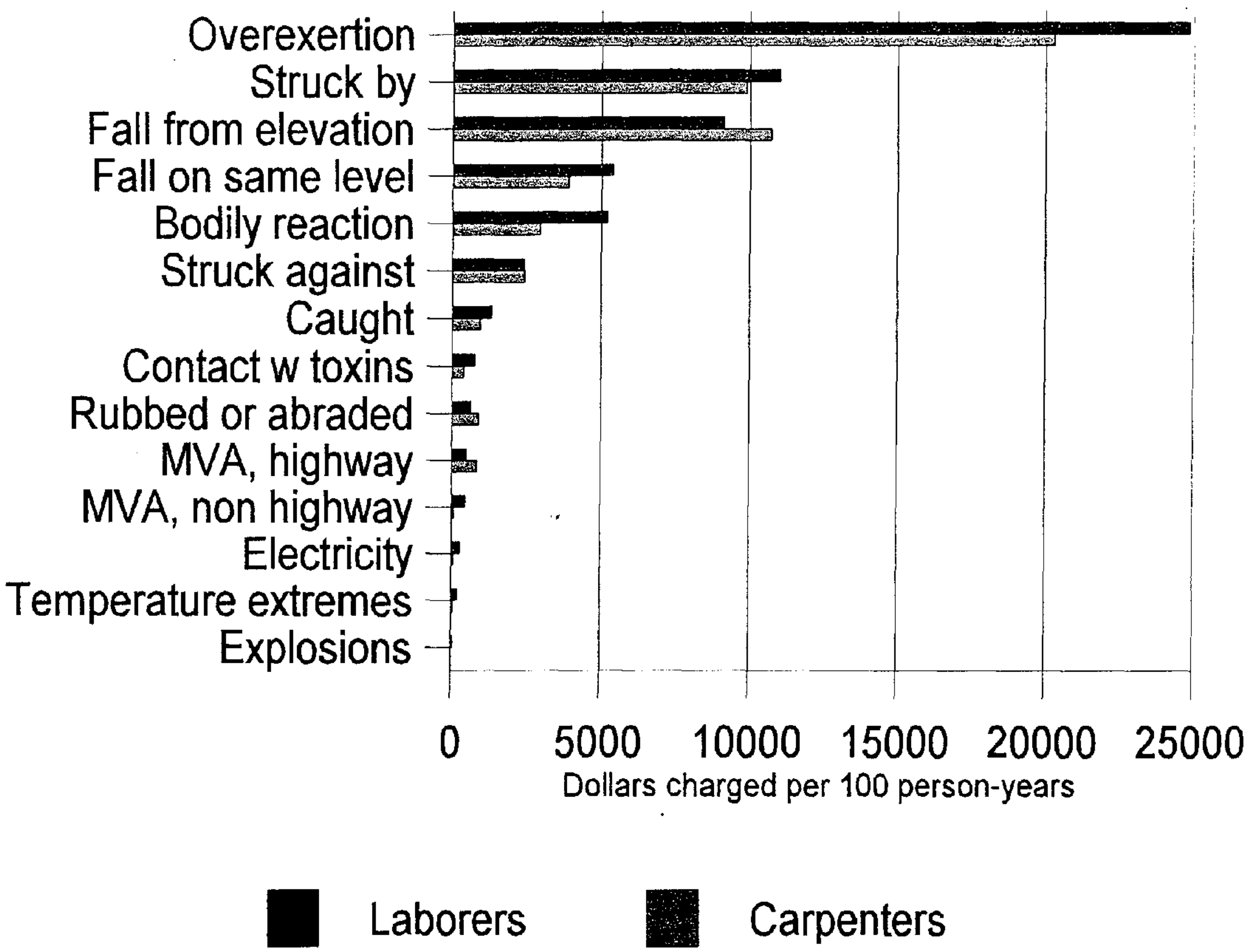


Figure 15

Charges for Work-Related Medical Care per 100 Person-years of Work for Most Common Nature of Injury Carpenters and Laborers Washington State

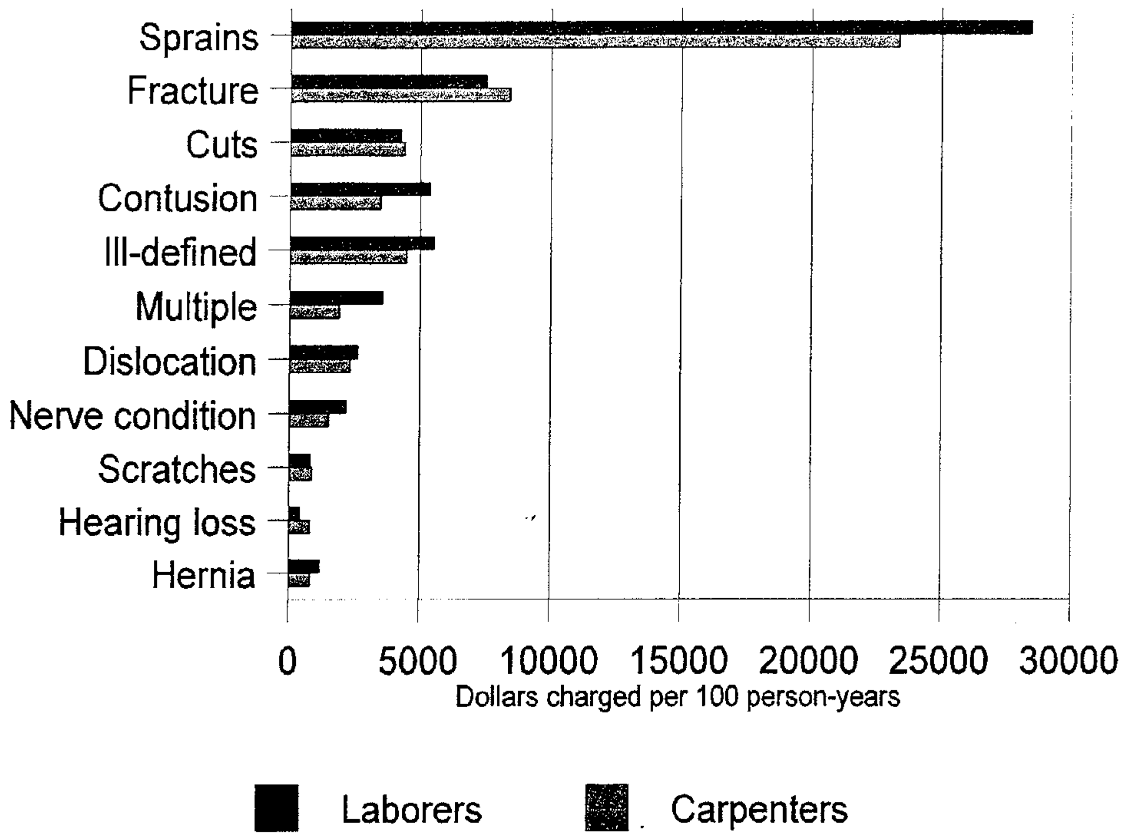
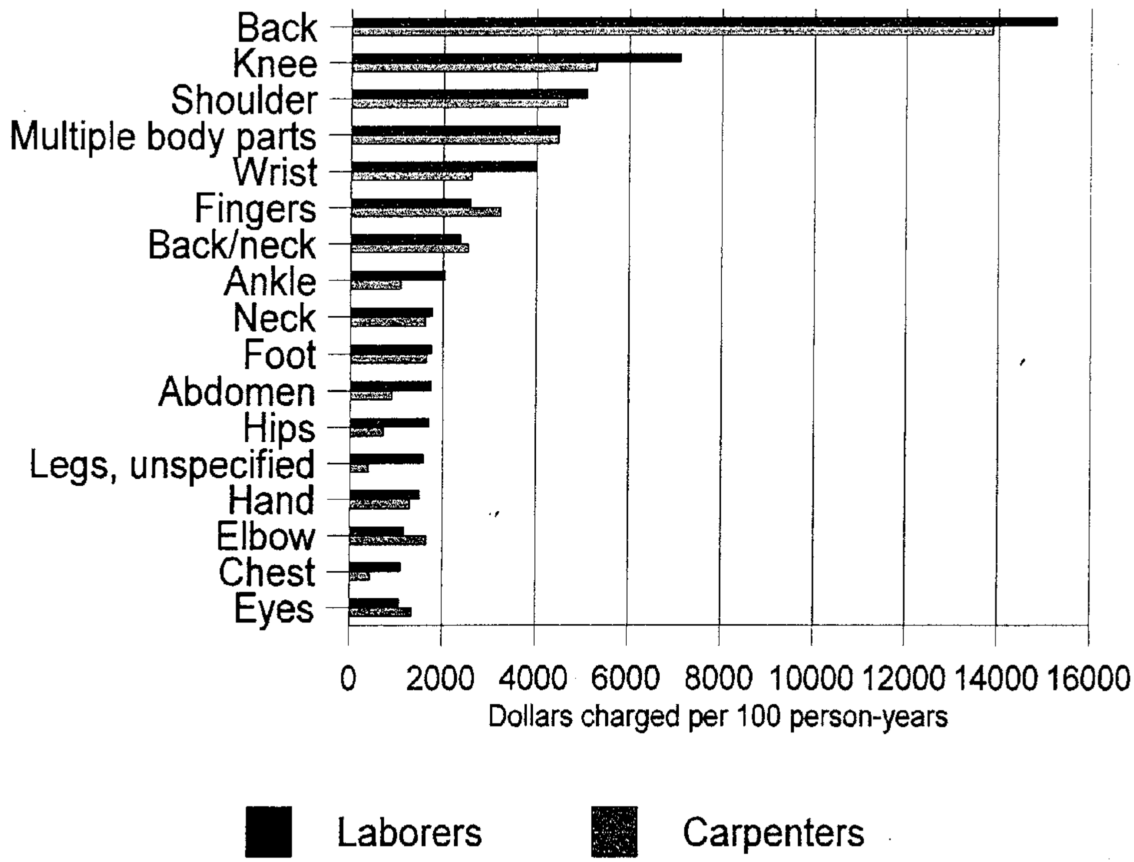


Figure 16

Charges for Work-Related Medical Care
per 100 Person-years of Work
for Most Common Body Parts Injured
Carpenters and Laborers Washington State



XV. Publications

Lipscomb HJ, Dement JM, McDougall V, Kalat J. Work-Related Eye Injuries Among Union Carpenters. Appl Occup Environ Hyg 14(10):665-676, 1999.

Lipscomb HJ, Dement JM, Gaal JS, Cameron W, McDougall V. Work-Related Injuries and Associated Costs In Drywall Installation (Manuscript; In review: Appl Occup Environ Hyg, July 1999)

Lipscomb HJ, Dement JM. Health Care Utilization Among Carpenters with Alcohol and/or Substance Abuse (Manuscript; In review: Am J Pub Hlth)

Shults R. Upper Extremity Musculoskeletal Injuries Among Union Carpenters (Dissertation; manuscript in preparation)

Additional planned publications:

Results of cost analyses at least of work-related injuries for carpenters and laborers.

Results of further injury specific analyses (falls by example)

XVI. APPENDICES

- Modified NIOSH Lifetable groupings (Appendix 1)
- Survey and letter used for follow back with injured carpenters (Appendix 2)

- Specialized analyses by trade
  Carpenters
    - Detailed Workers' Compensation Analyses
        - Work Injuries and Associated Costs In Drywall Installation (manuscript; in review) (Appendix 3)
        - Work-Related Eye Injuries Among Union Carpenters (Publication attached) (Appendix 4)
        - Upper Extremity Musculoskeletal Injuries Among Union Carpenters (dissertation; manuscript in preparation) (Appendix 5)
    - Injury Related Health Care Utilization Among Carpenters with Alcohol and/or Substance Abuse
      (manuscript; in review) (Appendix 6)
    - The Social, Emotional and Economic Effects of Injuries on Carpenters in Washington State (Appendix 7; Microsoft Word file)

Appendix 1

Modified NIOSH Lifetable Groupings

Modified from:

NIOSH LIFE-TABLE ANALYSIS SYSTEM GROUPS

Disease Category	ICD-9 Codes
INFECTIOUS DISEASES	**001-139**
Respiratory Tuberculosis	010-012
Other Tuberculosis	013-018, 137
Other Infectious Diseases	001-009,019-139
MALIGNANT NEOPLASMS (MN) OF BUCCAL CAVITY & PHARYNX	**140-149**
MN of Lip	140
MN of Tongue	141
MN of Other Parts of Buccal Cavity	142-145
MN of Pharynx	146-149
MN OF DIGESTIVE ORGANS & PERITONEUM	**150-159**
MN of Esophagus	150
MN of Stomach	151
MN of Intestine Except Rectum	152,153
MN of Rectum	154
MN of Liver and Biliary Passages	155, 156
MN of Pancreas	157
MN of Peritoneum & Unspecified of Digestive Organs	158,159
MN OF RESPIRATORY SYSTEM	**160-165**
MN of Larynx	161
MN of Trachea, Bronchus & Lung	162
MN of Other Parts of Respiratory System	160,163-165
MN OF BREAST	
MN of Breast	**174-175**
MN OF FEMALE GENITAL ORGANS	**179-184**
MN of Cervix Uteri	180
MN of Other Parts of Uterus	179, 181, 182
MN of Ovary, Fallopian Tube and Broad Ligament	183
MN of Other Female Genital Organs	184

MN OF MALE GENITAL ORGANS	**185-187**
MN of Prostate	185
MN of Other Male Genital Organs	186,187
MN OF URINARY ORGANS	**188-189**
MN of Kidney and other urinary organs	189
MN of Bladder & Other Urinary Organs	188
MN OF OTHER & UNSPECIFIED SITES	**170-173, 190-199**
MN of Skin	172,173
MN of Eye	190
MN of Brain & Other Parts of Nervous System	191,192
MN of Thyroid Gland	193
MN of Bone	170
MN of Connective Tissue	171
MN of Other & Unspecified Sites (Minor)	194-199
NEOPLASMS OF LYMPHATIC & HEMATOPOIETIC TISSUE	**200-208**
Lymphosarcoma & Reticulosarcoma	200
Hodgkin's Disease	201
Leukemia and Aleukemia	204-208
Other Neoplasms of Lymphatic & Hematopoietic Tissue	202,203
BENIGN NEOPLASMS	**210-229**
CANCER IN SITU	**230-234**
NEOPLASMS OF UNCERTAIN BEHAVIOR OR UNSPECIFED NATURE	**235-238, 239**
ENDOCRINE, METABOLIC, IMMUNE DISORDERS	**240-279**
Diabetes Mellitus	250
Other Endocrine, Metabolic, and Immunity Disorders	240-246, 251-279
DISEASES OF THE BLOOD & BLOOD FORMING ORGANS	**280-289**
Iron Deficiency Anemias	280
Other Deficiency Anemias	281
Hereditary Hemolytic Anemias	282
Acquired Hemolytic Anemias	283
Aplastic Anemia	284
Other and Unspecified Anemias	285
Other Diseases of Blood and Blood Forming Organs	286-289

MENTAL, PSYCHONEUROTIC & PERSONALITY DISORDERS	**290-319**
Alcoholism	303
Other Mental Disorders	290-302 304-319
DISORDERS OF THE NERVOUS SYSTEM & SENSE ORGANS	**320-389**
Multiple Sclerosis	340
Other Diseases of the Nervous System & Sense Organs	320-337 341-389
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Appendix 2

Survey and Accompanying Letter to Injured Workers

DUKE UNIVERSITY MEDICAL CENTER
Department of Community & Family Medicine
Division of Occupational & Environmental Medicine

Name
Address
City, State

Dear _________,

The United Brotherhood of Carpenters and Joiners and the Division of Occupational and Environmental Medicine at Duke University Medical Center are working together to better understand how job-related injuries affect carpenters and their families, including their ability to work and their health care needs and coverage. The project has been funded by the National Institute for Occupational Safety and Health (NIOSH) in an attempt to better understand the effects of work related injuries on carpenters.

We are asking for your help in this project. Your participation is important to the success of this work; however, your participation is absolutely voluntary. Participation involves completing the enclosed questionnaire and returning it in the enclosed stamped envelope to the Duke study team. The questionnaire asks if you have experienced a work-related injury or illness in the last 10 years and the effects that injury or illness may have had on you and your family. Participation will in no way affect medical or workers' compensation benefits. **ALL INFORMATION OBTAINED IN THIS STUDY WILL BE KEPT CONFIDENTIAL AND USED FOR RESEARCH ONLY**. No personal identifiers, such as your name or social security number, will be kept with your responses to the questionnaire. Any reports or publications resulting from the work will contain only summaries of the data. You will not be identified.

If you do not choose to participate, we ask that you still return the questionnaire in the stamped envelope that is provided. If you have any questions about this study or the enclosed questionnaire, you may call Dr. John Dement or Dr. Hester Lipscomb at Duke University. You can call collect at (919) 286-3232. Please identify yourself with the carpenters' project. You may also contact Buck Cameron with the Health and Safety Fund of the United Brotherhood of Carpenters and Joiners. He can be reached in Seattle at (206) 935-7748. Mr. Cameron can also be called collect. In addition, you may contact the Office of Risk Management at Duke University Medical Center (919 684-3277) for any questions you may have about your rights as a research subject.

We hope you will decide to assist us with this survey.

Sincerely,

John M. Dement, Ph.D.

Hester J. Lipscomb, Ph.D.

DUMC-3834 • DURHAM, NORTH CAROLINA 27710
TELEPHONE: (919) 286-3232 • FACSIMILE: (919) 286-1021
http://occ-env-med.mc.duke.edu/oem • e-mail: occ-env-med@mc.duke.edu

EFFECTS OF WORK-RELATED INJURIES OR ILLNESSES

Date:_____/_____/_____ Identification number:____________

1) In the last 10 years, have you had a work-related injury or illness which occurred while you were working as a carpenter?

[ ] No
[ ] Yes

If No, PLEASE SKIP TO QUESTION 29 ON PAGE 7.

2) Did this event cause you to miss over a week (more than 5 days) of work?

[ ] No
[ ] Yes

If No, PLEASE SKIP TO QUESTION 29 ON PAGE 7.

If Yes,

Have you had more than one work-related injury or illness, while working as a carpenter, that required you to miss over a week of work in the last 10 years?

[ ] No
[ ] Yes

If Yes,

How many injuries or illnesses have you had in the last 10 years which required you to miss over a week of work? ______
(number)

We are particularly interested in what you consider **your most serious work-related injury or illness. The next series of questions ask about this most serious injury or illness and the effects it may have had on you and your family.**

3) Please describe your most serious work-related injury or illness in the last 10 years. Tell us how you were injured, what you were doing when you got hurt, what you were working with when you got hurt.
For example: 'I cut my hand while working with a power saw' or 'I fell off a scaffold while hanging drywall'
Give us as much detail as possible so we can understand what happened to you.

____

____

____

____

____

4) When did this event occur? _______ ________
(Month) (Year)

5) At the time of your injury, how many years had you worked as a carpenter, or worked construction related jobs?
(If less than 1 year, please write 'NONE')
______ years

6) At the time of this injury, how many years had you been in the union?
(If less than 1 year, please write 'NONE')
_______years

7) How many weeks were you out of work **immediately following your injury**?
_______ weeks

8) Did you ever have to miss work again because of this injury? (Check the best answer)
[ ] No, I did not miss work again because of this injury.
[ ] Yes, I did miss work again after I first returned to work
If Yes, how many days do you estimate missing from work after you first returned to work after this injury? ____ days
[ ] I never returned to work after this injury.

9) Did the injury ever cause you to miss so much work that you did not have enough hours to be eligible for your union provided health insurance benefits?
[ ] No
[ ] Yes
If Yes, for how many months did you lose benefits?_____ months

10) At the time of your injury did you have health insurance coverage provided by your spouse's employer?
[ ] No
[ ] Yes
If Yes, did you ever use this insurance coverage through your spouse?
[ ] No, I never filed a claim using my spouse's insurance.
[ ] Yes, I did file claim(s) using my spouse's insurance.

11) Currently, do you **personally** have health insurance benefits? **(Check all that apply)**

[ ] No, I do not have health insurance coverage

[ ] Yes, I have health insurance through my employment or union (including built up or banked hours)

[ ] Yes, I have health insurance coverage through my spouse's employer

[ ] Yes, I have coverage through Medicare or Medicaid

[ ] Yes, I have health insurance through some other mechanism, (pay premiums myself such as COBRA, etc)

12) Are **your spouse and any dependent children** covered by health insurance now? **(Check all that apply)**

[ ] No, they do not have health insurance coverage

[ ] Yes, they do have health insurance through my employment or union (including built up or banked hours)

[ ] Yes, they do have health insurance coverage through my spouse's employer

[ ] Yes, they do have coverage through Medicare or Medicaid

[ ] Yes, they do have health insurance through some other mechanism, (pay premiums myself such as COBRA, etc)

13) Did you receive medical care expenses or payments for lost wages through workers' compensation benefits for your injury?

[ ] No

[ ] Yes

If No, why not?

[ ] Did not chose to file a workers' compensation claim

[ ] I filed a claim for workers' compensation but it was rejected

[ ] Other: Please explain____

____

14) Are you **currently** receiving workers' compensation benefits because of this injury?

[ ] No

[ ] Yes

15) Are you **currently** receiving disability payments other than through workers compensation [**such as social security disability or a disability pension**] ?

[ ] No

[ ] Yes

16) Because of your injury, did any of your family members have to take time off of work or school to assist you?

[ ] No
[ ] Yes
If Yes, for how many days did they have to be off work or school?_____ days

17) Did the injury result in a significant loss of income for you?

[ ] No
[ ] Yes
If Yes, how much income would you estimate that you have lost because of this injury?
[ ] Less than $5,000
[ ] $5,000-10,000
[ ] $10,000-20,000
[ ] $20,000-30,000
[ ] $30,000-40,000
[ ] $40,000-50,000
[ ] Over $50,000

18) Because of your injury, have you experienced any of the following? **(Check all that apply)**

[ ] Inability to pay bills on time
[ ] Deferring planned purchases
[ ] A lower standard of living than planned
[ ] Having to move your place of residence
[ ] Other financial impact (Please explain)

____

____

19) Because of your injury, are you afraid that in the future you will be unable to earn a living? **(Check the best answer)**

[ ] Never
[ ] Rarely
[ ] Sometimes
[ ] Often
[ ] Almost always or always

20) Has this injury: **(Check all that apply)**

[ ] affected the types of work you accept?
[ ] affected the speed with which you are able to work?
[ ] kept you from doing certain job tasks?
Please explain :____

____

21) Because of your injury, have you ever felt like you could not cope with stressful problems -- like financial difficulties, conflicts with your spouse or partner -- as well as you used to? **(Check the best answer)**

[ ] Never
[ ] Rarely
[ ] Sometimes
[ ] Often
[ ] Almost always or always

22) Are you currently under the care of a doctor **for health problems related to your injury?**

[ ] No
[ ] Yes

23) At the time of your injury were you under the care of a doctor or chiropractor for any health problems?

[ ] No
[ ] Yes

If Yes, what were those problems?

____

____

24) Are you currently under the care of a doctor or chiropractor **for health problems other than those related to your injury?**

[ ] No
[ ] Yes

If Yes, what are those problems?

____

____

25) How do you feel about the results of your medical treatment for this injury?

[ ] Very dissatisfied
[ ] Somewhat dissatisfied
[ ] Neither satisfied or dissatisfied
[ ] Somewhat satisfied
[ ] Very satisfied

26) **Before your injury**, did you ever fail to see a doctor when you thought you needed to because of concern over health insurance coverage or out-of-pocket expenses?

[ ] No

[ ] Yes

27) **Since your injury**, have you ever failed to see a doctor when you thought you needed to because of concern over health insurance coverage or out-of-pocket expenses?

[ ] No

[ ] Yes

Those are all of the specific questions we wanted to ask about your injury or illness.

28) **We are interested in any significant effects a work-related injury, or illness, can have on the worker and their family members. Please share with us anything else that you think is important for us to know?**

____

____

____

____

____

____

____

____

____

____

____

____

____

____

The next series of questions are about your general health - not just problems directly related to a work-related injury. Please try to answer the questions as accurately as you can.

29) In general, would you say your health is :
[ ] Excellent
[ ] Very good
[ ] Good
[ ] Fair
[ ] Poor

30) The following items are about activities that you might do during a typical day. Does your health now limit you in these activities?

Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf?
[ ] Yes, limited a lot.
[ ] Yes , limited a little
[ ] No, not limited at all.

Climbing several flights of stairs?
[ ] Yes, limited a lot.
[ ] Yes , limited a little
[ ] No, not limited at all.

The next two questions are about your physical health and your daily activities.

31) During the past 4 weeks, have you accomplished less than you would like as a result of your physical health?
[ ] Yes
[ ] No

32) During the past 4 weeks, were you limited in the kind of work or other regular activities you do as a result of your physical health?
[ ] Yes
[ ] No

The next two questions are about your emotions and your daily activities.

33) During the past 4 weeks, did you not do work or regular activities as carefully as usual as a result of any emotional problems, such as feeling depressed or anxious?
[ ] Yes
[ ] No

34) During the past 4 weeks, how much did pain interfere with your normal work, including both work outside the home and housework? Did it interfere:

[ ] Not at all?
[ ] A little bit ?
[ ] Moderately?
[ ] Quite a bit?
[ ] Extremely?

The next questions are about how you feel and how things have been with you during the last 4 weeks.

35) How much of the time during the past 4 weeks have you felt calm and peaceful?

[ ] All of the time
[ ] Most of the time
[ ] A good bit of the time
[ ] Some of the time
[ ] A little of the time
[ ] None of the time

36) How much of the time during the past 4 weeks did you have a lot of energy?

[ ] All of the time
[ ] Most of the time
[ ] A good bit of the time
[ ] Some of the time
[ ] A little of the time
[ ] None of the time

37) How much of the time during the past 4 weeks have you felt downhearted and blue?

[ ] All of the time
[ ] Most of the time
[ ] A good bit of the time
[ ] Some of the time
[ ] A little of the time
[ ] None of the time

38) During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities, like visiting friends or relatives?

[ ] All of the time
[ ] Most of the time
[ ] A good bit of the time
[ ] Some of the time
[ ] A little of the time
[ ] None of the time

Please tell us a little bit about yourself.

39) What is your age? _____ (years)

40) With what race or ethnic group do you identify?

[ ] American Indian [ ] African American [ ] Asian [} Hispanic [ ] White
[ ] Other_______________

41) What is the highest grade you completed in school? (Please circle the correct answer)

1 2 3 4 5 6 7 8 9 10 11 12 More than high school

42) What is your current marital status?
[ ] Single
[ ] Married
[ ] Divorced
[ ] Widowed

43) How many people live in your home? _____

44) Are you currently a member of the United Brotherhood of Carpenters and Joiners?
[ ] Yes
[ ] No

45) How long have you been (or were you) a member of the union?
________years

46) What is your current work status?
[ ] Working full-time in carpentry or construction
[ ] Working part-time in carpentry or construction
[ ] Working full-time but not in carpentry or construction
[ ] Working part-time but not construction
[ ] Retired
[ ] Not working due to lack of available work
[ ] Not working due to disability
If so, is the disability the result of your injury? [ ] Yes [ ] No
[ ] Other
Please explain ______________________________

47) If you are not currently working in construction can you tell us why? (Check all that apply)
[ ] Because of injury described in letter
[ ] Because of another work injury
[ ] Because of some other medical condition or injury
[ ] Fired or laid off and could not find work
[ ] Other
Please explain: ____
____

PLEASE RETURN THE QUESTIONNAIRE IN THE PROVIDED ENVELOPE. THANK YOU.

Appendix 3

Work Injuries and Associated Costs in Drywall Installation

(Manuscript in review: Applied Occupational and Environmental Hygiene, August 1999)

In review: Applied Occupational and Environmental Hygiene, July 1999

WORK-RELATED INJURIES IN DRYWALL INSTALLATION

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Running heading: Work-related Injuries in Drywall Installation

ABSTRACT (Abstract word count =297)

Administrative data sources were used to describe the work-related injuries of drywall carpenters, to calculate rates of occurrence, and to explore high risk sub-groups. Health insurance eligibility files were used to identify a cohort of active union carpenters affiliated with a union local whose predominant work involved drywall installation in the State of Washington. These files contained the hours worked by each individual for each month between January 1989 and December 1995, providing person-hours at risk as a union carpenter. The Washington Department of Labor and Industries (L&I) provided records of workers' compensation claims filed by these individuals. Over seven years 1,773 drywall carpenters filed 2,567 workers' compensation claims representing an overall rate of 53.3 per 200,000 hours worked. These claims were filed by 1,046 different individuals, or 59.0% of the cohort. Claims resulting in paid lost time from work were filed at a rate of 12.5 per 200,000 hours worked (n=609) by 445 (25.1%) different individuals. The most common mechanisms of injury involved being struck (38.3%), overexertion (28.1%) and falls (13.2%). Struck by injuries most commonly involved cuts to the upper extremity. Overexertion injuries were most commonly described as sprains or strains involving the back. Sheetrock was associated with over 40% of these injuries. Falls most commonly involved injuries to the knee followed by the back and multiple injuries. Struck by injuries decreased steadily with increasing age and increasing time in the union. There was a steady increase in the rate of falls with increasing age. Overexertion injuries were responsible for the greatest proportion of costs for medical care, permanent impairment, and paid lost days. The high rates of overexertion injuries among these workers is consistent with known ergonomic stresses on drywall jobs. However, these workers are also at high risk of acute traumatic injuries.

Key words: construction workers, injury, sheetrock, falls, overexertion, struck, cohort studies, surveillance

INTRODUCTION

Construction workers have higher rates of nonfatal injuries than other U.S. workers, [1] and they are also among the most likely workers to experience serious occupational injuries. [2] Fatal and lost work time injuries in the construction trades continue to rank among the the highest in the United States. [3-6] Although there are few sources of information specific to drywall work, there are data suggesting that these individuals may be a high risk group for injuries, including disabling events, within the construction trades. Practical problems which make the study of construction workers and their safety and health hazards difficult are especially salient when considering those who do drywall work. This is a very mobile workforce with individuals frequently changing job sites and employers. On residential drywall projects particularly, sites are typically small with few workers at any given site.

Based on analyses of Bureau of Labor Statistics (BLS) data, rates of traumatic injury resulting in days away from work have been reported to be higher among drywall workers than for all construction workers combined.[7] Analyses of workers' compensation claims of musculoskeletal injuries and disorders among union carpenters in Washington State revealed that carpenters affiliated with a union local doing predominantly drywall work had rates of injuries to the axial skeleton (back sprains, back and neck sprains, and back ill-defined conditions) that were twice as high as those of their union counterparts doing heavy or light commercial carpentry work or piledriving. These individuals also had higher rates of sprains to the shoulder, forearm, knee, and ankle than other union carpenters.[8]

The high rates of musculoskeletal injuries among drywall carpenters are not surprising. They have exposures[9] to recognized occupational risk factors for back disorders - heavy work, materials handling, pushing, twisting, frequent lifting over 25 pounds (4' X 8' sheetrock =80 lbs), and awkward postures.[10-14] The heavy weight and bulky size of drywall sheets present ergonomic risk for injuries to multiple body parts.[9] Physical demands on these workers are increasing as the use of heavier and bulkier materials increases, such as 12 foot sheets of drywall with weights in excess of 100 pounds per sheet.

In order to describe the work-related injuries of drywall carpenters, to calculate rates of occurrence, and to explore high risk sub-groups, a historical cohort of union drywall carpenters was identified and their workers' compensation claims were analyzed for the years 1989-1995.

METHODS

Data sources and linkage

Health insurance eligibility files from the Carpenters Trusts of Western Washington were used to identify a cohort of active union carpenters affiliated with a union local whose predominant work involved drywall installation. Each of these individuals worked at least three months of union hours between 1989 and 1995. These files contained the hours worked by each individual for each month between January 1989 and December 1995, providing person-hours at risk as a union carpenter. The Washington State and the national union membership files of the United Brotherhood of Carpenters and Joiners of North America (UBC) provided dates of birth, sex, and earliest date of union activity for cohort members. No race information was available from these sources.

The Washington State Department of Labor and Industries (L&I) provided records of workers' compensation claims filed by these individuals during this time period, including medical only claims as well as those which resulted in lost work time. The compensation claims data included the date of injury, American National Standards Institute (ANSI) codes describing the events in terms of body part injured, the nature of the injury, the type of event causing the injury, and the source of the injury as recorded on the first report of injury. In addition, information was available on the amount of lost work time associated with the event and the costs associated with lost time and medical care.

A unique identifier was assigned to each individual by the Carpenters Trusts of Western Washington. Data from all sources were provided with this identifier to allow linkage of data on an individual level.

Events of interest and time at risk

Only events which occurred in a month that the individual worked union hours were counted so that events and time at risk were counted on the same basis for rate calculations. Initially we included all claims filed by these workers, excluding claims which were rejected for workers' compensation coverage. Later analyses were limited to events which resulted in paid lost time from work and events that resulted in loss of time from work of more than three months.

Person-hours of work as a union carpenter were used as the measurement of time at risk. The individual was considered to be at risk of filing a claim at any time they were working union hours. The occurrence of one injury did not remove the worker from the risk set for a new event as long as he/she was still working. Although person-hours are used as the measurement of time at risk, the person-month is effectively the unit of analysis since we do not know when the hours in any given month were accumulated. All hours in months in which an injury occurred were counted as time at risk for that injury.

Analyses

Using these data, descriptive statistics were generated on age, sex, time in the union and hours worked. The sum of hours worked by the entire group was calculated by adding all hours worked over the seven year period. The sum of hours worked was calculated by five year age groups, time in the union in two year increments, and calendar year. Age and time in the union were treated as time-varying variables with time at risk accumulating in the appropriate strata over the seven year period. Crude and stratified incidence density rates were calculated per 200,000 hours worked. For the most prevalent injury mechanisms, time at risk and events were stratified by categories of age and time in the union for multivariate analyses using Poisson regression to model failure rates. [15] Costs associated with these compensation claims for medical care, paid lost time, and permanent impairment were calculated and compared for the most common mechanisms of injury, as were number of days paid. All descriptive analyses and data stratification were done using SAS [SAS Version 6.12]. [16] Poisson regression was done using EGRET. [17]

RESULTS

Description of the cohort and hours worked

From the union eligibility files, 1,773 carpenters were identified who were affiliated with a union local whose predominant work involved drywall installation between 1989 and 1995. Union carpenters hang drywall but do not perform drywall finishing tasks such as taping, plastering, or sanding. There were only 11 females (0.6%) in the cohort. Because of the small number of women in the cohort, no sex-specific analyses were performed. Age at entry into the study cohort (not union initiation) ranged from 18 to 66 years of age, with a mean of 32 years and a median of 31 years. Seventy-five percent of the cohort were 37 years old or younger. Time in the union ranged from less than one year to 42 years. Mean time in the union was seven years, median was two years and 75% had been in the union 12 years or less.

Over this seven year period of time the cohort worked a total of 9,631,822 hours. Hours worked per person ranged from 66 to 16,033 hours. The mean number of hours worked per month after entry into the cohort was 129 hours and ranged from 22 hours to 246 hours, representing a mean of 1,548 hours per year.

Claims filed for work-related injuries and disorders

Over this seven year period of time, the cohort filed 2,567 workers' compensation claims representing a crude rate of 53.3 per 200,000 hours worked. These claims were filed by 1,046 different individuals, or 59.0% of the cohort. All but 57 of these claims were medical or paid lost time claims. Claims resulting in paid lost time from work, which occurs after the third lost day in Washington, were filed at a rate of 12.5 per 200,000 hours worked (n=609). The paid lost time claims were filed by 445 (25.1%) different individuals. Two-hundred thirty (230) claims resulted in three months or more of paid lost time. These more serious claims were filed by 203 different individuals or 11.5% of the cohort.

The rates at which all claims and paid lost time claims were filed by year are presented in Figure 1. Between 1989 and 1995 there was a 20% reduction in the overall rate of filing claims. Paid lost time claims also decreased over time but to a less significant degree.

The overall rates at which claims were filed decreased steadily with increasing age (Figure 2A). Individuals under the age of 20 filed claims at a rate of 92.1 per 200,000 hours worked. Although those under the age of 20 also had the highest rate of claims resulting in paid lost time from work, there is not the consistent decline in paid lost time claims with increasing age. The more serious events which resulted in prolonged loss of time from work were lowest among the oldest age group (e.g., over age 60) and among those under age 20 (Figure 2B) .

In Figures 3A and 3B the rates of claims are presented by time in the union. There is a decline overall in claim rates after four years of union membership, but this pattern is not seen for paid lost time claims and claims resulting in prolonged loss of time from work.

ANSI code descriptions of claims

The frequencies and the rates of filing claims are presented in Table I by body part injured, nature of injury, type (mechanism), and source for all claims filed and for those that resulted in paid lost time. Overall, the most frequent body parts injured were the back, fingers and eyes. Back injuries were also the most common body part injured in claims that resulted in paid lost time, but the back accounted for a greater percentage of the more serious events (29.1%

vs 17.1%). Eye injuries rarely resulted in paid lost time. Injuries involving the knee, fingers, wrist, and shoulders were responsible for greater proportions of the paid lost time claims.

Overall and for claims resulting in paid lost time, the nature of the injuries were most commonly described as sprains and cuts. There were a number of objects associated with these injuries with the most common being sheetrock, particles, structural metal, metal items, and metal fasteners. Sheetrock was associated with over 25% of the more serious injuries. The rate of paid lost time claims associated with sheetrock was over three times greater than the rate associated with any other single object.

The 230 claims which resulted in paid lost time of at least three months most commonly involved the back (27%), followed by the shoulder (10.9%), wrist (9.6%), and the knee (8.3%). Over half (52%) were described as sprains followed by ill defined symptoms (11%), fractures (8.8%), and nerve conditions (8.4%). Sheetrock was most frequent source of injury (27.4%), followed by the floor (10.2%) and work surface (8.8%) consistent with patterns seen for all paid lost time claims.

The most common mechanism of injury involved being struck, followed by overexertion and falls. Struck by injuries most often resulted in cuts (69.6%) and the upper extremity was the most common body part injured (68.5%). The sources of injury were most commonly structural metal, unspecified metal items, knives, and sheetrock. Overexertion injuries were most commonly described as sprains or strains (80.3%) and they predominantly involved the back (49.1%). Sheetrock was associated with over 40% of these injuries. Overexertion injuries were most often due to lifting (40.8%), followed by carrying (9.2%), and pushing or pulling (5%). However 44% of these injuries were described as 'unspecified' providing little information about what the individual was actually doing when they were injured. Falls most commonly involved the knee (15.4%) followed by the back (13.1%) and multiple injuries (12.8%). The nature of the injuries sustained in falls were predominantly sprains (38.9%), contusions (21.9%) and cuts (12.6%), followed by injuries of a more serious nature such as fractures (9.9%) and multiple injuries (12.8%). In the case of falls, the objects associated with the injuries describe onto what the person fell and does not provide any information about what the person was doing at the time of the fall. The distribution of the descriptions of these falls are presented in Figure 4.

With few exceptions, the patterns for claims that resulted in paid lost time from work (greater than three days of missed work) were very similar. The object most commonly associated with struck by injuries with paid lost time was sheetrock. The nature of paid lost time falls were most often described as sprains or fractures, with the latter consistent with more serious injuries.

Results of multivariate analyses of struck by injuries, overexertion injuries and falls are presented in Table II. Rates of struck by injuries decrease steadily with increasing age and increasing time in the union. Those in the union two to four years had the highest rates of overexertion injuries, but there is no distinct pattern in the rates of injury based on age or time in the union. Likewise for falls there was really no pattern based on time in the union. However, there was a steady increase in the rate of falls with increasing age. Those over the age of 45 had a 60% higher rate of falls than those under age 30.

Costs Associated with Drywall Injuries

The number of paid lost days and the costs associated with these compensation claims for medical care, paid lost time, and permanent impairment are presented for overall claims filed and for the three most common mechanisms of injury in Table III. Although struck by injuries were the most common injuries, they accounted for a relatively small percentage of costs for medical care (12.8%) and even lesser percentages for time loss (8%) and permanent impairment (7.1%). Overexertion injuries accounted for approximately 50% of medical costs, indemnity and impairment costs. Falls were responsible for 25% of the costs for permanent impairment and approximately 30% of costs associated with medical care and paid lost time.

Costs associated with claims for which the injury source was coded as sheetrock were calculated separately . These claims accounted for 26.5% of medical costs ($960,446), 32.1% of dollars for paid lost days ($1,919,679) and 20.9% of permanent impairment costs ($220,109).

DISCUSSION

Overall rates of filing claims among these drywall workers are very high and are 25% higher than rates identified using the same methods of cohort analyses for all union carpenters in Western Washington State. [18] Drywall workers are clearly a high risk group within union carpentry. Nearly 60% of this cohort filed at least one claim in this seven year period, 25% had a claim which resulted in at least four days away from work, and 11% had claims which resulted in prolonged loss of time from work of three months or more.

This group represents a very young cohort with little union experience indicating that many people do not stay in drywall work for long periods of time. We do not know if these individuals migrate to other areas of carpentry or whether they are lost to the trade due to high injury rates.

Although there are significant limitations to analyses based on ANSI coded injury data, the stratified analyses by injury mechanism provided more revealing information about the nature of the injuries and the objects associated with the injuries. Struck by injuries predominantly involved cuts to the upper extremities, overexertion injuries most often involved the back and falls most often involved injuries to the knees. The different patterns of risk for struck by injuries, overexertion, and falls -- at least for filing claims -- are interesting. The decreasing risk of struck by injuries with age and time in the union may very well be related to training and experience, although we do not have information about how exposures may vary for these groups. The pattern, or actually lack of any real pattern, for overexertion injuries may be related to the generally heavy nature of all drywall work. The increasing risk of falls with aging has been reported by others [19] but is particularly interesting in this very young cohort. In interpreting these findings it is important to keep in mind that we studied claims that were filed. Anything which influences why a worker chooses to file a claim, or not, will be reflected in the results.

Analyses of Bureau of Labor Statistics data for 1992 and 1993 revealed that falls, bodily reaction, and overexertion injuries accounted for 84% of the total days away from work among drywall installers in 1992 and 1993. Falls from scaffolds resulted in the greatest lost work days. Overexertion was responsible for more lost work days than falls from the same level. One third of trunk injuries occurred while lifting building materials, particularly drywall, and problems were more commonly reported in lifting than in carrying tasks.[7] These patterns are similar to the patterns we saw in this group of union carpenters who do predominantly drywall installation, although for a large percentage of claims the type of overexertion was unspecified providing no clear information about what the worker was doing when injured. In addition, we have analyzed the workers' compensation experience of North Carolina homebuilders engaged in drywall work during 1986-1994 using data provided by the North Carolina Homebuilders Association. Even though the reporting definitions are different for North Carolina and Washington, and the fact that North Carolina drywall workers install and finish as well, the patterns by mechanism for serious injuries were similar to those observed among the Washington cohort.[22]

Among drywall carpenters in Washington State overexertion injuries were responsible for the greatest proportion of costs for medical care, permanent impairment, and paid lost days. The high rates of overexertion injuries among these workers is not surprising based on knowledge of known ergonomic stresses on drywall jobs.[9] However, these workers are also at high risk of acute traumatic injuries from falls and being struck. Although overexertion injuries were the most common lost time injuries among drywall workers and plasterers in Ontario, fall injuries were

50% more prevalent among drywall workers than for all construction. Most of these falls occurred in direct installation, consistent with the high rates of falls among these Washington carpenters who do predominantly drywall installation. Falls were more prevalent on residential drywall projects, mainly because of improper work platforms. Cuts were common on non residential projects and were commonly from metal studs and ceiling tracks. [20]

Claims for which sheetrock was identified as the object associated with injury accounted for approximately 30% of costs. Since the source of injury for falls is coded as the object to which the person fell, we cannot determine for these injuries how many were actually associated with handling sheetrock. There is evidence from other sources that falls among these workers are associated with manual materials handling tasks such as handling drywall sheets from scaffolds.[20] Half of non-fatal falls in the West Virginia construction industry occurred among individuals who were using power tools or handling materials at the time of their falls. [21] Considering the weight and size of materials drywall installers must handle, the contribution of these materials to causes of acute injuries warrants further exploration.

We do not know the distribution of hours worked by the cohort on residential compared to commercial projects, and we were unable to identify the type of jobs these individuals were working on when injured. This makes it impossible for us to identify whether rates of injuries vary by type of site. The nature of some of the injuries, such as those involving structural metal, seem more consistent with commercial projects, but the data do not allow us to determine whether certain types of injuries are more prevalent on residential or commercial projects.

Although these data provide information about injuries of drywall carpenters, in order to plan preventive strategies, we need more information about the circumstances surrounding these injuries. For overexertion injuries there is the potentially significant interplay between cumulative exposures and the rates at which they accrue, and peak exposures. For example, one exposure or a series of peak exposures may be predictive of an overexertion injury. A peak exposure could also represent the 'straw that broke the camel's back' following longer term cumulative exposures. Consideration needs to be given to ways we can measure and evaluate cumulative stresses, exposure rates, and peak exposures among these high risk workers. Access to more detailed information, not available through these passive surveillance methods, is needed to clearly understand the etiology of these common injuries among drywall carpenters.

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Table I
ANSI Codes on Workers' Compensation Claims of Drywall Carpenters
Washington State 1989-1995

	All claims		Paid Lost Time Claims	
Body Part Injured	**Frequency (%)**	**Rate**	**Frequency (%)**	**Rate+**
Back	433 (17.1)	9.0	177 (29.1)	3.7
Finger(s)	415 (16.4)	8.6	44 (7.2)	0.91
Eye(s)	366 (14.5)	7.6	7 (1.2)	0.15
Hand	207 (8.2)	4.3	33 (5.4)	0.69
Wrist	130 (5.1)	2.7	43 (7.1)	0.90
Knee	126 (5.1)	2.6	54 (8.9)	1.1
Shoulder	95 (3.8)	2.0	43 (7.1)	0.90
Back/neck	93 (3.7)	1.9	29 (4.8)	0.60
Elbow	80 (3.2)	1.7	23 (3.8)	0.48
Foot	66 (2.6)	1.4	18 (3.0)	0.37
Multiple	64 (2.5)	1.3	24 (3.9)	0.50
Forearm	65 (2.6)	1.3	6 (1.0)	0.12
Ankle	61 (2.4)	1.3	22 (3.6)	0.47
Neck	42 (1.7)	0.87	18 (3.0)	0.37
Abdomen	35 (1.4)	0.73	20 (3.3)	0.42
Nature of Injury	**Frequency (%)**	**Rate**	**Frequency (%)**	**Rate+**
Sprain	859 (34.0)	17.8	313 (51.7)	6.5
Cut	777 (30.8)	16.1	68 (11.2)	1.4
Scratches	335 (13.3)	7.0	8 (1.3)	0.17
Contusion	174 (6.9)	3.6	35 (5.8)	0.73
Ill defined symptoms	103 (4.1)	2.1	50 (8.3)	1.0
Fracture	67 (2.7)	1.4	43 (7.1)	0.90
Multiple injures	37 (1.5)	0.77	13 (2.1)	0.27
Nerve condition	34 (1.3)	0.71	25 (4.1)	0.52
Dislocation	25 (0.99)	0.52	16 (2.6)	0.33
Hernia	21 (0.8)	0.44	19 (3.1)	0.40
Source of Injury	**Frequency (%)**	**Rate**	**Frequency (%)**	**Rate**
Sheetrock	334 (14.0)	7.0	143 (25.2)	3.0
Particles	259 (10.9)	5.4	3 (0.5)	0.06
Structural metal	210 (8.8)	4.4	27 (4.7)	0.56
Metal items	162 (6.8)	3.4	19 (3.3)	0.39
Metal fasteners	127 (5.3)	2.6	13 (2.3)	0.27
Floor	106 (4.4)	2.2	47 (8.3)	0.98
Bodily motion	104 (4.4)	2.2	41 (7.2)	0.85
Work Surface	97 (4.1)	2.0	45 (7.9)	0.93
Metal chips	78 (3.3)	1.6	2 (0.4)	0.04
Timber/slab	79 (3.3)	1.6	24 (4.2)	0.50
Knife	54 (2.3)	1.1	4 (0.7)	0.08
Ground Outdoors	55 (2.3)	1.1	29 (5.1)	0.60
Scaffolds	39 (1.6)	0.81	8 (1.4)	0.17
Non power tool	39 (1.6)	0.81	13 (2.3)	0.27
Building structure	35 (1.5)	0.73	4 (0.7)	0.08
Pipe fittings	36 (1.5)	0.75	8 (1.4)	0.17
Type of Injury	**Frequency (%)**	**Rate**	**Frequency (%)**	**Rate+**
Struck	946 (38.3)	19.6	102 (17.3)	2.1
Overexertion	694 (28.1)	14.4	281 (47.6)	5.8
Fall	325 (13.2)	6.7	139 (23.6)	2.9
Abraded	304 (12.3)	6.3	9 (1.5)	0.19
Bodily reaction	104 (4.2)	2.2	41 (6.9)	0.85

+ All rates are per 200,000 hours worked
* All others each accounted for <1.5% or rate of < 0.77/200,000 hours

Table II
Most Common Injuries Among Drywall Carpenters
Washington State 1989-1995
by Type of Injury

	Crude Rate*	Rate Ratios	
		Crude	Adjusted (95% CI)
Struck by Injuries			
Age			
< 30	28.6	1	1
30-44	17.8	0.62	0.76 (0.66, 0.90)
>= 45	0.8	0.38	0.52 (0.40, 0.70)
Time in the Union			
< 2 years	27.2	1.0	1.0
2-4 years	30.0	1.1	1.1 (0.92, 1.4)
4-6 years	22.4	0.83	0.87 (0.70, 1.1)
6-8 years	18.4	0.67	0.73 (0.56, 0.96)
8-10 years	18.6	0.68	0.76 (0.58, 1.0)
10+ years	14.0	0.51	0.66 (0.54, 0.82)
Overexertion Injuries			
Age			
< 30	13.8	1	1
30-44	15.4	1.1	1.2 (0.99, 1.5)
>= 45	11.6	0.85	0.95(0.70, 1.3)
Time in the Union			
< 2 years	13.6	1.0	1.0
2-4 years	19.4	1.4	1.4 (1.1, 1.8)
4-6 years	12.8	0.94	0.90(0.66, 1.2)
6-8 years	14.2	1.0	0.98(0.71, 1.4)
8-10 years	13.6	1.0	0.92(0.65, 1.3)
10+ years	13.8	1.0	0.96(0.74, 1.2)
Falls			
Age			
< 30	6.6	1	1
30-44	6.6	1.0	1.2 (0.87, 1.6)
>= 45	8.0	1.2	1.6 (1.1, 2.4)
Time in the Union			
< 2 years	7.4	1.0	1.0
2-4 years	7.0	0.95	0.95 (0.63, 1.4)
4-6 years	7.6	0.97	1.0 (0.66, 1.5)
6-8 years	6.2	0.83	0.80 (0.49, 1.3)
8-10 years	8.4	1.1	1.1 (0.68, 1.7)
10+ years	6.0	0.82	0.69 (0.48, 1.0)

* Rate is per 200,000 Hours Worked

Table III

Costs Associated With Drywall Injuries
Washington State 1989-1995

	OVERALL		Struck By		Overexertion		Falls	
	Mean	Total	Mean	Total	Mean	Total	Mean	Total
Medical	$ 1,412	$ 3,623,897	$ 492	$ 465,455 (12.8%)	$ 2,486	$ 1,725,179 (47.6%)	$ 3067	$ 996,658 (27.5%)
Permanent Impairment	$ 409	$ 1,051,117	$ 79	$ 74,635 (7.1%)	$ 835	$ 579,693 (55.2%)	$ 803	$ 261, 262 (24.9%)
Time Lost	$ 2,331	$ 5,982,821	$ 509	$ 481,522 (8.0%)	$ 4,561	$ 3,165,162 (52.9%)	$ 5,480	$ 1,780,874 (29.8%)
Days Paid	37	95,899	8.5	8,037 (8.4%)	72	49,660 (51.8%)	91	29,728 (31.0%)

Figure 1
Claim Rates Among Union Carpenter Drywall Installers
in Washington State
By Year 1989-1995

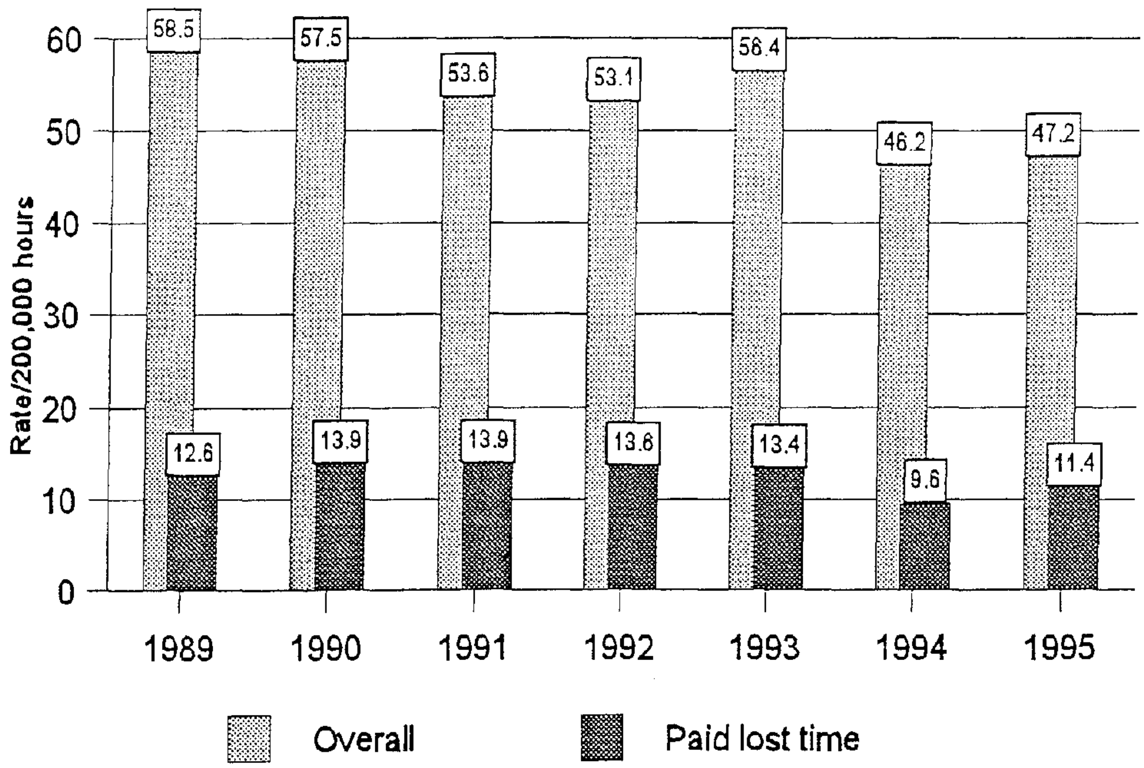
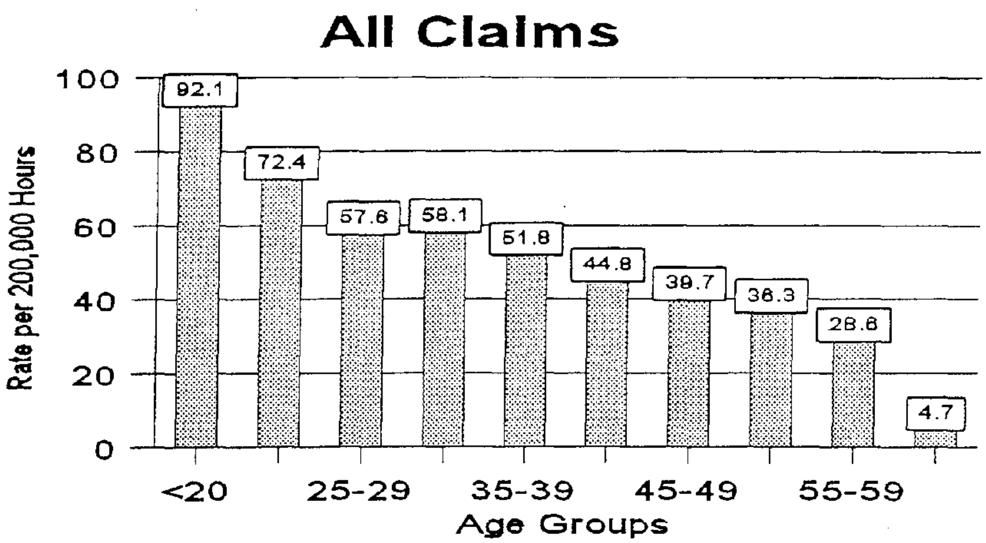


Figure 2

Age Specific Claim Rates Among Union Drywall Installers
Washington State 1989-1995

A.



B.

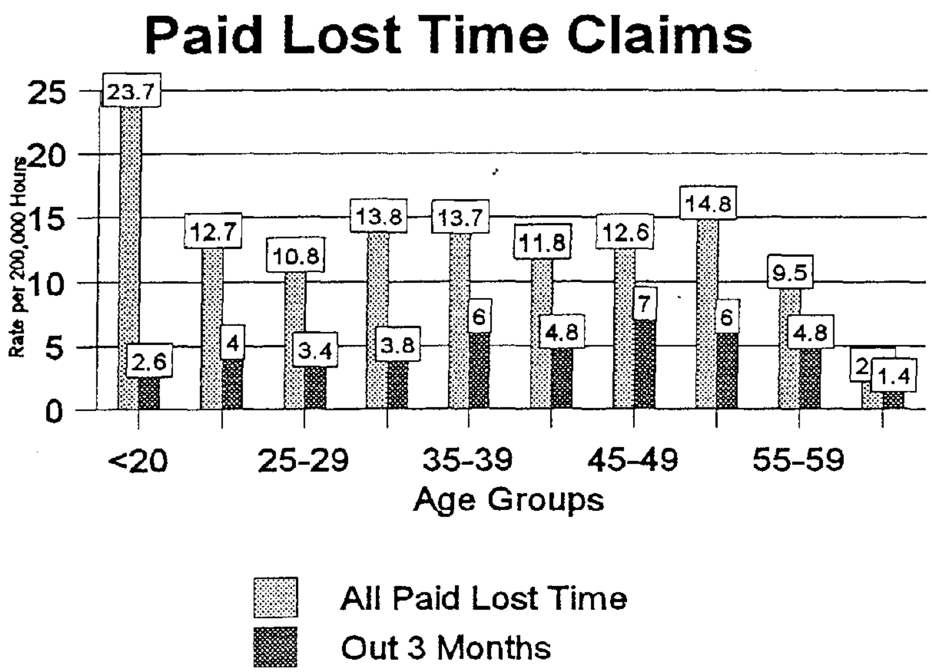
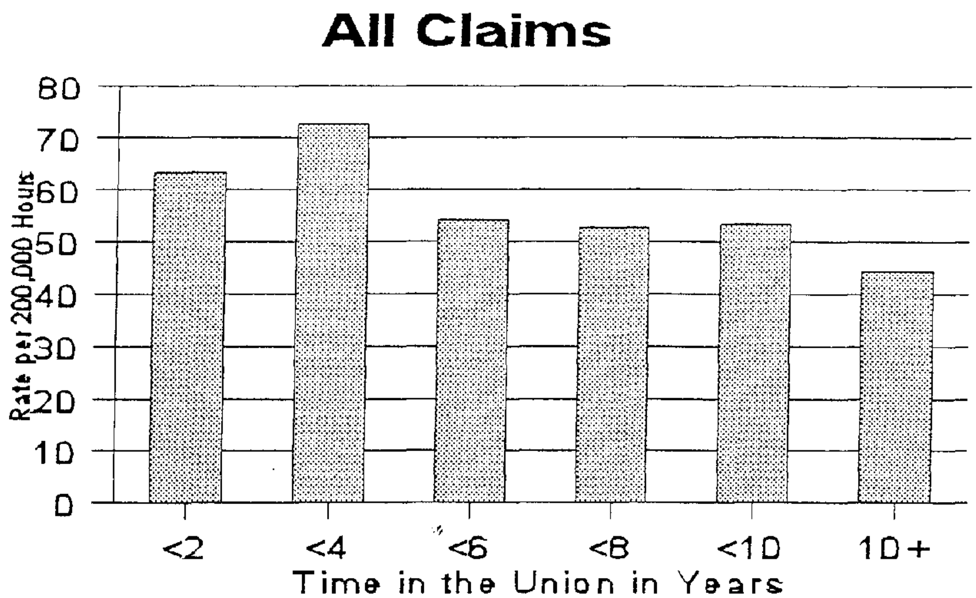


Figure 3
Rates of Filing Claims Among Union Drywall Installers
By Time in the Union
Washington State 1989-1995

A.



B.

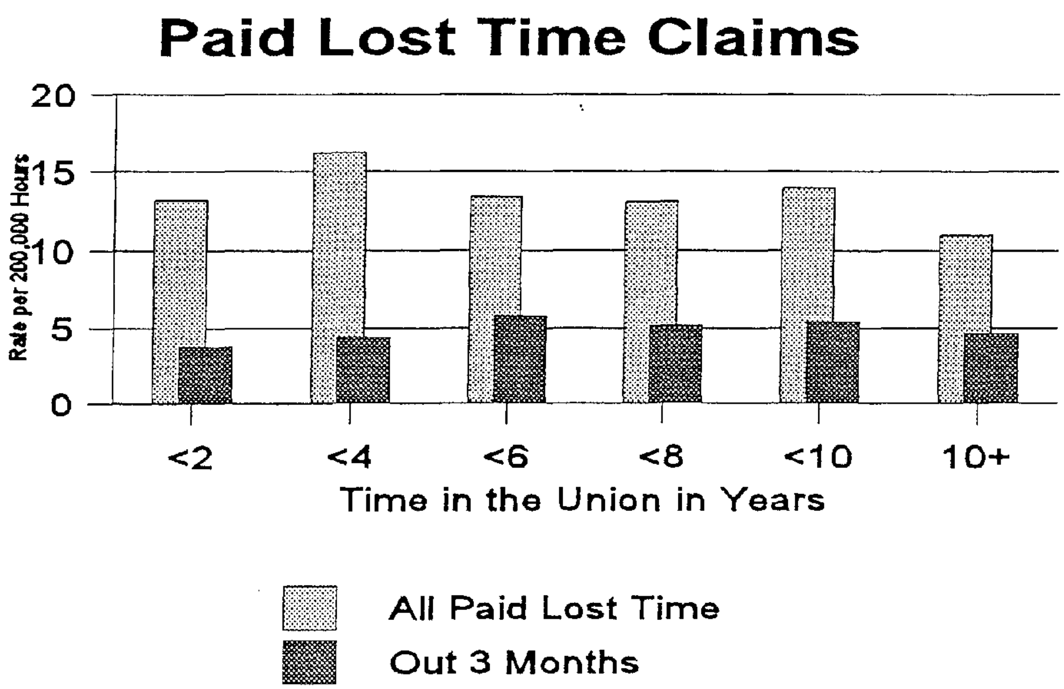
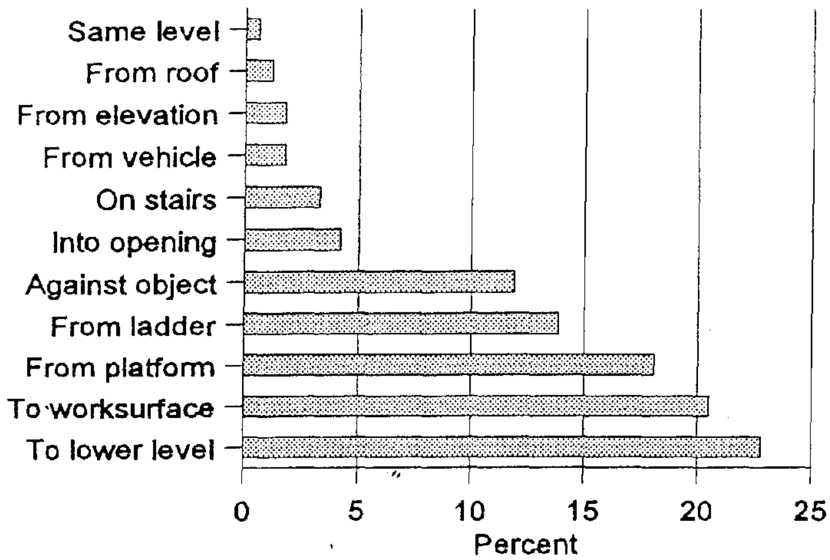


Figure 4

Description of Falls
Union Carpenter Drywall Installers
Washington State 1989-1995



Appendix 4

Work-Related Eye Injuries Among Union Carpenters

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WORK-RELATED EYE INJURIES AMONG UNION CARPENTERS

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WORK-RELATED EYE INJURIES AMONG UNION CARPENTERS

ABSTRACT

Union administrative records were combined with workers' compensation data to identify a cohort of 12,598 active union carpenters, their person-time at risk, and their documented work-related eye injuries between 1989 and 1995 in the State of Washington. The injuries were described using ANSI codes for injury nature, type (mechanism), and source or object associated with the event. Injuries which resulted in paid lost time from work were also described based on the ICD-9 codes attached to claims for their medical treatment. Overall rates of filing compensation claims for eye injuries as well as age, gender, and union local specific rates were calculated. To identify high risk subgroups and explore incident and recurrent events, the person-time and events were stratified by age, sex, time in the union, claim status, and predominant type of work of the union local with which each carpenter was affiliated for multivariate analyses with Poisson regression. Eye injuries were responsible for 12% (n=1730) of workers' compensation claims during this time period, exceeded only by back and finger injuries. Thirty-one claims resulted in paid lost time from work and these cases accounted for one third of all costs for medical care for eye injuries. <u>At least</u> 10% of all medical costs for eye injuries and 35.5% of medical costs for eye injuries which resulted in paid lost time were associated with injuries sustained while hammering -- a very common carpenter exposure. Claims were filed at an estimated rate of 6.1 per 200,000 hours worked. Individuals with previous compensation claims for eye injuries had rates of injury 1.6 times higher than individuals without previous eye injuries. Rates decreased significantly with age and time in the union. Eye injuries among these union carpenters were very common, but the rate of injuries severe enough to require paid time off work was quite low. These findings raise questions about factors which might influence the failure to use appropriate protection including availability and acceptability of eye protection, use by peers, and perception of risk.

KEYWORDS

eye injuries

carpenters

workers' compensation

cohort studies

BACKGROUND

Eye injuries are common work-related injuries among construction workers.[1-3] The Bureau of Labor Statistics (BLS) reported over 77 thousand occupational eye injuries or illnesses in all private industries that involved days away from work in the year 1995. Twelve percent of these injuries (9.5 thousand) occurred in the construction trades (SIC codes 15,16,17)[4] which employ less than 6% of private sector workers.[5] Among construction workers treated in an urban emergency room, lacerations were the most commonly treated injuries followed by sprains/strains, contusions and eye injuries.[1] Data from emergency department surveillance[1] may fail to give a representative picture of work-related injuries to the eye since many may not be serious enough to need emergency treatment[2] and may be seen in physicians' offices or urgent care centers. Similarly, data from eye injury registries provide information on the small percentage of injuries that result in serious ocular trauma, but they lack information on the vast majority of claims that are of a less serious nature. Neither of these sources provide information about the population from which the events arose. This lack of information makes it difficult to calculate rates at which these injuries occur which could be used to monitor trends over time and to evaluate the effect of interventions. The BLS data do not allow the differentiation of recurrent events in the same person which could be important in understanding risk among workers in jobs with high rates of eye trauma--such as construction workers.

Combined administrative data sources were used to identify a cohort of union carpenters and to describe their work-related eye injuries between the years 1989 and 1995, including the calculation of rates, costs, and the exploration of possible high risk groups. More serious events are described in detail including the descriptions of the cause of injury obtained from workers' compensation claims and the ICD-9 (International Classification of Diseases) codes assigned to medical claims for treatment of these injuries.

MATERIALS AND METHODS

Data Sources and Linkage

Health insurance eligibility files from the Carpenters' Trusts of Western Washington (CTWW) were used to identify a cohort of active union carpenters who worked at least three months of union time and had at least one month of insurance eligibility between the years of 1989 and 1995. These files contained the hours worked by each individual for each month from January 1, 1989 through December 31, 1995 providing person-hours at risk as a union carpenter. The CTWW and national union membership files of the United Brotherhood of Carpenters and Joiners of North America (UBC) provided dates of birth, sex, union local affiliation, and initiation date into the union for cohort members. No race information was available from these data sources.

The Washington State Department of Labor and Industries (L&I) provided records of workers' compensation claims filed by these individuals during the period of 1987-1995, including medical only claims as well as those which resulted in paid lost work time. These data were used to identify the injury events of interest. The compensation claims data included the date of injury, American National Standards Institute (ANSI) codes describing the events in terms of body part injured, the nature of the injury, the type of event causing the injury, and the source of injury as recorded on the first report of injury.

In addition, information was available on the amount of lost work time associated with the event and the costs associated with lost time and medical care. The ICD-9 (International Classification of Diseases) codes assigned to medical claims for treatment of the injury also were available through the Department of Labor and Industries.

Employers who self-insure for workers' compensation in the State of Washington are not required to report events which do not result in lost time from work to the Department of Labor and Industries, and lost time cases do not have to be reported until the case is closed. The data were extracted in December of 1996, a year after the last claims were filed in our data set, resulting primarily in the under representation in these data of less serious events.

A unique identifier was assigned to each individual by the Carpenters' Trusts of Western Washington. Data were provided from all sources with this identifier to allow linkage of all data on an individual basis.

Definition of Events of Interest

The analyses presented in this report were based on claims with an ANSI body part code of '130,' identifying an injury to the eye as the primary injury. Only events which occurred in a month that the individual had worked union hours were counted so that events and time at risk were counted on the same basis for rate calculations. Work-related injuries did occur in months when no union hours were worked, but these non-union claims were not included since no information was available regarding the type of work or the number of hours worked in these months. Our data thus reflect an attempt to identify injury rates for work as union carpenters. Initially we included all claims which were filed by these carpenters, excluding only the claims which were rejected for workers' compensation coverage. Later analyses were limited to events which resulted in paid lost time from work, which occurs in Washington State after the third lost work day.

Incident events were defined by claims filed between the years 1989 and 1995 by individuals who had not filed a previous claim for an eye injury in the State of Washington since 1987. Individuals who filed previous claims in periods of non-union work also were excluded from being considered an incident case.

Definition of Time at Risk and Covariates

Person-hours of work as a union carpenter was used as the measurement of time at risk. For the initial analyses of overall injury rates, individuals were considered to be at risk of filing a work-related claim at any time they were working union hours regardless of prior events. The occurrence of one injury did not remove the worker from the risk set for a new event as long as he/she was still working. When evaluating first and second events, time at risk for the incident event stopped accumulating when the person had an event. Time at risk for a second injury began accumulating in the first month of work following the incident case. Although person-hours are used as the measurement of time at risk, the person-month is effectively the unit of analysis since we do not know when the hours in any given month were accumulated. All the work hours in a month in which an injury occurred were counted as time at risk for that injury.

The covariates considered in these analyses included age, sex, time in the union, and the predominant type of carpentry work. Prior analyses of a smaller cohort (1989-1992) had shown that women and workers under the age of 30 had higher rates of filing all claims.[2] Time in the union was dichotomized at four years in an attempt to separate apprentices from journeymen carpenters. To reach journeyman status an inexperienced carpenter must typically be in the union at least four years and complete the appropriate training. The union local affiliation was the only surrogate available for characterizing the type of work done by cohort members. The locals represented by this cohort were grouped into eight categories by the Carpenters' Health and Safety Fund's District Environmental Coordinator based on the predominant type of carpentry work done by the locals. These work categories included light commercial, heavy commercial, drywall, millwrighting, piledriving, cabinet and fixture work, residential, and a mixed category. Light commercial work involved construction on projects of 2-3 stories. Heavy commercial involved high rise buildings, as well as interstate and freeway work. Millwrights are craftworkers in industry and are often involved in installation, repair and maintenance of heavy machinery. The mixed category includes those locals for which there was not a predominant type of work.

Analyses

The frequency and proportion of claims filed for eye injuries were calculated from the total number of claims filed. The crude incidence density rate of filing claims for eye injuries was calculated including a correction estimate to account for failure to identify self-insured claims that did not result in paid lost time from work. This correction was based on the assumption that the percentage of all claims (for all injuries and illnesses) from self-insured employers for any local, would be the same as the percentage of paid lost time claims that came from self-insured employers among members of the local. The same assumption was made for categories of age, sex, and time in the union.

All claims and those resulting in paid lost time were described using the codes for nature of injury, source of injury and type of event, or mechanism, of injury. Serious claims which resulted in lost time with pay (after three days of missed work in Washington State) were described in more detail including the ICD-9 (International Classification of Diseases) codes attached to medical claims for the treatment of these injuries. Medical costs were calculated for claims covered by L&I using the variable for paid medical costs for closed claims and estimated total medical cost for claims which were still open at the time the data were extracted (n=9).

The percentage of paid lost time claims (not just to the eye) varied considerably by local, ranging from none to 80%. Multivariate analyses exploring incident and recurrent claims and high risk sub-groups were restricted to union locals which had less than 10% of their paid lost time claims from self-insured employers to decrease potential bias created by the failure to adequately identify cases that did not result in paid lost time. These analyses involved carpenters affiliated with locals doing predominantly light commercial work, residential carpentry and drywall work. The percentages of self-insured paid lost time claims from self-insured employers were 8%, 1.4% and 1.9% respectively for these categories overall.

The number and rates (events/person-hours at risk) of incident and recurrent claims were calculated. Using a customized program, each of the events of interest and person-time at risk for these individuals were stratified by age, sex, time in the union, and predominant type of carpentry work for analyses with Poisson regression. The program treated age and time in the union as time varying variables allowing them to change appropriately throughout the 84 month follow-up period. A popular application of Poisson regression concerns the modeling of failure rates for different subgroups.[6] In this case, it was used to determine whether the rates of eye injuries were significantly different for incident and recurrent events and across strata of age, sex, predominant job task, and time in the union. Recurrent events were differentiated from incident ones using standard dummy variable coding. *A priori* it was decided that age and sex would be left in the models for descriptive purposes.

The generation of descriptive statistics, initial calculation of crude and stratified rates, and the data stratification were done using SAS (Version 6.12).[7] Poisson regression analyses were done using EGRET.[8]

RESULTS

Description of the Cohort

From the union eligibility file, 12,958 individuals were identified who worked at least three months of union time and had at least one month of insurance eligibility through the CTWW between 1989 and 1995. The cohort was dynamic with entrances and exits over the seven year period; months worked ranged from 3 to 84, with a mean of 35 months and a median of 29 months. Over this seven year period the cohort worked 65,187,647 hours. The total hours worked peaked in the year 1992 (10,248,436 hours) and was lowest in 1995 (8,850,748).

Date of birth and sex were identified for 99% of the cohort. The mean age when first observed was 35 years and median age was 33 years. The cohort was predominantly male with only 323 women (2.5%), who contributed just under 2% of the hours worked. The union initiation date, only available from the national union membership files, was missing for 24% of the cohort. Using the records from the CTWW, the first year that each individual was observed in the Washington State trust files was identified, i.e., the first year that the CTWW had a record of participation in <u>any</u> union pension fund even if outside the State of Washington. Each individual was assigned the earliest of these observed dates (observed in trust data files or union initiation) to estimate time as a union carpenter.

There are 18 union locals included in the Carpenters' Trusts of Western Washington. In addition, the trust maintains records for individuals with a local assignment of

'99;' these '99' individuals are members of locals outside of Western Washington but are working in the State of Washington. For 253 individuals, we were unable to identify a union local that is covered through the Carpenters' Trusts of Western Washington. Among the group of 253 people, there were 15 'travelers' assigned a '99,' and 238 individuals for whom a Washington State local was identified in the years of interest but not a local in Western Washington. These individuals made up 2% of the cohort and contributed less than 1% of the hours worked during this seven year period. For another 987 individuals, we were unable to identify a union local in Washington State during this time period. These individuals made up 7.6% of the cohort but contributed only 1.5% of the hours worked.

Claims Filed

Overall Claims

A total of 1730 non-rejected claims for eye injuries were filed by 1428 different individuals between the years 1989 and 1995 in months in which the individual worked union hours. The eye was the third most common body part injured, following back and finger injuries, and accounted for 12% of all non-rejected claims.

The ANSI code descriptions of the claims are presented in Table I. The vast majority of these injuries were described as scratches (82.6%) and were most commonly caused by being abraded by a foreign object (74%) or struck by something (17.2%). The most common source of injury was described as particles (66.3%), followed by metal chips (14.3%). Although there were many objects (source codes) associated with eye injuries, 95% were included in the 13 most common which are presented in the table.

Paid Lost Time Claims

There were only 31 claims filed for eye injuries which resulted in paid lost time from work, which occurs on the fourth day away from work in the State of Washington. The nature and source of these more serious injuries are contrasted with those of claims which did not result in paid lost time in Table II. Scratches from particles were the most common injuries overall, but they are responsible for a much greater proportion of the less serious events. Cuts from metal fasteners and cuts from particles were responsible for greater proportions of the lost time injuries.

Twenty-five (80.6%) of the lost time injuries were covered through Labor and Industries, and six were reported from self-insured employers. In Table III, information is provided on days lost, medical costs paid, the ANSI description of the events and the ICD-9 codes which were assigned to the claims for medical care for these more serious eye injuries covered by L&I for which all the information was available. The actual description from the first report of injury was available for seven of the serious injuries and is included to supplement the ANSI description. When comparing ANSI coded data and ICD9 codes for treatment of these injuries, some coding imprecision and error is obvious. One event described by ANSI codes as 'ill-defined symptoms' appeared to have involved a contusion to the eye based on the ICD9 codes associated with the treatment of this injury. One event was described as 'scratches from inhaled toxins', clearly a coding error.

The injury from ICD9 codes appeared to have been related to toxic effects on the eye of exposure to a metal or fume.

Twelve of the paid lost time injuries resulted in over two weeks of lost time from work (i.e., > seven paid days). These injuries are clearly different from those resulting in a speedier return to work, and the 12 events accounted for over 95% of the costs for medical care and paid lost days for paid lost time claims. This group of serious events was most often described as the result of being struck by metal fasteners (6/12 or 50%), resulting in lacerations of the eye, ocular penetrations, and open wounds of the eyeball. The descriptions from the first report of injury identify 'metal fasteners' as nails in five of the six injuries, and we could document that four of the injuries occurred while hammering.

Rates

The overall rate of filing claims for eye injuries, based on reported cases, was 5.3 per 200,000 hours worked. Overall, 13.6% of all claims filed (not just for eye injuries) were from self-insured employers. Estimating additional cases which did not result in lost time among individuals working for self-insured employers would inflate the frequency of claims an additional 273 cases, resulting in an estimated rate of 6.1 per 200,000 hours. Claims resulting in paid lost time from work were filed at a rate of 0.10 per 200,000 hours worked. The rates of filing all non-rejected eye claims and those resulting in paid lost time are presented by year and by age, sex, time in the union, and union local affiliation in Tables IV and V, respectively. The total number of claims reported in each of these categories is presented, as is an adjusted frequency to include the estimation of self-insured claims that did not result in paid lost time that would not have been reported to L&I.

There was a steady decline in the rate of filing claims for all eye injuries over the seven year period. Although not as steady and not at a level of statistical significance, there was also a decline in the rates of paid lost time claims. The overall rates for men and women were similar. The rates generally declined with increasing age and increasing time in the union. Individuals without a Washington State local identification had significantly higher rates of claims than those for whom the local identification information was available. Individuals affiliated with locals doing predominantly millwrighting, residential carpentry, and drywall work had the highest rates of filing eye injury claims. No women filed claims for lost time eye injuries. There were no significant differences in the rates at which paid lost time claims were filed when comparing age categories or time in the union. Interestingly, the only group that had significantly higher rates of paid lost time eye injuries were those for whom no local could be identified. However, all the rates for paid lost time claims are based on very small numbers.

Costs

The costs associated with medical care for these 1730 claims are summarized in Table VI. The injuries which did not result in paid lost time are presented separately from those which did result in paid lost time. Total medical costs of $309,966 were reported for medical only claims with a mean cost per claim of $157 -- this is in marked contrast to the 25 claims covered by L&I which resulted in paid lost time with a mean cost per claim of $4,848. Estimating costs for the expected 273 self-insured medical only claims and the six self-insured claims that resulted in paid lost time, based on average costs for L&I covered claims, results in total costs for all claims of $460,837 for which $150,291 (32.6%) is attributable to the 1.5% of claims that resulted in paid lost time from work.

Incident and Second Claims

Among the group (n=5,981) whose locals had less than 10% of their paid lost time claims from self-insured employers between 1989 and 1995, 596 incident eye injuries and 88 second eye injuries were identified. Incident events occurred at a rate of 5.1 per 200,000 hours, compared to a rate of 8.3 per 200,000 hours for individuals who had filed a claim previously for an eye injury event (RR=1.6).

Hours at risk in each strata, number of events, crude rates and rate ratios, and adjusted rate ratios from Poisson regression analyses are presented in Table VII. There was a steady decline in the rate of filing claims with increasing age and increasing time in the union. No statistically significant differences were seen between men and women which is not surprising since there were very few women in the cohort. Individuals affiliated with the local doing predominantly drywall work had significantly higher rates of claims (RR=1.2) than the light commercial group. The rate ratio for second events (1.6) did not change when adjusted for the other variables in the model. Five (16.1%) of the 31 individuals in our cohort with paid lost time claims had filed a previous eye injury claim.

DISCUSSION

Eye injuries were the third most common work-related injury among this group of union carpenters. The rates of these injuries appear to be decreasing over time, consistent with the overall pattern of compensation injuries among the group. Although very common, these eye injuries rarely resulted in paid lost time from work. One third of the total costs were attributable to a very small group of serious injuries. Recurrent injuries in this cohort occurred at a rate 1.6 times higher than incident events when controlling for age, sex, time in the union and the predominant type of work of the union local with which the carpenter was affiliated. High risk groups included younger carpenters and those with less union experience. The highest rates of injury were among individuals with no known union local affiliation. In addition, millwrights and drywall workers appear to be at higher risk of eye injuries than their counterparts doing other types of carpentry work.

Our findings regarding severity and cost are consistent with those of Waller, et al.[(3)] in their description of injuries to carpenters in Vermont using data from patients seen in a hospital emergency department. Three percent (3%) of the cases of injury to the eye involved an Abbreviated Injury Score (AIS) of 2 (AIS 1=minor, 2=moderately severe, 3=severe, not life threatening),[(9)] with none higher then 2.[(3)] The average of the paid lost time for these eye injuries was 1.4, and the median was 0.[(10)] This reported average time would not have resulted in paid lost time from work in most workers' compensation systems including Washington State, which pays lost time on the fourth day after injury. The average medical costs were $150 with a median of $50, and the majority resulted in little to no follow-up care. Although the vast majority of these injuries did not reach the threshold for paid lost time in the State of Washington, we do not know how many injuries resulted in loss of time from work of three days or less. The costs associated with this loss would be borne directly by the injured worker.

There is little in the literature about repeat eye injuries among worker populations. In a case-control study of eye injuries among soldiers, prior eye injury in the last year was associated with repeat eye injury (OR 4.8, 95% CI 1.7-13.5).[11] An Australian study of eye injuries among workers seen in an emergency room found that 71% had previous eye injuries at work,[12] indicating that repeat injuries are common among other occupational groups as well.

The first report of injury information allowed us to identify that nails were the 'metal fasteners' most commonly associated with serious ocular lacerations and penetrations. These injuries most frequently occurred while hammering (67%) -- not while using nail guns as we had originally suspected. Hammering is a documented risk factor for serious penetrating injuries.[13-15] Fong[14] reported 53% of penetrating work-related eye injuries were the result of hammering which is consistent with our findings related to the most serious eye injuries among these carpenters. With limited data from first reports, we were able to document that <u>at least</u> 10% of all medical costs for eye injuries and 35.5% of the medical costs for eye injuries which resulted in paid lost time were associated with injuries sustained while hammering. ANSI coded data, which describe the object which caused the eye injury such as the particle or metal fastener, do not allow us to document all of the eye injuries which were the result of hammering.

We observed similar patterns of eye injuries in our study of residential construction workers in North Carolina.[2] Descriptive information was available for 46 medical cost (greater than or equal to $2000) or paid lost time (greater than seven lost days) eye injury cases for the period, 1993-1994. Injuries due to nails accounted for 16 (34.8%) of these more serious eye injuries. The use of a hammer to drive or pull nails accounted for nine (56.3%) of the injuries while nails from nail guns accounted for two injuries (12.5%). In five of the cases (31.3%), it could not be determined from the descriptive information whether a hammer or a nail gun was involved. The use of a hammer is a very common occupational exposure among carpenters, and the serious nature of injuries sustained from the use of this tool may not be appreciated. This is an important point for preventive efforts among these construction workers.

The higher rates of injuries among younger workers and those with less union experience may be related to training and experience or different job exposures. The group of workers for whom we could not identify a union local affiliation had markedly higher rates of eye injuries than other carpenters. These individuals worked proportionately fewer hours and may represent a more transient workforce. Millwrights were not included in our multivariate analyses since greater than 10% of their paid lost time claims had come from self-insured employers. Their crude rates were as high as those of drywall workers and residential carpenters and raises concerns. The millwrights exposures in industry may be quite different from those of construction carpenters.

Strengths and Limitations

Anything which influences an individual's decision to file a compensation claim would affect our findings. In addition, the failure to identify claims which did not result in paid lost time from work from self-insured employers resulted in an underestimation of the overall rate. We attempted to estimate the magnitude of this error to allow crude comparisons of patterns by age, sex, time in the union, and the predominant type of work. We did not feel that it was appropriate to look for high risk subgroups or explore incident and repeat claims using all the locals. For this reason, we limited the latter analyses to union locals which had less than 10% of their paid lost time claims from self-insured employers over this seven year period. We recognize that we still failed to identify all claims and that there was some misclassification of incident and repeat events. However, the bias should be of a lesser extent, and the information gleaned should still be useful in beginning to identify high risk groups and in understanding eye injuries among this group of construction workers.

These data, based largely on ANSI coding, provided information about the object that entered the eye (usually particles) but did not provide information about what the individual was actually doing at the time of injury. We do not have detailed information concerning the type of work performed by members of this cohort, and the categorization of the predominant type of work of the union locals is crude. For example, we do not know in how many instances the injured party was actually working with the offending substance as opposed to working near someone else who was. This information could be important if workers are at risk from stand-by exposures. The Georgia Eye Injury Registry reported approximately 20% of eye injuries were sustained by bystanders. These were serious events "resulting in permanent and significant structural or functional change..." and were not limited to occupational injuries.[16] Hunting[1] and Waller, et al.[3] had the advantage of interviewing injured workers, allowing the collection of more detailed information about what the workers were doing at time of injury. In this manner, they were able to identify that welding, drilling, and the use of power tools were often associated with eye injuries[1] and that the majority of eye injuries from circular saws were from flying sawdust.[3] However, the predominantly descriptive data for our carpenter cohort do allow identification of hammering as a significant hazard for the rare but very serious injuries.

We had no information about the use of protective eye equipment among this group of workers. However, among individuals with eye injuries there is a marked variation in the proportion of individuals who report the use of eye protection ranging from less than 8% in a largely non work-related urban trauma series,[17] to 10% among injured agricultural workers,[18] and finally to "many" carpenters.[3] de la Hunty, et al.[12] found that 63% of Australian workers seen in the emergency department for eye injuries reported wearing protection, but only 14% were wearing protection that complied with the current Australian standard. In addition to the quality and condition of the eye protection, the workers reported the history of a previous eye injury as an influential factor in their decision to use eye protection -- which seems particularly interesting since these were individuals presenting for treatment of an eye injury. Waller[3] reported that many of the injuries from circular saws among carpenters occurred despite the use of protective goggles, such as while goggles were being removed. He felt that this fact pointed to the need for mechanical controls such as a built in dust collection systems.

It has been pointed out that relatively little is known about less severe injuries that cause most of the visits to physicians.[19] In this case, understanding more about the nature of eye injuries among the construction workers may give more insight into factors which may play important roles in understanding preventive behaviors. A matrix for understanding injury and identifying multiple points of intervention has been described by William Haddon (Robertson, 1992) [20]. This conceptual model uses the classic public health paradigm of agent, host, and environment applied to pre-event, event, and post-event factors associated with the injury. Haddon separates the events leading to the injury and those that occur subsequently that can affect the ultimate outcome. The goal is primary prevention which, within the context of this investigation, involves the prevention of eye injuries. However, Haddon's model looks at prevention at other junctures as well and would involve evaluation of appropriate medical care to maximize visual conservation after injury. While these administrative data do not allow us to evaluate prevention at this level, we acknowledge this is an important aspect of prevention of visual impairment after eye injury.

CONCLUSIONS

The literature points to the preventable nature of eye injuries through the use of protective equipment and education of workers.[12, 21] While these steps may seem to be obvious, we question whether this simplistic approach focused solely on individual worker's carefulness and compliance with safety measures is adequate.

Motivation of workers to take personal safety initiatives has been reported to be closely related to perceived safety norms of the supervisor. This motivation is higher when the supervisor has some power and influence over decisions that affect the safety of his or her work group and practices joint involvement with his work team in injury prevention.[22] In addition, these same researchers reported that the supervisor's involvement in safety was also correlated with other predictors of safety behaviors, including group cohesiveness and cooperative relationships between group members and the supervisor. These findings, from a study of industrial settings, may be even more salient when considered within the context of the culture of construction work.

Construction workers are always working themselves out of a job and, consequently, frequently change employers and work sites. The work assignments change on construction sites as do the cast of workers and contractors. Several trades may work on sites simultaneously, with each trade reporting to different contractors and supervisors. In contrast to many industrial settings, the lack of a permanent job site and the small size of many construction sites make it more difficult to place environmental controls or to easily regulate or encourage the use of safety practices. Construction workers structure their work environment on a daily basis, making decisions that have great potential to affect their health and safety. This is an aspect of construction that can be viewed as an opportunity -- if supervisors and workers make appropriate choices and establish work norms that will protect their health.[23, 24]

In addition, there is evidence that perceived severity of risk may have more impact on preventive behavior than frequency of events from the consumer product safety literature.[25-27] The worker's involvement in activities aimed at improving health and safety in industry has been shown to be influenced by perceived level of risk as well.[28, 29] Minor lacerations or abrasions are likely not to be perceived as serious events by these workers, even though they can become serious without appropriate care. The possible lack of perceived severity of eye injuries may be an impediment to use of eye protection and seems consistent with the high rates of incident and repeat eye injuries we saw among these construction workers. This has practical implications for the messages that carpenters, and their supervisors, should receive regarding their risk for eye injuries and the serious nature of eye injuries associated with the use of a tool common to their work -- the hammer.

The prevention of eye injuries among construction workers is likely to require a multi-faceted approach. The development of more mechanical controls to decrease exposures to flying particles and chips is clearly reasonable and should have payoffs, as have other public health interventions that do not rely on personal behavior change. Barriers to the use of eye protection, such as visibility, cleanliness, comfort, condition of goggles or glasses, storage near the work site, and group norms[12, 3] are all potentially real impediments for construction workers and these issues need to be addressed through organizational factors and design improvements of eye protection. Attention should be given to ways of changing the norms on job sites through training of supervisors or foremen regarding risk and safety measures -- not just focusing on individual workers.

By addressing the problem from multiple perspectives, the Built-Rite program reduced injuries by 77% over a two year period.[30] This program on one large job site involved unions, craftsmen, and contractors in focus groups to evaluate eye injuries and plan preventive strategies for a large petrochemical construction project. An optical company was brought on site during work hours to fit workers for prescription safety glasses. Attention was made to decrease dust exposure by wet-washing some areas before work began, and eye wash stations were located near work areas. This type of intervention warrants further evaluation particularly since some of these interventions will require more effort to implement on smaller construction sites.

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Table I. ANSI Nature of Injury Descriptions of Eye Injuries Among Union Carpenters Washington State 1989-1995

Nature of Injury	Frequency (%)[A]
Scratches	1421 (82.6)
Conjunctivitis	77 (4.5)
Cut	73 (4.2)
Welders' Flash	42 (2.4)
Contusion	33 (1.9)
Ill-defined Symptoms	29 (1.7)
Burn/chemical	21 (1.2)
Burn/heat	15 (0.9)
Eye/other	3 (0.2)
Eye Diseases	2 (0.1)
Multiple Injury	2 (0.1)
Radiation/non-ionizing	2 (0.1)
Injury, NEC	1 (0.1)
(Missing=9)	

Mechanism of Injury	Frequency (%)[A]
Abraded	1270 (74.1)
Struck by	298 (17.2)
Skin absorbed toxin	81 (4.7)
Hot object	13 (0.8)
Skin contact w toxin	6 (0.4)
Caught	2 (0.1)
Toxin NEC	1 (0.1)
(Missing=16)	

Source of Injury	Frequency (%)[A]
Particles	1129 (66.3)
Metal chips	243 (14.3)
Metal fasteners	43 (2.5)
Welding equipment	43 (2.5)
Wood dusts	33 (1.9)
Wood items	26 (1.5)
Metal binders	24 (1.4)
Scrap/waste	17 (1.0)
Cement	16 (0.9)
Chemicals	15 (0.9)
Sliver/splinter	11 (0.6)
Calcium hydroxide	10 (0.6)
Branches/bark	9 (0.5)
(Missing=27)	

(all others accounted for < 5%; each less than 0.5%)

[A] % of those with code

Table II. Injury Nature and Source for Non-rejected Eye injuries
Among Union Carpenters
Washington State 1989-1995

All claims

Nature and Source	Frequency (%)
Scratches from particles	1029 (60.7)
Scratches from metal chips	221 (13.0)
Conjunctivitis from particles	51 (3.0)
Welders' flash from welding equipment	42 (2.5)
Scratches from wood dusts	30 (1.8)
Scratches from wood items	23 (1.4)
Scratches from metal fasteners	20 (1.2)
Cut from metal chips	17 (1.0)
Cut from particles	20 (1.2)
Scratches from metal binders	14 (0.8)
Ill-defined symptoms from particles	13 (0.8)
Contusion from metal fasteners	11 (0.6)
Cut from metal fasteners	10 (0.6)
Scratches from sliver/splinter	9 (0.5)

(Missing=34)
(all others together account for < 11%)

Claims Resulting in Paid Lost Time From Work

Nature and Source	Frequency (%)
Scratches from particles	8 (28.6)
Cut from metal fasteners	6 (21.4)
Scratches from metal chips	3 (10.7)
Cut from particles	2 (7.1)
Scratches from metal items	1 (3.6)
chemicals	1 (3.6)
mineral	1 (3.6)
nonpower tool	1 (3.6)
wood items	1 (3.6)
Cut from metal items	1 (3.6)
Contusion from cement	1 (3.6)
head coverings	1 (3.6)
Welders flash	1 (3.6)

(Missing=3)

Table III. Paid Lost Time Eye Injuries: 26 Events (81.2%) Covered by Labor and Industries with Medical Data and ANSI Codes

Paid Lost Days	**Costs for Medical Care**	**ANSI Nature, Mechanism and Source** *Description from first report*	**ICD-9 Diagnoses**
198	$ 27,982	Cut from being struck by metal fastener *Nailing up form; nail stuck in L eye*	Laceration of eye; ill-defined symptoms; retinal detachment; recurrent retinal detachment; cataract; profound impairment both eyes; disorder of refraction; aphakia
94	$ 14,654	Cut from being struck by flying object; metal fastener *Hammering nails while framing; nail flipped back and struck L eye*	Laceration of eye; ocular penetration; vascular disorder of iris and ciliary body; unspecified disorder of refraction; corneal opacity; corneal degeneration
74	$ 4,654	Cut from being struck by metal fastener *Nail hit eye while hammering*	Penetrating wound of orbit; ocular laceration without prolapse of tissue; laceration of eye; central opacity of cornea; punctate keratitis; unspecified disorder of refraction
65	$ 13, 972	Cut from being struck by flying object; metal fastener *Hit nail with hammer; nail glanced off board into eye*	Open wound of eyeball; ocular penetration
64	$ 9,908	Scratches from being abraded by foreign object; particles *Pulling a nail while installing bridging at truss joint; unidentified object struck eye.*	Penetration of eyeball with magnetic foreign body; corneal foreign body; other foreign body eye; recent retinal detachment, partial with giant tear; vitreous hemorrhage
52	$ 8,826	Ill-defined symptoms *Putting in wires with lag gun*	Unspecified contusion of the eye; hemorrhage of iris and ciliary body; vitreous hemorrhage; penetration of eyeball with magnetic object
36	$ 9,705	Cut from being struck by metal fasteners *Struck in eye with nail after loose nail on floor hit by hammer*	Laceration of eye; ocular penetration; unspecified open wound of the eyeball; foreign body on external eye; retinal hemorrhage; vitreous hemorrhage; corneal opacity; cortical senile cataract; congenital nystagmus; visual field defect
27	$ 1,422	Scratches from being abraded by foreign object; particles	Superficial injury to cornea; corneal ulcer; other corneal deformity

25	$ 3,448	Contusion from being struck by metal items	Ocular laceration without prolapse of ocular tissue; unspecified laceration of eye; other anomalies of iris and ciliary body; corneal opacity
23	$ 3,793	Contusion from being struck against head coverings	Hemorrhage of iris or ciliary body; unspecified disorder of optic nerve; contusion of eye; intra cranial injury
18	$ 3,691	Cut from being struck by falling objects; particles	Ocular laceration with prolapse of intra ocular tissues; penetration of eyeball with foreign body
15	$ 1,806	Cut from being struck by metal fasteners	Contusion of eyeball; unspecified laceration of eye; undiagnosed eye disease; optic neuritis, unspecified
7	$ 84	Welder's flash; skin absorbed toxin; welding equipment	Contusion of eyeball
5	$ 415	Scratches from being abraded by foreign object; particles	Superficial injury to eye; acute conjunctivitis; foreign body on cornea
4	$ 280	Scratches from being abraded by foreign object; metal chips	Corneal abrasion; corneal foreign body
3	$ 543	Scratches from being abraded by foreign object; particles	Abrasion infected; (joint disorder; selling of limb)
3	$ 871	Scratches from being struck by non-power tool	Contusion of eyeball; recession of chamber angle; ocular hypertension
3	$ 270	Scratches from being abraded by particles	Corneal abrasion; pain in/around eye
3	$ 111	Scratches from being abraded by foreign object; particles	Corneal abrasion; foreign body
2	$ 299	Scratches from being abraded by foreign object; metal chips	Foreign body; corneal foreign body
1	$ 135	Scratches from being abraded by foreign object; particles	Conjunctivitis
1	$ 698	Scratches from inhale toxin; chemicals	Toxic effect of metals; toxic effects of unspecified gases, fumes, vapors
1	$ 166	Scratches from abraded by foreign object	Superficial injury to conjunctiva
1	$ 287	Cut from being abraded by foreign object; particles	Penetration of eyeball with foreign body
1	$ 217	Struck by foreign object; wood items	Superficial injury to cornea

Table IV. Estimated rates of eye injuries by year union carpenters 1989-1995 Washington State

Year	All Claims			Paid Lost time Claims	
	Reported Frequency	Estimated Frequency	Rate[A] (95%) CI[B]	Frequency	Rate[A] (95%) CI[B]
1989	320	364	8.1 (7.2, 9.1)	6	0.13 (0.05, 0.28)
1990	276	310	6.9 (6.2, 7.7)	4	0.09 (0.02, 0.23)
1991	306	352	7.2 (6.5, 8.0)	4	0.08 (0.02, 0.20)
1992	267	308	6.0 (5.4, 6.7)	6	0.12 (0.04, 0.28)
1993	212	259	5.5 (4.9, 6.2)	4	0.08 (0.02, 0.21)
1994	186	219	4.9 (4.2, 5.7)	4	0.09 (0.02, 0.23)
1995	163	190	4.3 (3.7, 5.0)	3	0.07 (0.01, 0.20)

[A] Rates (cases/200,00 hours worked) based on estimated frequency including non-reported claims without lost time from work from self-insured employers

[B] approximate Poisson 95% confidence interval

Table V. Estimated rates of filing claims for eye injuries by age, sex, time in the union and predominant type of carpentry work for union carpenters 1989-1995 Washington State

	Hours worked	Overall claims Frequency Reported	Estimated[A]	Rate (95% CI)[A,B]	Paid lost time claims Frequency	Rate (95%CI)[B]
Age						
<20	479,591.7	18	19	7.9 (4.8, 12.3)	0	--
20-24	4,098,550.4	203	223	10.9 (9.5, 12.5)	4	0.19 (0.05, 0.49)
25-29	8,367,937.6	316	355	8.5 (7.6, 9.5)	7	0.17 (0.14, 0.70)
30-34	12,520,719.2	411	478	3.8 (3.5, 4.2)	6	0.10 (0.07, 0.22)
35-39	13,344,818.4	372	433	3.3 (3.0, 3.6)	7	0.10 (0.04, 0.21)
40-44	10,071,049.6	188	221	4.4 (3.8, 5.1)	2	0.04 (0.004, 0.14)
45-49	6,205,783.4	96	116	3.7 (3.1, 4.4)	3	0.10 (0.02, 0.29)
50-54	4,689,650.5	67	82	3.5 (2.8, 4.4)	1	0.41 (0.01, 2.3)
55-59	3,563,723.7	37	45	2.5 (1.5, 3.4)	1	0.60 (0.02, 3.3)
60-64	1,625,954.6	17	22	2.7 (1.7, 4.1)	0	--
65 and >	145,967.9	5	5	6.7 (2.2, 15.6)	0	--
unknown age	73,900.0	0	0	--	0	--
Sex						
Males	64,079,314.9	1701	1955	6.1 (5.7, 6.5)	31	0.10 (0.07, 0.14)
Females	1,087,903.6	29	39	5.3 (3.8, 7.2)	0	--
missing	20,358.3	11	11		0	--
Time in union						
<2 years	10,295,574.3	395	439	8.5 (7.7, 9.3)	5	0.10 (0.03, 0.23)
2-3 years	7,007,903.6	248	279	8.0 (7.1, 9.0)	6	0.17 (0.06, 0.37)
4-5 years	5,510,456.2	175	203	7.4 (6.4, 8.5)	3	0.11 (0.02, 0.32)
6-7 years	3,995,024.2	121	141	7.1 (6.0, 8.4)	2	0.01 (0.01, 0.36)
8-9 years	3,398,248.5	89	125	7.4 (6.2, 8.9)	1	0.06 (0.002, 0.33)
10 years and >	34,980,440.2	697	830	4.7 (4.4, 5.0)	14	0.08 (0.04, 0.13)
Type of work						
Light commercial	17,030,900.5	475	520	6.1 (5.6, 6.7)	7	0.08 (0.03, 0.16)
Heavy commercial	24,653,605.7	514	643	5.2 (4.8, 5.6)	12	0.10 (0.05, 0.18)
Residential	896,358.9	31	31	6.9 (4.7, 9.9)	0	--
Drywall	9,631,821.9	366	373	7.7 (6.9, 9.9)	7	0.15 (0.06, 0.31)
Millwrights	1,251,635.7	41	51	8.2 (6.1, 10.8)	0	--
Piledrivers	4,354,286.4	90	126	5.8 (4.8, 7.0)	0	--
Cabinet/fixtures	415,458.7	1	3	1.4 (0.29, 4.1)	0	--
Mixed	5,383,666.7	114	146	5.4 (4.6, 6.4)	1	0.04 (0.001, 0.22)
Local outside W. Washington	609,510.5	15	17	5.6 (3.3, 9.0)	0	--
No local identified	961,402.0	82	93	19.4 (15.7, 24.1)	4	0.83 (0.23, 2.1)

[A] rate (per 200,000 hours worked)includes estimate of non-reported claims without lost time from work from self-insured employers
[B] approximate Poisson 95% confidence interval

Table VI. Costs for Medical Care for Eye Injuries Among Union Carpenters
Washington State 1989-1995

Medical Only Claims **Reported to Labor and Industries**	**Paid Lost Time Claims** **Covered by Labor and Industries**
Number of claims =1705 Mean cost per claim=$157 **Total reported costs=$309,966**	Number of claims=25 Mean cost per claim=$4848 **Total reported costs=$121,203**

Table VII. Incident and First Recurrent Eye Injuries Union Carpenters[A]
Washington State 1989-1995

	Number of events	Hours at risk	Crude Rate[B]	Crude Rate Ratio	Adjusted Rate Ratio (95% CI)
Age					
< 30 years old	242	5,747,744	8.4	1	1
30-44 years old	368	13,671,429	5.4	0.64	0.80 (0.66, 0.97) [C]
45+ years old	74	5,857,395	2.6	0.30	0.46 (0.34, 0.63) [C]
Sex					
Males	674	25,026,950	5.4	1	1
Females	10	286,500	7.0	1.3	1.0 (0.51, 2.1)
Time in the Union					
< 4 years	338	8,701,113	7.8	1	1
4-9 years	112	4,018,647	5.6	0.72	0.68 (0.54, 0.85) [C]
10+ years	234	12,611,450	3.8	0.48	0.62 (0.50, 0.76) [C]
Missing					
Local Affiliation					
Light Commercial	348	14,508,505	4.8	1	1
Residential	29	889,891	6.6	1.4	1.1 (0.76, 1.6)
Drywall	282	8,983,392	6.2	1.3	1.2 (1.0, 1.4) [C]
Missing					
Claim Status					
Incident	596	23,198,833	5.2	1	1
Recurrent	88	2,132,377	8.2	1.6	1.6 (1.2, 1.9) [C]

Deviance 175 df=176.3

[A] Includes only locals with less than 10% of paid lost time claims from self-insured employers 1989-95
[B] Rate per 200,000 hours worked
[C] Statistically significant at 0.05 level

Appendix 5

Work-Related Upper Extremity Musculoskeletal Injuries Among Union Carpenters

(Approved doctoral dissertation: University of North Carolina, Department of Epidemiology, School of Public Health, 1999)

Microsoft Word Document

WORK-RELATED UPPER EXTREMITY MUSCULOSKELETAL INJURIES AMONG UNION CARPENTERS

by

Ruth A. Shults

A dissertation submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of doctor of philosophy in the Department of Epidemiology, School of Public Health.

Chapel Hill

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ABSTRACT

RUTH A. SHULTS: Work-related Upper Extremity Musculoskeletal Injuries among Union Carpenters

(Under the direction of Dana Loomis, Ph.D.)

Musculoskeletal injuries are the leading cause of disability among adults of working ages, and they account for 40 to 65 percent of workers' compensation costs in construction trades. We combined union administrative data with workers' compensation data to explore risk factors associated with upper extremity musculoskeletal injuries among 12,725 carpenters in western Washington during 1989-1995. Because personal exposure data were not available, predominant type of work performed by each local was used as a surrogate for work exposures of its members. Person-hours of work as a union carpenter were used to measure time at risk. Crude injury claim rates were calculated and Poisson regression analyses were used to explore associations between predominant type of work and risk of filing a claim. Finally, survival analyses were used to assess the effect of injury- and individual-level factors on the length of time away from union carpentry work after filing a paid lost time claim for an upper extremity musculoskeletal injury.

We identified 1,720 approved workers' compensation claims for upper extremity musculoskeletal injuries filed by 1,482 cohort members; one third of all claims involved paid lost time. The overall crude claim rate was 5.3 per 200,000 hours worked.

In the multivariate analyses, inexperience and sex were consistent risk factors for filing a claim. Carpenters with less than 1 year of union experience had nearly a two-fold increased rate of filing a claim compared to carpenters with 15 or more years of experience. Once injured, the least experienced carpenters were about twice as likely as their most experienced counterparts to file a second claim. Women were about twice as likely as men to file a claim and nearly 3 times as likely to require paid lost time. The increase in risk for paid lost time claims among women was mostly due to lower arm injuries. Women were about 50 percent more likely than men to file a second claim, although the risk estimate was

imprecise. Future studies of this cohort should consider interviewing a sample of carpenters and observing work practices to see if work exposures differ systematically by experience or sex.

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1. BACKGROUND AND METHODS

1.1 Background

Musculoskeletal disorders are the leading cause of disability among working-aged adults.[1] The disorders involve inflammation of the tendons, insertions, and joints, and compression of the nerves.[2,3] They can result from an acute injury or develop over time.[4,5] The terms "musculoskeletal disorder" and "musculoskeletal injury" are used interchangeably to describe the conditions. The terms "cumulative trauma disorder" (CTD) and "repetitive motion disorder" refer to musculoskeletal injuries that develop incrementally. Although dissenting views exist,[6] there is general agreement that some upper extremity musculoskeletal disorders are work-related. These conditions include muscle strains, carpal tunnel syndrome, tendonitis, tenosynovitis, hand-arm vibration syndrome, and thoracic outlet syndrome.[7-11] Localized osteoarthritis may also be accelerated by work exposures.[2] Appendix 6.1 contains a summary of musculoskeletal injuries that are associated with cumulative trauma.

Symptoms of musculoskeletal injuries include tenderness, pain, swelling, weakness, loss of sensation, and restricted movement. Symptoms can be localized or diffuse, intermittent or constant, and they can migrate over time.[12] For these reasons, diagnosing musculoskeletal injuries and assessing their work-relatedness can be challenging.[13] Indeed, a 1984 study of Washington State compensation claims reported that the rejection rate for CTDs was over three times greater than for traumatic injuries (13 percent versus 4 percent).[14] This differential rejection rate for musculoskeletal injuries may lead to falsely low estimates of their incidence and may encourage workers with CTDs to report an acute onset of their symptoms.

Characteristics of work tasks that may increase the risk of developing musculoskeletal disorders include repetitive motions, forceful motions, external mechanical stresses, static or awkward postures, local vibration, and extreme temperatures.[2,15] The contribution of work-related psychosocial factors to musculoskeletal injuries is less well understood. Although inconsistent findings exist, the literature suggests that workers' perceptions of intensified workload, monotonous work, limited job control, uncertainty about job expectations, and limited social support from supervisors and coworkers are associated with musculoskeletal injuries in the workplace.[16] The relative importance of these psychosocial factors for workers with physically demanding jobs is not well understood.

1.1.1 Musculoskeletal injuries and the construction industry

Musculoskeletal injuries are common in the construction industry, and they are costly in terms of personal suffering, absenteeism, and loss of productivity. An estimated 40 to 65 percent of all workers' compensation costs in construction is due to musculoskeletal injuries.[5] Their high cost is primarily due to the long periods of lost work time associated with a small proportion of cases.[17-19]

The physical characteristics of construction sites and construction work contribute to the risk of musculoskeletal injury. Unlike most work environments, construction sites are in a constant state of change. Workers routinely handle heavy construction materials and move equipment around the work site. Other common activities that increase the risk of musculoskeletal injury include using power hand tools, working on scaffolding or in other confined spaces, maintaining awkward work postures, performing repetitive movements, working at shoulder level or overhead, and working in extreme weather conditions.[2,20-22] The culture of the construction trade may also contribute to musculoskeletal injuries among its workers. "Construction work is considered to occur in a 'rough and tumble' culture that encourages workers to get the job done at any physical cost."[23] Safe work practices may be compromised when workers are paid on a piece rate basis or when scheduling pressures impose short completion deadlines. Work can be sporadic and layoffs between assignments are common, making a steady income uncertain. Some jobs may require workers to travel long distances from home or to live in temporary housing. These factors may encourage experienced workers to leave the trade, resulting in a workforce with proportionately few seasoned carpenters to perform the demanding and sometimes hazardous jobs.[24] Less experienced workers have a greater risk of being injured on the job.[17,25,26] Furthermore, in times of high unemployment workers may be more likely to risk injury, not report an injury, or work while injured.[23]

The majority of U.S. construction contractors employ fewer than ten workers. Resource limitations in these small firms may discourage investment in injury prevention training, ergonomically designed tools, or other improvements. Whatever the causes, small firms have the highest injury rates in the trade.[24,27] In addition, employers of any size who have only a short-term contract with workers may not feel accountable for improving ergonomic conditions at the work site.[23]

1.1.2 Surveillance of musculoskeletal injuries among construction workers

The nature of construction makes on-site surveillance impractical. Work sites are often small and scattered. Workers move from job to job, often having several employers within a year.[5] For these reasons, passive surveillance and secondary data sources have been used to document injuries among construction workers. The most common source of injury data for U.S. construction workers is the U.S. Department of Labor, Bureau of Labor Statistics (BLS). Each year, the agency obtains data from the Occupational Safety and Health Administration (OSHA) Form 200 Injury and Illness Logs from about 250,000 private employers in all 50 states and the District of Columbia.[28] With this information, the Bureau estimates national rates of occupational injury and illness and resulting disability. Conditions are characterized using the American National Standards Institute (ANSI) standard method for coding injuries and illnesses. ANSI codes describe four aspects of a condition: (1) the *nature* (sprain/strain, contusion); (2) the *body part* affected; (3) the *source*, which identifies the object, substance, exposure, or bodily motion that caused the condition; and (4) the *type* of event (mechanism) that caused the condition (fall, overexertion).[28] A list of ANSI body part and nature codes that are compatible with upper extremity musculoskeletal injuries is contained in Appendix 6.2.

BLS data have several limitations. Most importantly, firms with fewer than 50 employees may underreport workplace injuries on OSHA logs.[27] If this is true, BLS data may greatly underestimate injury rates in the construction industry because at least 80 percent of the 1.9 million U.S. firms employ fewer than ten workers.[29] Results from two recent studies of injuries among construction workers support this view. An analysis of workers' compensation claims filed by carpenters in Washington found the overall claim rate, including injury and illness, was greater than twice the BLS claim rate for the construction industry (29.8 versus 14.2 per 200,000 hours, respectively).[25] Forty-five percent of all claims filed by the Washington carpenters were for musculoskeletal injuries. The authors did not report claim rates by size of construction firm. The second study analyzed injury claims filed during construction of the Denver International Airport (DIA). The authors reported injury rates among construction workers of at least 2.3 times the BLS injury rates.[30] The largest difference between the DIA rates and BLS rates was seen among firms with fewer than 20 employees, where DIA rates exceeded BLS rates by more than three-fold.

Another limitation of the BLS that is common to passive surveillance systems is the tendency to underreport less severe injuries and conditions that develop incrementally.[24,31] One study that compared OSHA 200 logs to medical claims data in five manufacturing plants found that the OSHA 200 logs underreported work-related CTDs by 20 to 80 percent.[32] Lastly, BLS data do not distinguish between initial and recurrent events, so patterns of recurrence cannot be studied.

1.1.3 Disability due to occupational injuries

Disability is defined as a loss of occupational functioning caused by an impairment.[33] Although most work-related injuries involve no disability, a small proportion result in extended periods of lost work time. Each year, about 569,000 U.S. workers become disabled for at least 5 months, and about one-half of those never return to the work force.[34] Personal factors that may influence the duration of disability include the severity of injury, pre-injury income, age, sex, race, fear of re-injury, ability to manage symptoms, and presence of a social support system. Job- and community-level factors include the physical demands of the work, flexibility of employers to reintegrate injured workers and to make ergonomic modifications, availability of vocational rehabilitation, quality of the disability benefit system, and labor market conditions. At least one study has suggested that the longer periods of disability experienced by women and racial minorities may be due to discrimination by employers.[35]

Population-based studies have used workers' compensation claims to identify individual- and job-level risk factors for work-related disability.[18,36-39] In an analysis of about 28,000 Washington State worker's compensation claims for injury-related disability, Cheadle et al. found that 12 percent of workers remained disabled for more than 1 year.[18] Factors that strongly predicted longer periods of lost work time included age > 45 years (relative hazard ratio (HR) = .67, 95% CI = .64 - .69), female sex (HR = .85, 95% CI = .82 - .88), and a diagnosis of carpal tunnel syndrome (HR = .55, 95% CI = .50 - .60) or back/neck sprain (HR = .79, 95% CI = .77 - .82). Less strong predictors included working in construction or agriculture, divorced marital status, firm size of fewer than 50 employees, and county unemployment rate of over 7 percent. A Minnesota study of more than 2,000 employees with back injuries who were disabled for at least 8 weeks found similar results for older workers and employees of smaller firms.[36] A study of 148 Canadian workers who remained on workers' compensation for at least 3 months after a musculoskeletal injury also found that women took longer to return to work.[37] Once they returned to work, however, women were more likely than men to remain at work and recurrence-free. The authors concluded that acceptable family role alternatives (e.g., homemaker) might help explain the longer periods of disability among women. Older workers took longer to return to work and had higher rates of repeat disability. The authors suggested that continuing vocational rehabilitation even after the employee returns to work might reduce recurrent disability.

Clinic-and hospital-based studies have explored various psychosocial and demographic correlates for disability due to musculoskeletal injuries.[40-42] In a study of 124 workers evaluated at an occupational clinic for upper extremity injuries, Himmelstein et al. found that the work-disabled group had less job seniority, underwent more surgeries, reported a higher frequency of acute antecedent trauma, and reported higher levels of pain than the working group.[40] The authors suggested that more aggressive pain control and more effective management of employer-employee conflicts could help reduce the duration of disability. Another U.S. study of temporarily disabled workers concluded that treatment of depression associated with chronic pain is important in helping patients return to work.[43]

A Swedish study of vocational rehabilitation clients identified male sex and a personal belief in ability to return to work as the most important predictors for returning to work over a 2-year period.[44] Lastly, in two hospital-based studies of patients with traumatic injuries, Mackenzie et al. identified post-high school education, strong social support, and personal income above the poverty level before the injury as independent predictors for returning to work.[45,46] The latter study found that workers with lower income and less education prior to injury had to change jobs more frequently than their counterparts. Reasons for not returning to their previous job included being replaced because of long absences and inability to meet the job's physical demands. These two factors may be of particular relevance to injured construction workers given the sporadic nature of the work and its high physical demands.

1.1.4 Recurrence of musculoskeletal injuries

Recurrent injury is of interest for several reasons. Recovery time may be longer for recurrences,[39] and for some workers, recurrence may portend permanent disability. The literature regarding recurrent work-related musculoskeletal injury is scant, consisting mostly of studies of recurrent low back pain. Risk factors identified in these studies include younger age at first occurrence,[47] inexperience,[48] female sex,[48] longer periods of paid lost time and high costs of medical treatment with the first occurrence,[39,48,49] and diagnosis of a degenerative disorder.[48] Disability due to recurrent back pain appears to be fairly common among working populations. A study conducted in northwest England reported a 49 percent recurrence rate in the first year among workers who sought medical care for back problems.[50] A similar study in Quebec found that 36 percent of workers had a least one recurrence causing them to miss work during a 3-year follow up.[39] The amount of missed work increased gradually with each successive episode. Finally, a study of union carpenters in Washington State reported that compensation claims for recurrent back pain were filed at 3.3 times the rate of incident claims.[48] Recurrence was more common among females and workers with less than 4 years of union experience.

1.1.5 Summary of the Washington State Workers' Compensation program

Washington is one of six states that require employers who are not self-insured for workers' compensation to obtain insurance through a state-managed program. The Washington Department of Labor and Industries program (L & I) insures approximately two-thirds of the state's 2.5 million workers. L & I pays for medical care for approved work-related injury and illness claims, compensates workers for lost wages if they miss at least 4 days of work, and pays lump-sum settlements to workers who become permanently disabled.

For this study, workers' compensation claims involving only medical costs were referred to as "medical claims". Claims that also involved compensation for lost time were referred to as "lost time claims". L & I electronically codes *all claims* (medical claims and lost time claims) from state-insured firms and *lost time claims* from self-insured firms. For the study, we excluded claims that were not approved, thereby limiting the analyses to claims that L & I considered "work-related".

1.1.6 Methodologic issues in studying injury recurrence and disability

To date, studies of work-related musculoskeletal injuries have followed workers for 1 - 4 years. Longer periods of follow up are needed to investigate the patterns of recurrence. Multivariate techniques used to study the factors associated with recurrence and length of disability include linear regression,[38,42] logistic regression,[43,51] and factor analysis.[44] These techniques have two important limitations; they cannot accommodate time varying factors or utilize information from subjects who are lost to follow-up. The potential for these limitations to bias risk estimates increases as the period of follow-up lengthens.

Longitudinal data analysis techniques can address these limitations. A study of back disorders among union carpenters in Washington State used Poisson regression to assess the role of demographic, injury history, and work-related factors in recurrence.[48] Other studies have used proportional hazards regression.[18,35,36,52,53] As applied, these methods did not account for the potential correlation between multiple outcomes.

Correlation can occur at the injury- or individual-level. For recurrent injuries, the assumption of independence of observations would be satisfied only if the injured worker recovered fully before returning to work. Requiring full recovery as a condition for returning to work, however, is not always practical or even possible. Even determining whether a musculoskeletal injury has fully healed is often impossible. At the individual-level, personal characteristics probably influence the risk of injury and the course of disability for all injuries for a particular worker, whether the injuries involve the same body part or not. If correlation exists, failing to account for it does not usually bias risk estimates, but it can produce artificially low estimates of their variance. Methods for estimating the variance of regression coefficients that account for correlation are available for both Poisson regression[54,55] and survival analysis.[56-58]

1.1.7 Summary and rationale for work

Despite the personal and economic impact of work-related musculoskeletal injuries, research on the conditions is in the early stages. Only a handful of studies have described the injuries among construction workers, and even less is known about the course of injury and recovery over time. Secondary data analysis, which can be conducted relatively quickly and economically, is most useful during these early stages of research.

In this analysis, we combined administrative data with information obtained through telephone interviews with union representatives to study work-related upper extremity musculoskeletal injuries among union carpenters in western Washington. Specifically, we:

- Described work-related upper extremity musculoskeletal injuries over a 7-year period in a cohort of 12,725 union carpenters;
- Explored associations between the predominant type of work performed and risk of injury;
- Examined factors associated with sustaining a second injury;
- Examined factors associated with the duration of time away from work after an injury.

Previous studies of this cohort have demonstrated the practicality of using these administrative databases for injury surveillance and to assess risk factors for injury.[25,26,48]

For this study, we supplemented the administrative data sources with information collected from union representatives. We interviewed the field representative from each local to learn more about the type of work performed, work schedules, and the process for reassigning carpenters who returned to work after a musculoskeletal injury.

1.2 Methods

1.2.1 Overview

We used administrative data sets and information collected from union field representatives to study work-related upper extremity musculoskeletal injuries among union carpenters. An historical cohort of 12,725 union carpenters who worked in western Washington State between 1989 and 1995 was defined. We identified and described 1,720 upper extremity musculoskeletal injury claims that were filed by cohort members. Proportionate morbidity ratios (PMRs) and rates of musculoskeletal injury claims were calculated. Poisson regression was used to (1) explore the association between filing a claim and the predominant type of work performed, and (2) examine risk factors for filing a second claim during the 7-year study period. Lastly, Cox proportional hazards regression was used to explore factors associated with returning to work among carpenters who filed a paid lost time claim and missed at least one month of work after an upper extremity injury.

1.2.2 Administrative data sources

We used the health insurance eligibility files from the Carpenters Trusts of Western Washington (CTWW) to define the cohort of union carpenters. The Washington State Department of Labor and Industries (L & I) provided records on workers' compensation claims filed by the cohort members. The data sets from the union and L & I were linked using a separate blind identifier assigned to each carpenter. The blind identifier was assigned and all personal identifiers were removed from the data sets before they were provided to us for analysis. The data files used in the study are described below.

The *health insurance eligibility file* from the CTWW contained the number of hours worked per month by every union member from January 1, 1989 through December 31, 1995. The file provided the number of person-hours worked per month by each cohort member. Knowing the exact number of person-hours worked per month is important in determining injury rates for construction workers because they tend to work less than the standard full-time equivalent of 40 hours a week, 50 weeks per year.

The *Washington State Membership file* of the CTWW contained date of birth, sex, and union local affiliation for all cohort members. The union local affiliation was used to assign the predominant type of work, which was used as a proxy for work exposures.

The *United Brotherhood of Carpenters and Joiners (UBC) National Membership file* contained each carpenter's initiation date into the union. Length of membership in the union was used as a proxy for experience as a carpenter.

The Washington State Department of Labor and Industries' (L & I) workers' compensation claims files provided the date of the injury; ANSI codes describing the body part injured, nature of injury (sprain, nerve condition), type of event (fall, overexertion), and source of the injury (power saw, bodily motion), and number of days of paid lost time, if any. The ANSI codes were assigned and electronically entered in the files by L & I staff based on information in the first report of injury. As described in the Background, the L & I files included all claims (medical and lost time) from state-insured firms and lost time claims from self-insured firms. For state-insured claims, L & I provided medical treatment information including place and cost of treatment, International Classification of Diseases, Ninth Revision (ICD-9) diagnostic codes (one for each outpatient visit and up to three for each hospitalization), Current Procedural Terminology (CPT) codes for outpatient visits, and ICD-9 procedure codes for hospitalized cases. This information was extracted from the medical providers' bills by L & I staff.

1.2.3 Interviews with field representatives

Each local has a field representative who is in charge of assigning union members to jobs. The representatives are generally long-time union members who have thorough knowledge of the local's history and the type of work performed by its members. They are elected by the local membership. We interviewed the field representatives from all of the locals under study to verify the predominant type of work performed by each local and obtain local-level information about working conditions, work exposures, and procedures for placing workers after an upper extremity musculoskeletal injury. A structured questionnaire was used to conduct the interviews. The process used to create the questionnaire is summarized in Chapter 2 along with the results of the interviews. The interview questionnaire is contained in Appendix 6.3.

1.2.4 Definition of the cohort

We used the health insurance eligibility files from the Carpenters Trusts of Western Washington (CTWW) to define the cohort of union carpenters. To initially qualify for union health insurance, union members had to have worked at least 275 union hours during any 3-month period. This minimum work requirement was applied as a condition for cohort membership. Union members who were not doing construction work including administrative personnel and field representatives were excluded. Initially, 12,871 carpenters were identified as eligible for the study. One hundred forty-six (1.1%) carpenters whose records were missing values for sex or age were excluded, leaving a final cohort of 12,725 carpenters. The cohort was dynamic with entrances and exits over the 84-month period. Workers contributed person-hours at risk during any month in which they worked union hours. No restriction was placed on the minimum number of hours worked per month.

1.2.5 Identification of upper extremity musculoskeletal injury claims

First, we compiled a list of ICD-9 diagnostic codes that are associated with upper extremity musculoskeletal injuries by combining lists from the National Institute for Occupational Safety and Health[8] and Duke Occupational Medicine Clinic in Durham, North Carolina (unpublished). The list was reviewed for completeness by an occupational medicine physician (Sam Moon, M.D., Duke University Medical Center) and an industrial engineer (Carolyn Sommerich, Ph.D., North Carolina State University) who specialize in musculoskeletal disorders. The list is contained in Appendix 6.4.

The 12,725 cohort members filed 13,818 approved claims for all types of work-related illnesses and injuries during 1989-1995. Eighty-six percent of all claims and 89 percent of the 3,005 paid lost time claims were filed by workers who were insured by L & I (state-insured claims). ANSI body part and nature codes were available for 89 percent of the 13,818 claims. ICD-9 diagnostic codes were available for 78 percent of the 11,935 state-insured claims.

From these claims, we identified upper extremity musculoskeletal injury claims using ANSI z16.2 body part and nature codes, ICD-9 diagnostic codes, and Current Procedural Terminology (CPT) codes. A claim was eligible for the study if the injury occurred during a month when the carpenter worked union hours and if payment for medical treatment and/or paid lost time were approved. After restricting the data set to approved claims filed by cohort members, we identified eligible claims using these steps (Figure 1.1):

Step 1. ANSI body part and nature codes for musculoskeletal injury: We selected claims with an ANSI body part code for upper extremity including the shoulder (300-389, 450) and reviewed the ANSI nature codes. Claims with an ANSI nature code of contusion (160), dislocation (190), bursitis (260), sprain (310), or nerve condition (562) were retained. Step 1 identified 1,481 claims.

Step 2. ICD-9 diagnostic codes for musculoskeletal injury: To identify claims that would be missed in Step 1, we reviewed the ICD-9 diagnostic codes for claims with: (1) an ANSI body part code for upper extremity (300-389, 450) and a nature code of ill-defined symptoms (580) or multiple injuries (400); or (2) an ANSI body part code of multiple (700), musculoskeletal (830), nervous system (840), or multiple body (870). Claims that had at least one ICD-9 diagnostic code for an upper extremity musculoskeletal injury and no indication of a laceration or fracture were retained. Claims that also involved an upper extremity laceration or fracture were excluded because the musculoskeletal injury could have been a consequence of the other injury. Table 1.1 presents the frequency distribution of three-digit ICD-9 categories for the 233 claims identified in Step 2.

Step 3. ICD-9 procedure codes for musculoskeletal surgery: Claims involving surgery were reviewed to identify carpal tunnel releases (04.43) and rotator cuff repairs (83.63) that were not identified in Steps 1 or 2. Surgeries to repair damage caused by lacerations or fractures were excluded. Step 3 identified 6 claims.

In total, 1,720 upper extremity musculoskeletal injury claims were identified. Of those, 1,671 (97%) were state-insured claims. Five hundred twenty-eight (93%) of the 568 paid lost time claims were state-insured. We classified each claim by location of the injury and whether the claim involved paid lost time. Paid lost time was used as an indicator for more serious injuries. Injury location was coded as upper arm (shoulder and upper arm), lower arm (elbow and below), or both upper and lower arm. The location of the injury for 19 claims could not be classified because the ANSI body part codes were nonspecific.

1.2.6 Definition of predominant type of work

Because personal exposure information was not available, the predominant type of work performed by each local was used as a surrogate for personal work exposures. The methods used to define predominant type of work are described in Chapter 2.

1.2.7 Definition of time at risk

We used person-hours worked as a union carpenter to measure time at risk for injury. Carpenters contributed person-hours during any month in which they worked union hours; no restriction was placed on the minimum number of hours worked per month. The individual was considered to be at risk of filing a claim during any month in which he worked, regardless of prior injuries. Because we did not know when the hours in any given month were accumulated, all hours worked during the month in which an injury occurred were assigned to the pre-injury period and considered as time at risk for injury.

1.2.8 Definition of covariates

Covariates included sex, age, and years in the union, which was used as a proxy for work experience as a carpenter. Age and years in the union were categorized. The final category boundaries were chosen after reviewing the distributions of injuries, rates of injury, and the results of regression analysis using finer category boundaries. We collapsed the more finely defined categories where doing so did not materially change the injury rates or the rate ratio estimates for predominant type of work.[59]

1.3 Analysis

1.3.1 Descriptive analysis of cohort and injury claims

Characteristics of the cohort members including age, sex, time in the union, and predominant type of work were described. Upper extremity musculoskeletal injury claims filed by cohort members were described in terms of the number of medical and lost time claims; the location, nature, and mechanism of injury; and distribution of multiple claims. Days of paid lost time and the cost of medical care, paid lost time, and permanent partial disability were also estimated. Proportionate morbidity ratios (PMRs) were calculated to see if the types of injury (fall, overexertion) and the nature on injuries (sprain, contusion) occurred in equal proportions across predominant types of work. Next, a series of incidence density rates for all claims (medical and lost time) and lost time claims alone were calculated. Rates were reported per 200,000 person hours, the equivalent of 100 full-time workers working for 1 year. Separate rates for upper arm (including the shoulder), and lower arm (from the elbow down) injuries were also produced.

To assess the usefulness of the local-level exposure information collected from the field representatives for predicting risk of injury, we produced injury claim rates based on two questions from the telephone interviews. These questions were chosen because the answers given by the field representatives showed sizable variation. The first question was, "In a typical day's work, how much time do workers spend doing one task such as hanging drywall or installing windows?" Response categories included: more than ¾ of a typical day; between ½ and ¾; more than ¼ but less than ½; and ¼ or less of the day. The other question involved reading a list of nine work tasks that are considered risk factors for upper extremity musculoskeletal injuries and asking the field representative's opinion of the degree to which each task contributed to musculoskeletal injuries among his local members. For each local, we recorded the total number of work tasks that the field representative ranked as either a moderate or major contributor to injury (problem work tasks). The number of work tasks identified as "problem work tasks" ranged from 0-8. We categorized the "problem work tasks" variable using the cutpoints 0-2, 3-5, and 6-8 and produced rates based on these cutpoints. The 906 carpenters who did not have a local affiliation had missing values for the questions. They were retained in the rate calculations and treated as a separate category. No dose-response relation existed between exposure and the rate of injury for either variable, so we did not use these questions or any others from the questionnaire as exposure variables in the risk analyses. The rates are reported in Appendix 6.5.

1.3.2 Association between predominant type of work and filing an injury claim

We explored the association between predominant type of work and risk of injury using Poisson regression. The entire cohort of 12,725 carpenters was included in analysis. As with the PMRs, we used the mixed commercial construction category as the reference group for the predominant type of work. Covariates included sex, age, and time in the union.

1.3.3 Risk factors for filing a second injury claim

We used Poisson regression analysis to examine potential risk factors for filing a second upper extremity musculoskeletal injury claim among workers who had filed one claim during the 7-year study period. Because only 36 of the 1,482 carpenters (2.4%) who filed at least one upper extremity claim filed more than two claims, we used the filing of the second claim as the outcome of interest. The sub-cohort consisted of all carpenters who filed at least one upper extremity musculoskeletal injury claim during the study period. Time at risk for a second claim began accumulating when the carpenter returned to work after the initial injury. Independent variables included predominant type of work, time in the union, age, location of the first injury (upper arm, lower arm, or both), sex, and whether the first claim involved paid lost time.

1.3.4 Returning to carpentry work after a disabling musculoskeletal injury

We examined the influence of injury- and personal-level characteristics on the length of time between injury and returning to union carpentry work among temporarily disabled men. The cohort included male carpenters who filed paid lost time claims for an upper extremity musculoskeletal injury and missed at least 1 month of work following the injury. Independent variables included predominant type of work, years of union membership, age, and location of the injury. Kaplan-Meier life tables were used to compare crude differences in survival curves for months until returning to work. Adjusted hazard ratios and 95 percent confidence intervals were calculated using Cox proportional hazards regression. The potential for bias due to censoring was explored.

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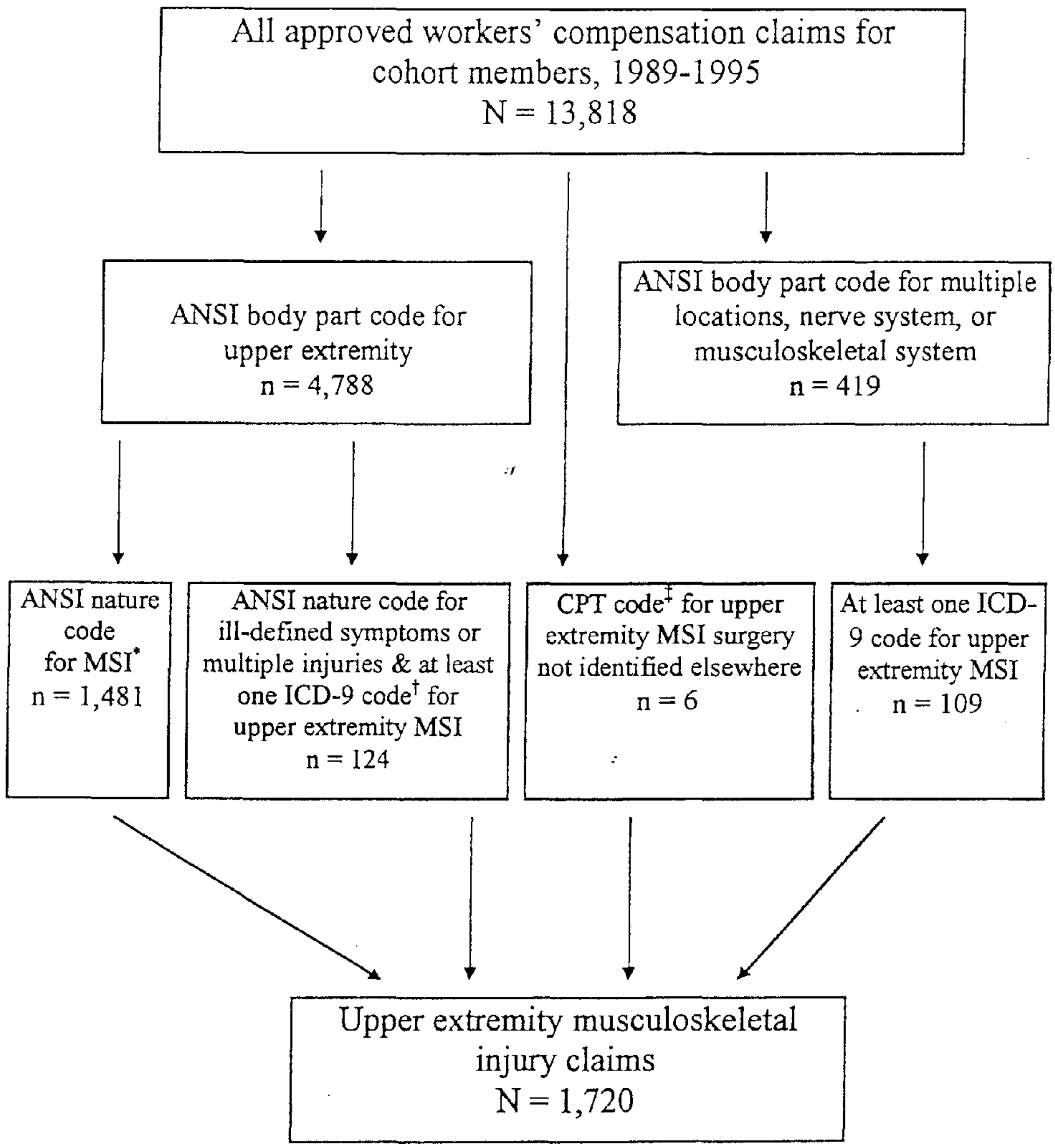
Table 1.1

International Classification of Diseases, Ninth Revision (ICD-9) diagnostic code categories for upper extremity musculoskeletal injury claims identified by ICD-9 codes

Three-digit ICD-9 code categories	ICD-9 code	Number (N = 233)	Percent
Contusion of upper limb	923	44	18.9
Peripheral enthesopathies (rotator cuff syndrome, bursitis, epicondylitis)	726	43	18.5
Spain of shoulder or upper arm	840	32	13.7
Mononeuritis of arm (includes CTS)	354	29	12.4
Other or unspecified disorders of joint	719	19	8.2
Sprain of wrist or hand	842	18	7.7
Other disorders of synovium, tendon, or bursa excluding the back	727	12	5.2
Sprain of elbow or forearm	841	11	4.7
Other derangement of the joint	718	5	2.1
Other disorders of soft tissue	729	5	2.1
Dislocation of shoulder	831	3	1.3
Osteoarthritis and allied disorders	715	3	1.3
Other or unspecified arthropathies	716	3	1.3
Injury to peripheral nerves of shoulder girdle and upper limb	955	2	0.9
Brachial plexus lesions	353	2	0.9
Injury other or unspecified	959	2	0.9

Figure 1.1

Flow diagram of identification upper extremity musculoskeletal injury claims filed by union carpenters, western Washington, 1989-1995



* MSI, musculoskeletal injury.
† ICD-9 code, International Classification of Diseases, Ninth Revision diagnostic code.
‡ CPT code, International Classification of Diseases, Ninth Revision, Current Procedural Terminology code.

2. SUMMARY OF INTERVIEWS WITH FIELD REPRESENTATIVES

2.1 Background

We undertook a study of work-related upper extremity musculoskeletal injuries among members of the United Brotherhood of Carpenters and Joiners (UBC) in western Washington. The methods and additional findings of the study are presented in Chapters 1, 3, and 4. As part of the study, we interviewed the field representative from each of the 17 locals included in the study. Field representatives are generally long-time union members who have thorough knowledge of the local's history and the type of work performed by its members. Their responsibilities include assigning union members to jobs. The primary purpose of the interviews was to verify the predominant type of work performed by each local during 1989-1995; predominant type of work was used as a surrogate for personal work exposures. We also collected information about common types of projects, working conditions, work exposures, and procedures for placing workers after an upper extremity musculoskeletal injury. This report summarizes the results of the interviews with field representatives.

The original classification system for predominant type of work was developed by the District Environmental Coordinator with the Carpenter's Health and Safety Fund and has been used in previous studies of the cohort.[1-3] The period of time covered by these studies was 1989-1992. The categories were: (1) residential construction; (2) heavy commercial construction; (3) light commercial construction; (4) mixture of heavy and light commercial (mixed commercial); (5) drywall; (6) millwright; and (7) pile driving. Heavy commercial construction involves projects with more than three stories, dams, bridges, and highway overpasses. Light commercial construction involves projects of one to three stories. Millwrights are carpenters who work in industry installing, repairing, and maintaining heavy machinery. Pile drivers install long shafts of wood, steel, or concrete into the earth to support the weight of large structures such as buildings, bridges, and docks.

2.2 Methods

We conducted telephone interviews with the field representative from each of the UBC locals in western Washington using a structured questionnaire (Appendix 6.3). The questionnaire was designed in consultation with UBC union representatives; Scott Schneider, Center to Protect Workers' Rights; Dana Loomis, Ph.D. and Carol Runyan, Ph.D., University of North Carolina; and Hester Lipscomb, Ph.D. and John Dement, Ph.D., Division of Occupational and Environmental Medicine, Duke University Medical Center. A draft of the questionnaire was reviewed by the union's District Environmental Coordinator and piloted tested with one field representative, and their comments were incorporated.

In early June 1998, a letter describing the purpose of the interviews was mailed to each field representative. The letter, which was signed by the District Environmental Coordinator, requested the representative's participation in a telephone interview. A copy of the questionnaire was attached. In late June 1998, the field representatives were contacted and telephone interviews were scheduled. Two field representatives completed the questionnaire and returned it by mail or facsimile. Telephone interviews were completed with the remaining locals during June, July, and August of 1998. One field representative who served two locals was interviewed twice.

2.3 Results

One local was excluded from the analysis because most of its members were lumber and sawmill workers rather than construction carpenters, leaving 17 participating locals. Most of the field representatives were long-time members of their locals; years of membership in the local ranged from 5 to 30, with a median of 19 years. Years of service as the local's field representative ranged from less than 1 to 17, with a median of 4 years.

2.3.1 Predominant type of work performed by locals

Each field representative was asked to identify the predominant type of work performed by his local during 1989-1995. Eleven of the 17 field representatives reported the same predominant type of work as had been originally assigned by the District Environmental Coordinator (Table 2.1). Differences in the predominant type of work were limited to the locals involved in commercial construction. Four locals that were originally designated as light commercial (buildings less than 4 stories) and two locals that were originally designated as heavy commercial (buildings 4 stories and higher, bridges, and dams) were re-categorized to mixed commercial. For this study, we used the predominant type of work assigned by the field representatives.

The predominant type of work performed remained the same throughout the 7-year study period for 16 of the 17 locals. About 85 percent of the members of the remaining local, a light commercial local, worked full time building a dam during 1991-1994. We accounted for the dam construction by assigning all members of the local the predominant type of work of heavy commercial construction for the years 1991-1994 and light commercial construction for 1989, 1990, and 1995.

Nine hundred six (7.1%) of the cohort members were not affiliated with a UBC local in western Washington. Because these carpenters were not affiliated with a local, we could not assign them to one of the existing categories of predominant type of work. Previous studies of this cohort have excluded these workers.[1-3] To learn more about these carpenters, we asked each field representative if his local ever assigned work to carpenters who were not members of the local. Ten of the 17 field representatives, representing every category of predominant type of work except for residential construction, reported that his local at least occasionally assigned work to nonmembers. According to the field representatives, most of the these carpenters were from nearby areas such as eastern Washington or Oregon, and they came to western Washington when work was not available closer to home. Based on this information, we decided to include the unaffiliated carpenters in the study and assign them to a separate predominant type of work category of "no local assignment".

2.3.2 Common types of projects

To learn about the types of projects the locals worked on, we asked the field representatives to identify the three most common types of projects their local completed. We produced the list of types of projects by adapting a list of phases of new construction published by Schneider and Susi.[4] Table 2.2 summarizes the results. Foundation or concrete work was one of the three most common types of projects for most locals. The locals reported building many controlled atmosphere buildings, or tilt-ups, which involve extensive concrete work. The term "tilt-up" refers to the construction process. The walls of the tilt-up are formed on the ground by pouring concrete into a frame of large square blocks. When the concrete has hardened, the walls are tilted up into an upright position. The tilt-ups were used primarily for storage, often for apple storage. Other structures that required extensive concrete work were bridges, overpasses, and fish hatcheries.

2.3.3 Usual work schedules

Ten of the 17 locals reported that most jobs lasted from 1-6 months. For the remaining locals, jobs either took longer than 6 months or varied too much in length to generalize. Most jobs employed ten or fewer local members. The usual apprentice to journeyman ratio was 4:1 or 5:1. The most common work schedule was 8 hours a day, 5 days a week. Four of the locals reported that they sometimes worked 10-hour days, 4 days a week. Work schedules remained about the same over the 7-year study period. Several locals reported working more overtime during the latter years. The millwright local reported working some 10- and 12-hour days when manufacturing processes were shut down for maintenance or repair. Millwrights also reported working more shift work than any other group. Most locals reported that they did not commonly work under strict time constraints; three locals reported working under strict time constraints on between one-fourth and one-half of all jobs.

2.3.4 Work activities associated with upper extremity musculoskeletal injuries

To learn more about the carpenters' work exposures, we questioned the field representatives about eight work activities that are associated with upper extremity musculoskeletal injuries. For each activity, we asked the following questions: Is it part of the job for your local members? If so, has the activity contributed to musculoskeletal injuries for your members? For activities that were thought to contribute to injuries, the field representative ranked the task as a minor, moderate, or major problem. The results are presented in Table 2.3. The work activities most associated with upper extremity musculoskeletal injuries were repeating a hand or arm motion over and over (hammering, cutting with a circular saw), and holding tools or equipment that vibrate or kick (rotor hammer, drill, compressed air tools).

2.3.5 Placing workers after an upper extremity musculoskeletal injury

Carpenters who returned to work after an upper extremity musculoskeletal injury generally returned to the job where they were injured. If, however, the carpenter had blatantly violated safety policies or was impaired by drugs or alcohol at the time of the injury, the carpenter would generally not return to the job. If the carpenter preferred not to return to the job, he could sign the out-of-work-list and wait to be dispatched to another job.

Twelve of the 17 locals reported that temporarily disabled carpenters rarely if ever returned to work with a "light duty" work restriction. And, only three locals reported that contractors could almost always find a light duty assignment when one was needed. Large contractors and self-insured contractors were more frequently able to accommodate a carpenter with work restriction. Possible motivations for contractors to offer a light duty assignment included stopping the accrual of lost work time for the injury and a desire to help out a long-term employee.

2.4 Discussion

As in previous studies of this cohort,[1-3] we used the predominant type of work performed by each union local as a surrogate for personal work exposures of its members. We interviewed each field representative to verify the predominant type of work performed by his local and to see if the type of work performed remained stable over the entire study period. For the most part, the field representatives' classification of predominant type of work matched the classification used in the previous studies. Six of the 13 commercial construction locals were reclassified from either heavy commercial or light commercial to mixed commercial, which includes both heavy and light commercial. The predominant type of work performed by each local remained the same throughout the 7-year study period for all but one of the locals; we allowed predominant type of work for that local to vary with time.

We also asked the field representatives about common types of projects completed by the locals. The representatives confirmed our hypothesis that there was substantial overlap in the types of projects undertaken by locals from different categories of predominant type of work. For example, 14 of the 17 locals reported concrete formwork to be one of their three most common types of projects. Nine of these 14 locals also reported framing as one of their three most common types of projects; all nine were commercial construction locals (four light commercial, four mixed commercial, and one heavy commercial). Because of the high degree of overlap in types of projects completed by the locals, the predominant type of work variable is probably an inadequate surrogate for personal work exposures. Future studies of this cohort should explore alternative ways to characterize work exposure.

Collecting survey or observational data on personal work exposures for each member of this cohort is not practical. However, tracking the types of construction projects that individual carpenters work on over time with administrative data may be feasible. The potential for using administrative records from field representatives, contractors, and job foremen for this purpose should be explored. This information could provide additional insight into the contribution of work exposures–both cumulative exposures and work activities near the time of the injury–to musculoskeletal injuries among carpenters.

2.5 References

1. Lipscomb HJ. The use of combined administrative data sources for surveillance of occupational back disorders among union carpenters [dissertation]. Chapel Hill (NC): University of North Carolina; 1995.

2. Lipscomb HJ, Dement JM, Loomis DP, Silverstein B, Kalat J. Surveillance of work-related musculoskeletal injuries among union carpenters. Am J Ind Med 1997;32:629-40.

3. Lipscomb HJ, Kalat J, Dement JM. Workers' compensation claims of union carpenters 1989-1992: Washington State. Appl Occup Environ Hyg 1996;11:56-63.

4. Schneider S, Susi P. Ergonomics and construction: a review of potential hazards in new construction. Am Ind Hyg Assoc J 1994;55:635-49.

Table 2.1

Predominant type of work assigned to each local by the field representative versus the District Environmental Coordinator of the Health and Safety Fund

Local	City	Predominant type of work assigned by field representative	Predominant type of work assigned by District Environmental Coordinator
1144	Seattle	Drywall	Drywall
1797	Renton	Heavy commercial	Heavy commercial
2127	Centralia	Heavy commercial	Heavy commercial
770	Yakima	Light commercial	Light commercial
1303	Port Angeles	Light commercial	Light commercial
1532	Mount Vernon	Light commercial	Light commercial
2205	Wenatchee	Light commercial	Light commercial
204	Renton	Millwright	Millwright
2396	Tacoma	Pile driving	Pile driving
456	Bremerton	Residential	Residential
562	Everett	Mixed commercial	Mixed commercial
131	Seattle*	Mixed commercial	Heavy commercial
1597	Bremerton*	Mixed commercial	Heavy commercial
317	St. Aberdeen*	Mixed commercial	Light commercial
470	Tacoma*	Mixed commercial	Light commercial
756	Bellingham*	Mixed commercial	Light commercial
1148	Olympia*	Mixed commercial	Light commercial

* The field representative reported a different predominant type of work for his local than was originally reported by the District Environmental Coordinator.

Table 2.2

Distribution of the three most common types of projects reported by the locals

Types of construction projects*	Number of locals
Foundation/concrete work for buildings	14
Framing	11
Building interior (drywall, flooring, trim work, door installation)	7
Bridges/overpasses/docks	7
Building exterior (siding, sand blasting, window installation)	4
Work outside building	2
Millwright work	2
Structural steel work	1

* The drywall local listed two common types of project and millwright local listed one.

Table 2.3

Field representatives' perceptions of the role of common work activities in the development of upper extremity musculoskeletal injuries among local members*

Work activity	Not part of job	Not a problem*	Minor Problem	Moderate Problem	Major Problem	Tools and materials commonly involved
Holding arms in same position†	8	3	4	1	0	
Working with arms above shoulder level	0	8	4	2	3	Drywall, ceilings, soffits, drilling
Lifting ≥40 lbs.: floor to waist	1	5	5	3	3	Welding rods
Lifting ≥40 lbs.: waist to chest or above	0	5	4	4	4	Drywall (105 lbs.), tilt braces (210 lbs., 2 men), windows
Repeating hand or arm motion over and over	0	1	4	7	5	Hammering, welding, circular saw
Using power hand tools	0	6	5	4	2	Power hammer, Hilti gun, skill saw, grinder, hydro tork, air rattle gun
Using non-power hand tools	0	6	5	3	3	Hammer, screwdriver
Holding tools or equipment that vibrate or "kick"	0	3	4	8	2	Rotor hammer, recipro-cating saw, compressed air tools, chain saw, drill

* The interviewer read the following text, "Certain work tasks are thought to increase the risk of musculoskeletal injury. We would like to get an idea of how common these tasks are among your members and whether they seem to pose a problem for the local. Think back on the type of work the local was involved in during the years 1989-1995. I will read each task and ask you if it was a routine part of the job for your local. If the task was usually part of the job, I will ask if it created problems for the workers." For tasks that were problems, the field representative was asked to rate the problem as minor, moderate, or major.

† Activity is part of a typical job but does not contribute to upper extremity musculoskeletal injuries.

‡ One local did not answer.

3. WORK-RELATED UPPER EXTREMITY MUSCULOSKELETAL INJURIES AMONG UNION CARPENTERS: DESCRIPTION OF CLAIMS, CLAIM RATES, AND RISK FACTORS FOR FILING A CLAIM

3.1 Background

Musculoskeletal injuries are common in the construction trade, and they are costly in terms of personal suffering, absenteeism, and loss of productivity. An estimated 40 to 65 percent of all workers' compensation costs in construction is due to musculoskeletal injuries.[1] Despite their personal and economic toll, musculoskeletal disorders among construction workers have not been well described. Practical problems make on-site surveillance of construction workers difficult. Work sites are often small and scattered, and workers move from job to job, often having several employers within a year.[1] For these reasons, secondary data sources are particularly useful for surveillance of work-related injuries among construction workers. Recent studies have demonstrated the practicality of combining union administrative data with workers' compensation records to describe work-related injuries in a cohort of union carpenters in western Washington.[2-4] The current study used these data sources to describe upper extremity musculoskeletal injuries and assess risk factors for injury among 12,725 active union carpenters during 1989-1995.

Washington State requires employers that are not self-insured to purchase workers' compensation insurance through a state-managed program. The Washington Department of Labor and Industries program (L & I) insures approximately two-thirds of the state's 2.5 million workers.[5] L & I maintains an electronic database of workers' compensation claims. The database contains all claims filed by workers who are insured through L & I (state-insured claims). Claims filed by employees of self-insured firms (self-insured claims) are included only if the claim involved compensation for lost work time (paid lost time) or permanent disability; self-insured claims involving only medical care are not consistently entered. In Washington, workers receive paid lost time if they miss more than 3 work days with work-related illness or injury. The proportion of the states' construction workers who are insured by the state-managed program is not known.

L & I classifies work-related injuries by American National Standards Institute (ANSI) codes. Codes are provided for the part of the body injured, the nature of the injury, the type (mechanism) of injury, and the source (substance or object associated with the injury). The codes are assigned by L& I staff based on the first report of injury, and they are included in the electronic database. For state-insured claims, L& I staff also enter the International Classification of Diseases, Ninth Revision (ICD-9) diagnostic codes and Current Procedural Terminology (CPT) codes in the database. This information is not available for self-insured claims because self-insured firms are not required to submit medical billing data to L & I. For the current study, workers' compensation claims involving only medical costs were referred to as medical claims. Claims that also involved paid lost time were referred to as lost time claims.

The objectives of this study were to describe work-related upper extremity musculoskeletal injuries over a 7-year period in a cohort of 12,725 union carpenters, explore the association between predominant type of work performed and risk of filing an injury claim, and examine factors associated with filing a second injury claim.

3.2 Methods

3.2.1 Administrative data sources

The cohort was identified using the health insurance eligibility files from the Carpenters Trusts of Western Washington (CTWW). Upper extremity musculoskeletal injury claims were identified using the Washington State Department of Labor and Industries (L & I) files to identify the workers' compensation claims. These databases are described in Chapter 1.

3.2.2 Identification of upper extremity musculoskeletal injury claims

The methods used to identify upper extremity musculoskeletal injury claims are described in Chapter 1.

3.2.3 Definition of predominant type of work and covariates

Each cohort member was assigned the predominant type of work performed by the local he or she was affiliated with at the time we received the data from CTWW in December 1996. Assignment of predominant type of work was based on interviews with the field representatives, as described in Chapter 2. About 7 percent of the carpenters in the cohort were not affiliated with a UBC local in western Washington. These carpenters were assigned to a separate category entitled "no local assignment". Predominant type of work categories included: (1) residential construction; (2) heavy commercial construction; (3) light commercial construction; (4) mixture of heavy and light commercial (mixed commercial); (5) drywall; (6) millwright; (7) pile driving; and (8) no local assignment.

The union membership files provided the date of birth, sex, and time in the union for cohort members. Time in the union was used as a surrogate for years of carpentry experience. Previous studies of the cohort dichotomized time in the union into less than four and four or more years in an attempt to separate apprentices from journeymen carpenters. In the current study, we categorized time in the union into four groups (<1, 1-4, 5-14, ≥15 years) to see if a dose-response relation existed between time in the union and risk of filing a claim.

3.2.4 Definition of time at risk

We used person-hours worked as a union carpenter to measure time at risk for injury. Carpenters contributed person-hours at risk during any month in which they worked union hours; no restriction was placed on the minimum number of hours worked per month. The individual was considered to be at risk of filing a claim during any month in which he worked, regardless of prior injury claims. Because we did not know when the hours in any given month were accumulated, all hours worked in a month in which an injury occurred were assigned to the pre-injury period and considered as time at risk for injury.

3.2.5 Analysis

We calculated proportionate morbidity ratios (PMRs) to see if the location of the injury, the nature of the injury (sprain, contusion), and the types of events leading to injury occurred in equal proportions across predominant types of work. Women were excluded from the PMRs because they represented less than five percent of the cohort. Mixed commercial carpenters served as the reference group because they comprised the largest predominant type of work category and their overall claim rate was lower than all other groups except for pile drivers. The PMRs were indirectly adjusted to the age distribution of the mixed commercial carpenters. Statistical significance of each PMR was assessed using a chi-square test with 1 degree of freedom.[7]

We calculated crude injury claim rates for all claims and for claims involving paid lost time. Rates were standardized per 200,000 person-hours worked, the equivalent of 100 full-time workers working for 1 year. Age and time in the union were allowed to vary with time. The unit of analysis was the claim, and each claim was considered to be independent even though some carpenters filed multiple claims. We calculated ninety-five percent confidence intervals (CIs) for the rates assuming the Poisson distribution.[8]

Separate rates for upper and lower arm claims were also produced. For this set of rates, the 87 claims involving both the upper and lower arm were included in the upper arm category because: (1) the paid lost time and medical expenses associated with these injuries was more similar to those for upper arm claims than lower arm claims; and (2) rates based on only 87 claims would be unstable. The 19 claims for which the location of the injury could not be classified from these calculations were excluded.

We used Poisson regression analysis to explore the association between predominant type of work and risk of filing a claim. As with the PMRs, the mixed commercial construction category served as the reference group for the predominant type of work. The initial multivariate model included claims for all upper extremity musculoskeletal injuries. Next, we modeled the risk for filing a paid lost time claim.

Finally, to see if some risk factors were more strongly associated with either upper arm or lower arm injuries, we constructed separate models by location of injury. In total, we constructed models for the following six outcomes: all upper extremity claims (medical and lost time); upper arm claims; lower arm claims; all lost time claims; upper arm lost time claims; and lower arm lost time claims. As with the rate analysis, the 87 claims involving both the upper and lower arm were included in the upper arm category and the 19 claims for which the location of the injury could not be classified were excluded from the models involving location of the injury. The unit of analysis was the claim. Covariates included sex, age, and time in the union. All variables were represented by indicator variables, and age and time in the union were allowed to vary with time. The final category boundaries for age and time in the union were chosen after reviewing the distributions of injuries, rates of injury, and the results of regression analysis using finer category boundaries; the categories were collapsed where doing so did not materially change the rate ratios for predominant type of work.[9] Goodness of fit of each model was assessed using the estimate of dispersion (deviance divided by its degrees of freedom).[10,11] Estimates of dispersion close to one indicated that the random variation in injury claim rates was roughly equal to that specified by the Poisson distribution. None of the models constructed for this study had an estimate of dispersion substantially greater than one (overdispersed). The estimate of dispersion for the model containing only the upper arm claims was 0.6, indicating that the observed variation in claim rates was less than predicted by the Poisson distribution (underdispersed). For this model, the standard errors of the rate ratios were adjusted by multiplying the covariance matrix by the estimate of dispersion.[12] The adjusted standard errors were produced with the DSCALE option in the GENMOD procedure of SAS.[13] The resulting confidence intervals for the rate ratios were slightly narrower than those produced by the unscaled model (range of differences in confidence intervals between unscaled model and scaled model = 0.1 – 0.5).

Finally, using Poisson regression we examined potential risk factors for filing a second claim among workers who had filed one claim during the 7-year study period. The sub-cohort consisted of all carpenters who filed at least one claim during the study period. Because only 36 of the 1,482 carpenters (2.4%) who filed at least one claim filed more than two claims, we used the second claim as the outcome of interest. Time at risk for a second claim began accumulating when the carpenter returned to union carpentry work after the initial injury. Independent variables included predominant type of work, time in the union when the first claim was filed, sex, age when the first claim was filed, whether the first claim involved paid lost time, and location of the first injury (upper arm, lower arm, or both). The three claims for which the location of the first injury could not be classified were included in the "both" category. Preliminary models also included the nature of the first injury and whether the first injury required hospitalization. These variables were dropped from later models because they did not add to the model's predictive capacity or confound the risk estimates for other covariates. The estimate of dispersion for the final model was 0.8, indicating that the data were slightly underdispersed. As described above, we adjusted the standard errors of the rate ratios to account for the underdispersion.

3.3 Results

3.3.1 Description of the cohort

The cohort consisted of 12,725 union carpenters, each of whom had worked at least 3 months of union hours during 1989-1995. Cohort members worked a total of 64,661,839 hours during the 7-year study period. Nearly 98 percent of the cohort members were male. Age at entry into the cohort ranged from 17 to 76 years, with a mean of 35 and a median of 33 years. Time in the union at entry into the cohort ranged from less than 1 year to 62 years, with a mean of 7 years and a median of 2 years. Nearly 43 percent of carpenters had less than 1 year of union experience when they entered the cohort (Table 3.1).

3.3.2 Description of claims and claim costs

We identified 1,720 workers' compensation claims filed by 1,482 cohort members; 568 (33%) claims involved paid lost time between 1989-1995. Carpenters who worked for self-insured firms filed forty-nine claims. The costs of medical care and paid lost time were totaled as of December 1996. Seventy-nine claims (4.6%) remained open at that time. Costs for medical care, which were recorded for state-insured claims but not for self-insured claims, totaled nearly $4.1 million. We estimated the total cost of medical care for the self-insured claims to be $323,155 by multiplying the mean cost of state-insured lost time claims by number of self-insured claims (N = 49). Claimants were compensated for 134,728 days of paid lost time at a cost of nearly $8 million. The median number of paid lost time days was 75, and the median payment was $4,378. One hundred ninety-five claimants received compensation for permanent partial disability totaling nearly $1.4 million. We estimated the total workers' compensation payments for medical care, paid lost time, and disability for the 7-year period to be $13,770,270, for an average cost of nearly $2.0 million per year or $0.21 per hour worked.

Lower arm claims accounted for 68 percent of all upper extremity claims and 54 percent of lost time upper extremity claims (Table 3.2). Twenty-six percent of all lower arm injuries required paid lost time. In contrast, 43 percent of upper arm claims and 74 percent of claims involving both the upper and lower arm required paid lost time. The median cost of lower arm claims was $177, compared to $340 for upper arm claims and $4,787 for upper and lower arm claims. Likewise, carpenters who were temporarily disabled with lower arm claims required fewer days of paid lost time. The median number of paid lost time days for lower arm claims was 55 days, compared to 92 days for upper arm claims and 382 days for upper and lower arm claims.

Sprains were the most common nature of injury, accounting for nearly one-half of all claims and slightly over one-half of lost time claims. Contusions were also common, but they were less likely than sprains to result in paid lost time (14 percent of all claims for contusions versus 35 percent of all claims for sprains required paid lost time). Claims for disorders of the peripheral nervous system represented eight percent of all claims and 16 percent of all lost time claims. The most common type of event was overexertion, accounting for 46 percent of all claims and 60 percent of paid lost time claims.

3.3.3 Proportionate morbidity analysis

The PMRs revealed few important differences in the characteristics of upper extremity musculoskeletal injury claims by predominant type of work (Table 3.3). Because PMRs based on five or fewer claims were considered unstable, statistical tests of significance were reported only on PMRs based on more than five claims. The proportion of claims involving both the upper and lower arm among drywall carpenters was higher compared to mixed commercial carpenters (PMR = 165). A higher proportion of claims filed by millwights (PMR = 717) and light commercial carpenters (PMR = 201) involved getting the arm caught compared to mixed commercial carpenters.

3.3.4 Claim rates

The overall crude claim rate for upper extremity musculoskeletal injury was 5.3 per 200,000 hours worked (95% CI = 5.0, 5.7); annual claim rates remained stable throughout the 7-year study period. Claim rates ranged from 2.0 per 200,000 hours for pile drivers to 11.0 per 200,000 hours for carpenters with no local assignment (Table 3.4). The lost time claim rate was 1.8 per 200,000 hours worked (95% CI = 1.6, 1.9), with claim rates ranging from 0.6 per 200,000 hours for pile drivers to 3.8 per 200,000 hours for carpenters with no local assignment. Claim rates were higher among the less experienced carpenters. Women were about twice as likely as men to file a claim and three times as likely to file a lost time claim. Overall, claim rates declined with age for carpenters through age 55 years. Lost time claim rates, however, remained fairly stable across the age categories.

3.3.5 Risk factors for filing a claim

Table 3.5 presents the results of the Poisson regression analysis for risk of filing an upper extremity musculoskeletal injury claim. The results from the upper arm lost time claims and lower arm lost time claims models were not presented because the results were not materially different from those for all lost time claims. Residential carpenters, drywall installers, and carpenters with no local assignment had a modest increased risk of filing a claim compared to mixed commercial construction carpenters. The pattern of increased risk for these groups held for lost time claims as well as upper arm and lower arm claims. Upper arm claims contributed more than lower arm claims to the increased relative risk of filing a claim for all three groups. Pile drivers had a consistently lower relative risk of filing a claim. A dose-response relation existed between years of union experience and risk of filing a claim. Carpenters with less than 1 year of union experience upon entering the cohort had nearly a two-fold risk of filing a claim compared to carpenters with more than 15 years experience (rate ratio [RR] = 1.9, 95% CI = 1.6, 2.3). The least experienced carpenters were 2.5 times as likely as the most experienced to file a paid lost time claim (RR = 2.5, 95% CI = 1.8, 3.4). Women were about twice as likely as men to file a claim (RR = 2.1, 95% CI = 1.6, 2.8) and nearly 3 times as likely to require paid lost time (RR = 2.9, 95% CI = 2.0, 4.3). The increase in risk for filing a paid lost time claim among women (versus men) was mostly due to lower arm injuries (rate ratio for lower arm lost time claim for women = 4.3, 95% CI = 2.8, 6.7; rate ratio for upper arm lost time claim for women = 1.2, 95% CI = 0.6, 2.3). Workers aged 25 years and younger were only slightly more likely than older workers to file a claim. The youngest carpenters were, however, less likely to require paid lost time for their injuries (rate ratio for age $\leq$ 25 years old versus $\geq$41 years = 0.6, 95% CI = 0.4, 0.8).

In this analysis, we treated each claim as if it were independent even though 196 carpenters filed multiple claims. Violating the assumption of independence among observations can produce falsely low variance estimates of the rate ratios, a phenomenon referred to as overdispersion.[12] It seems unlikely that the correlation between claims filed by the same carpenter affected the variance estimates in this study because none of the models were overdispersed. To further explore this possibility, we restricted injuries to the first event and constructed regression models for all claims and lost time claims. Neither the rate ratios nor the confidence intervals produced by these models differed materially from those in the final models (Appendix 6.6).

3.3.6 Risk factors for filing a second claim

There were 196 claims for a second musculoskeletal injury filed during the study period. Hours at risk for a second injury totaled 4,475,824. Sixty-seven claims (34%) required paid lost time. Second claims were no more likely to require paid lost time than first claims. For claims requiring paid lost time, however, the median number of paid lost time days for second injury claims was nearly twice that for first injury claims (123 days versus 72 days). The distributions of nature of injury and location of injury for second claims were similar to the distributions for all claims (data not presented). Women filed only seven claims (3.6%) for second injuries. Table 3.6 presents the results of the Poisson regression analysis. Drywall installers had a small increased risk of filing a second upper extremity musculoskeletal claim compared to mixed commercial construction carpenters. The rate ratios for residential carpenters, millwrights, pile drivers and carpenters with no local assignment were considered unstable because they were based on five or fewer claims. Consistent with the analysis of all claims, the least experienced carpenters were most likely to file a second claim (rate ratio for < 1year union experience versus ≥ 15 years = 2.2, 95% CI = 1.2, 3.6), and the risk of filing a second claim steadily decreased as years of experience increased. Women were about 50 percent more likely than men to file a second claim, although the estimate was imprecise (RR = 1.5, 95% CI = 0.8, 3.1). To see if the precision of the other risk estimates improved when the number of variables in the model was reduced, we removed the indicator variables for predominant type of work. Neither the rate ratios nor the confidence intervals changed appreciably. Lastly, the reduced model was restricted to only men, and the rate ratios and confidence intervals stayed virtually the same (Appendix 6.7).

3.4 Discussion

We described upper extremity musculoskeletal injury claims and assessed risk factors for injury among 12,725 active union carpenters during 1989-1995. The overall claim rate for upper extremity musculoskeletal injuries was 5.3 per 200,000 hours worked. The average annual cost of the claims was nearly $2.0 million; the average cost per hour worked was $0.21. Claim rates for all upper extremity musculoskeletal injuries and for injuries requiring paid lost time were highest for residential carpenters, drywall installers, and carpenters from locals outside of the western Washington. The claim rate for pile drivers was less than one-half of the next lowest rate.

For the most part, the patterns of risk for filing a claim seen in the crude rate analysis persisted in the multivariate analysis. The inverse dose-response relation between years of union experience and risk of filing a claim persisted, while the inverse dose-response relation between age and filing a claim diminished. These findings suggest that the risk of injury for an inexperienced carpenter may be related more to work activities than to his age. Lacking personal exposure data, the current study could not examine the effect of individual work exposures on risk of injury. Separate focus groups of union members in the Seattle area revealed that carpenters attribute the increased risk of injury among inexperienced workers to a desire of new recruits to prove themselves and the tendency to use inexperienced workers as pack horses.[14] Limited safety training among inexperienced workers may also contribute to their higher injury rates.

When other factors were controlled in the multivariate analysis, workers aged 41 years and older were most likely to require paid lost time for their injuries. One possible explanation for this finding is that older individuals may take slightly longer to recover from injuries that require short recovery times. In Washington, compensation for lost work time begins on the fourth day of missed work. If older workers take a few days longer to recover from these injuries, they would be more likely to require paid lost time. Older carpenters may also be more susceptible to chronic musculoskeletal disorders that have long latent periods and long recovery periods. Lastly, older workers may become accustomed to the physical discomfort associated with strenuous work, and they may delay filing a claim until their discomfort becomes disabling.

Women were about twice as likely as men to file a claim and nearly 3 times as likely to require paid lost time. The increased risk for filing a paid lost time claim among women was mostly due to lower arm injuries. This finding suggests that women's reduced upper body strength compared to men may not necessarily predispose them to upper extremity injury. Factors associated with wrist and forearm disorders including repetitive movements of the forearm and wrist and use of ill-sized tools may be more important contributors.

The finding of higher rates of lower arm injury among women is consistent with findings of an earlier study of this cohort. In a 4-year follow-up of the cohort, Lipscomb et al. reported that women were about 4 times as likely as men to file a claim for a forearm sprain or nerve condition.[3] There was no significant difference in relative risk by sex for filing claims for musculoskeletal injuries of the axial skeleton or lower extremity. Studies in other workforces[15-17] and in all private industries[18] also reported higher rates of wrist and forearm CTDs among women. Still, other studies found no sex difference in rates of carpal tunnel syndrome when accounting for work exposures.[19,20] Possible explanations for the sex differences seen in some studies include physiological differences, ergonomic design factors, exposure differences, differential reporting of injuries, and differences in perceived work- and non-work-related stress.[6,17] Because of the small number of women in the cohort and the lack of personal exposure data, the causes of the sex differences in risk of injury seen in this study could not be examined.

Interpretation of the analysis of risk of filing a second claim was somewhat limited because of the small number of second claims (N = 196). Nonetheless, the inverse dose-response relation between union experience at the time of the first injury and risk of filing a second claim was similar to the relation of union experience and filing any claim.

3.4.1 Strengths and limitations

The ability to obtain actual person-hours at risk in a population of carpenters is a unique strength of this study. Because of the temporary nature of construction projects, carpenters often do not work a standard schedule of 40 hours per week, 50 weeks per year. We accounted for the carpenters' variable work schedules by using person-hours worked during each month of the 84-month observation period. Carpenters were included in the cohort during any month in which they worked union hours. Poisson regression analysis was ideally suited for studying this cohort because the method can accommodate variable entry times and censoring.[10,11] Additionally, the analysis did not require consent of the cohort members or active follow-up, eliminating the potential for selection and recall bias.

The data sources used in this analysis imposed several limitations. The most important limitation was the lack of personal exposure information. Without this information, the study could not identify the particular work tasks that were associated with an increased risk of upper extremity musculoskeletal injury.

During interviews with the field representatives, we asked each representative about the most common types of projects undertaken by his local. This information confirmed our belief that there was substantial overlap in the types of projects completed by locals from different categories of predominant type of work. Indeed, nine of the 13 commercial construction locals reported that concrete formwork and framing were among their most common types of projects. This overlap in the types of projects undertaken may explain why there was little difference in the relative risks for injury among the three groups of commercial construction carpenters.

We used approved workers' compensation claims to identify injuries associated with working as a union carpenter. For an injury to be included, the injured worker had to file a claim, and the employer and the health care provider had to agree that the injury was work-related. To the extent that these conditions were not met, workers' compensation data would underestimate the burden of work-related injuries. Conversely, some potential exists for misclassifying off-the-job injuries as work-related. Many of the cohort members worked sporadically as a union carpenter. It is possible that some carpenters worked nonunion jobs during their hours off. We had no information on the number of hours they may have worked or the type of work they may have performed. In an attempt to avoid overestimating injury rates, we excluded the 121 claims for injuries that occurred in a month in which the individual did not work union hours. Nonetheless, exposure to nonunion work, as well as these other injuries that occurred on nonunion time, could have had an impact on the injury claim rates reported in this study.

The L & I data did not include self-insured claims for medical care only. Excluding these claims from the study caused us to underestimate the rates for less serious injuries. Because only seven percent of the paid lost time claims were self-insured, we probably underestimated the overall injury claim rate by less than ten percent. We may have, however, substantially underestimated the injury claim rate for pile drivers. This group had the highest proportion of lost time claims that were self-insured (36%). The proportion of lost time claims that were self-insured for all other predominant types of work ranged from 0 to 13 percent. Even if we substantially underestimated the injury claim rate for pile drivers, the effect on the overall claim rate would remain small because pile drivers represent only five percent of the cohort and their relative risk of injury was low.

If the carpenters who worked for self-insured firms differed from carpenters who worked for state-insured firms in ways that affected their injury risk (e.g., more experienced, no females), the rate ratios for injury claims involving medical care only could be biased. We could not directly assess the potential for bias with existing data. But, given the small proportion of lost time claims that were self-insured, it seems likely that any bias introduced by the missing self-insured medical claims would be small for most predominant types of work.

The ANSI codes definitions used to identify musculoskeletal injuries are crude. The codes are based predominantly on the first report of injury, which is often completed before the worker visits a physician. Therefore, misclassification of the nature of injury and the body part involved is possible. Additionally, the ANSI codes do not indicate which arm was injured. Without this information, we could not distinguish between true recurrent injuries, multiple injuries to the same arm but to different tissue, and injuries to both arms. By analyzing these separate categories of injuries as one, we may have masked associations that exist for some but not all categories (e.g., dry wall hangers may be at increased risk for bilateral shoulder injuries, or residential construction workers may have an increased incidence of recurrent wrist injury).

We used ICD-9 diagnostic codes to help identify claims that were not identified by ANSI codes alone. In doing so, we assumed that an ICD-9 code consistent with an upper extremity musculoskeletal injury reflected an actual diagnosis. It is possible, however, that that some ICD-9 codes represented a clinician's presumption rather than an actual diagnosis. To see if the relative risk for filing a claim differed according to how the claim was identified (with or without ICD-9 codes), we constructed a regression model that included only the claims identified by ANSI codes (N = 1,481). The rate ratios for predominant type of work and all of the covariates were nearly the same as those in the final model for all claims (Appendix 6.8).

3.4.2 Conclusions

Previous studies of this cohort established that the risk of musculoskeletal injury is greater for carpenters with less than 4 years of union experience.[2,3] In this study, we found the risk of filing an upper extremity musculoskeletal injury claim decreased steadily as the years of union experience increased. Once injured, the less experienced carpenters were also more likely to file a second claim than their more experienced counterparts. These findings speak to the need for enhanced primary, secondary, and tertiary prevention of musculoskeletal injuries among new recruits and apprentice carpenters. The UBC is addressing this need, at least in part, by integrating ergonomic awareness into the 4-year carpenter apprenticeship course.[21]

Women are beginning to enter the construction trades in sizable numbers. As their numbers grow, there will be an increasing need to understand the influence of sex on the risk of musculoskeletal injury among carpenters. Our results suggest that musculoskeletal injuries of the wrist and forearm may pose a substantial threat to the careers of female carpenters. The reasons for the increased risk of injury among women carpenters are not well understood. Research to identify tools and work tasks associated with these disorders among female carpenters is needed. The protective effect of physical conditioning in reducing the risk of injury and the course of recovery from musculoskeletal injury may also differ by sex. Answers to these questions may help women gain a foothold in the construction trade and in other physically demanding, male-dominated trades.

3.5 References

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Table 3.1

Characteristics of union carpenters, western Washington, 1989-1995 (N = 12,725)

Characteristic	Number	Percent
Predominant type of work		
Mixed (heavy and light commercial)	5,411	42.6
Heavy commercial	1,976	15.5
Drywall	1,768	13.9
Light commercial	1,482	11.6
No local assignment	906	7.1
Pile driving	633	5.0
Residential	333	2.6
Millwright	216	1.7
Years of union experience at entry into cohort		
< 1	5,416	42.6
1-4	1,745	13.7
5-14	2,936	23.1
≥ 15	2,628	20.6
Sex		
Female	320	2.5
Male	12,405	97.5
Age at entry into cohort (years)		
≤ 25	2,429	19.1
26-40	6,977	54.8
≥ 41	3,319	26.1
Distribution of upper extremity musculoskeletal injury claims		
0 claims	11,243	88.4
1 claim	1,286	10.0
≥ 2 claims	196	1.5

Table 3.2

Characteristics of upper extremity musculoskeletal injury claims among union carpenters by type of claim (medical or lost time), western Washington, 1989-1995

	Medical claims (N = 1,152)		Lost time claims (N = 568)	
	Number	Percent	Number	Percent
Part of arm injured				
Lower	872	75.7	306	53.9
Upper	247	21.4	189	33.3
Both	23	2.0	64	11.3
Unknown	10	0.9	9	1.6
Nature of injury				
Sprain	531	46.0	292	51.4
Contusion	425	36.9	70	12.3
Peripheral nerve condition	43	3.7	93	16.4
Ill-defined symptoms	66	5.7	47	8.3
Bursitis	43	3.7	14	2.5
Multiple injuries	27	2.3	27	4.8
Dislocation	17	1.5	23	4.0
Other	0	0	2	0.4
Type of event				
Overexertion	456	39.6	341	60.0
Struck	413	35.8	85	15.0
Fall	186	16.1	106	18.7
Caught	56	4.9	9	1.6
Bodily reaction	8	0.7	4	0.7
Other or missing	33	2.9	23	4.0

Table 3.3

Proportionate morbidity ratios (PMRs)* for upper extremity musculoskeletal injury claims among male union carpenters, western Washington, 1989-1995

Characteristic of claim	Resi-dential (N=41)	Drywall (N=362)	Mill-wright (N=37)	Light comm. (N=184)	Heavy comm. (N=281)	Pile driving (N=43)	No local assignment (N=51)	Mixed comm. (N=721)
Part of arm injured								
Upper	139	112	67	82	81	116	100	100
Lower	82	92	114	107	106	94	94	100
Both	†123	‡165	†119	98	133	†119	†181	100
Nature of injury								
Sprain	117	112	‡51	96	105	71	120	100
Contusion	86	‡73	†192	90	96	157	95	100
Nerve condition	.	132	†36	121	84	.	62	100
Ill-defined symptoms	†75	104	†117	96	113	†107	77	100
Bursitis	†163	96	†175	158	120	†74	.	100
Multiple injuries	†236	120	†167	128	66	†308	†84	100
Dislocation	†86	56	.	122	85	†80	.	100
Type of event								
Overexertion	109	‡122	55	117	106	60	130	100
Struck	63	‡74	141	77	90	140	100	100
Fall	145	111	†83	109	98	153	†42	100
Caught	†285	78	‡717	‡201	‡221	†97	.	100
Bodily reaction	.	†362	.	†180	†752	.	.	†100

* PMRs are indirectly adjusted for age distribution of the mixed commercial construction category of predominant type of work.

† PMR may be unstable because the point estimate is based on five or fewer claims.

‡ p value ≤ 0.05 and PMR based on more than five claims.

Table 3.4

Crude injury claim rates for upper extremity musculoskeletal per 200,000 hours worked among union carpenters, western Washington, 1989-1995

	All claims (N = 1,720)		Lost time claims (N = 568)	
	Rate	95 % CI*	Rate	95 % CI
Predominant type of work				
No local assignment	11.0	8.2, 14.6	3.8	2.3, 6.0
Residential	9.2	6.6, 12.5	2.7	1.4, 4.7
Drywall	7.5	6.7, 8.4	2.8	2.3, 3.3
Millwright	5.9	4.1, 8.1	1.4	0.7, 2.7
Light commercial	5.4	4.6, 6.2	1.4	1.0, 1.8
Heavy commercial	5.2	4.7, 5.9	1.7	1.4, 2.1
Mixed	4.8	4.5, 5.2	1.6	1.5, 1.9
Pile driving	2.0	1.4, 2.6	0.6	0.3, 1.0
Years in union at entry into cohort				
< 1	7.5	7.0, 8.1	2.3	2.0, 2.7
1-4	6.3	5.6, 7.2	2.3	1.9, 2.8
5-14	4.3	3.9, 4.7	1.3	1.1, 1.6
≥ 15	3.6	3.2, 4.1	1.4	1.1, 1.7
Sex				
Female	12.0	11.2, 13.3	5.2	3.4, 7.5
Male	5.2	4.3, 6.3	1.7	1.5, 1.9
Age at entry into cohort (years)				
< 21	7.7	6.7, 9.0	1.6	1.1, 2.2
21-25	6.4	5.6, 7.3	2.2	1.8, 2.8
26-30	5.8	5.2, 6.4	1.9	1.6, 2.2
31-35	5.6	5.1, 6.3	1.7	1.4, 2.0
36-40	5.1	4.6, 5.8	1.9	1.5, 2.3
41-45	3.9	3.3, 4.7	1.2	0.9, 1.7
46-55	3.3	2.8, 3.9	1.5	1.2, 1.9
> 55	3.7	2.5, 5.3	1.9	1.1, 3.0
Injury location				
Upper arm or both†	1.6	1.5, 1.8	0.8	0.7, 0.9
Lower arm	3.6	3.4, 3.9	0.9	0.8, 1.1

* 95% CI, confidence interval.

† Includes 87 claims for injuries to both the upper and lower arm. The location of injury for 19 claims could not be classified as upper arm, lower arm, or both. These 19 claims were excluded from the rates stratified by location.

Table 3.5

Adjusted rate ratios for filing a claim: all claims, upper arm claims, lower arm claims, and lost time claims among union carpenters, western Washington, 1989-1995

	All claims		Upper arm claims*		Lower arm claims		Lost time claims	
	(N = 1,720)		(N = 523)		(N = 1,178)		(N = 568)	
Characteristic	Rate Ratio†	95% CI‡	Rate Ratio	95% CI	Rate Ratio	95% CI	Rate Ratio	95% CI
Predominant type of work								
No local assignment	1.7	1.3, 2.3	2.0	1.4, 3.1	1.6	1.1, 2.3	1.9	1.1, 3.1
Residential	1.6	1.1, 2.2	2.1	1.4, 3.2	1.3	0.9, 2.0	1.3	0.7, 2.4
Drywall	1.5	1.3, 1.7	1.8	1.5, 2.1	1.4	1.2, 1.7	1.7	1.4, 2.1
Millwright	1.3	0.9, 1.8	1.0	0.6, 1.7	1.4	1.0, 2.1	0.9	0.4, 1.7
Light commercial	1.1	0.9, 1.3	0.9	0.7, 1.2	1.2	1.0, 1.4	0.8	0.6, 1.1
Heavy commercial	1.1	0.9, 1.2	1.0	0.8, 1.2	1.1	0.9, 1.3	1.0	0.8, 1.3
Pile driving	0.4	0.3, 0.6	0.4	0.3, 0.7	0.4	0.3, 0.6	0.4	0.2, 0.6
Mixed	1.0		1.0		1.0		1.0	
Time in union								
< 1	1.9	1.6, 2.3	1.8	1.4, 2.4	1.9	1.5, 2.4	2.5	1.8, 3.4
1-4	1.5	1.3, 1.8	1.6	1.3, 2.0	1.5	1.2, 1.8	1.9	1.5, 2.5
5-14	1.1	1.0, 1.3	1.3	1.1, 1.7	1.0	0.9, 1.3	1.4	1.1, 1.8
≥ 15	1.0		1.0		1.0		1.0	
Sex								
Female	2.1	1.6, 2.8	1.5	1.0, 2.3	2.4	1.8, 3.2	2.9	2.0, 4.3
Male	1.0		1.0		1.0		1.0	
Age (years)								
≤ 25	1.2	1.0, 1.4	1.0	0.7, 1.3	1.3	1.0, 1.6	0.6	0.4, 0.8
26-40	1.1	1.0, 1.3	0.9	0.7, 1.0	1.2	1.1, 1.5	0.8	0.6, 1.0
≥ 41	1.0		1.0		1.0		1.0	
Unscaled estimate of dispersion§	1.1		0.6		1.2		0.9	

* Includes 87 claims for injuries to both the upper and lower arm. The location of injury for 19 claims could not be classified as upper, lower, or both upper and lower arm. These claims were excluded from models involving upper and lower arm claims.

† Each rate ratio is adjusted for the other three variables in the model.

‡ 95% CI, confidence interval.

§ Unscaled estimate of dispersion: deviance divided by its degrees of freedom. Confidence intervals for the model containing upper arm claims were calculated using the scaled deviance dispersion parameter.

Table 3.6

Characteristics of second claims filed and adjusted rate ratios for filing a second claim for an upper extremity musculoskeletal injury among union carpenters, western Washington, 1989-1995

	Second claims (N = 196)			
Characteristic	Number	Percent	Adjusted Rate Ratio	95% CI*
Predominant type of work				
Drywall	49	25.0	1.4	1.0, 2.0
Heavy commercial	32	16.3	1.0	0.7, 1.6
Light commercial	20	10.2	1.0	0.6, 1.6
Millwright†	5	2.6	1.0	0.4, 2.4
Residential†	4	2.0	1.5	0.5, 4.1
Pile driving†	3	1.5	0.4	0.1, 1.3
No local assignment†	1	0.5	0.4	0.1, 3.1
Mixed commercial	82	41.8	1.0	
Years in union when first claim was filed				
< 1	35	17.9	2.2	1.2, 3.6
1-4	62	31.6	1.4	0.8, 2.3
5-14	62	31.6	1.3	0.8, 2.0
≥ 15	37	18.9	1.0	
Sex				
Female	7	3.6	1.5	0.8, 3.1
Male	189	96.4	1.0	
Age when first claim was filed (years)				
≤ 25	27	13.8	1.1	0.6, 1.8
26-40	130	66.3	1.1	0.8, 1.8
≥ 41	39	19.9	1.0	
Location of the first injury				
Lower arm	131	66.8	1.6	1.1, 2.3
Both upper and lower arm	17	8.7	1.6	0.9, 3.7
Unknown‡	3	1.5	.	.
Upper arm or shoulder	45	23.0	1.0	
Type of claim for first injury				
Paid lost time	67	34.2	1.4	1.0, 1.9
Medical	129	65.8	1.0	
Unscaled estimate of dispersion§	0.9			

* 95% CI, confidence interval.

† Rate ratios for predominant types of work with five or fewer second claims.

‡ Three claims for which location of the injury was unknown were included in the both upper and lower arm category.

§ Unscaled estimate of dispersion: deviance divided by its degrees of freedom.

4. TIME UNTIL RETURN TO CARPENTRY WORK AFTER A DISABLING UPPER EXTREMITY MUSCULOSKELETAL INJURY

4.1 Background

Work-related musculoskeletal injuries are common in the construction trade. The disorders account for an estimated 40 to 65 percent of all workers' compensation costs in the trade.[1] The contribution of musculoskeletal injuries to absenteeism, loss of productivity, and early exit from the construction trade has not been quantified.

In most industries, when a worker recovers from an injury, he returns to the office or work station where he worked before he was injured. For employees who return to work immediately after being released from medical care, paid lost time is an accurate measure of *all* lost work time associated with a work-related injury. For construction workers, however, the period of lost work time associated with a work-related injury may extend beyond the period of *paid* lost time. Because construction jobs are inherently temporary, a recovered construction worker may not have a job to return to. In these instances, a recovered union worker would report to his local and wait to be assigned to another construction project. The construction worker would not receive wages or paid lost time while he waited to be reassigned. These periods of unemployment may increase the personal burden of work-related injuries among union carpenters.

In this study, we examined the period of time between filing an injury claim and returning to union carpentry work among carpenters who were temporarily disabled by a work-related upper extremity injury. We used survival analyses to assess the influence of predominant type of work, time in the union, age, and location of the injury on the duration of absence from work after filing a paid lost time claim for an upper extremity musculoskeletal injury.

4.2 Methods

The data sources and methods used to identify upper extremity musculoskeletal injury claims have been described in previous chapters. As in the previous analyses, predominant type of work was used as a proxy for personal work exposure, and the study period extended from January 1, 1989 to December 31, 1995.

4.2.1 Definition of cohort

The cohort in this analysis consisted of male union carpenters who had filed a paid lost time claim for an upper extremity musculoskeletal injury and did not work union hours in the month after the claim was filed. Several data limitations shaped how we defined the cohort. The number of hours each carpenter worked per month and the number of days of paid lost time associated with an injury claim were reported as lump sums. Thus, we did not know if the days of paid lost time were consecutive, and we could not pinpoint exactly when each carpenter returned to work for the first time. Given these limitations, survival time was defined as the number of calendar months between filing a lost time claim and returning to union work among carpenters who did not return to work for at least 1 month. Defining the cohort in this way retained the more seriously injured carpenters–those requiring at least 1 month of temporary disability. The cohort probably also contained some carpenters who were disabled for less than 1 month but did not return to work for other reasons (e.g., job was complete and other work was not immediately available, took a nonunion job). Because only five women met the inclusion criteria, the survival analysis was restricted to men.

4.2.2 Definition of the outcome and independent variables

The outcome of interest was the return to union carpentry work after a period of temporary disability due to an upper extremity musculoskeletal injury. Survival time referred to the months between filing a claim and returning to union carpentry work. Carpenters who did not return to work were censored at the end of the study period. The independent variables included predominant type of work, years of union experience when injured (< 1, 1-4, 5-14, ≥ 15 years), age when injured (< 30, 30-39, 40-49, ≥ 50 years), and location of the injury (upper arm, lower arm, or both). As in the previous analyses, claims for which the location of the injury could not be classified (N = 2) were included in the "both" category of location of injury (Chapter 3, page 37). The predominant type of work categories were described in Chapters 2 and 3. As in the previous analysis, mixed commercial construction was used as the reference category for predominant type of work.

4.2.3 Analysis

We produced Kaplan-Meier curves to compare differences in the time until carpenters returned to union work by levels of each independent variable. The curves were compared qualitatively and using the log-rank statistic.[2] Relative hazard ratios (HRs) and 95% confidence intervals (CIs) for the independent variables were produced using Cox proportional hazards regression. The covariates were entered in the models as indicator variables. The log-log plot for each variable was reviewed to assess the proportional hazards assumption. Finally, several additional regression models were constructed to assess the potential effect of right censoring on the hazard ratios.

4.3 Results

We identified 568 paid lost time workers' compensation claims for upper extremity musculoskeletal injuries filed by 485 cohort members during the 7-year study period. The carpenters who filed 418 of the claims returned to work within 1 month. The remaining 150 claims (26%) filed by 148 carpenters who were away from work for at least 1 month were included in the survival analysis. The second claim filed by each of the two carpenters who filed two claims was assumed to represent a new injury and the claims were retained in the analysis. Selected characteristics of all cohort members who filed paid lost time claims and of carpenters whose claims were retained in the survival analysis are summarized in Table 4.1.

Figure 4.1 shows the crude survival curve of the months until carpenters returned to union work after filing a paid lost time claim. Nearly all carpenters who returned to work did so within 12 months of being injured. Fifty-eight carpenters (39%) did not return to union work during the study period.

The Kaplan-Meier curves for the independent variables (predominant type of work, years of union experience when injured, age when injured, and location of the injury) indicated that the survival functions differed little by level of the variables during the first 6 months post-injury (Figure 4.2). The p-values for the log-rank tests were > 0.10 for all four covariates, indicating that none significantly predicted survival time. The proportional hazards regression analysis confirmed that the independent variables were poor predictors of survival time (likelihood ratio chi-square = 16.5, 17 degrees of freedom, $p = 0.4$). The log-log plots for the independent variables suggested that the proportional hazards assumption may not have been fully satisfied for any of the covariates. Because of the small sample size and the poor explanatory capacity of the model, we did not stratify the data or introduce interaction terms into the model to account for differences in the hazard functions over time. Table 4.2 presents the relative hazard ratios and 95% confidence intervals for the full model. If the proportional hazards assumption had been satisfied, the hazard ratios would represent the conditional probability of returning to union carpentry work at any given month during the study period compared to the reference group. Relative hazard ratios less than one indicate longer periods of time away from union carpentry work compared to the reference group.

Fifty-eight carpenters (39%) did not return to work during the study period; these observations were censored at the end of the study. To see if the non-returning carpenters were actually disabled at the close of the study, we examined their dates of injury and number of paid lost time days. We numbered the months of the study period (January 1989 - December 1995) from 1 to 84 and assigned each claim the number that represented the month of injury. Next, we divided the number of paid lost time days by 20 (to represent 1 calendar month) and added that number to the numeric injury date. If the sum was greater than 84, we assumed that the carpenter was disabled at the close of the study. Thirty-five of the 58 carpenters (60%) who did not return to work were receiving paid lost time at the close of the study. The remaining 23 carpenters, who were neither receiving paid lost time nor working as union carpenters, were lost to follow-up. We constructed three additional proportional hazards regression models to assess the potential effect of right censoring on the hazard ratios. The first model contained the same four independent variables as in the primary model and added a continuous variable to represent the month of injury.[3] Next, we restricted the cohort to the 115 carpenters who either returned to work or were still disabled at the close of the study and constructed a model containing the four independent variables used in the primary model. Finally, we repeated the process after restricting the cohort to the 92 carpenters who returned to work. None of the three models produced hazard ratios measurably different from those in the primary model, indicating that bias due to censoring was unlikely. Results of these analyses are presented in Appendix 6.9.

4.4 Discussion

The relative hazard ratios produced in the analysis were imprecise, and they reflected the return to work experience for carpenters who missed more than 1 month of work after filing a paid lost time claim for an upper extremity musculoskeletal injury. Thus, the findings cannot be generalized to injured cohort members who filed a paid lost time claim and returned within 1 month being injured; 70% percent of injured workers returned within 1 month.

Predominant type of work performed by each local was used as a proxy for personal work exposures. The types of projects completed by locals assigned to various categories of predominant type of work were quite similar. Thus, the variable was probably an inadequate measure of the differences in personal exposures among the various groups of carpenters. Personal work exposure data probably would have been more useful. Clinical information (e.g., ICD-9 diagnostic codes, impairment ratings) may have also improved the model's ability to predict the duration of time off.

Nonetheless, the results suggested that an inverse relation may exist between time in the union and time off after a disabling upper extremity musculoskeletal injury (HR for <1 year union time versus ≥15 years = 0.4, 95% CI = 0.2, 1.2; HR for 1-4 versus ≥15 years = 0.7, 95% CI = 0.3, 1.3; HR for 5-14 versus ≥15 years = 0.7, 95% CI = 0.4, 1.4). This finding could be unique to the sub-cohort used in the analysis, or it may have wider application. As discussed in Chapter 3, carpenters with less than 1 year of experience had at least a two-fold higher risk of filing a claim compared to the carpenters with 15 or more years of experience. And, once injured, the least experienced carpenters were most likely to file a second claim. Workers who sustain multiple musculoskeletal injuries over a short period of time may take longer to fully recover. Also, an inexperienced worker with a temporary work restriction may be more difficult to accommodate than his more experienced counterpart who has a wider variety of skills. And, contractors may be more motivated to find a light duty assignment for a long-time employee than for an inexperienced apprentice (Chapter 2). Less experienced workers may also be less likely to return to union carpentry work after an injury for reasons unrelated to the injury. Because they have little time vested, less experienced carpenters may be more likely to leave the trade.

At least four population-based studies have examined risk factors for the duration of temporary disability due to work-related musculoskeletal injuries.[4-7] Three of the four studies were limited to back injuries.[5-7] All four studies reported longer periods of disability for older workers; none examined the effect of length of employment on duration of disability. The apparent lack of effect of age on duration of time off work in the current study may be explained by the young age of the cohort; only 26 percent were aged 41 years or older. Because construction work is physically demanding, carpenters with serious musculoskeletal injuries may opt to change trades at higher rates compared to workers in other industries. Regardless of the reasons why, as experienced workers leave the trade, they are replaced by younger recruits.[8] This cycle of movement through the trade produces a perpetually youthful workforce that may be lacking in skills and safety training.

The current study raises an important question: Are some of the risk factors for long term disability among injured carpenters unique to the trade? A better understanding of the effect of age and work experience on the duration of work-related disability could be gained by studying all musculoskeletal-related disability in the western Washington cohort. The broader question of how musculoskeletal injuries impact work absenteeism, loss of productivity, and early exit from the construction trade remains. Answers to these questions, combined with knowledge of the work tasks associated with disabling musculoskeletal injuries, could have important implications for preventing these injuries and rehabilitating injured carpenters.

4.5 References

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Table 4.1

Characteristics of union carpenters who filed paid lost time claims for an upper extremity musculoskeletal injury, western Washington, 1989-1995

Characteristic	All carpenters who filed at least one lost time claim (N = 485) Number	Percent	Carpenters who filed a lost time claim and missed ≥ 1 month work (N = 148) Number	Percent
Predominant type of work				
Mixed (heavy and light commercial)	207	42.7	52	35.1
Drywall	110	22.7	44	29.7
Heavy commercial	77	15.9	22	14.9
Light commercial	43	8.9	12	8.1
No local assignment	17	3.5	9	6.1
Pile driving	12	2.5	3	2.0
Residential	12	2.1	2	1.4
Millwright	8	1.6	4	2.7
Years of union experience at time of first lost time injury				
< 1	77	15.9	18	12.2
1-4	137	28.2	39	26.4
5-14	153	31.6	51	34.5
≥ 15	118	24.3	40	27.0
Sex				
Female†	22	4.5	--	--
Male	463	95.5	148	100.0
Age at time of first lost time injury (years)				
< 30	126	26.0	32	21.6
30-39	180	37.1	63	42.6
40-49	112	23.1	32	21.6
≥ 50	67	13.8	21	14.2
Location of first lost time injury				
Lower arm	268	55.3	76	51.4
Upper arm	160	33.0	48	32.4
Both upper and lower arm	49	10.1	22	14.9
Unknown	8	1.6	2	1.4

† Females were excluded from the analysis because only 5 missed 1 month or more of work.

Table 4.2

Relative hazard ratios and 95% confidence intervals for returning to union carpentry work after filing a lost time claim for an upper extremity musculoskeletal injury among male union carpenters, western Washington, 1989-1995 (N=150 claims)

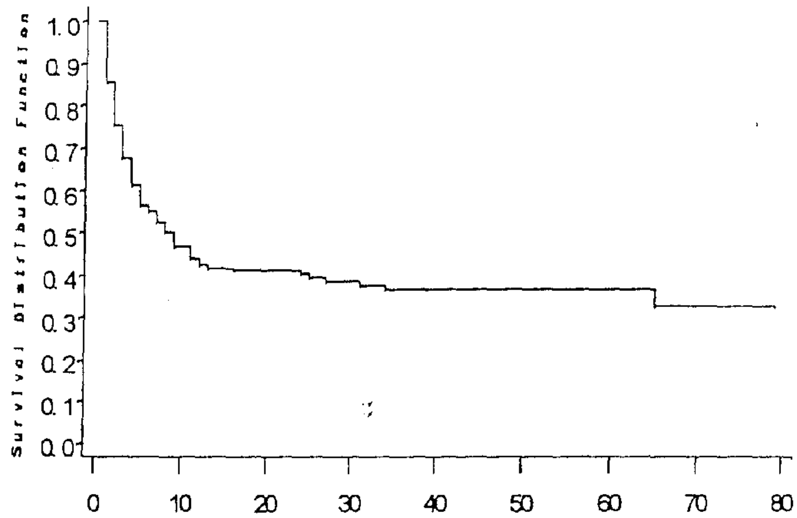
Characteristic	Adjusted Hazard Ratio	95% CI†
Predominant type of work		
No local assignment	0.5	0.1, 1.7
Heavy commercial	0.6	0.3, 1.1
Light commercial	0.6	0.2, 1.4
Residential	1.0	0.1, 8.7
Drywall	1.0	0.6, 1.7
Millwright	1.2	0.3, 4.0
Pile driving	1.3	0.3, 5.8
Mixed commercial	1.0	
Years of union experience at time of injury		
< 1	0.4	0.2, 1.2
1-4	0.7	0.3, 1.3
5-14	0.7	0.4, 1.4
≥ 15	1.0	
Age at time of injury (years)		
< 30	0.8	0.3, 2.0
30-39	1.3	0.6, 2.7
40-49	1.1	0.5, 2.3
≥ 50	1.0	
Location of injury		
Upper arm	0.7	0.4, 1.2
Both upper and lower arm	0.7	0.4, 1.2
Lower arm	1.0	

* Each hazard ratio is adjusted for the other three variables in the model.
† 95% CI, confidence interval.
‡ Two claims for which location of the injury could not be categorized were included in the both upper and lower arm category.

Figure 4.1

Kaplan-Meier survival curve: proportion of temporarily disabled male carpenters who had not returned to union carpentry work by month post-injury

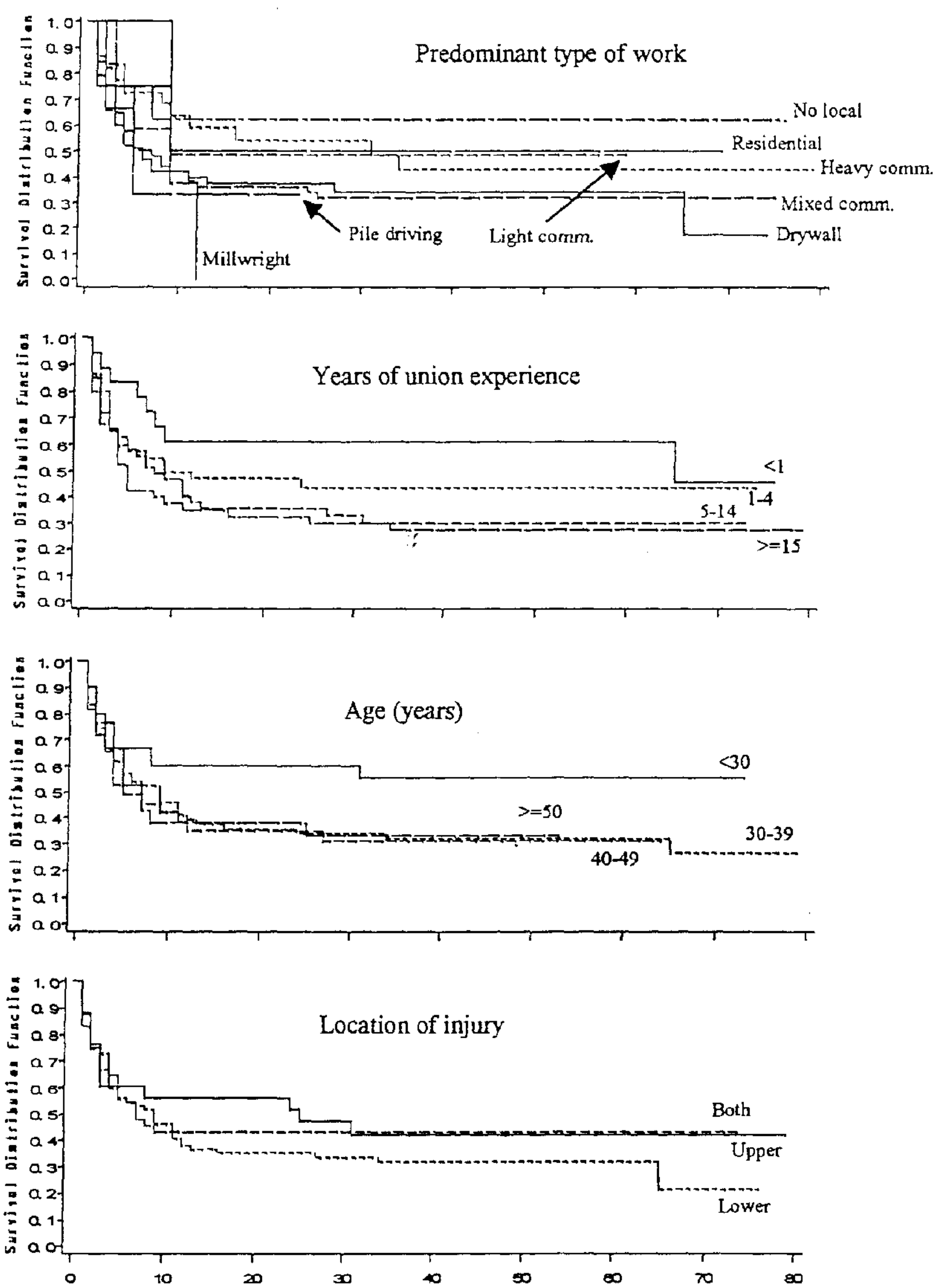
Men who were off work ≥ 1 month after filing an upper extremity musculoskeletal injury claim (N = 150 claims)



Months until return to union carpentry work or censored

Figure 4.2

Stratified survival curves for return to work after an injury in male carpenters who were off work ≥ 1 month after injury



Months until return to union carpentry work or censored

5. SUMMARY AND IMPLICATIONS

Compared to other workers, construction workers have high rates of work-related upper extremity musculoskeletal injury. A recent study of workers' compensation claims in Washington State reported that the construction industry ranked among the highest in overall upper extremity musculoskeletal disorders, with claim rates of over 4 times those for all industries combined.[1] Activities that may contribute to construction workers' risk of upper extremity injury include frequent handling of heavy materials, maintaining awkward work postures, performing repetitive and/or forceful movements, working at shoulder level or overhead, and using vibrating power tools.[2-5] Few published studies, however, have described musculoskeletal injuries among construction workers.

This study examined work-related musculoskeletal injuries of the upper extremity in a large cohort of union carpenters in western Washington. Data from workers' compensation files and the union's administrative files provided information on each worker's approved injury claims, work history, demographics, and union local characteristics. Because personal exposure data were not available, predominant type of work performed by each local was used as a surrogate for work exposures of its members. The study described work-related upper extremity musculoskeletal injury claims filed by the cohort during a 7-year period, explored demographic and work-related factors associated with filing claims, and examined factors that influenced the length of time away from union carpentry work after filing a claim.

We found an inverse dose-response relation between time in the union and risk of filing an upper extremity musculoskeletal injury claim. Carpenters with less than 1 year of union experience were nearly twice as likely to file a claim and 2.5 times as likely to require paid lost time as carpenters with more than 15 years experience. Once injured, the least experienced carpenters were about twice as likely as their most experienced counterparts to file a second claim. And, among carpenters who were disabled and missed at least 1 month of work, the least experienced carpenters had longer periods of time away from work than their more experienced counterparts.

The finding of higher claim rates among less experienced carpenters is consistent with an earlier study of the cohort.[6] Lipscomb et al. reported consistently higher claim rates for musculoskeletal injury to the axial skeleton, upper extremities, and lower extremities among carpenters with less than 4 years of union experience. In focus group discussions, union carpenters in the Seattle area attributed the increased injury claim rate among inexperienced workers to a desire to prove themselves and the tendency to use these workers as "pack horses".[7] This information suggests that inexperienced carpenters may have systematically different work exposures than their more experienced coworkers. Other potential influences on claim rates for less experienced carpenters include limited safety training and a greater likelihood of filing claims that do not result in paid lost time.

Female carpenters may also be at increased risk for upper extremity musculoskeletal injury. In this study, women were about twice as likely as men to file a claim and nearly 3 times as likely to require paid lost time. The increased risk for filing a paid lost time claim among women was mostly due to lower arm injuries. This finding suggests that women's reduced upper body strength compared to men may not necessarily predispose them to upper extremity injury. Factors associated with wrist and forearm disorders, such as repetitive movements and use of ill-sized tools, may be more important contributors.

The finding of an increased rate of lower arm claims filed by women is also consistent with the earlier study of this cohort. Lipscomb et al. reported that women were about 4 times as likely as men to file a claim for a forearm sprain or nerve condition.[6] There was no significant difference in relative risk by sex for filing claims for axial skeleton or lower extremity musculoskeletal injuries. Studies of work-related injuries in other industries have also found higher rates among women compared to their male counterparts.[8-10] Possible reasons for women's higher rates include physiological differences, ergonomic design factors, exposure differences, differential reporting of injuries, and differences in perceived work- and non-work-related stress.[8,11] Both women[8,12] and new recruits[7] may attempt work that is unsafe in an effort to prove themselves to their coworkers. Future studies of this cohort should consider interviewing a sample of carpenters and observing work practices to see if work exposures differ systematically by experience or sex.

Most of the locals included in this study performed a wide range of tasks, and there was substantial overlap in the types of projects completed by locals from different categories of predominant type of work. The overlap in the types of projects completed may explain why there was little difference in the relative risks for filing a claim among the three categories of commercial construction carpenters. Combined, the three commercial construction categories represented 70 percent of the cohort. Thus, the predominant type of work variable had limited usefulness as a surrogate for personal work exposures. Future studies of this cohort should explore alternative ways to characterize work exposure.

Collecting survey or observational data on work exposures for each member of a large cohort is not practical. However, tracking the types of construction projects that individual carpenters work on over time with administrative data may be feasible. The potential for using administrative records from field representatives, contractors, and job foremen for this purpose should be explored. This information could provide additional insight into the contribution of work exposures–both cumulative exposures and work activities near the time of the injury–to musculoskeletal injuries among carpenters.

Clearly, the physical demands of construction work contribute to upper extremity musculoskeletal injuries among carpenters.[13-15] Because the work is strenuous, injured carpenters may take longer to return to full duty compared to workers in industry. Restricted light duty assignments may not be available. Once injured, carpenters may also face an increased risk of reinjury and extended disability compared to other workers. Reducing the burden of musculoskeletal injuries in the construction trade will require changes in work practices, technological improvements, and management support.[14] To this end, the United Brotherhood of Carpenters and Joiners has integrated ergonomic awareness into the 4-year carpenter apprenticeship course.[14] Additionally, increasing the variety of jobs performed by all carpenters may reduce the harmful effects of any one job.[14] Other promising modifications include reducing the size and weight of materials, redesigning hand tools so that they exert less torque and vibration on the hand and forearm, and, when possible, using mechanical means to perform repetitive tasks.[16,17]

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6. APPENDICES

APPENDIX 6.1

UPPER EXTREMITY MUSCULOSKELETAL INJURIES COMMONLY ASSOCIATED WITH CUMULATIVE TRAUMA

DISORDER	DESCRIPTION
Primarily to Nerves	
Carpal tunnel syndrome (writer's cramp, neuritis, median neuritis)	Compression of median nerve in carpal tunnel of wrist
Cubital tunnel syndrome	Compression of ulnar nerve below notch of elbow
Pronator (teres) syndrome	Compression of median nerve in distal third of forearm
Ulnar nerve entrapment (Guyon tunnel syndrome)	Entrapment of the ulnar nerve where it passes through Guyon tunnel in wrist
Thoracic outlet syndrome (cervicobrachial disorder, brachial plexus neuritis)	Compression of nerves and blood vessels between clavicle and first and second ribs at brachial plexus
Primarily to Tendons and Tendon Sheaths	
de Quervain's syndrome	Tendosynovitis that occurs in abductor and extensor tendons of thumb where they share a common sheath.
Epicondylitis ("tennis elbow")	Irritation of the tendons attaching to epicondyle, lateral protrusion at distal end of humerus bone
Ganglion ("Bible bump")	Swelling of tendon sheath with synovial fluid, or cystic tumor at tendon sheath or joint membrane
Shoulder tendonitis (rotator cuff syndrome, supraspinatus tendonitis, subacromial or subdeltoid bursitis, partial tear of the rotator cuff)	Soreness of shoulder where rotator cuff tendons pass through a small passage between humerus and acromion
Tendonitis	Inflammation of a tendon, causing it to be thick, bumpy, irregular, or calcified
Tendosynovitis (tenosynovitis, tendovaginitis)	Swelling of a synovial sheath that impedes movement of tendons within the sheath
Trigger finger or thumb	Tendosynovitis where the tendon becomes nearly locked and movement is jerky
Primarily to Joints	
White finger ("dead finger," Raynaud's or vibration syndrome)	Closure of the digit's arteries resulting in insufficient blood supply
Ulnar artery aneurysm	Weakening of section of ulnar artery where it passes through Guyon tunnel in wrist, causing bubble to press on ulnar nerve in Guyon tunnel

Source: Williams R, Westmorland M. Occupational cumulative trauma disorders of the upper extremity. Am J Occup Ther 1994;48:411-20.

APPENDIX 6.2

ANSI BODY PART AND NATURE CODES COMPATIBLE WITH UPPER EXTREMITY MUSCULOSKELETAL INJURIES

Code	Body part
300, 398	upper extremity
310	arm(s) unspecified
311	upper arm
313	elbow
315	forearm
318	arm multiple
320	wrist
330	hand
340	finger(s)
350	hand & finger
450	shoulder
700	multiple
830	musculoskeletal
840	nerve system
870	multiple body
880	body system (or systemic)

Code	Nature
160	contusion
190	dislocation
260	bursitis
310	sprain
400	multiple injuries
560	nervous system
562	nerve condition
580	ill-defined symptoms

APPENDIX 6.3

TELEPHONE QUESTIONNAIRE FOR FIELD REPRESENTATIVES: MUSCULOSKELETAL INJURIES

We are studying arm injuries of the muscles, tendons, and nerves among members of the UBC of Western Washington for the years 1989-1995. These injuries can happen suddenly, as with muscle strains, or they can develop over time, as with carpal tunnel syndrome. To help us understand the work that UBC carpenters do, we are talking with each local's business agent. The interview takes about 15 minutes. Your participation is voluntary. The information that you and the other business agents provide will be released only in summary form so that the answers provided cannot be traced back to any specific agent. Is now a good time for you to complete the interview? (if no, reschedule)

Local information

First, I have a few questions about your local.

1. Where is the local located: _______________

2. About how many active members were there in December 1995: _______

Types of work

Next, I have several questions about the types of construction work that your local did during the years 1985-1995?

3. We plan to group the locals by the type of work that they do most often. Please listen as I read the list and tell me which category best describes your local's most common type of work?

___ residential construction
___ heavy commercial construction: buildings over 3 stories
___ heavy commercial construction: roads, dams, bridges
___ light commercial construction (buildings less than 4 stories)
___ drywall
___ millwrighting
___ cabinet and fixture work
___ pile driving
___ mixed (heavy and light commercial)
___ other (specify) ___________________________

4. During the years 1989 through 1995, were there any changes in the most common type of carpentry work done by the local? Yes____ No____ Don't know____

4a. If yes, what were the previous types of carpentry work?

____

4b. When did the changes in types of carpentry work occur? __________

month / year

5. Scott Schneider and his coworkers at The Center to Protect Worker's Rights have divided new construction work into phases beginning with excavation and ending with cleanup. We would like to know which of these phases of construction your local was involved in during 1989-1995. Did your local do (read list).

<u>Yes</u> <u>No</u>

___ ___ excavation/foundation/concrete work
___ ___ structural steel work
___ ___ framing
___ ___ building interior (drywall, flooring, painting, trim work, door installation)
___ ___ building exterior (cladding, sand blasting, window installation)
___ ___ work outside the building (setting sidewalk)
___ ___ clean up

___ ___ road construction
___ ___ other (specify)______________________

5a. Of the phases of construction that I just listed, which 3 would you say that your local was most involved in?

1)__________________
2)__________________
3)__________________

Working conditions

The next few questions are about working conditions.

6. About how long does your most common type of job take?

___ 1 week or less
___ more than 1 week but less than 1 month
___ 1 - 6 months
___ more than 6 months
___ varies too much to generalize

7. On a typical job:

   a. About how many workers are assigned to a job?

   ___ 10 or fewer
   ___ 11 - 49
   ___ 50 or more
   ___ it is different on different jobs

   b. How many apprentices are there for each journeyman? ____

   c. How many hours do union members usually work each day? ____

   d. How many days a week do they usually work? ____

8. How often do the members work shift work? Would you say it is:

   ___ more than half of all jobs
   ___ between ¼ and ½ of jobs
   ___ less than ¼ of jobs
   ___ never

9. How often do members work on the Saturdays or Sundays?

   ___ more than half of all jobs
   ___ between ¼ and ½ of jobs
   ___ less than ¼ of jobs
   ___ never

10. How often do members work under strict time constraints, such as during shutdown conditions in a manufacturing plant? Would you say this happens on:

   ___ more than half of all jobs
   ___ between ¼ and ½ of jobs
   ___ less than ¼ of jobs
   ___ never

11. In a typical day's work, how much time would workers spend doing one job task such as hanging drywall or installing windows?

   ___ more than 3/4 time
   ___ between 1/2 time 3/4 time
   ___ more than 1/4 time but less than 1/2 time
   ___ 1/4 time or less

12. The Carpenters Trust file has some people in it who do not have a local assignment listed with the Trust. Do you ever assign individuals to jobs who are not members of your local? Yes____ No____

(If yes, describe the circumstances)

13. Have there been any major changes in these working conditions since 1989?

Yes____ No____

(If yes, describe the changes)

Work tasks

Certain work tasks are thought to increase the risk of musculoskeletal injury. We would like to get an idea of how common these tasks are among your members and whether they seem to pose a problem for the local. Think back on the type of work the local was involved in during the years 1989-1995. I will read each task and ask you if it was a routine part of the job for your local. If the task was usually part of the job, I will ask if it created problems for the workers.

(For tasks that were problems, ask agent to rate the problem as minor, moderate, or major).

Work task	Not part of job	Part of job but not a problem	Problem minor =1 mod. =2 major =3	Comments
Holding arm(s) in the same position				
Working with arms above shoulder level				
Lifting/moving objects weighing 40 lbs or more from the floor to the waist				
Lifting/moving objects weighing 40 lbs or more from waist to chest or above				
Repeating a hand or arm motion over and over				(list motions)
Using power hand tools				(list common tools)
Using non-power hand tools				(list common tools)
Holding tools or equipment that vibrate or "kick"				(list common tools)
Performing the same task over and over				(list tasks)
Working in a kneeling or squatting position				
Working bent over at the waist				
Working in cramped or awkward positions				
Other (specify)				

Placing injured workers

We plan to look at the paid lost time that resulted from upper extremity musculoskeletal injuries. So, we would like to understand the process for returning workers to the job after an arm injury. The next few questions ask about that process.

14. Of the carpenters who return after an upper extremity musculoskeletal injury such as a sprain or rotator cuff injury, how many return to work with some type of work restriction?

___ almost all
___ most
___ about ½
___ about ¼
___ only a few

15. On average, how often is a "restricted duty" assignment available when an injured member needs one?

___ almost always
___ more than ½ the time
___ between ¼ and ½ the time
___ less than ¼ the time
___ never or nearly never

16. How is a "restricted duty" work assignment found for a returning carpenter?

17. Who decides what jobs the carpenter can do while he or she has the work restriction?

18. How is a work assignment found for a returning carpenter who *does not* have a work restriction?

19. Who makes the decision as to which job the worker is assigned to?

20. Does a carpenter who has recovered from an injury automatically go back to the job site where he/she was injured if that job is still ongoing? Yes____ No____
(if no, explain)

21. If the job is still ongoing, who actually reassigns the recovered worker?

___ business agent
___ contractor
___ supervisor on site
___ it varies
___ someone else

Questions for the business agent

Thank you providing this information about your local members. It will help our understanding of work that UBC members do. Lastly, I'd like to get your opinion on a few questions.

22. Among your local members, are there job tasks or working conditions that may contribute most to sprains, strains, and other injuries to the muscle or nerves of the *arm*? (If yes, list them)

23. Are there job tasks or working conditions that may contribute most to musculoskeletal injuries to the soft tissue of the *knee* among your local members?

24. And, are there job tasks or working conditions that may contribute most to these injuries of the *back* among your local members?

25. How long have you been the business agent for this local? (in years) __________

26. How long have you been affiliated with this local? (in years) __________

APPENDIX 6.4

ICD-9 CODES COMPATIBLE WITH UPPER EXTREMITY MUSCULOSKELETAL INJURIES

A. Upper extremity ICD-9 codes listed by NIOSH as associated with ergonomic hazards

353	Nerve root and plexus disorders (limit to 353.0 thoratic outlet syndrome)
354	Mononeuritis of upper limb and mononeuritis multiplex
354.0	Carpal tunnel syndrome
354.1	Other lesion of median nerve
354.2	Lesion of ulnar nerve
354.3	Lesion of radial nerve
443.0	Raynaud's syndrome (due to vibration)
712	Crystal arthropathies
715	Osteoarthrosis and allied disorders (limit to 715.x1-715.x4 for up. extrm. if ANSI body part code <> up. extrm.)
716.1	Traumatic arthropathy
716.9	Arthropathy, unspecified
719	Other and unspecified disorders of joint (limit to 719.x1-719.x4 for up. extrm. if ANSI body part code <> up. extrm.)
719.0	Effusion of joint
719.4	Pain in joint
719.5	Stiffness of joint, not elsewhere classified
719.8	Other specified disorders of joint
726	Peripheral enthesopathies and allied syndromes
726.0	Adhesive capsulitis of shoulder
726.1	Rotator cuff syndrome of shoulder and allied disorders
726.10	Disorders of bursae and tendons in shoulder region, unspecified
726.11	Calcifying tendonitis of shoulder
726.12	Bicipital tenosynovitis
726.19	Other specified disorders
726.2	Other affections of shoulder region, not elsewhere classified
726.3	Enthesopathy of elbow region
726.30	Enthesopathy of elbow, unspecified
726.31	Medial epicondylitis

726.32	lateral epicondylitis
726.33	Olecranon bursitis
726.39	Other
726.4	Enthesopathy of wrist and carpus
726.8	Other peripheral enthesopathies
726.9	Unspecified enthesopathy
726.90	Enthesopathy of unspecified site
726.91	Exostosis of unspecified site
727	Other disorders of synovium, tendon, and bursa
727.0	Synovitis and tenosynovitis
727.03	Trigger finger (acquired)
727.04	Radial styloid tenosynovitis
727.2	Specific bursitides often of occupational origin
727.4	Ganglion and cyst of synovium, tendon, and bursa
727.8	Other disorders of synovium, tendon, and bursa
727.9	Unspecified disorder of synovium, tendon, and bursa
728	Disorders of muscle, ligament, and fascia
729	Other disorders of soft tissues
729.1	Myalgia and myositis, unspecified
729.2	Neuralgia, neuritis, and radiculitis, unspecified
729.5	Pain in limb
729.8	Other musculoskeletal symptoms referable to limbs
840	Sprains and strains of shoulder and upper arm
840.0	Acromioclavicular (joint) (ligament)
840.1	Coracoclavicular (ligament)
840.2	Coracohumeral (ligament)
840.3	Infraspinatus (muscle) (tendon)
840.4	Rotator cuff (capsule)
840.5	Subscapularis (muscle)
840.6	Supraspinatus (muscle) (tendon)
840.8	Other specified sites of shoulder and upper arm
840.9	Unspecified site of shoulder and upper arm
841	Sprains and strains of elbow and forearm
841.0	Radial collateral ligament
841.1	Ulnar collateral ligament
841.2	Radiohumeral (joint)
841.3	Ulohumeral (joint)
841.8	Other specified sites of elbow and forearm
841.9	Unspecified site of elbow and forearm

842	Sprains and strains of wrists and hand
842.0	Wrist
842.00	Unspecified site
842.01	Carpal (joint)
842.02	Radiocarpal (joint) (ligament)
842.09	Other
842.1	Hand
842.10	Unspecified site
842.11	Carpometacarpal (joint)
842.12	Metacarpophalangeal (joint)
842.13	Interphalangeal (joint)
842.19	Other
955	Injury to peripheral nerves of shoulder and upper limb
959	Injury, other and unspecified
959.2	Shoulder and upper arm
959.3	Elbow, forearm and wrist
959.4	Hand

Source: NIOSH. Cumulative trauma disorders in the workplace: bibliography. Cincinnati, OH: U.S. DHHS, PHS, CDC, NIOSH. 1995:20-4.

B. ICD-9 codes from Duke list not on NIOSH list

354.4	Causalgia of upper limb
354.8	Other mononeuritis of upper limb
354.9	Mononeuritis of upper limb, unspecified
715.x1	Shoulder (osteoarthritis)
715.x8	Other specified sites
715.x9	Multiple sites
716	Other and unspecified arthropathies
716.x	
716.x0	Site unspecified
716.x1	Shoulder
716.x8	Other specified sites
716.x9	Multiple sites
718	Other derangement of joint (limit to 718.x1-718.x4 for up.extrm. if ANSI body part code <> up. extrm.)
719.x	Other and unspecified disorders of joint (limit to 719.x1-719.x4 for up. extrm. if ANSI body part code <> up. extrm.)

719.1	Hemarthritis
719.2	Villonodular synovitis
719.3	Palindromic rheumatism
719.6	Other symptoms referable to joint
719.9	Unspecified disorder of joint
727.05	Other tenosynovitis of hand and wrist
727.3	Other bursitis
727.5	Rupture of synovium
727.6	Rupture of tendon, nontraumatic
727.61	Complete rupture of rotator cuff
831	Dislocation of shoulder
832	Dislocation of elbow
833	Dislocation of wrist
834	Dislocation of hand
923	Contusion upper limb
923.0	Contusion shoulder and upper arm
923.0x	0=shoulder, 1=scapular, 2=axillary, 3=upper arm, 9=multiple sites
923.1	Contusion elbow and forearm
923.1x	1=elbow, 0= forearm
923.2	Contusion wrist and hand except finger
923.3	Contusion finger
923.9	Unspecified part of upper limb
953	Injury to nerve root and spinal plexus
953.4	Brachial plexus
953.9	Unspecified site

APPENDIX 6.5

CRUDE UPPER EXTREMITY MUSCULOSKELETAL INJURY CLAIM RATES PER 200,000 HOURS WORKED AMONG UNION CARPENTERS FOR THE EXPOSURE VARIABLES CREATED FROM INTERVIEW DATA

	All claims (N = 1,720)		Lost time claims (N = 568)	
	Rate	95% CI*	Rate	95% CI
Time spent doing one task in a typical day's work				
¼ of time or less	5.2	4.8, 5.6	1.8	1.5, 2.0
> ¼ of time, < ½ of time	4.4	4.0, 4.8	1.5	1.3, 1.8
Between ½ and ¾ of time	5.8	4.7, 7.0	1.5	1.0, 2.3
More than ¾ of time	6.0	5.5, 6.5	2.0	1.7, 2.3
No local assignment	9.3	7.3, 11.9	1.9	1.3, 2.8
Number of problem work tasks†				
0 – 2	4.8	4.3, 5.3	1.5	1.3, 1.8
3 – 5	4.7	4.1, 5.4	1.8	1.4, 2.3
6 – 8	5.5	5.2, 5.9	1.8	1.6, 2.0
No local assignment	9.3	8.7, 10.1	2.9	1.8, 4.4

* 95% CI, confidence interval.

† Number of problem work tasks was defined as the number of tasks performed by a local that the field representative ranked as either a moderate or major contributor to upper extremity musculoskeletal injuries.

APPENDIX 6.6

ADJUSTED RATE RATIOS FOR FILING A FIRST UPPER EXTREMITY MUSCULOSKELETAL INJURY CLAIM DURING THE STUDY PERIOD: ALL FIRST CLAIMS AND PAID LOST TIME FIRST CLAIMS

	All first claims (N = 1,482)		First claims: lost time claims (N = 485)	
Characteristic	Rate Ratio*	95% CI†	Rate Ratio	95% CI
Predominant type of work				
No local assignment	1.8	1.4, 2.5	2.0	1.2, 3.3
Residential	1.6	1.2, 2.3	1.4	0.8, 2.6
Drywall	1.5	1.3, 1.7	1.8	1.4, 2.2
Millwright	1.3	0.9, 1.8	0.8	0.4, 1.7
Light commercial	1.1	0.9, 1.3	0.9	0.6, 1.2
Heavy commercial	1.1	0.8, 1.2	1.1	0.8, 1.4
Pile driving	0.4	0.3, 0.6	0.4	0.2, 0.7
Mixed	1.0		1.0	
Time in union				
< 1	2.1	1.7, 2.5	2.5	1.8, 3.5
1-4	1.5	1.3, 1.8	1.9	1.5, 2.5
5-14	1.1	1.0, 1.3	1.4	1.1, 1.9
≥ 15	1.0		1.0	
Sex				
Female	2.3	1.7, 3.0	2.8	1.8, 4.2
Male	1.0		1.0	
Age (years)				
≤ 25	1.2	1.0, 1.4	0.6	0.4, 0.8
26-40	1.1	0.9, 1.2	0.8	0.6, 1.0
≥ 41	1.0		1.0	
Unscaled estimate of dispersion‡	1.1		0.9	

* Each rate ratio is adjusted for the other three variables in the model.
† 95% CI, confidence interval.
‡ Unscaled estimate of dispersion: deviance divided by its degrees of freedom.

APPENDIX 6.7

ADJUSTED RATE RATIOS FOR FILING A CLAIM FOR A SECOND UPPER EXTREMITY MUSCULOSKELETAL INJURY, WITH PREDOMINANT TYPE OF WORK REMOVED FROM THE MODEL

Characteristic	All second claims (N = 196)		Second claims, men only (N = 189)	
	Rate Ratio*	95% CI†	Rate Ratio	95% CI*
Years in union when first claim was filed				
< 1	1.8	1.1, 2.7	1.7	1.1, 2.7
1-4	1.6	1.0, 2.6	1.6	1.0, 2.7
5-14	1.2	0.8, 1.9	1.2	0.8, 1.9
≥ 15	1.0		1.0	
Sex				
Female	1.3	0.7, 2.6	--	--
Male	1.0		--	--
Location of the first injury				
Lower arm	1.6	1.1, 2.3	1.5	0.8, 3.8
Both upper and lower arm or unknown‡	1.9	0.9, 3.8	1.8	1.0, 2.3
Upper arm or shoulder	1.0		1.0	
Type of claim for first injury				
Paid lost time	1.4	1.0, 1.9	1.3	1.0, 1.8
Medical	1.0		1.0	
Unscaled estimate of dispersion§	0.8		1.0	

* Each rate ratio is adjusted for the other three variables in the model.

† 95% CI, confidence interval.

‡ Three claims for which location of the injury was unknown were included in the both upper and lower arm category.

§ Unscaled estimate of dispersion: deviance divided by its degrees of freedom.

APPENDIX 6.8

ADJUSTED RATE RATIOS FOR FILING AN UPPER EXTREMITY MUSCULOSKELETAL INJURY CLAIM IDENTIFIED USING ONLY ANSI CODES

Characteristic	All claims identified by ANSI codes alone (N = 1,481)	
	Rate Ratio*	95% CI†
Predominant type of work		
No local assignment	1.8	1.3, 2.5
Residential	1.6	1.1, 2.2
Drywall	1.5	1.3, 1.7
Millwright	1.3	0.9, 1.8
Light commercial	1.1	0.9, 1.3
Heavy commercial	1.1	0.8, 1.2
Pile driving	0.4	0.3, 0.6
Mixed	1.0	
Time in union		
< 1	2.1	1.6, 2.3
1-4	1.5	1.3, 1.8
5-14	1.1	1.0, 1.3
≥ 15	1.0	
Sex		
Female	2.3	1.6, 2.8
Male	1.0	
Age (years)		
≤ 25	1.2	1.0, 1.4
26-40	1.1	1.0, 1.3
≥ 41	1.0	
Unscaled estimate of dispersion‡	1.1	

* Each rate ratio is adjusted for the other three variables in the model.

† 95% CI, confidence interval.

‡ Unscaled estimate of dispersion: deviance divided by its degrees of freedom.

APPENDIX 6.9

COX PROPORTIONAL HAZARDS REGRESSION RESULTS OF ASSESSMENT OF CENSORING

Characteristic	Continuous variable for month of injury added (N = 150) Hazard Ratio	95% CI*	Model restricted to those who returned to work or were on paid lost time at close of study (N = 115) Hazard Ratio	95% CI	Model restricted to those who returned to work (N = 92) Hazard Ratio	95% CI
Predominant type of work						
No local assignment	0.5	0.1, 1.8	0.5	0.1, 1.8	1.4	0.3, 5.7
Residential	1.0	0.1, 8.4	0.7	0.1, 6.1	0.8	0.1, 8.0
Drywall	1.0	0.6, 1.7	0.8	0.5, 1.4	0.8	0.5, 1.4
Millwright	1.0	0.3, 3.5	1.0	0.3, 3.5	0.6	0.2, 2.0
Light commercial	0.6	0.2, 1.5	0.8	0.3, 1.9	0.9	0.4, 2.3
Heavy commercial	0.5	0.3, 1.1	0.9	0.4, 1.8	0.4	0.2, 0.9
Pile driving	1.5	0.3, 6.6	1.8	0.4, 7.7	0.8	0.2, 3.6
Mixed	1.0		1.0		1.0	
Time in union						
< 1	0.4	0.1, 1.0	0.8	0.3, 2.1	0.3	0.1, 1.0
1-4	0.6	0.3, 1.2	0.5	0.3, 1.1	1.0	0.5, 2.0
5-14	0.8	0.4, 1.4	0.8	0.4, 1.4	0.8	0.4, 1.5
≥ 15	1.0		1.0		1.0	
Age (years)						
≤ 30	0.9	0.3, 2.2	1.6	0.6, 4.4	3.1	1.1, 9.0
30-39	1.4	0.7, 3.0	1.6	0.7, 3.6	1.5	0.7, 3.2
40-49	1.3	0.6, 2.6	1.3	0.6, 2.7	1.6	0.7, 3.4
≥ 50	1.0		1.0		1.0	
Location of first lost time injury						
Upper arm	0.7	0.4, 1.2	1.0	0.6, 1.6	1.7	1.0, 3.1
Upper and lower arm†	0.6	0.3, 1.1	0.8	0.4, 1.5	0.9	0.4, 1.7
Lower arm	1.0		1.0		1.0	
Month of injury	1.0	1.0, 1.0	--	--	--	--

* 95% CI, confidence interval.

† Two claims for which location of the injury could not be categorized were included in the both upper and lower arm category.

Appendix 6

Injury Related Health Care Utilization Among Carpenters with Diagnoses of Alcohol or Substance Abuse

(Manuscript in review: American Journal of Public Health, July 1999)

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TITLE:

Injury Related Health Care Utilization Among Carpenters with Diagnoses of Alcohol or Substance Abuse

ABSTRACT (word count 177)

Objectives: We explored whether individuals with diagnoses of alcohol or substance abuse had higher rates of health care utilization for injuries and whether there were differences based on insurance coverage for care.

Methods: A cohort of carpenters and their health insurance claims filed through private coverage and workers' compensation between 1989 and 1995 were identified. Injury care utilization rates were compared for those who were and were not treated for alcohol or substance abuse during this time period.

Results: Individuals who had been treated for alcohol or drug abuse had higher injury related outpatient utilization rates through private insurance coverage (rate ratio=2; $p<0.001$), but did not have higher rates of occupational injury related care (rate ratio=0.89; $p<0.001$).

Conclusions: Worker's with substance abuse problems may be unlikely to engage in those behaviors on the job or they may be more likely to file occupational injury related care through private insurance. Analyses of rare serious events (e.g. due to hospitalizations), in which the individual could not exercise a payment option, are not consistent with the latter explanation.

There are a number of reports linking alcohol and injury. While these relationships appear stronger for some types of injuries than for others, the associations hold for fatal and non-fatal injuries and for intentional and non-intentional injuries.[1-6] Problem drinkers have been reported to have higher injury related costs than those who drink sensibly due in part to their propensity for more serious injuries,[1,7] and individuals who experience alcohol-related injuries are more likely to be readmitted for subsequent injuries compared to people without alcohol-related injuries.[8]

Although there is some evidence that alcohol may contribute to work-related injuries, these data are contradictory and relatively little is known about the role of alcohol and drugs to workplace injuries. The discrepancies in findings suggest substance abuse plays different roles in different settings.[9,10] This needs to be better defined since alcohol and/or substance abuse could have a greater impact on work-related injuries among individuals performing jobs which are inherently more dangerous. Perhaps due to the logistics in carrying out research which can address these issues, much work in this area has focused on analyses of blood alcohol levels among those who sustained fatal work injuries without examining the effect on the vast majority of injuries which are not fatal.[11-15]

In the current study, administrative sources were used to identify a cohort of union carpenters previously documented to have high rates of occupational injury,[16] their health insurance claims filed through private health insurance coverage and workers' compensation, and the periods of time when they were eligible to file claims for health care delivery through each of these systems. These data were used to explore whether carpenters with diagnoses of alcohol or substance abuse related disorders had higher rates of injury related health care utilization and whether there were differences based on the type of insurance coverage for that care.

METHODS

Data Sources

Union carpenters receive health insurance benefits through jointly trusteed health and welfare funds. Eligibility for coverage is based on working a required number of hours. Health insurance eligibility files from the Carpenters' Trust of Western Washington, one such fund, provided union hours worked each month and a marker indicating months in which each individual had insurance eligibility from January 1989 through December 1995. Union membership files were used to identify date of birth, sex, and union initiation date. The trust also provided health insurance claims filed by these individuals. These records of medical care included the date of service and the International Classification of Disease Version 9 code (ICD9), the place of treatment, and charges.

The Washington State Department of Labor and Industries provided the workers' compensation claims for these carpenters for the same time period. Actual claims for medical care for these work-related injuries including variables similar to those provided by the trust for private health care also were provided. Methods for linking these data on an individual basis have previously been described.[17]

Definition and stratification of the cohort

A historical cohort of carpenters was identified who worked at least three months of union time and had at least one month of insurance eligibility between 1989 and 1995. Individuals were identified who were treated during this period for alcohol or substance abuse related disorders based on the primary diagnosis code assigned to outpatient claims and primary or secondary ICD9 codes assigned to inpatient claims. The alcohol related diagnoses were taken from a set of diagnoses causally linked to alcohol use determined by literature review.[18] Diseases felt to be specifically related to alcohol were included omitting those for which alcohol is not considered the primary cause but a risk factor (cardiovascular disease, cancers, diabetes). The alcohol or substance abuse related diagnoses included ICD9 codes for alcoholic psychoses (291), drug psychoses (292), alcohol dependence syndrome (303), drug dependence (304), non-dependent abuse of drugs (305, excluding 305.1 for tobacco dependence), toxic effects of alcohol (980), alcoholic cardiomyopathy (425.5), alcoholic gastritis (535.3), alcoholic fatty liver (571.1), acute alcoholic hepatitis (571.1), alcoholic cirrhosis of the liver (571.2), and unspecified alcoholic liver damage (571.3).

Definition of time at risk

Eligibility for health care utilization was used to define time at risk for these analyses. Individuals were considered at risk of filing a claim for health care through the trust in any month in which they had health insurance eligibility after they met cohort entry criteria. Through workers' compensation individuals were considered eligible for health care utilization from the month when the individual first entered the cohort until they were last observed having either hours worked or insurance eligibility. For these analyses it was assumed that individuals were eligible for medical care through compensation by virtue of working in the State of Washington and that they were eligible to receive care for a work-related injury even when out of work or working non-union jobs. Alcohol or substance abuse diagnoses were not treated as time-dependent variables; therefore all time at risk for each person was assigned to the dichotomous classification of alcohol or substance abuse related diagnoses group or no such diagnosis. This was based on the belief that these are not acute problems with a discrete onset or remedy .

Definition of events of interest

For these analyses, claims were limited to those for which the primary diagnosis reflected treatment for an injury (ICD9 codes 800-999, excluding 980 for toxic effects of alcohol).
For outpatient utilization, events of interest included unique provider-patient encounters. For analyses of inpatient utilization the unit of analysis was the hospitalization. Analyses were limited to care delivered through the carpenter's private insurance in months of eligibility and in workers' compensation to care delivered in any month from cohort entry to last observation in an attempt to define events of interest and time at risk in a comparable manner.

Analyses

The cohort was described by age, gender, time in the union, eligibility for health care utilization, and patterns of work. Crude and stratified rates and rate ratios of injury related health care utilization were compared for those with and without alcohol or substance abuse related diagnoses. Private health care utilization and workers' compensation were considered independently. Events of interest were divided by the time at risk in each system, expressing utilization as a rate per 1000 person-years of eligibility. Age and sex specific rates were generated in a similar manner with person-time and events of interest for both groups being distributed by gender and ten year age groups, with time at risk accumulating in the appropriate strata as age changed during the follow-up period.

Using methods of indirect standardization[19] age (ten year age groups) and sex specific rates of injury care utilization among those without alcohol or substance abuse related diagnoses were applied to the time at risk of those with these diagnoses to calculate expected numbers of events. Observed to expected ratios were then compared for each strata, and a summary measure was computed to separately compare utilization through workers' compensation and private insurance systems. Separate analyses were done for inpatient and outpatient utilization. Statistical significance of the summary measure was measured using a chi square statistic with one degree of freedom.

Charges for medical care for injury related care were summed and costs per 1000 person-years of observation were calculated separately for those with and without alcohol or substance abuse related diagnoses. Cost ratios were calculated allowing comparisons by place of treatment and type of insurance coverage. To assess the role that type of injury may have had on utilization and costs, rates were calculated by major categories of ICD9 codes for injuries stratified by place of treatment and type of insurance coverage.

Workers' Compensation Claims Analyses

For comparisons of rates of filing individual workers' compensation claims (injury events not health care utilization), time at risk was defined by hours of work as a union carpenter. Of interest were those compensation claims filed in months in which the individual worked union hours, again in an attempt to define numerator and denominator data in a comparable manner. Crude and stratified rates and rate ratios were calculated and similar methods of indirect standardization were used to compare those with and without diagnoses of substance abuse.

RESULTS

From the trust eligibility file 12,958 individuals were identified who met the cohort definition. Mean and median age at first observation were 35.3 years and 34 years, respectively. The cohort was predominantly male with under 2% of the hours worked contributed by 323 women (2.4%). Mean time in the union was 7.8 years and the median was 2.7 years.

From the medical claims data 491 (3.8%) individuals were identified with alcohol or substance abuse related diagnoses during this seven year period. The number of individuals with these diagnoses are presented in Table 1. The total does not equal the number of individuals represented since individuals often had more than one diagnosis. No individuals were identified with alcoholic gastritis, cirrhosis or alcoholic hepatitis who were not also diagnosed with alcohol abuse, and no individuals had substance abuse diagnoses without also having a diagnosis of alcohol abuse.

In Table 2 individuals with alcohol or substance abuse related diagnoses and those without are compared by age, time in the union, gender, and months of insurance eligibility. Individuals with these diagnoses were slightly younger, they had more months of eligibility for insurance coverage in both systems and they worked more hours. They were not significantly different by gender or mean time in the union, although median time in the union was slightly longer for those with alcohol or substance abuse related diagnoses.

Injury Utilization and Cost Analyses

Crude rates and rate ratios of injury care utilization comparing those with and without alcohol or substance abuse related diagnoses by place of treatment and type of insurance coverage are presented in Table 3. Stratum specific rates and summary rates adjusted for age and sex (standardized utilization ratios (SUR)) are presented by type of insurance and place of care. Outpatient care through private insurance and workers' compensation is presented in Table 4. Those with substance abuse diagnoses had significantly higher rates of outpatient health care utilization due to injury through their private insurance (RR=1.99). The ratio was markedly higher for those under the age of 20 than for any other age group. Although individuals under the age of 20 had higher outpatient utilization rates through workers' compensation, overall those with substance abuse related diagnoses had a modestly lower rate of outpatient injury utilization (RR=0.89; 95% CI 0.86-0.92). Despite small numbers of hospitalizations among those with these diagnoses, a significantly increased SUR through private insurance was seen for those with substance abuse related diagnoses (RR=4.3; 95% CI 2.7- 6.5). In contrast, in workers' compensation the utilization rate ratio was 0.58 (95% CI 0.18-1.35). The stratum specific person-months of observation for women in this cohort were quite small, making their analyses very unstable. Restriction of analyses to men did not appreciably change the results.

Costs associated with injury related care and the cost ratios for those with and without alcohol or substance abuse related diagnoses are presented in Table 5. In private insurance the cost ratios are greater than the rate ratios for both outpatient and inpatient care, raising questions about whether the injuries experienced by those with substance abuse diagnoses were more severe. They had much higher outpatient utilization rates for a number of potentially serious types of injuries including internal injuries (RR=12.5), injuries to blood vessels (RR=18.2), late effects of injury (RR=16.9), and crush injuries (RR=22.9). However, these comparisons were based on small numbers. Due to the very small number of hospitalizations, the ratios for inpatient care are not presented.

Workers' Compensation Claims

During this seven year period the cohort filed 13,865 workers' compensation claims. Those with alcohol or substance abuse related diagnoses worked 3,231,456 hours and filed 761 claims, representing a rate of 47.1 (95% CI 43.9-50.5) per 200,00 hours worked. The remainder of the cohort worked 61,956,191 hours and filed 13,104 workers' compensation claims at a rate of 42.3 (95% CI 39.7- 45.0) per 200,000 hours worked (RR=1.1). Of these injury claims, 3,061 resulted in paid lost time from work which occurs in Washington State after three days away from work. Individuals with substance abuse related diagnoses filed 176 lost time claims at a rate of 10.9 (95% CI 9.4-12.6) per 200,000 hours worked compared to 2,855 claims filed at a rate of 9.2 (95% CI 8.6- 9.8) per 200,000 hours worked among those without these diagnoses (RR=1.2). Rate ratios for those under the age of 20 were highest overall (RR=1.5) and for paid lost time claims (RR=3.1), but none were significantly different from 1.

DISCUSSION

By combining existing administrative data we identified a dynamic cohort of working carpenters and their health insurance claims through private and workers' compensation insurance coverage. Data were analyzed using a cohort approach to evaluate whether individuals with alcohol or substance abuse related diagnoses had higher rates of health care utilization for injuries. Those individuals with alcohol or substance abuse related diagnoses experienced significantly higher injury related utilization rates through their private insurance coverage (RR=2 for outpatient care and RR= 4.3 for inpatient care). This pattern was consistent for all age groups under the age of 60. Cost ratios were greater than the rate ratios for both inpatient and outpatient care through private insurance. This finding seems to indicate that those with alcohol or substance abuse related diagnoses have a disproportionate share of more expensive and likely more serious injuries. Although based on small numbers of injuries in each category, this is supported by the rate ratios observed for specific types of injury diagnoses.

Individuals treated for substance abuse did not have higher utilization rates for injury related care through workers' compensation, with the exception of males under the age of 20 years old. These very young men also had higher rates of filing claims for work-related injuries consistent with their higher outpatient utilization rates. No other group had higher compensation injury utilization rates, and overall individuals with alcohol or substance abuse related diagnoses had outpatient compensation utilization rates that were 10% lower and charges that were 15% less.

Our findings based on private insurance are consistent with reports of higher health care costs and utilization for injury related care among individuals with alcohol related problems[7,8]

In analyses of work-related injury rates, but not utilization, using data very similar to ours, Pollack[20] reported that construction laborers between 25 and 34 years of age with diagnoses of alcohol or substance abuse had significantly higher rates of filing claims for work injuries that resulted in paid lost time from work. Although the laborers who appeared at risk were slightly older than the carpenters we identified at greatest risk, Pollack also found the risk of occupational injury among those with alcohol or substance abuse related diagnoses to be limited to younger aged workers.

Dawson[21] demonstrated that heavy drinking was associated with a small increased risk of occupational injury. In addition, the odds ratio for occupational injury increased from 1.08 for those with one occasion of heavy drinking to 1.74 among those with daily heavy drinking. The highest level of drinking and occupational injury were in workers between 19 and 29 years of age. These analyses, based on the National Health Interview Survey, also lacked direct information linking drinking behaviors to the work place. The analyses were based on self-report of an injury which occurred at work for which medical care was sought. No documentation was available that the injury was officially reported as work-related or that medical care was received through the workers' compensation system.

Our study has several limitations. We analyzed health insurance claims data, identifying and labeling our cohort based on diagnoses on claims over a seven year period. The cohort was dynamic and all members did not have equal periods of observation. We realize that there is some inherent misclassification in these methods. It seems unlikely that someone would have received one of these diagnoses falsely, and the bias in this misclassification is likely to be in failing to identify individuals with alcohol or substance abuse behaviors. This bias may not be insignificant.

Individuals with alcohol dependence have been reported to be involved in a disproportionate number of traumatic injuries, although most alcohol-related injuries have been reported to occur in individuals with less severe alcohol problems.[22] However, bias potentially created by this differential misclassification would likely underestimate risk and would be unlikely to change the marked differences we observed between the private insurance and workers' compensation systems.

The Department of Labor and Industries does not have records of health care utilization associated with self-insured claims, and electronic records are only maintained on lost-time injuries from these employers. Our inability to identify medical claims from self-insured employers would result in an underestimation of medical claims associated with workers' compensation claims. To create bias in these analyses individuals with alcohol or substance abuse related diagnoses would have to have had significantly greater numbers of injuries which occurred while working for a self-insured employer which seems unlikely.

Other limitations include lack of information about patterns of alcohol consumption and information that directly related alcohol consumption and the injury events. We also lacked information on outcomes of treatment making it impossible to compare injury rates of those with and without successful outcomes.

Counting time at risk for health care utilization through workers' compensation is not straightforward. Individuals become eligible for health care through workers' compensation by virtue of working, but health care is received only after a reported injury. The compensation system is responsible for the care of the injured worker until he or she reaches maximum medical improvement, meaning that care is not necessarily delivered when the individual is working.

However, work exposures associated with compensation care only occur when individuals are working. In our situation, if individuals with alcohol or substance abuse related diagnoses worked less hours, they may not have had exposures that were comparable to those without alcohol or substance abuse related diagnoses. Even though we considered time at risk in the same manner for both groups some adjustment might be indicated for time spent working. In this cohort this was not the case. Individuals with alcohol or substance abuse related diagnoses actually worked more hours than those without these diagnoses, again meaning bias would likely underestimate the differences we saw in the workers' compensation system.

CONCLUSIONS

We did not identify individuals with diagnoses specific for drug abuse who did not also have diagnoses of alcohol abuse making these findings relevant for alcohol abuse diagnoses. For the 5% who had diagnoses of drug abuse there may be significant risks associated with joint alcohol and substance abuse.

Individuals who had been treated for alcohol related diagnoses were not at greater risk of filing workers' compensation injury claims and were not responsible for greater health care utilization or costs for occupational injury related care than individuals without alcohol related diagnoses – with the exception of those under 20 years of age. Through private insurance coverage those with alcohol or substance abuse related diagnoses had significantly higher rates of injury care utilization with the cost ratios exceeding the rate ratios. These findings indicate greater risk of injury among those with alcohol or substance abuse related diagnoses and a greater likelihood that their injuries are more severe. As in workers' compensation, those under the age of 20 were at greatest risk but, in contrast, the elevated risk was not restricted to this very young group.

One possible, or perhaps partial, explanation for the patterns we saw is cost-shifting with individuals with substance abuse problems being more likely to file injury related care through their "no fault" private insurance. However, if this were the case we would not have expected to see the same patterns among hospital cases. An individual sustaining an injury on the job serious enough to require hospitalization would be less able to exercise an option for payment. Inpatient analyses were based on a small number of cases and must be kept in mind in interpreting these results.

We did not have personal job exposure information, and it is possible that the work exposures were less dangerous among those without alcohol or substance abuse related diagnoses. However, we feel that this is an unlikely explanation. We had seen decreasing compensation injuries with increasing time in the union in other analyses[23]. We had attributed this to differences in exposures, experience and training,with increasing union experience. However, we found no differences in these results when we adjusted for time in the union (results not presented).

Another plausible explanation is that workers' with alcohol or substance abuse problems are not likely to engage in those behaviors on the job. This finding is consistent with analyses of mortality data among construction workers in North Carolina. Blood alcohol levels for construction workers who died of external causes of injury were elevated above the legal limit in 52% of injuries that were not work-related and 5.4% of those which were work-related.[24]

These findings are not intended to minimize problems of alcohol or substance abuse among these construction workers. The drug screening policy of the large number of contractors who hire these carpenters is unknown and likely variable. Perhaps the threat of testing on the job in recent years made individuals with alcohol related problems less likely to work while impaired. Individuals with these diagnoses had significantly higher rates of injury related health care utilization, particularly for more serious events, through their private insurance. While we cannot confirm from these analyses of claims data that alcohol use was directly related to the excess injuries sustained, we believe this indicates the need for prevention and intervention programs and the evaluation of the effect of these programs on alcohol consumption and health care utilization. Successful interventions could reduce injuries and a number of other conditions associated with excess alcohol consumption as well as their associated costs. Interventions on behalf of the very young group, which seem indicated based on their level of risk, would not be expected to have a large impact on overall injury related care or associated costs since these very young men represent a very small proportion of the overall cohort (n=242, or 3%) and only 1.2% (n=8) of those with alcohol or substance abuse related diagnoses .

Despite the acknowledged limitations, these data provided a unique opportunity to evaluate the relationship of alcohol related diagnoses and health care utilization for injury care across two different payment systems. We are unaware of other studies examining the interplay of utilization across private insurance and workers' compensation. In doing this we documented significant differences between utilization rates for injury care through the private insurance and workers' compensation systems. The findings document the necessity of looking at multiple sources of coverage in understanding health care delivery for a cohort of working individuals.

This may be particularly important when examining injury related care among construction workers who have high rates of occupational injuries.

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Table 1

Frequency of Alcohol and Substance Abuse Related Diagnoses
Union Carpenters Washington State 1989-1995

	Frequency [1] (%)
Alcoholic psychoses (291)	8 (1.4)
Drug psychoses (292)	3 (0.50)
Alcohol dependence syndrome (303)	442 (79.6)
Drug dependence (304)	60 (10.8)
Non-dependent drug abuse (305) excludes tobacco dependence (305.1)	34 (6.1)
Alcoholic gastritis (535.3)	2 (0.36)
Acute alcoholic hepatitis (571.1)	1 (0.18)
Alcoholic cirrhosis of the liver (571.2)	1 (0.18)
Toxic effects of alcohol (980)	2 (0.36)
Total	**553**

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[1] These represent claims and not individuals as each person can have more than one diagnosis.

Table 2
Comparison of Individuals with and without Substance Abuse Diagnoses
Union Carpenters Washington State 1989-1995

	Diagnoses of Substance Abuse n=520	No Diagnoses of Substance Abuse n=12,438	
Age in years			
Mean	33.0	35.1	p<0.001
Median	32	34	
Range	18-60	17-88	
Time in the Union in years			
Mean	7.1	7.3	p=0.56
Median	4	2	
Range	0-33	0-62	
Percent female	2.1	2.5	p=0.50
Months at risk			
Health and Welfare			
Mean	49	36	p<0.001
Median	50	29	
Range	3-82	1-82	
Workers' compensation			
Mean	60	42	p< 0.001
Median	71	39	
Range	3-82	1-82	
Hours Worked			
Mean	6581	4970	p<0.001
Median	6139	4412	
Range	285-14,915	55-18,833	

Table 3

Crude Rates of Health Care Utilization for Injuries by Alcohol or Substance Abuse related Diagnoses, Place of Treatment and Source of Payment Union Carpenters Washington State 1989-1995

	Rate* (n) Substance Abuse Diagnoses Yes	No	Rate Ratio
Private Medical Insurance			
• Outpatient	757.0 (1,500)	373.0 (14,069)	2.0
• Inpatient	11.6 (23)	2.1 (80)	5.5
Workers' Compensation			
• Outpatient	1670.1 (4,112)	1792.3 (78,645)	0.93
• Inpatient	2.0 (5)	3.6 (159)	0.56

* Rates are per 1000 person years of insurance eligibility or time at risk
n=number of medical encounters

Table 4
Standardized Utilization Ratios for Outpatient Injury Related Care
Union Carpenters Washington State 1989-1995

Age-sex specific category	Person-months of observation	Rate [1] in those without substance abuse diagnoses	Observed	Expected	Ratio
Private Health Care Utilization					
Males <20	73	26.5	20	1.9	10.3 *
20-29	5058	32.1	288	162.1	1.8 *
30-39	10868	31.2	740	339.5	2.2 *
40-49	5282	33.6	269	177.6	1.5 *
50-59	1763	27.7	92	48.9	1.9 *
60-69	416	22.8	0	9.5	0
Females <20	0	0	-		
20-29	73	32.3	43	2.4	18.2 *
30-39	124	51.4	3	6.3	0.47
40-49	114	41.6	45	4.6	9.8 *
50-59					
60-69					
Overall (approximate 95% confidence interval)			1500	752.8	1.99 * (95% CI 1.90- 2.09)
Workers' Compensation Utilization					
Males <20	74	157.0	34	11.6	2.9 *
20-29	6269	165.4	777	1052.0	0.74
30-39	13661	160.8	2305	2324.4	1.0
40-49	6635	144.3	909	1041.7	0.94
50-59	2062	135.5	79	322.0	1.01
60-69	441				
Females <20	0	113.2	0	--	
20-29	128	166.5	2	21.3	0.09
30-39	144	272.6	4	39.3	0.10
40-49	126	331.4	2	41.8	0.05
50-59	0	76.9	0	--	
60-69	0			--	
Overall (approximate 95% confidence interval)			4112	4610.7	0.89 (95% CI 0.86-0.92)

(1) rate per 1000 person-months of insurance eligibility
* significantly different from 1($p<0.05$)

Table 5

Costs for Injury Related Medical Care by Diagnoses of Substance Abuse By Place of Treatment and Type of Insurance Coverage Union Carpenters Washington State 1989-1995

	Cost [1] Substance Abuse Diagnoses		Cost Ratio
	Yes	No	
Private Medical Insurance			
• Outpatient costs	$ 126,187	$ 42,526	3.0
• Inpatient costs	$ 269,282	$ 32,346	9.2
• Overall	$ 422,469	$ 74,872	5.6
Workers' Compensation			
• Outpatient costs	$ 170,055	$ 179,799	0.95
• Inpatient costs	$ 9,977	$ 31,336	0.32
• Overall	$ 180,032	$ 211,135	0.85

[1] per 1000 person-years of insurance eligibility

Appendix 7

The Social, Emotional and Economic Effects of Injuries on Carpenters in Washington State

(Report of Injured Worker Interviews)

Microsoft Word Document

THE SOCIAL, EMOTIONAL AND ECONOMIC EFFECTS OF INJURIES ON CARPENTERS IN WASHINGTON STATE

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August 1999

CONTENTS

INTRODUCTION

The purpose of this study was to gain an in-depth understanding of the social, emotional and economic impacts of workplace injuries on carpenters. As part of this study, 20 carpenters living in western Washington state participated in either interviews or focus groups during the summer and fall of 1998. Participants included 17 men and three women ranging in age from 31 to 59. The interviews and focus groups were conducted by staff of the Center for Working Life, a non-profit organization based in Portland, Oregon.

This qualitative study follows a survey conducted by the Carpenters Health and Safety Fund in association with Duke University. Some survey participants indicated an interest in discussing their experiences in greater detail. This study allowed such in-depth discussions to take place to more fully reveal the effects that injuries have on the lives of carpenters and their families.

METHODOLOGY

The original plan was to conduct several focus groups to identify general concerns and then develop questions to conduct more in-depth interviews. This plan did not account for the challenges of getting two or more carpenters together in the same place at the same time. Staff quickly realized that focus groups would be difficult to arrange for participants living so far apart with such conflicting work and family schedules. One-on-one interviews proved easier to arrange.

Two men and one woman did eventually take part in a focus group where carpenters were gathering later for a meeting at a union hall. This was a lively two hour event which allowed participants to probe and challenge each other. The discussion followed the same general format and raised the same issues as the interviews.

Fifteen men and two women took part in interviews, which averaged about an hour. Interviews were conducted in participants' homes or workplaces or at restaurants. When in homes, they often involved some participation by spouses of the carpenters.

The interviews and focus group covered four general areas: availability and cost of medical care, direct and indirect economic impact of injuries, effects on family and community activities, and impact on sense of self. Interviewers attempted to elicit responses in these areas through open-ended questions which allowed those being interviewed to address issues most important to them. For example, some carpenters focused more on the frustrating experiences of getting compensation from Labor and Industries (L&I), while others quickly moved the discussion towards the economic or emotional impact on the family. Some, especially those whose injuries resulted from a specific accident, described the events surrounding their injury and the immediate aftermath in great detail.

The results reported here fall into categories which cut across those of the original interview protocol. Rather than focusing on the areas described above, the results here honor the outcomes of the interviews and focus group where carpenters organized their stories in response to open-ended questions. This report describes the challenges carpenters faced, how they coped with them, changes that they had made or tried to make in their lives, their inability to make the changes they wanted, their needs, and suggestions for how they might be better met, especially by the union. Issues concerning the cost and availability of medical care, economic effects, and impacts on family life and sense of self are examined in light of these broader categories. Other issues, such as concerns for new work cultures, which came out of the interviews, but which were not directly elicited, are also covered.

PARTICIPANTS

Most participants were drawn from those carpenters identified by Duke University as having had an injury in the past 10 years. They were selected based on their willingness to participate. All but two had previously responded to the survey administered by the Carpenters Health and Safety Fund. The other two (one the spouse of a carpenter being interviewed and the other a participant at a union hall meeting where a focus group was being held) were welcomed into ongoing discussions because they were carpenters who expressed interest in participating and had experienced workplace injuries. It is recognized that this method of selection tends to favor those who have had the greatest negative impact from their injuries. This bias, however, is consistent with the study's objective of developing in-depth understandings rather than knowledge than can be generalized to a wider population. Moreover, findings indicate some balance between positive and negative outcomes following injuries.

Participants reported their major or most recent injuries in the following areas: knees (e.g., bursitis, torn cartilage), arms and elbow (e.g., carpal tunnel, ulnar neuritis), shoulders (e.g, torn rotator cuffs, deteriorated collar bone) , foot (e.g., broken or injured), hand and wrist (e.g., fractured, injured by nail gun), head , neck (herniated discs), back, and respiratory system (non-allergic rhinitis/sinusitis).

Some of these injuries resulted from specific incidents (i.e., a fall). Those who suffered their injuries as a result of a specific incident told elaborate stories about the moments leading up to their injury and following it. Two carpenters who say that their injuries resulted from the carelessness of coworkers expressed anger about how the injury happened.

Other injuries grew out of cumulative damage from years of wear and tear (e.g., bursitis in the knee). One 45 year old man jokingly described his cumulative injuries as "old man-itis." Some participants could recount many injuries during their working lives, some from specific accidents (i.e., nails through the hand) or from cumulative degeneration of muscle, bone or ligament tissues.

In addition to major injuries, two carpenters also reported respiratory and skin problems that they believed stem from chemicals and toxins in their working environment. During the interviews, two other carpenters mentioned their increasing concern for such risks.

Pseudonyms have been used throughout the report to protect the identity of the individuals who agreed to participate in the study. The names of locations and companies have also been left purposely vague for the same reason.

SUMMARY OF FINDINGS

Those interviewed highlighted the challenges they faced, the changes they experienced, the coping strategies they used, and identified what would have helped them. These have been organized into chapters as summarized below:

CHALLENGES

Those interviewed faced a variety of challenges. Many emphasized more than one as being most difficult following their injuries. Eight highlighted the difficulties or limitations they had in family, home and social life. This included participation in leisure or basic household tasks, relationships with children, marriage and personal relationships, and friendships and social life. Six participants focused on economic challenges as being the most difficult following their injury, and all of those interviewed touched on economic difficulties at some point during the interview. These challenges included temporary or permanent loss of income, problems getting compensation, economic strains on relationships, and control over income. Seven emphasized the hardship of becoming slower, less efficient workers and the stresses this creates on the job. While some of the respondents also worried about losing jobs and income because of their injury, they highlighted their emotional responses such as feelings of worthlessness and incompleteness. Three participants discussed medical issues, such as problems in diagnosis, treatment, and the aggravation of injuries, as being most difficult. Other participants discussed the challenges of these at some point during the interview, although they did not necessarily highlight medical issues as being most difficult. Two participants claimed that dealing with L&I, doctors, and the legal system was most difficult. This sheds light on experiences that many other participants shared, the emotional stress and often humiliation of dealing with health care, Labor & Industries, insurance companies, the legal system, and employers. Several carpenters responded at some point during their injury history by not making claims or seeing doctors. This suggests that with each injury, workers must weigh the emotional stress and economic risks of making a claim or seeking medical advice against the benefits they might gain.

Examining the challenges across areas reveals practical needs for economic support, quality health care, and responsive programs. However, interviews also show what may not be as obvious: that just as much attention needs to be given to the emotional needs of carpenters as they deal with tensions in their family and home life, the stresses of not feeling as efficient on the job, declines in earning power and what many describe as the humiliation of dealing with doctors and claims managers.

CHANGES

The changes carpenters experienced and highlighted in interviews reveal how individuals make decisions about the need for change based on their sense of self, interests, physical ability, educational level, family histories, attitudes, and information about available opportunities. Thirteen of those interviewed continued to do carpentry work for various reasons: lack of alternatives, love for their work, disappointment with other options. Three men and one woman had left carpentry work and successfully made transitions into new careers. Two of the men and the woman had made their way into "white collar" work: management and computer systems. One man had remained in "blue collar," union work but moved into a new industry where he felt he received better benefits and better working conditions. Three participants had not returned to steady work since their injury because of permanent disability or ongoing complications with occupational disease. These three men expressed the most anger about the changes in their lives and the lack of support they believe they have received from the medical system, from L&I and from the union.

Seven of those interviewed described experiences with or plans for retraining as a way of changing careers. Only one had successfully entered a new field. Two had tried retraining following injuries and eventually ended up working in carpentry again, one because of low pay in the field he had retrained for, the other because he was unable to continue in school following a divorce. Another tried retraining and remained unemployed at the time of the interview. Three others were making plans to enroll in training programs in the future and were optimistic about their abilities to change careers.

The primary life change faced by those interviewed was in the area of work, however, individuals also discussed changes in life expectations, safety awareness and work culture. They experienced changes that ranged from minor setbacks, such as having to dip into savings to support themselves for several months, to major life disruptions, such as several years of lower income that changed retirement and other savings plans.

Some of those who feel that they did not experience too much disruption in their lives because of their injuries worry about their future. They face accumulated wear and tear on their bodies, aggravation of existing injuries, and the possibility of new ones.

Three of those interviewed also discussed changes in work culture, especially their discomfort in leaving "blue collar", union work and moving to "white collar" work. When asked how they had changed, many of those interviewed also described their greater safety awareness. This included becoming more cautious about how they do their work to prevent re-injury, becoming aware of a greater range of possible injuries, evaluating safety hazards on-site, and using the knowledge they have accumulated through experience to ensure that workplaces are safer for everyone.

Each individual's case is unique, suggesting the need for vocational and life guidance that takes into account the family, work, and educational histories in steering injured carpenters towards new careers, new leisure activities, and ways to revise and meet their life expectations.

COPING

The diverse coping strategies developed by individuals grew out of their lifestyles and personalities, the circumstances of their injuries, other current life challenges, and perceived opportunities. Almost all of those interviewed who remained in carpentry described how they had to change they way they do their work to accommodate their injuries. This can lead to conflict with coworkers and frustration about their being unable to work up to speed. It also leads to fears about unemployment. Those interviewed also highlighted the importance of changing their physical routines at home to avoid re-injury and strengthen their muscles. They emphasized the importance of rest, regular exercise, proper tools, and appropriate medical cafe.

Participants also discussed what may not be as obvious as physical coping strategies: how they handled their emotions about getting injured and having to make life changes. Many experienced anger and frustration about their circumstances and turned their anger inward on themselves. Others turned their anger outward towards the union, L&I, their employers, or the economy in general. A number described how keeping busy or drawing on their religious faith or optimistic life attitudes helped them heal more quickly and adjust to their physical limitations, pain or life changes.

Most of those interviewed benefited from social support from family or friends. A few described support received from the company. Only one of those interviewed described social support from within the union as a factor in helping them cope with their injury or consequent changes in their lives. However, he emphasized that the support came from union members rather than from the organization. The anger that many expressed about the lack of support from the union suggests a need for greater consideration of how the union might address the expectations and needs of injured carpenters.

Most of those interviewed developed individual coping strategies based on their frustration with available services and programs. Some injured carpenters were angry, depressed or frustrated while others were optimistic about their life outlook. While seemingly more positive than anger and frustration, optimism can reflect some denial about the seriousness of an injury and the need for change. This suggests a need for careful examination of why individuals cope the way they do and for programs that build on strategies already being used. Those interviewed made various suggestions for how their individual strategies for coping could be enhanced by better services, programs, and policies.

NEEDS

The primary needs that participants identified were for various kinds of information, guidance and social support. Most emphasized that they would prefer to receive their information and support from someone who would best understand their circumstances. Several described the information and support as needing to come from a union representative for injured workers. The desire for receiving even basic information from a sympathetic person who understands injured carpenters reflects the concern shown elsewhere for addressing emotional along with financial, health care and legal needs. This became clearer as individuals discussed their desire for emotional support more directly, in the form of peer contact and counseling. Other needs highlighted were for changes in union benefits to take into account the unique life circumstances of carpenters as they age and become injured, more opportunities for training and mobility, improvements in safety and health, and education and political advocacy to demonstrate the value of carpentry and carpenters to employers and society.

Examination of all of these areas demonstrates the importance of the following:

1. Understanding and addressing not only the financial and health care needs of injured carpenters, but also the emotional and mental health effects of injury and subsequent life changes.

2. Addressing the need that injured carpenters have for receiving clear information and social support from those who understand and empathize with their circumstances.

3. Understanding the diverse career and life changes that can occur with aging or following an injury and developing benefits, retraining and career mobility systems that take such changes into account.

These will be examined in greater detail in the final chapter.

CHALLENGES

In the interviews and focus groups, those interviewed focused attention (often without being prompted) on the various challenges they faced following their injuries. Most faced multiple challenges ranging from healing and rehabilitation to the permanent disruption of their work and/or family life.

Responses to the question: "what was the hardest thing for you after your injury?" revealed important themes for understanding the effects of injuries on carpenters. Responses ranged across the themes listed below. Some responses covered several themes. For example, one participant discussed how not having enough money contributed to the breakup of his marriage. He identified both of these together as the hardest outcome of his injury.

1. Inability to do everyday tasks at work or at home
2. Having to be slower and extra cautious at work leading to embarrassment and conflicts with coworkers or supervisors
3. Decreased physical involvement with children
4. Getting laid-off or not getting hired
5. Not being believed.
6. Dealing with pain and recovery
7. Not having enough money
8. Not having control over when and from where money comes
9. Break-up of marriage
10. Trying to hide injury and making it worse

These themes will be further explored by clustering them into the following categories (explained in greater detail below): Quality of Family/Home Life, Economic Issues, Quality of Work Life, Medical Issues, Dealing with the System. Some categories overlap and several participants made responses that cut across categories. For example, one woman described the inability to do everyday tasks both at work and at home as most challenging. Identifying the primary aspects of each individual's response uncovers important insights into the emotional effects of injury and suggests possibilities for providing improved resources and support for injured carpenters.

At some point during the interview, each participant went beyond describing the "hardest" challenge they faced after their injury and discussed the full range of difficulties. These will also be explored under each category below.

QUALITY OF FAMILY, HOME, AND SOCIAL LIFE

Eight participants discussed the problems caused by the injury outside of work as being most difficult. This ranged from being unable to do daily tasks at home (e.g., gardening, cooking, writing, holding a book, driving, walking) to not being able to play with their children to having their marriages break up.

At some point during each interview and focus group, all of the participants discussed the effects of their injuries on their families and also on their ability to participate in activities with friends and neighbors (e.g., helping neighbors with repairs or going hunting). During the interviews that took place in homes, some spouses were present and made comments on how the injuries had effected them.

The effects on home, family, and social life fell into the following categories: leisure activities, household tasks, relationships with children, marriage and intimate relationships, and friendships and social life.

LEISURE ACTIVITIES

Many of those interviewed reported that they find it difficult to participate in athletic, recreational and social activities such as dancing, jogging, water-skiing, bike riding, basketball, climbing, volleyball, rollerblading, fly fishing, or hunting. Some also reported that this effects their social life. As described in greater detail later, an inability to participate in recreational activities with friends and family also leads to feelings of isolation. Phil, who has experienced various injuries over his work years, summed up the dilemma faced by injured carpenters who continue working in carpentry. "You can't do what you want to do on the weekends because you're trying to recuperate so you can go back to work."

HOUSEHOLD TASKS

Many also reported difficulties in carrying out basic household tasks such as gardening, cooking, writing, driving, walking, or climbing stairs.

Todd discussed how his knee injury severely limited his daily activities:

> I don't take my legs for granted anymore. If I'm going grocery shopping I have to plan ahead. I have to feel good enough to go. It never stops hurting. I don't take anything. I don't like to take painkillers. I have to live with the pain. I had injuries before and just worked through them. I'll work through this one too.

Several also discussed their limitations in making household repairs and improvements. For example, Martin said that he has had to hire contractors to do landscaping and build his deck, work that would have been easy for him before his back injury. Now he was to pay someone to do it.

RELATIONSHIPS WITH CHILDREN

Several described their frustration at being unable to provide recreational and nurturing activities for their children.

Todd described his frustration at not being able to take a 45 minute drive with his kids to enjoy recreational and educational opportunities in a nearby city because of his knee injury. Kevin, who has a hand injury, described his challenges in caring for his visually impaired child. He was going through a divorce and his child "needed extra snuggling." He could not provide such nurturing very well because of the pain in his hand.

Art, 31, described how his depression following a disabling neck and shoulder injury has changed his relationship with his kids:

> Before I used to come home and see my little girl at the door. Couldn't wait to play with her. Now I just feel irritated by the kids. I love my kids, but don't feel good about myself anymore.

MARRIAGE AND INTIMATE RELATIONSHIPS

Several carpenters traced challenges in intimate relationships, including marriage, to their injuries. One woman described the physical aspect of this challenge when she talked about her knee injury as causing "trouble beneath the sheets."

Others described the emotional challenges in their intimate relationships. Two carpenters traced the break-up of their marriages directly to their injuries and cited this as the hardest challenge they faced. Two other carpenters suggested that work injuries contributed to their divorces or added to challenges they faced at the time of divorce. Todd described the tensions that a work injury can cause in a marriage:

> My wife couldn't handle it. I was in too much pain. There was a lot of stress. We were divorced in November. It was hard on the kids. The pain gets to me, and then I get angry. I can't run or jump. I used to run 6 nights a week. I was very active physically. I got very grumpy. That was hard for my wife. I wanted her attention. We had a lot of arguments. The pain often interfered with conversations. She felt she had to take the whole load. We would have been married 17 years in December.

Other carpenters successfully overcame tensions in their marriages. Larry, a 52 year old man, describes the sorrow he felt when his head injury made him unable to talk to his wife for some time:

> See that's the worst part. I mean a guy breaks his back and becomes...paralyzed. That's a bad thing, and I'm sure it impacts a family relationship like ours was impacted, but at least they can talk to each other. We couldn't take to each other. It was awful. For awhile it was real bad. I had no idea. I didn't even know how to say her name for months.

Larry and his wife built on their strong friendship and marriage and struggled through the tensions caused by his injury.

Several men described their depression, grumpiness and short temper as having an impact on their family. During an interview, the spouse of one of the men described the years following his injury and subsequent unemployment and depression as a "roller coaster ride." When asked how she endured it, she said:

> I don't know. I really don't know. We had to do it for the kids. Sometimes I'd ask myself, why am I still here? It's because I love him. I couldn't do it if I didn't love him.

Another man described how hard it was for his wife to see him suffer. Uncertainty about whether the carpenter would fully recover, what kind of work he or she would do, how much time they would go with limited income, and whether they would get benefits also caused tension in marriages.

FRIENDSHIPS AND SOCIAL LIFE

Injuries also had effects on friendships and social life inside and outside of work. Several described themselves as becoming more isolated. This isolation stems from inability to participate in recreational activities, tension in intimate relationships, or changes in work.

Sue, a 35 year old woman with a knee injury, reflects on how she feels when she can't participate in recreational activities with her friends.

> Depressed? Yeah, at times. When I look at my bicycle and my girlfriends call me up and say, oh let's just go around (the lake). Sounds simple enough and if I do, my knee swells. And that's a flat area.

Not being able to participate in recreational activities is especially difficult for men since many physical activities as a primary aspect of their friendships. Art, 31 years old, described how his inability to participate in hunting and work exchanges with his male friends has had a major impact on his social life.

> Lost my hunting buddies. Used to do a lot of hunting...Don't see those friends so much. They were friends I would do things with. Now I can't do those things. I'd go to help a guy with some work on his house. He'd come help me. Now I can't do that, so I don't see those friends.

Art also described his frustration at not being able to help neighbors and relatives with maintenance and repair jobs because of his injury. For example, he used to help out his widowed mother-in-law by mowing her law, "but can't even mow my own lawn now."

Jack, 39 years old, describes his experience of losing the support of family, a girlfriend and his friends from work:

> I'm isolated right now. Yeah, definitely isolated. Me and my parents don't talk. Girlfriend moved out. Me and my brothers don't talk. I got four brothers...Worked with a bunch of guys before all this happened. We always helped each other, getting each other jobs all the time...They're all getting foreman's jobs, stuff like that. These guys that know me know that I've had my neck crushed and my back surgery and the carpal tunnel surgery. They will not do nothing to give me a job. In fact, when I went on a job, the first thing they say is, 'you got to get rid of this guy.' So when you say friends, I'm pretty picky about my friends. They're usually not in construction, and if they are, they've had back surgery and they're not doing it no more.

Art described how it's also hard to maintain friendships with coworkers after an injury because many just feel uncomfortable with those who are injured. "They could see themselves there, and that's scary."

ECONOMIC ISSUES

Six participants focused primarily on economic challenges as being the most difficult following their injuries. Almost all of those interviewed discussed economic challenges as being significant at some point during their injury. For some, the challenge was temporary, for others it has been more long-term.

Economic challenges ranged across many issues: loss of income, problems with compensation, economic strains on relationships, and lack of control over income. Specific aspects of these issues are examined below.

LOSS OF INCOME

Temporary loss of income was a challenge for almost all the carpenters interviewed. For some, the loss of income was exacerbated by an inability to get L&I compensation or frustrations with allowances provided by the Carpenter's Union. Often, loss of income because of injury coincided with other life challenges, such as pregnancy, the illness or injury of a spouse, or the special needs of children. Rick, a 37 year old man illustrates the problem he and his wife Nancy, also a carpenter, had in temporarily losing income:

> Two and a half months with no income and this one (the baby) on the way. We went from $80,000/year income to $40,000 a year income and then down to less than that. (My wife) had to take time off. She couldn't work while she was pregnant.

Others experienced loss of income for longer periods. Mark, 40 years old, described how he went from $35,000 a year to the option of earning $6.75 an hour after he ripped a muscle in his shoulder. He had 6 months without enough money and had to go to the food bank to fill in the gaps. He then had a year and a half of making less than before. Retraining in the computer field allowed him to move into new work where he is making more than he did as a carpenter. However, he described the transition as being very difficult.

Some have suffered what they see as more permanent reductions in income. Some complained of less earning power in carpentry work because of their injury. They often take jobs that pay less because they fear not getting work at all. Sometimes they take non-union jobs and then lose benefits.

PROBLEMS WITH COMPENSATION

Several of those interviewed did not have their claims recognized, some for present injuries, some for past injuries. Rick, a 37 year old man with bursitis was still working with his employer's insurance company and L&I trying to get his claim recognized for bursitis. After a year and a half, he still had no compensation because his company declined any responsibility for the occupational disease.

Some such as 36 year old Doug, who injured his hand, had their claims recognized but only got the money long after they needed it. During his recuperation period, Doug had to rely on a second income, borrow money from friends and family and take money out of savings. This increased pressure on his spouse and on other relationships and also increased personal stress.

Two men explained how narrow the notion of compensation is since it does not take into account the loss of investment income, penalty fees and taxes incurred when withdrawing money from certain kinds of investment accounts. For example, after six months of waiting for his claim to be researched, Martin, 43 years old, did finally receive reimbursement for time lost after his back surgery. However, he did not get reimbursed for the interest he lost and the fees he paid when he took money out of investments to cover his expenses. Mark, 40 years old, had been investing so that he could retire at 53 and even take vacations with his family while still working. However, he had to take money out his investment accounts to compensate for a lower income for several years. He thus lost the investments and plans for the future while also having to pay penalty fees for removing money from pension accounts and to pay taxes on the amount he took out.

Many received allowances from the Carpenters' Trust. However, several complained about the money not being enough or lasting long enough. Others complained about having to pay taxes on the minimal amount paid by trust.

Some received L&I compensation, although two carpenters described how they were only able to get settlements by hiring attorneys who then took a substantial portion of the final claim. The settlement amount less the attorney fee came nowhere near to compensating for time lost. Mary complained that she could not get L&I compensation because caseworkers kept recommending that she take jobs that her doctor said would aggravate her carpal tunnel syndrome. Because she refused to take the jobs, L&I denied her claim.

Sporadic work since their injuries mean that some carpenters are no longer covered by carpenter's insurance. For example, Art and his wife have been paying for their health insurance privately for themselves and their two children. However, he claimed that the premium for the family would soon go up to over $800 per month. He worried that despite his debilitating shoulder injury, he might have to go back to union carpentry work just to get health benefits. At one point, Ted's wife took a low-paying job in a fabric store just to get health benefits for the family. Jerry and his wife also experienced problems with health insurance. He is currently only covered through L&I for medical claims related to his non-allergic rhinitis/sinusitis. He has no coverage for other health care. His wife works full-time and earns just enough to cover the cost of her own health insurance.

ECONOMIC STRAIN ON RELATIONSHIPS

As described earlier, economic difficulties increased tensions in relationships. Many of those interviewed described how anxiety about lack of money and about where money will come from in the future had caused stress in their marriages. 54 year old Tom attributed the break-up of his marriage directly to loss of income following his shoulder injury.

In some cases, the loss of income following an injury forced spouses into full-time employment. Todd said his wife had to go to work full-time after his knee injury. She had to drop out of college, "which she really loved." Eventually they divorced.

CONTROL OVER INCOME

Gary, 45 years old, worried less about the amount of income and more about control over it after shoulder and elbow surgery:

> The lack of control over your income. Getting a check from somebody that doesn't give a hoot about you. For what? For doing nothing! ... Checks not being on time, having to tell people, creditors that I'm not in control of this. You just have to sit and wait for it to come. So it was a living, enough to live on. That wasn't the problem. It's just the waiting.

This comment, especially the worry that the money comes from "doing nothing" relates to issues of self-esteem, identity and pride around work that will be explored at greater length in other sections.

Many of the carpenters who stayed in carpentry work expressed their fear of unemployment. They had to balance risks of making claims and having the stigma of injury with the possible benefits of getting a settlement. Some did not receive a settlement but still have the stigma of having filed a claim. Most of those interviewed asserted that filling a claim is a way of publicizing their injury. They expressed what appears to be a common belief: that companies will refuse to hire injured carpenters if they know about a claim. Some got around this by finding sympathetic employers, hiding their injuries, not revealing on an application that they had an L&I claim, or taking lower paying jobs that do not inquire into the health and history of employees. This leads to economic hardship as well as psychological stress. These strategies will be explore further under "Coping."

QUALITY OF WORK LIFE

Seven participants made comments that reflect concerns with how they have changed in relation to their work. They described themselves as unable "to put their tools on" or as slower and less efficient. They also described the demands of a work culture that values speed, strength, toughness and risk-taking. In some cases, their efforts to compensate reflected concern over economic effects (i.e., the stigma of the injury makes it hard to get work). However these participants highlighted their emotional responses to how their injury changed their work rather than loss of income or loss of control over income per se as the greatest challenge. This reflects a key theme that runs through most of the interviews: the pressures to keep up with everyone else on the job and the enormous pride carpenters take in their ability to do their work and to do it well. Responses ranged from simply not being able to work as efficiently as before to compensating for the injury in various ways to feeling the loss of their work identity.

A 31 year old man, who became permanently disabled at age 27 in a serious construction accident, provided a poignant account of how the injury diminished his sense of self in relation to work:

> I grew up in a family of carpenters. My stepdad was a carpenter. I piloted my life to be a carpenter. It's all I wanted to be. I enjoy it, but I can't do it anymore. It's part of me that's been taken away.

Other comments echoed this sense of loss. Larry, who is recovering from a head injury talked about the anxiety that comes with finding out "you have no value" and "the need to reconstruct yourself." Mark expressed a feeling of incompleteness: "I'm not a whole person anymore, like I was, and that's tough." Martin described how "confidence, pride, everything's destroyed. It's very hard to regain your pride when you spent 20 years to hone your skills, to have to start all over again when you're 43 years old."

The following statements show different physical and emotional responses to injury on the job:

> I find myself being defensive, over cautious. But far more cautious than I was before, so it takes me longer. And sometimes I won't do it. Well, then they look at you like, 'c'mon, what are you doing?' (Phil 55 year old man with various injuries)

> Just as much as the guys have the testosterone, I had the same problem and it has nothing to do with the gay issue. It's the fact that hey, I wanted to prove I could come back to work. And for the first - it happened on the 11th of November, and the doctor is like, 'a week at home, give your knee a chance to rest and we'll put you on light duty.' I'm like the kid with the broken thumb, it just didn't work. 'I'm sorry, take this cast off, I'm going back to work' I know how this works. So here I am, we're working 7 days a week, 10 to 12 hour days, so we're working lots of hours, and I told my boss, I said 'okay, I'll do light duty, I'll only work 8 hours, and I'll give my leg a chance to heal.' In the meantime I won't be kneeling like I've been doing, I promise, I'll baby my knee. I'm a girl, I'm not afraid to admit that. And my knee was swollen, so I had the limitations just on the physical end of it. But the desire to go back to work? Oh, it was there. And the guys are like, she's back to work, she's one of us, she can handle it. She's tough. (Sue, 35 year old woman with knee injury)

> See mine is not quite that clear-cut, it's more like whining, but after 30 years of dealing with this stuff, it wears you down. When it impacts your ability to pass exams, or to hold a job, and it knocks you down and all of a sudden your paycheck isn't coming - (Nick, 55 year old man with many unreported injuries)

Phil had been denying his injuries for years - not getting examined or treated in order to live up to his self-image as an uninjured worker. During a focus group, he admitted that the years of ignoring the injuries might be catching up with him but still found it hard to identify his injuries without apologizing about "whining" or "not having clear-cut injuries."

Some commented that coworkers contributed to their feelings of worthlessness and incompleteness. Jack discussed how his "so-called friends" on a job often inform the manager that he is an injured worker and recommend that he not work there. Jack also described the challenge of working on a job where he needs accommodation but having to try to hide the fact that he has an injury so he can keep working.

> When I go to a new job, new guys, new faces the same grumpiness is there. The same pain is there, just new people. And some people are not going to deal with that, okay? I don't like to... I cannot volunteer the information out there that, 'hey, you know, I'm sorry guys, but I got my neck crushed and it really hurts to do that every now and then.' You just get pissed, and the madder you get, the people around you see it and then next thing you know you're out looking for another job.

The work culture creates an expectation that everyone will pull their own weight. As described in subsequent chapters, many carpenters have had to change the way they do work by slowing down or asking for assistance. When they receive little sympathy from coworkers let alone managers in coping with their injury, they experience even greater challenges, leading to anger and sometimes depression.

Fear of losing a job and the income that the job brings clearly underlies some of these responses. Being identified as someone "who can't keep up" or is "accident prone" can lead to layoffs or difficulties in being rehired. However, the responses that have been clustered in this category deserve to be looked at separately from those that highlight more economic concerns. They hint at how carpenters perceive themselves in relation to their work, their coworkers and their work culture after an injury. This self-perception and the ways that carpenters compensate for it have significant implications for determining the risk of re-injury and the likelihood that an injured carpenter will seek necessary medical, economic, psychological, or social support.

Many other discussions in interviews and focus groups revealed that carpenters value the quality of their work life: the satisfaction of doing the job well; the respect of coworkers; and their perception of themselves on the job as hardworking, skilled, and fully capable. Experiencing a decline in quality of work or work life leads to anger, depression, and frustration. These themes will be elaborated more fully in the following chapters.

MEDICAL ISSUES

Three participants discussed medical issues, especially the pain, surrounding their injury as being most difficult. One recalled the painful and exhausting routine of repeated hospital visits and surgeries. Another mentioned the chronic pain that comes from a permanent disability.

In several cases, not surprisingly, the respondents in this category discussed how the pain and the rehabilitation routine related to their inability to work and their worries about losing income. However, they focused on the pain itself as being most difficult.

Not surprisingly, all of the carpenters interviewed discussed the pain of their injury and the complications of the medical routine to some extent. As described earlier, many deal with chronic pain and partial or permanent disabilities that has effects on their ability to do physical work and take part in leisure activities.

PROBLEMS IN DIAGNOSIS

Several of those interviewed faced the challenges of receiving conflicting diagnoses from different doctors. This variability in diagnoses led to many problems, some economic, some medical. In some cases, it complicated and sometimes set back their rehabilitation. At least one man had complications following his first surgery, thus lengthening recovery time and necessitating more follow-up treatment. For those with cumulative injuries, the nature of the diagnosis made a difference in claiming L&I compensation. Several of those interviewed argued that occupational disease claims are much more difficult to trace and receive compensation for than occupational injury claims.

TREATMENT

Several carpenters questioned the quality and direction of their treatment. For example, Gary claimed that some of his treatment for torn rotator cuffs and ulnar neuritis was dictated by L&I rather than by appropriate medical practice. Jerry claimed that many physicians denied him treatment for his non-allergic rhinitis because they would not take patients making L&I claims. He also expressed frustration that he only got treated for symptoms but never received treatment to improve his immune system so that he could become well. At one point during his treatment, a physician diagnosed him with depression and put him on prozac because he expressed frustration with his attempts to get quality treatment and deal with financial problems caused by inconsistent L&I compensation.

Several carpenters also expressed frustration with rehabilitation therapy. Mary who had surgery for carpal tunnel syndrome found that caseworkers did not necessarily understand the nature of work that carpenters do. They advised her to do work that conflicted with her doctor's treatment plan. Larry, who is recovering from a head injury found that the group therapy prescribed by his doctor did not provide benefits because others in the group did not relate to the experience of occupational injuries. Moreover, the group served spouses and parents of head injury patients rather than the patients themselves. He felt that having a peer group of those with occupational injuries would have made more sense for him.

AGGRAVATING INJURIES

Several of those interviewed did not initially seek medical advice and did not consider their injuries serious until the pain became overwhelming. Others claimed that doctors and employers did not take their injuries seriously. Two carpenters endangered their L&I claims by refusing to take jobs that violated their doctor's advice.

Some aggravated their injuries by continuing to work or be active and then required further medical treatment. 45 year old Gary offers an extreme example of this. After having shoulder and elbow surgery, he was told he could never go back to carpentry, but he went back anyway risking further injury.

Martin described how his employer did not take his injury seriously:

> I was punking steel across the jobsite and I just twisted and I felt something like pop and fizz, and I thought well, you strained it...And like I said, if I would have been able to sit down at any time and just allow it to maybe rehabilitate itself, we never would have made it to any surgeries. But I took it to the company several times and

> said there's something more there, and they said, 'ah, it's in your head, we can't replace you, even at seventy percent you're better than the people that go out there, ...da, da, da - just a sales pitch. I should have had the sense to quit or walk away from it.

After pushing through several more months of work to avoid layoff, Martin "went down for good" and faced two major back surgeries and a year off of work, which he claimed almost bankrupted him.

DEALING WITH THE SYSTEM

Two of those interviewed said that dealing with various aspects of the health care, state compensation, insurance and legal systems were the hardest thing they had to deal with following their injuries. As Jack, a 39 year old carpenter, "Nobody believes you. I feel that if I was to fall off a bridge on a job, hit the freeway, get bounced off two or three cars, that they would deny me." During the course of the interviews, other carpenters mentioned the humiliation of having to justify and verify their labor and industries claims, being bounced from one claims officer or counselor to another, or of trying to get doctors to take them seriously.

Jerry's case captures various aspects of "dealing with the system." Age 44, Jerry was diagnosed with non-allergic rhinitis. He faced the challenge of getting a diagnosis that showed his disease was work-related. He described how he had been in contact with "probably 30 different claims managers and 10 different vocational counselors" over the course of four years. He described his relationship with them: "You call up, they don't know who you are." L&I did eventually cover medical needs related to his respiratory condition and provided some time loss compensation. However, his coverage has been inconsistent because of communication problems between his doctors and L&I. At the time of the interview, L&I had recently stopped sending checks because they claimed they had not received any current medical information from his doctors. He then described the challenges of finding a doctor who will take a patient trying to verify L&I claims. "Doctors won't take you because they don't want to deal with L&I." Being unable to find one locally, he has to make frequent trips to Idaho where his former doctor practices. He has also tried to find attorneys to help him get his full claim, retraining and a settlement from L&I, but has also been frustrated with them. He had made plans to enroll in a training program to prepare for a profession which would allow him to use his skills in an environment that would not aggravate his condition. However, L&I has been delaying the process which would allow him to enroll in the program. When interviewed, he had still not received about $5000 in time loss compensation. He eventually filed bankruptcy and said that in the next few weeks following the interview he was going to have to borrow money or return to working in conditions that made him sick.

THE STRESS OF MAKING COMPENSATION CLAIMS

Almost all of those interviewed, described the stress of dealing with Labor and Industries or "L&I" - the Washington state system for work injury compensation. Several carpenters explained that for cases of occupational disease, companies can often deny that any injury took place on their job. For example, Rick with bursitis had been through several years of trying to make a claim, being shuffled around and still had no settlement. Gary ended up hiring an attorney to get his claim for a cumulative shoulder injury honored.

THE HUMILATION OF NOT BEING BELIEVED

Besides the frustration of dealing with L&I comes the humiliation of not being believed. Those interviewed prided themselves on being hard and honest workers. They felt humiliated when their honesty, especially as workers, was questioned. Several also complained of no personalized attention and a lack of sympathy. For example, Tom described claims managers as "all overworked and stressed out" and explained that "they don't usually have any experience in carpentry. They don't understand the nature of the work." Mary described the problem as more than the overwork and stress of claims managers. She claimed that claims managers make recommendations without trying to understand the nature of the work or the injuries. Her refusal to take the work recommended by her claims manager led to the loss of her claim.

Tom summed up his perception of the workers' compensation and company health and safety systems:

> What I found was very consistently with both the L&I people and those people who dealt with these issues for the contractors, their agendas were CYA- Cover Your Ass....And their basic approach from the very beginning was we will make every effort to deny having any responsibility, either financial, moral, whatever.

This experience of being shuffled through a government agency or through company bureaucracy which had an agenda of disclaiming responsibility left many of those interviewed with some feeling of being "humiliated" or "belittled" as their integrity, skill, value, and honesty were questioned.

NOT MAKING CLAIMS

The difficulties of dealing with the system led some injured carpenters not to file claims at all. Nick, who at 55 had a string of unreported and mostly untreated injuries, complained of not understanding L&I. He believed there was too much paperwork and feared getting "a black mark" on his record. Some carpenters who had previous injuries had filed claims on some injuries and not on others. With each injury, carpenters must weigh the hassle and risks involved with the benefits they might gain.

SUMMARY

Those interviewed faced a variety of challenges. Many emphasized more than one challenge as being most difficult. Eight highlighted the difficulties or limitations they had in family, home and social life. This included participation in leisure or basic household tasks, relationships with children, marriage and personal relationships, and friendships and social life. Six participants focused on economic challenges as being the most difficult following their injury, and all of those interviewed touched on economic difficulties at some point during the interview. These challenges included temporary or permanent loss of income, problems getting compensation, economic strains on relationships, and control over income. Seven emphasized the hardship of becoming slower, less efficient workers and the stresses this creates on the job. While some of the respondents also worried about losing jobs and income because of their injury, they highlighted their emotional responses such as feelings of worthlessness and incompleteness. Three participants discussed medical issues, such as problems in diagnosis, treatment, and the aggravation of injuries, as being most difficult. Other participants discussed the challenges of these at some point during the interview, although they did not necessarily highlight medical issues as being most difficult. Two participants claimed that dealing with L&I, doctors, and the legal system was most difficult. This sheds light on experiences that many other participants shared, the emotional stress and often humiliation of dealing with health care, Labor & Industries, insurance companies, the legal system, and employers. Several carpenters responded at some point during their injury history by not making claims or seeing doctors. This suggests that with each injury, workers must weigh the emotional stress and economic risks of making a claim or seeking medical advice against the benefits they might gain.

Examining the challenges identified by these twenty carpenters reveals practical needs for economic support, quality health care, and responsive programs. However, interviews also show what may not be as obvious: that just as much attention needs to be given to the emotional needs of carpenters as they deal with tensions in their family and home life, the stresses of not feeling as efficient on the job, declines in earning power and what many describe as the humiliation of dealing with doctors and claims managers. Ways to address these challenges will be described in the final chapters.

CHANGES

This section looks at the changes or sometimes the lack of change carpenters have experienced in their lives due to injuries. In responding to specific questions about how they have changed, the challenges they faced and future plans, carpenters discussed changing work lives, plans for making changes or why they decided not to make changes in their work. They also reflected on how their injuries contributed to changing expectations, changing social lives and work cultures and changing safety awareness and practices.

CHANGES IN WORK

Following an injury, carpenters often face limitations which require them to change the way they work or the kind of work they do. Most of those interviewed did not change careers. They stayed in carpentry and found various ways to cope with chronic pain and their physical limitations (described more in the next chapter). Others faced the need to make long-term changes in their work. For some, career changes have ultimately been positive, although individuals must still live with chronic pain and the limitations imposed by their injury or disability. For others, changes have been more negative. Among the small sample interviewed, education level and prior work experience appears to play a role in how well carpenters adapt to career changes. Cases studies in each section illuminate issues faced by individuals, how they weigh options and make decisions, and the benefits and challenges that their decisions bring.

STICKING WITH CARPENTRY

Thirteen of the twenty carpenters who participated in the study still worked in some form of carpentry. Some continued to do the same work they had done before. At least two say that their injuries have not kept them from returning to do heavy carpentry work. Some had moved into lighter kinds of work (e.g., finish work instead of sheetrocking). Many say that continuing carpentry causes pain or aggravates their injuries, but they do it anyway. Some continued working in carpentry but were making plans for changes in the future.

Carpenters gave several reasons for sticking with carpentry work despite the pain and risk of re-injury: money, identity, love for the work, family tradition, uncertainty about how else to use their skills. Several case studies will illustrate the various reasons why carpenters go back to their work despite the pain and risk of re-injury:

Dave. With torn rotator cuffs in both shoulders, this 59 year old man went back to carpentry. After trying to return to heavy construction, he ended up doing finish work. He still finds the work painful but is able to do it. For instance, last summer he did acoustic ceilings, holding his arms up eight to ten hours a day. Such work aggravates torn rotator cuffs. "It's a little bit painful, but it's not hard. It causes me pain, but I can handle it."

He claims that if he'd known what he knows now, he'd never have been a carpenter. "It's a young man's trade. It's hard on the body." He moved into the field after he retired from the army. He had the option of continuing in the field of aircraft maintenance which is what he did for the army, but he'd always been interested in woodworking. He put in for an apprenticeship not really expecting to get it. At 38, he was the oldest apprentice in his county at that time.

Mary. 46 years old, Mary returned to stapling work assembling exhibits at trade shows after surgery for carpal tunnel syndrome. Although she has three years of college classes, she has not really considered alternatives. "It's pretty hard to think of any jobs that don't require your hands all day long." Mary describes how she also feels suited to the work:

> I come from a family of people that pretty much like to work on their feet, work with their hands. It's the type of business I'm in. You use your resourcefulness. I've never considered myself to be an office person. Only maybe for part of a day if anything.

Larry. 52 years old, Larry could not go back to being a project manager, which is what he had been doing for ten years before his head injury. He had even been thinking about going into management before his injury. With a bachelor of science degree in building construction and his experience as a carpenter and a manager, he was well prepared for management. However, permanent damage from the injury has impaired some cognitive and communication abilities that would be necessary for management work. He feels more comfortable now doing physical work. He's currently doing drywall, which he says he likes. He talks about the challenges of putting his tools back on after 12 years:

> At first it hurt, physically hurt, and I was wondering if I even ought to be doing this. I'm 45 years old...I went back to college when I was 28 so I wouldn't have to do this when I got older., and here I am again. And you start blaming everything around you for that....I finally just decided that this isn't all that bad. I'm making a pretty good living, I can't complain.

He felt he could not fully consider other opportunities while recovering because of the nature of his injury, which effects cognition and communication. If someone had been able to make him aware of what to expect from his injury over time and what he might be able to do, he would have considered alternatives.

Rick. Rick, 37 years old, spoke passionately about his love for doing heavy construction building bridges, freeways, and dams. "Heavy concrete is what I do best." However, until he had several surgeries to remove the bursa in his knee, bursitis made it difficult for him to do the work he enjoyed:

> I enjoy working high. I enjoy working heavy concrete. I always have. I worked (a) dam from start to finish up about 300 feet above the river. So basically, as long as I did work that paid the same but wasn't as enjoyable to me, it didn't bother me much. But when I did what I enjoyed doing, that's when it really started irritating me…I could make the same kind of money doing a lot of different aspects of construction. But if you're not enjoying what you're doing, why do it?

After surgery, he was able to go back to heavy construction with minimal pain and limitations. He says he has been able to get hired because employers don't know about his injury since his claim has not yet gone through L&I.

37 years of age when he was interviewed, Rick had been in construction since he was 19 and with the union for 13 years. In his early teens, he saw himself doing construction work until his 40s. Now he sees himself staying in it until his 50s. While he would like to find an avenue into management, he does not see many possibilities. He expressed frustration about there being no avenue for moving up and about young guys out of college without experience in construction getting hired as managers. He sees that the experience accumulated by carpenters doesn't count for much in management. While he might consider going back to school, he finds it impossible economically to take four years off.

> There's really not a good avenue for an average working guy, regardless of how good he was in the trades for him to move up. You basically have to build the ladder before you can go up…I asked the union about it and they flat out told me management is a company man and we are union. We are a labor force. So if you want to go from being labor force to company man…you're on your own.

NEW CAREERS

Three men and one woman left carpentry work and pursued other opportunities. The men worked outside of the construction industry as administrator, computer specialist, and switchman/brakeman/conductor for the railroad. One woman stayed in the construction industry as a health and safety officer. Case studies highlight some of the strategies they used in making the transitions and the experience that helped them prepare for new careers.

Doug. This 36 year old man with a hand injury was hired in the maintenance department at a municipal port in Washington and then worked himself into an administrative position. He now oversees maintenance at the port. He spends half his time in the office, half in the field. He was in construction for 15 years and in the union for 11 years of that. He came from a family of three of four generations of carpenters. As a carpenter, he worked mostly as a pile driver.

His college degree in political science and graduate degree as a paralegal helped prepare him for his career transition. "I think personally that helped me because I had the confidence and knew that I could do the things that were necessary or at least have a clue to how to go about making things happen." He worked for some time as paralegal, where he developed technical skills, such as being able to write documents and understand filing systems, that have helped him in his administrative work. He also gained supervisory and estimating experience by being in a family of carpenters and being a foreman for one company.

He attributes some of his success to people who helped him move into the new position. "In retrospect it's the best thing I've ever done. Again, I look back and wonder how I would have made it to 65 as a pile buck." He says that prior to his injury he did have some expectation of moving into the management side of things but didn't look ahead too much when he was younger. He described himself in his early years as "just into making money."

Sue. 35 years old, Sue suffered a knee injury just before she finished her apprenticeship. With humor, she describes how her attempts to keep busy created an opportunity for her to work her way into health and safety administration.

> I'm back on light duty, I'm in the safety office because I refuse to sit at home and eat bonbons. Drives me crazy to sit at home. I'm just not that type of person. I told my boss at the time…I said, 'I have to do something. I'm going crazy sitting at home.'
>
> He said, 'you're just going to drive me insane. If that's your goal, you're doing it.'
>
> 'Let me go to work, please.'
>
> So he arranged so I could sit in the safety office and if nothing else, just be on the job site for 8 hours a day. And one thing led to another and being that I'm computer literate and have some savvy, have some background in office, I just walked into it and said, 'oh, I can do this for you, let me take this. I'll file this for you.' I made myself irreplaceable, and the safety office didn't realize how much they needed an extra hand. Well, one thing led to the other. The safety director at the time was fired. The kid that we had hired for his assistant who was just out of college took over as safety director. He had no experience out in the field, so it was perfect. He had all the book knowledge, I had the field experience. We made an awesome team. So he would come back and say, 'Sue, why do you have to have a ladder three foot above and tie it off at that point?' And I'd explain to him why and he would come back and explain to me why paperwork had to be done a certain direction.

Eventually the company invited her to stay on in health and safety. Her background as a former Coast Guardsmen with air search and rescue training, as well as a former Emergency Medical Technician helped qualify her in health and safety area. She had also been on safety committees in other companies. She took courses on health and safety The company paid for the time while she paid for courses. Now that she's director of safety, they pay for the courses too. She also took L&I courses to learn how to deal with the system better.

Kevin. 44 years old, Kevin became a switchman/brakeman/conductor for the railroad after his hand injury. He was a carpenter for 30 years and active in the union for five years. He still maintains his union membership. He started carpentry at a young age while working with his father. He became injured when "a dissipated worker" shot nails into his hand with a nail gun. His hand healed well, and he could have returned to carpentry. However, his injury as well as other circumstances prompted him to explore new opportunities. He says he got tired of working himself out of a job and of what he called "underhanded politics" in hiring and in the union. "I put a job interest card in at the railroad and sure enough they called me. I believe God did it. He's got a plan going for me." The railroad not only hired him, they also provided what he called a "really fine education" and more opportunities for mobility than does carpentry. He also claims that insurance coverage for family his is better.

> You know the Carpenters' Union provides a good living wage, if you can work. If there's enough union carpenters out there to keep the guys working. There's a whole lot of variables and the carpenters' trust sucks for keeping our families covered. I mean the benefits are good when you get them, but the consistent coverage isn't there.

INABILITY TO WORK FULL-TIME

Three participants had so far been unable to return to steady work at the time of their interview in 1998. Periodic attempts to earn a living through temporary construction work exacerbated their injuries and left them feeling angry and frustrated. One man attempted to retrain for a new career but experienced problems in getting financial support for what he wanted to do and gave up.

Art. At 31, Art was the youngest of those interviewed. He suffered a neck and shoulder injury during a serious fall. After having several discs removed from his neck, he has lost a great deal of dexterity and cannot work full-time without aggravating his injury.

After his injury he attended community college for two years to get a degree in construction management. During his studies he found out that the most he could do with such a degree was sit in an office making $12 an hour. He wanted to be out where people were working and decided that getting a degree in building inspection would be more suitable. However, L&I denied his request to take classes for one more quarter to change fields.

After deciding what he wanted to do and finding out he could not do it, he describes himself as losing motivation. He became unable to do anything. "Sit around the house all day. Don't take the care I used to. Just do things to get them over with. Don't care anymore." During a severe bout of depression, he considered suicide. "Figured I was useless. Maybe my family would be better off without me."

He identified strongly with his work as carpenter, an occupation that others in his family had had.

> I loved going to work. It was an adrenaline rush. It's like what some people get from skydiving. I got that everyday at work. Haven't felt that in a long time. There's no other job that's going to give me that.

He had one job during the summer painting lines of highways. He described it as being "O.K. but nothing great."

He said he's thinking about going back to carpentry work now. "Rationally I know I shouldn't. I'm going to be in a lot of pain. But the other part of me says, why not? Just do it until I can't do it no more."

Todd. In his 30s, Todd tore the meniscus in his knee when a heavy tool box fell on it. This has led to a permanent disability which limits his ability to participate in full-time work.

> I could work for myself right now. I just schedule around the pain. I can't work full days with other people. I get too irritated because of the pain. Before I was doing really well.

He says that he gets many calls to do contracting work, but he is unable to follow-up because of his injury. He said he gets depressed about his inability to do the work he enjoys.

> My vocational counselor keeps changing. I tell them, 'if you put me behind a desk, you'll kill me. You'll take the spirit out of me.' I've done carpentry since high school. My dad and brothers do related work. I'm the only carpenter.

RETRAINING

Seven of those interviewed described experiences with or plans for retraining as a way of changing careers. Only one successfully entered a new field. Others returned to carpentry work, remained out of work, or were only beginning to make plans for retraining at the time of the interview.

Three men tried retraining for new careers and became frustrated. As described above, Art could not get permission from L&I to take one more quarter of coursework to get a degree in the work he really wanted to pursue. Frank began taking classes at the local community college following an injury. He planned to work towards an engineering degree but had to return to full-time work after his divorce.

The case of Gary illustrates in more detail some of the challenges involved in retraining.

Gary. 45 years old, Gary has been in carpentry for 17 years. He has ulnar neuritis and a torn rotator cuff. He used to do sheetrock but now does more varied, although not necessarily lighter work, to relieve stress caused by repetitive motions. He had been working on his current job for about five weeks when he was interviewed.

Gary described himself as being in constant pain. His doctor had told him he could never do construction work again and advised him to be a security guard or work at a 7-11, where he wouldn't need any training. He says the doctor gave him the impression that that's all L&I would cover. "If I'd had any experience as a cashier, I might have had to take such a job."

Through a vocational rehabilitation program, he learned that he did have retraining opportunities. He expressed interest in computer assisted drafting to the vocational counselor. He had never done drafting before but had read prints during his career and explored computer programs through a friend. After some aptitude tests and some math improvement classes, he enrolled in a school for the handicapped where he took six months of board drafting and six months of computer classes.

He graduated with high grades and interviewed at Boeing. However, he found out that the aerospace company only paid $12 an hour. He and his wife hoped to build a house on their ten acres of land and couldn't see doing it on $12 an hour. He wondered about the quality of the education at the school and how well it matched the needs of the labor market. The school was the only one that fit L&I guidelines and offered anything substantial after graduation.

At the time of the interview he had given up on computer assisted drafting work and saw himself working in construction until 65 because economically he could perceive no other alternative. He expressed regret about decisions he had made earlier. He claimed that if he had started drafting when he was younger, he would have been able to move up. But he didn't believe he had time to start over at the bottom to move up. He said his decision to stay in carpentry was purely economical. "I loved the drafting. I loved the computers, completely obsessed with it."

He works with an employer who knows about his injury and is willing to accommodate him. Other places wouldn't hire him. At the time of the interview, he and his wife were just about to take out a loan to build a house so they are banking on his being able to overcome the pain enough to continue working:

> Right now it hurts. And I can hear it clunking, feel it clunking, and so the pain is a constant reminder... So I hope it lasts. About ready to go in the hole here, so I hope it lasts. Otherwise I'll lose everything...What else can I do?

Three other carpenters were making plans for retraining at the time of the interview. Jerry faced ongoing challenges in getting his retraining plans approved by L&I and felt frustrated by the delays. Two other men were optimistic about their ability to make career transitions. The case of Mike demonstrates some of the the issues involved in making decisions about training for new careers.

Mike. At 33, Mike is planning to be a building inspector and recently signed up for classes to begin making the transition. He's been in the trade ten years, nine years doing houses before that.

> You get up in the morning and you're sore to one extreme to the next and I'm not that old, I'm only 33...I've had five operations. I don't care for it no more.

He's a foreman now, working about three quarter time with tools on and one quarter with them off, doing paperwork. But his plans to do building inspection will lead him out of the work eventually.

> I want to try to get out of this. I enjoy the work. I'm tired of being sore. And of our local, we got 12-14000 members, under 200 the age of 50 and over. I've known three guys (in ten years) now that retired, which is great...They made it through retirement. There's no way I can...I can't imagine me doing this 'til I'm 55.

CHANGES IN EXPECTATIONS

For almost all of the carpenters interviewed, injuries challenged individuals to realign their expectations with reality. Some experienced minor setbacks, while others had to make major readjustments in retirement and other plans.

For some, the injury directly disrupted plans for the future. For example, Jack, 39 at the time of the interview, expected to have "a steady job with one company, taking a vacation every year, house all paid for, nice new car, wife, kids." He said "I don't have none of that." His injury makes it hard for him to keep a job and build up savings which would allow him to build his future. He also claimed that the injury contributed to the break up of his marriage, further disrupting his family plans.

In another example, Gary saw himself at age 45 building a house on his ten acres of land in rural Washington. He and his wife had been living in a trailer for seven years waiting to build the house. They still haul water in barrels to take care of household needs. They expected to start building their house 4 years ago when Gary got injured. His wife had broken her neck in a car accident just before he got injured. Luckily she fully recovered but both their injuries set back their plans. In order to achieve his plans, he has returned to carpentry despite his doctor's advice that he find other work. Because he felt he need to make more money, he turned down a $12 an hour drafting job that would have used the skills he had learned in a retraining program. At the time of the interview, he and his wife were shopping for a loan to build their house.

For others, the injury complicated efforts to recover from other life challenges. For example, Phil had planned to retire at 55 through his work as a contractor. But business challenges led him to bankruptcy and he ended up back with his tools on. He talked about the pressures that running a business put on his family, such as not being able to give proper attention to a son with dyslexia. He went back to carpentry work hoping to spend more time with his wife and kids. However, he injured his knee soon after returning to carpentry work.

> I was…trying to play catch up for 11 years of this business. Then I got hurt on the job….When I was in business if I got hurt… I could keep going, keep running the business. Well, when your hands are your business and you get hurt, then the tension started coming back again because I didn't have my nose to the grinding wheel. I wasn't getting where I wanted to be., I wasn't even providing the essentials. So that bothered me.

Now he can no longer see himself retiring at 55. As a contractor, he was out of the union for 11 years and lost benefits. He has been accumulating retirement benefits only since 1980. His wife earns $8.00 an hour at her job, so the family depends on him as a primary breadwinner.

Jerry expressed a different view of his expectations of work and retirement. Before being diagnosed with non-allergic rhinitis, he was preparing to retire in his 50s. However, he expected to be able to continue working. "I like working. I'm not afraid of work. My grandpa farmed 'til he was over '70. Like to fish, but you can only do so much." His respiratory condition and conflicts with L&I have delayed his entry into a retraining program and leave him unable to live up to his expectations of himself as a working man.

Several carpenters expressed gratitude that they had not yet experienced too many setbacks from their injuries, but they worried about the future. They realize that their bodies are wearing out and wonder how they will make it to retirement.

CHANGES IN WORK CULTURE

Those carpenters who moved or attempted to move into office jobs discussed the difficulty of adjusting to a new work culture and to the loss of their coworkers in carpentry. For example, two men described how they had a hard time adjusting to new methods of conflict resolution:

> In construction, if somebody gets in your way, when you're doing a job, you just tell him to get the hell out of the way or I'll run you over. I got a job to do, I'm trying to make money for my company, everybody on big jobs are stacked together, so it's eat or be eaten, you know. And I consider myself real good at that...Not there to be friends, you know? Just there to get a job done and don't have to kiss anybody's ass. All of a sudden to being in an ass kissing environment - pretentious, just blew me away...We get our work done. These petty little things that seem to happen on a constant basis are taken care of on the spot immediately in the blue collar world. And you go have a beer afterwards (Gary, 45)

> As a carpenter, when you go out on that job site, it's because you know that all of us guys are out here working together. We're a team. But here (in an office) the job site's different. There you could work out differences face-to-face. Here you don't. You don't know what people are thinking. So you go around wondering. There people would just tell you. That's a different world out there (Mark, 40).

Mark went on to describe how he adjusted to office culture by becoming an independent contractor. This allows him to change his work environment frequently.

Sue, who left carpentry to become a health and safety officer, worries about losing the connection she had with "the boys" when she was one of them. She also worried about losing the union connection and becoming "management."

> And so for management to say, give up their union, give up that connection, and I look at them and I'm like, you know, if I give up that, we're going to be the losers....I've made it mentally known in my own heart that I can't give that up...even if I go into management and I cannot be an official union member, I guarantee you that my boys, rank and file, will not lose me as a supporter. I am without a doubt a union member, whether I carry a card or whether I don't.

She describes herself as being from a white collar background "where my family would bust up a union in a heartbeat." But she says..."my heart's there and I got to follow my heart. If I don't do anything else in my life, I have to follow my heart."

CHANGES IN SAFETY CONSCIOUSNESS

When asked how they had changed following their injuries, many carpenters discussed their new awareness of safety and health issues. Some have become more aware of how certain tasks aggravate their pain; others look at the bigger picture - assessing safety hazards on a job site. A few who are in the position of being responsible for the safety of others build on their experiences to create safer workplaces for everyone.

Becoming More Cautious

All of those carpenters who stayed in the field after their injury had to make changes in their approach to doing carpentry. The strategies they used to adapt work styles to their injury will be described more under "Coping." Five of those interviewed described how their injury had led them to develop a more cautious, less "macho" attitude towards their work.

Carpenters who suffered injuries and continue in carpentry work became very aware of their own limitations and those of others. They described themselves as slowing down, being more cautious, and asking for help more.

> I didn't ever think I'd wear out. You know all of a sudden you're 45 years old, I mean it's just like that. And now that I'm back to work even, being able to do all these things yourself all the time and now I'm supposed to ask for help and I'm real fortunate I'm working with a friend of mine who understands and knows where I've been, so he goes 'hey, take it easy.' But its' hard to lose that macho...I've always been a real hard worker and get it done type of person (Gary, 45).

> I watch what I do. When you're young nothing can stop you. The older you get, you think about what you do now. I'm not going to lift a bunch of weight. I'll make two or three trips, if I got to get somebody to help me move stuff, I'll get somebody to help me move stuff. Yeah, I don't like getting hurt. I don't like the pain (Mike,33).

Rick, who works heavy construction and had surgery for bursitis, describes how he had been conscious of safety issues such as falls even before his injury, but had not thought much about the everyday wear and tear of body parts such as knees and elbows.

> A lot of guys who've known me for awhile, who've worked high with me call me the safety Nazi because if you're working high with me, you're going to be safe or you're not going to be on the job. And I've had guys who've wanted to come to blows with me because I've tied them off when they were working on heights...But there were other parts of the body I wasn't thinking of. I was looking at the fall potential. I wasn't looking at how my knees were being abused, my elbows were being abused...I wasn't really aware of it. Often times, I come home sore and achy and it's something I never think about.

He says he's more careful now about how much weight he straps to his body, even at the risk of being challenged by employers or coworkers. He may take pieces one at a time rather than all at once. "I just learned that I come first. I used to always be...let's get the job done. But it took surgery to figure out that, hey this body isn't going to last forever if I don't quit abusing it."

Frank who has many chronic injuries, including lower back, shoulder and elbow pain as well as carpal tunnel syndrome, says his attitude towards job safety has changed not only in the way he protects his body but also in evaluating safety hazards. He says before he trusted that those setting up a job, did it safely. Now, he inspects safety hazards himself. "I walk into the area and look at the job we're doing and how we're doing this job."

CREATING SAFER WORKPLACES

Several carpenters have used their injury to learn more about health and safety or to make workplaces healthier for everyone. For example, Rick and Nancy, who both continue to work in heavy construction following their injuries began educating themselves on health and safety and legal rights. During the interview, they talked at great length and in detail about the importance of better safety standards, the legal rights of workers, and ways to overcome macho attitudes.

In another example, Doug left carpentry following a hand injury. He now administers the maintenance department at a municipal port and builds on his experiences as a pile driver to impress on his workers the importance of safety. "The same things we faced in the construction world, we face every day, so that's been good to at least be a part of that." He says he was safety conscious before but getting injured and seeing other people get injured and even losing their lives heightened his consciousness about what he could to do prevent injuries. Being in a position of administration makes him realize he has the power to prevent such accidents.

> I've been on jobs where people have actually lost their lives and things like that hit home with you, and you don't ever want to have to see that. I guess when you get in a position where you're really able to carry that out, I think that becomes more real and certainly has helped me I think to be better in approaching safety.

As described elsewhere, Sue built on the experience of being injured to move into the health and safety field. She claims that she's effective on her job because "I've been there. I've been out in the field. I've worked with the boys."

SUMMARY

Following their injuries, those interviewed experienced various short-term and long-term changes in the kinds of work they do, how they do it, their expectations of the future, health and safety awareness, and work cultures.

One of the primary areas where change was made or considered was work. Although a majority of those interviewed remained in carpentry, most went through a decision making process that weighed the pros and cons of making changes. Thirteen of those interviewed continued to do carpentry work for various reasons: lack of alternatives, love for their work, disappointment with other options. Most all of those who stuck with carpentry had to make changes in the kind of work they do and how they do it to accommodate their injuries.

Three men and one woman had left carpentry work and successfully made transitions into new careers. Two of the men and the woman had made their way into "white collar" work: management and computer systems. One man had remained in "blue collar," union work but moved into a new industry where he felt he received better benefits and better working conditions.

Three participants had not returned to steady work since their injury because of permanent disability or ongoing complications with occupational disease. These three men expressed the most anger about the changes in their lives and the lack of support they believe they have received from the medical system, from L&I and from the union.

Seven of those interviewed described experiences with or plans for retraining as a way of changing careers. Only one had successfully entered a new field. Two had tried retraining following injuries and eventually ended up working in carpentry again, one because of low pay in the field he had retrained for, the other because he was unable to continue in school following a divorce. Another tried retraining and remained unemployed at the time of the interview. Three others were making plans to enroll in training programs in the future and were optimistic about their abilities to change careers.

Those interviewed also discussed how their life plans and expectations had changed following their injuries. They experienced changes that ranged from minor setbacks, such as having to dip into savings to support themselves for several months, to major life disruptions, such as several years of lower income that changed retirement and other savings plans.

Some of those who feel that they did not experience too much disruption in their lives because of their injuries worry about their future. They face accumulated wear and tear on their bodies, aggravation of existing injuries, and the possibility of new ones.

Although the interview questions did not address changes in work culture, several respondents described their concern with this aspect of their lives. Three discussed in great detail their discomfort with various aspects of leaving "blue collar", union work and moving to "white collar" work, or "suit culture" as one man described it.

When asked how they had changed, many of those interviewed described their greater safety awareness. This included becoming more cautious about how they do their work to prevent re-injury, becoming aware of a greater range of possible injuries, evaluating safety hazards on-site, and using the knowledge they have accumulated through experience to ensure that workplaces are safer for everyone.

The changes carpenters experienced and highlighted in interviews reveal how individuals make decisions based on their sense of self, interests, physical ability, educational level, family histories, attitudes, and information about available opportunities. Each individual's case is unique, suggesting the need for vocational and life guidance that takes into account the above factors in steering injured carpenters towards new careers, new leisure activities, and ways to revise and meet their life expectations. However, some patterns do emerge across the cases described here that merit further exploration and research. Those individuals who had higher education and work experience other than carpentry seem to have fared best in making the transition to new work. Some of those who returned to carpentry expressed a desire to consider other alternatives or regret about entering the profession in the first place but could not see what else to do. A family history of working in carpentry and a strong personal identification with the work also seems to have influenced the decisions of several carpenters to stay in the field. While not conclusive, such patterns suggest the need for greater awareness about the family, work and educational histories that carpenters bring with them as they consider change, especially vocational change, following an injury. Such histories influence their readiness for change and shape the directions they will take.

COPING

The individuals interviewed had various strategies and resources for dealing with the effects of their injuries and long-term changes. Some or these strategies, such as retraining and switching careers, have already been described. But individuals also had less dramatic ways of coping with the everyday stresses of injury and change. This included physical routines for healing and changing the way they work to prevent re-injury. It also included support that they received from family and friends and from the companies they worked for. Those interviewed also described how they dealt with feelings of anger, depression and frustration and the diverse strategies they developed for taking on the system, including health care facilities, L&I, the union, and work conditions. Emotional strategies for coping included falling into self-blame, abusing drugs and alcohol, keeping busy, drawing on religious faith and optimistic attitudes, and avoiding or criticizing the system. Understanding the full range of individual responses and coping strategies is an important aspect of developing programs to assist injured workers.

CHANGING WORK STRATEGIES

Most of the carpenters interviewed who have remained in carpentry have at least had to make changes in how they do their work. This means taking extra safety precautions, using proper gear, such as knee or elbow pads, diversifying tasks to reduce repetitive motions, making more trips for carrying materials and tools, or asking for help when needed.

Coping with carpal tunnel syndrome, Mary identified the need for "recognizing my limits and moving within them." She has learned to ask for help when needed even though it feels like she's imposing. In another example, Tom who injured his shoulder and wrist, decided to continue doing carpentry but now does different work within it. "No more driving steel stakes."

PHYSICAL ACTIVITY

Those interviewed identified some of the physical routines they rely on to help them heal and cope with the everyday effects of their injuries.

Mary summed up what works best for dealing with the pain of carpal tunnel syndrome:

> Rest. Because I've always been a person that's pretty well, other than putting on the 40 pounds. I've tried to take care of myself and be cognizant that maybe I'm doing something that is going to hurt later so I better try and find a different way to do it.

Mary also had help from family members in locating ergonomic gardening tools and kitchen utensils that help her carry out household tasks more easily without aggravating her carpal tunnel syndrome.

Larry had to develop tremendous patience to learn how to talk, think, and read again following his head injury. He did crossword puzzles when he came out of the hospital to help with spelling.

Mike, who healed surprisingly fast from torn ligaments in his knee described his physical routine:

> I don't run around. I take walks with the dog everyday, try to ride the bike two, three times a week, so that helps. I try to avoid climbing ladders. Once in awhile, climb scaffolding. Got to be careful on that, but it's doing good. I watch myself. Not going to overdo it. Ice my knee down still. Doing real good.

Frank has also developed an exercise routine which helps him manage the effects of previous injuries and reduce chances of re injury.

> I joined an exercise club… about 5 years ago and that's very good. If I'm unemployed I work to stay in shape and when I am working, I like to go there to relax. And also to stay in shape. And sometimes if I'm having problems with a certain area, start working that area to overcome whatever or find out if there's a big problem I can't overcome.

Martin identified his physical routine as being most important in helping him recover from two back surgeries. However, he had to pay out of his own pocket for a personal trainer to work out three days a week. Physical therapy prescribed through L&I did not provide sufficient rehabilitation.

For some, medical treatment has been the most effective strategy for coping with their injury. For Rick, who has bursitis, surgery improved his ability to work. Before surgery, the bursa in his knee would fill with fluid and swell up. Then the bursa sac would break and leak causing pressure around the knee cap. "It was very irritating, like kneeling on a balloon." Then it would get unbearably hot. Surgery removed the bursa and relieved the problem, allowing him to return to the heavy construction work he most enjoys doing.

DEALING WITH EMOTIONAL EFFECTS

Many of the carpenters interviewed discussed the emotional effects of their injuries and how they dealt with them.

Mary describes how she overcame being angry at herself and depressed about not being able to do basic household chores because of carpal tunnel syndrome:

> It took a while to just sort of tell myself that do what I can and be happy and do things in short periods of time. And learn to cut back and not feel bad about what I can't do but feel better about what I could do. But that took a while to battle.

Initially, rather than directing her anger and frustration outward towards the nature of the work that caused the injury, she turned on herself - a common response. She described going through self-pity and then self-recrimination wondering why she didn't recognize the signs of carpal tunnel syndrome and do something sooner. She wondered why she let it get so bad before seeking treatment. "(I) pretty much internalized it and beat myself up and put 40 pounds on."

While one might expect drugs and alcohol to be a major strategy for dealing with pain and depression, few individuals mentioned it. Only one man described it as his primary method of coping with the pain and emotions of the injury and the changes it caused in his life. Jack turned to alcohol and drugs primarily to deal with the physical pain following neck surgery. " Well, you know, you're in pain and you're given so much drugs and you take that and if that ain't working, you take something else." He also responded by spending money recklessly. He used up his compensation money very quickly -"partied every night." - went fishing, skiing. "I thought it was owed to me."

After getting a DWI, Jack developed other strategies for coping with the physical and emotional pain brought on by the injury and a divorce. Becoming sober led him into a new phase of life and also showed him that he had the strength to deal with the challenges on his own.

> During my back surgery...I really questioned myself a lot...I'm not the kind of person that gets depressed. I don't get down on myself and beat myself up that way. I try to pick up a few hobbies, try to keep myself active, try to keep my mind active, so that I don't have to think about that kind of stuff because I'm just trying to get well...Of course, during my back surgery...every morning that I got up and it brought tears to my eyes to get out of bed, and I had to get up...I had wondered then - I was pretty young at the time - how can I keep doing this? I mean, what am I going to start over at? I mean, I was going through a divorce, I was having back surgery, I was having a major drinking problem, and as a matter of fact I solved all three of them problems in the whole one year. I got my divorce. I got my back surgery taken care of, and I quit drinking. There was only way to make yourself stronger, you know, and that's just to

> take one step forward. Of course, I did it by myself because there was no one out there for you.

KEEPING BUSY

Most of those interviewed described themselves as people who need to keep busy, to do things, and to be physically active. They described the boredom and depression that comes from sitting at home not doing anything and not being able to support the family. Those who found ways to keep themselves active and feeling useful improved their emotional state and also sometimes opened up new career opportunities.

Sue offers a good example of this coping strategy. Following her knee injury, she "refused to sit at home and eat bonbons." She coped by getting back to the job site as soon as possible and working her way into being useful. She describes her first attempts to go back to work as aggravating her injury and delaying healing a bit. However, through her own persistence and determination she found office work she could do that didn't strain her knee. As described elsewhere this opened up a new career for her in health and safety.

FAITH AND OPTIMISM

A number of carpenters mentioned the importance of their religious faith or at least an optimistic life attitude in helping them heal and cope with changes in their lives. One man also mentioned the importance of the support he gained from his church community as he struggled to deal with the physical and emotional effects of a head injury.

Others did not speak of religious faith but described an optimistic life outlook that provided them with the hope that they could overcome adversity. As Frank said about his back injury "count your blessings instead of pain and keep on working."

Two men began developing a more positive outlook when they compared their plight to that of others. For example, following shoulder and elbow injuries, Gary enrolled in a retraining program for those with disabilities. This put him in everyday contact with others who had more severe disabilities to overcome.

> A lot of the people were severely handicapped, a lot of paraplegics down there, so with my injury, I mean I'm still able to do a lot of things and to rub shoulders with people like that, that were so disabled, was a real energy boost. They got such a good attitude, I'd better have a better one.

Mike also compared his misfortune to that of others " a lot worse of then we are" and expressed gratitude for what was going well in his life: his job, marriage, children, and house. He identified this optimistic attitude as being one of the most important strategies for helping him heal:

> My attitude's the one that helped me out the most, because the doctor said I'd be back to work September, October, and I went back in June. That's 3, 4 months. When I went back to him two weeks ago, he says, 'in about another month, two months, you should be kneeling on your knees.'
>
> 'I'm already doing that.' (I said).
> 'No, you should be kneeling'
> 'Oh! I'm doing that now.'
> He said, 'well I don't quite believe it.'
> So I showed him, got on my knees and he look at my other leg, had all my weight on my back knee.
>
> He says, 'you're just in that one percent. You did it all.'

While optimism and faith in an ability to overcome pain and adversity can have positive effects on healing and handling life changes, it can also prevent carpenters from seeking necessary medical attention. For example, Frank walked away from an accident without going to see a doctor and having an x-ray taken.

> I try to have faith that I can overcome pain. Pain is part of the job….And disability is something I fear and I hope the pain never drags me there. And I try to just not be a victim, overcome whatever does get in the way.

Past experience had also discouraged Frank from seeking assistance from doctors. "They examine you and say there's nothing they can do. So why bother?"

Helping injured carpenters find a healthy balance between their belief in their strength to overcome challenges while also encouraging them to seek whatever medical or emotional support they need should be a key aspect of providing assistance.

COPING WITH PUBLIC PERCEPTIONS

Two carpenters discussed the challenge of coping with how others perceive them and their injuries.

Larry explained how he had to get used to the effects of his head injury. He described being bothered when things he said come out "backward, like I was dyslexic." When people laughed he would feel hurt. "Well, it's gotten to the point in the last couple of years I laugh, I think it's funny and I'll catch it before they do…."

Todd describes his embarrassment at having a limp and how he tries to hide it:

> And then people make fun of me. When I go out shopping, people say things like: "How's the cripple doing today?" or Hey Gimp! What's up?" The pain is always

> there and I hide it as well as I can. I try very hard to walk straight so no one will notice.

Attempting to hide injuries or feeling stressed by public reactions to disability can impair the physical and emotional healing process. Facilitating contact among injured carpenters would provide a safe social space in which individuals could discuss their injuries openly.

DEALING WITH THE SYSTEM

Most of those interviewed coped with their injuries and subsequent life changes by taking on "the system" in some way or another. Many of these strategies are discussed in other sections in slightly different ways. However, it is important to highlight them here as part the coping mechanisms that individuals develop. Responses range from avoiding the system altogether, to criticizing it, to trying to change it for the better. The "system" may be the union, work conditions, L&I or the economic system.

AVOID THE SYSTEM

Several carpenters discussed times when they were injured when they did not bother to get time off, seek medical treatment or did not file L&I claims. They claimed that they did not trust the outcomes or felt it would be too much trouble. Some found more personal ways to deal with their injuries, such as developing faith in their own ability to overcome pain and heal. Nick, 55, sums up this attitude: "I've always had work injuries but I've never stopped working." He has had many unreported and often untreated injuries throughout his work life because he is unwilling to deal with the health care system or government agencies.

CRITICIZE THE SYSTEM

Several of those described how they have become more critical of how things work. Developing a critical attitude towards what they perceive as the system which disrupted their lives is a way of coping. It can also be a first step towards taking constructive actions which will bring personal or social change.

Several carpenters described themselves as becoming more cynical, less trustful or more aware of how the system works. Carpenters variously described themselves as being treated like "pieces of meat" or "machines." Jack described work strategies he used to make sure he gives the company no more than a fair share of his labor:

> I used to be humble. Now because of the accidents that I've been in, and I've been in may fair share of them, and because of the abuse that I've put up with from all of the above, I just outright tell people to kiss my ass right now. You don't like they way I'm doing it, just give me my money. I'll see you later. And I got to where I just don't care no more. I don't care what they want from me, they're not going to get it. I know what they're going to get. They're going to get an honest day's work for that pay, and

> that's all they're going to get. ...I don't give the extras no more. I used to. But not no more. Never again.

Others directed their criticism towards the union. Many of those carpenters interviewed expressed great anger in how the union handled their benefit claims and about how little support they got from the union. Most still supported and worked through the Carpenters' Union. However, three men developed a negative attitude about working through the union altogether. One man said he works non-union jobs now because of his anger at the Carpenters' Union. He did not describe himself as anti-union, but resents the way things work through the Carpenters' Union. He had belonged to the union for many years, been a union officer before, and works through a different union now on his regular job. He said he had tried to make changes in the Carpenter's Union to improve conditions for the rank and file but got frustrated. He describes his new attitude about working non-union jobs:

> Nowadays I put on my bags and load up my truck, and I work for $18 an hour. And people are glad to have it because I'm a good craftsman, you know. I don't have to answer to anybody in the union about me not being loyal to the local. How were they loyal to me? They wanted me to work for them but...they don't work for us that much.

Some criticized the "white collar world" they might have to go into following an injury. Gary developed a critical attitude toward the "suit culture" he was preparing himself for through retraining. He described how he not only learned computer and drafting skills but he also learned to be an "ass-kisser" in the retraining program. He learned how "to shave and put on a suit." Laughing, he described how he dealt with the cultural change he anticipated in moving into white collar work:

> Shirts versus suits...I mean graduation night I had hair down past the middle of my back and didn't own a suit. I skipped graduation, the formal one. Went and hung out with my friends but cut my hair off in the bar after several tequilas and went shopping for a suit and did the whole thing.

Besides buying a suit, he also took acting lessons. "I just figured it was another role and that probably most of the other people really didn't like playing it either. And that whoever made the rules up and continues to make them, it's just silly."

Jack, who has had sporadic work and limited compensation following a neck injury developed a more scathing critique of the class society that shapes our lives.

> Well, I know who makes the money - and that's the owner of the company with his motor home and his $12,000 a year taxes on his motor home, and oh yes, his big beautiful home while I was living in a single wide mobile. And...what else has he got? He's got everything. Might even have a little private plane somewhere where I've got a remote control. Yeah, I know who's making the money and I know who's not and I know who's getting beat up and who's getting tossed aside. Were just - like I said,

we're a piece of meat and when they're done chewing me up and spitting me out, I'm going down the road. Because when the job's done, they hand me two checks, I go down the road and I go find another one. Yeah, my attitude's not getting any better.

MAKING THE SYSTEM BETTER

While recognizing the trauma that injuries cause in their lives and those of others, several carpenters used the injury as an opportunity to learn as much as possible about health and safety and how the union and employers treat injured carpenters.

Rick and Nancy, who both suffered injuries in heavy construction just before having a baby, did not talk about how they coped with their different injuries directly. But they talked in great detail about L&I regulations, how safety should be improved, what the union should do, and the medical aspects of their injuries. It appeared that educating themselves and trying to work together as a couple to make changes became a way of coping with the injury and the anxieties it created.

As described elsewhere, Sue became a health and safety officer following her knee injury and has also been an outspoken member of her union, advocating for better health and safety awareness and education.

SOCIAL SUPPORT

SUPPORT FROM FAMILY/FRIENDS

While some carpenters reported that their injuries created family strife and even led to the break-up of their marriages, six of those interviewed described their families and friends as being a primary source of support while they were recuperating and coming to terms with the changes in their lives. Spouses, children, sisters, brothers, parents all provided emotional and practical support to injured carpenters. Several carpenters also relied on friends and neighbors.

For example, Mary described her husband and his son as having "to put up with a lot of crying for a while." Her husband took time off work to help her with everyday household chores and personal hygiene. "I was pretty much without hands." So whatever she needed had to be planned around when he was off work.

Todd, whose knee injury contributed to his divorce, said he relied on his brothers who are also in construction and his sisters. He also had a close friend who lost a leg in a construction accident. "He helped out a lot. We've known each other since we were five. I supported him when he lost his leg. "

SUPPORT FROM THE COMPANY

While a number of carpenters felt stigmatized by their injury and believed that they would not be hired by companies that knew about their injury, three expressed gratitude for the support received from the companies they worked for at the time of injury.

For example, Doug relied on the benevolence of the company he worked for following his hand injury. He said that the company provided support that the union did not offer. He recognized that their support for him was motivated by economic reasons. Since the company is self-insured, it's in their best interest to bring someone back as quickly as they can into the workforce. Doug described the camaraderie and the family-like feeling in the division he worked for:

> It's more of a family unit, kind of a closer situation. I did appreciate those guys because they were in contact, like I said. They brought me back as soon as they could and I ended up working in the office for about, I don't know, four weeks. So it was good that they were able to do that. Those are the kinds of things I think are important. The money end of things- I don't know what you can do in that aspect, but it's just the personal contact and just caring.

SUPPORT FROM THE UNION

Only one of the carpenters interviewed mentioned social support from the union as a way of coping with their injury or the changes it brought in their lives. However, the support received was from union members taking their own initiative rather than from the organization.

> The union guys came right in when I was first in the hospital. They took a big donation at one of the union meetings and walked in and laid about $800 cash on my bed. Which is great. That's all the brothers can do. But the union I don't think really did anything at all.

Several of the carpenters made clear that they are active in the union. However, they did not specifically identify this as a source of support or way of coping during their injury. In fact, as described elsewhere some of those most active in the union felt angry and hurt about how little social and emotional support they received from what they believed was a "brotherhood."

SUMMARY

Those interviewed coped with their injuries and life changes using various strategies and resources. Almost all of those interviewed who remained in carpentry described how they had to change they way they do their work to accommodate their injuries. As described elsewhere, this can lead to conflict with coworkers and frustration about their being unable to work up to speed. It also leads to fears about unemployment. Carpenters must weigh the need to work more slowly and ask for help against inclinations to hide their injury to avoid job loss. Those interviewed also highlighted the importance of changing their physical routines at home to avoid re-injury and strengthen their muscles. They emphasized the importance of rest, regular exercise, proper tools, and appropriate medical care.

Those interviewed also discussed what may not be as obvious as physical coping strategies: how they handled their emotions about getting injured and having to make life changes. Many experienced anger and frustration about their circumstances and turned their anger inward on themselves. Others turned their anger outward towards the union, L&I, their employers, or the economy in general. A number of those described how keeping busy or drawing on their religious faith or optimistic life attitudes help them heal more quickly and adjust to their physical limitations, pain or life changes.

Most of those interviewed benefited from social support from family or friends. A few described support received from the company. Only one of those interviewed described social support from the union as a factor in helping them cope with their injury or consequent changes in their lives. However, he emphasized that the support came from union members rather than the organization. The anger that many expressed about the lack of support from the union suggests a need for greater consideration of how the union might address the expectations and needs of injured carpenters.

The coping strategies developed by individuals grew out of their lifestyles and personalities, the circumstances of the injury, other current life challenges, and perceived opportunities. Most of those interviewed developed individual coping strategies based on their frustration with available services and programs. Some injured carpenters described themselves as angry, depressed or frustrated while others were optimistic about their life outlook. While seemingly more positive than anger and frustration, optimism can reflect some denial about the seriousness of an injury and the need for change. Feelings of anger must be addressed in ways that allow individuals to move from self-blame and recrimination, avoidance of help, or angry criticism to constructive actions. Similarly, optimism, faith or the inclination to keep busy must be addressed in ways that ensure that individuals are getting the physical and emotional help they need and are not risking re-injury. As discussed in the next chapter, those interviewed made various suggestions for how their individual strategies for coping could be enhanced by better services, programs, and policies.

NEEDS

Those interviewed spoke with great insight about what would have helped them better deal with their injury, overcome economic challenges and make needed career transitions. Many expressed regret or anger about how they had felt let down by the union, by their companies, by the L&I system, and sometimes by family and friends. A few felt that they had received adequate support from all quarters but still had suggestions for making improvements. This section looks at how those interviewed defined their needs - what would have made it easier in their specific situation - and then offers recommendations based on these needs and suggestions made by individuals. These recommendations will be summarized in the final chapter.

INFORMATION AND ADVOCACY

What most carpenters said they needed more of was information and someone to assist them or advocate for them as they navigated the health care, insurance, legal, and the state compensation system. Some expressed the need for clearer, more definitive medical information while others wanted to know how to claim their legal rights in situations where they felt they had been wronged. Three carpenters also said they wanted more information about what they could expect in the future. As Larry said, "you just want clear answers. You need more information about what it's going to effect - financial, spiritual, etc." Or as Jack said, just "knowing there was a future" would have helped. Todd said he wanted to know more about other opportunities.

Five of those interviewed expressed frustration about not being able to get the information they needed from the union. As Sue expressed, "nobody knew what L&I does. To this day I find that frustrating." Mary missed gaining her benefits from the union because she fell short just a few hours. If someone had contacted her to let her know that she needed to work a few more hours to claim her benefits, she could easily have done so. Mark complained that the union only calls "when they have something of mine or they want something of mine."

Gary said that what he needed most was "to be believed and trusted." He claimed that having a "vocabulary and ways to describe the injury to make people listen to you" would have helped. He felt he was "blown off" when trying to ask the union about benefits and needed more support there in understanding how to ask questions and make himself heard and understood. Dave also said that "knowing what questions to ask" in the beginning might have made hiring an attorney unnecessary. He claims he had never filed claims for previous injuries because he didn't understand the bureaucracy. He found out about an ombudsman in Olympia informally. If the union had provided information right after his injury he would have saved time, money and frustration.

A Union Representative for Injured Carpenters

Several carpenters suggested that there be someone available in the union to provide information and assistance as injured carpenters try to figure out what they need and how to get it.

Sue expressed very clearly how this person should be affiliated with the union.

> There needs to be a representative for injured workers at the district level that all local members are aware of. Someone to give advice on how to handle L&I, what questions to ask, how to ask the questions. Can't be business agent's responsibility. They have enough to do and they don't have the time and energy to keep accurate information.

Mary described what this person would do to provide information and guidance for injured carpenters:

> Step-by-step guidance on how to work through the system, what you need to do, what implications of actions are. An advocate from the union could maybe come in and say look, this is what you have to do, you can't expect the doctor to do all this, you need to keep track of what the doctor's done, you need to keep in contact with the state.

Those interviewed described the range of information they would like to see a representative provide or help injured carpenters get: how to make L&I claims, how to avoid gaps in union benefits, what to expect (financially, medically, emotionally, spiritually) in the future, options for retraining and new careers, options for physically appropriate work within carpentry, how to use existing skills to change jobs, legal rights, how to formulate and ask questions, how to talk with doctors, claims managers, and vocational counselors to get the most information and present a case.

Some described a representative for injured carpenters as more than a provider of information. He or she should also be an advocate or a go-between, helping to smooth interactions between the injured carpenter, L&I, vocational rehabilitation, the employer, and the medical system.

An advocate for injured carpenters could also make sure that individuals know about other community, regional and state resources that can assist them in their specific circumstances. In her work as a health and safety officer, Sue finds that most injured carpenters do not know about Project Help, an organization based in Olympia that helps injured workers. An advocate for injured carpenters might not be able to provide all the information needed in each case, but could help individuals figure out what information they need, what kinds of questions to ask to get it, and where to find it.

Having the union provide information, guidance or advocacy would have gone a long way towards meeting the needs of most of the injured carpenters interviewed. In some cases, it would have smoothed dealings with L&I, made the hiring of attorneys unnecessary, ensured that carpenters received benefits, and improved communications with health care staff. Contact with a union representative would also have provided an element of emotional and social support which many of those interviewed say they needed as well. This will be explored in the next section.

EMOTIONAL AND SOCIAL SUPPORT

Many of those interviewed expressed regret and even anger that the union had not provided emotional and social support for them during the injury. Some would have appreciated just a phone call. Others would have liked an opportunity to meet with other injured workers to discuss experiences, challenges, and hopes for the future. For many the need for social support goes hand in hand with the need for information, assistance and advocacy. However, it is more. It is an emotional need for knowing that someone out there cares enough to contact them and find out how they are doing.

CONTACT

The most basic level of social support desired was just a simple check-in or contact from the union. Several statements express this need:

> (You need) someone from union to call you, to see what you need. (The) union calls only when they need something (Phil, 55).
>
> Contact from union - hey how are you doing, what do you need, is there something that we can do?...Do we look at retraining possibilities or do we look at modifying your scope of work, your abilities. Again, there was never any contact from the union on that (Doug, 36).
>
> Someone from the union to call you would be comforting. Feeling like you have somebody on your side. Not feeling so alone (Jack, 39).
>
> Just to have the union check-up on me, to hear a friendly voice, that would have helped. It just seems like they wanted money. If our dues were late, they would be upset. I was with the union for ten years. I'm on a leave of absence now. When I took my dues in, there was one secretary who would ask about my knee. She was nice. The others never talked to me (Todd).

The feeling of being left alone and isolated from the union and from coworkers was common and left several of those interviewed, including staunch union supporters, feeling bitter about the union. Sue, an active union member, describes this anger:

> Nobody from the union called. The boys all knew I got hurt but they didn't call me. They didn't give me any advice on how to handle L&I. I didn't know that I should ask questions, that I should question L&I. I think that's the thing I'm most angry about. The support wasn't there.

Contact could be provided by a union representative for injured workers or by trained peer counselors. This initial contact begins to provide the emotional support needed and opens a process for finding out what other kinds of social support would be most helpful for each individual. As described by several of those interviewed, the union should provide a friendly voice, someone to check-in to see how those injured are doing and find out what they need.

PEER SUPPORT

Several carpenters saw the need for social support that went beyond just being contacted and provided with information and assistance. They saw the need for a process which would help them meet and share information and experiences with their peers - other carpenters who have been injured.

Larry, a 52 year old man, expressed regret that he had not been able to find a support group that helped him come to terms with the nature of his work and his head injury. He participated in one group for other head injury patients but felt like he did not have a chance to communicate The group provided support more for spouses and parents. He wanted a chance to talk with people like himself.

> I can't ever talk to anybody that has been where I have been….I'd like to be able to ask him some questions: 'Did this ever happen to you like this?'
>
> And he could say, 'nah'
> I'd say, 'you know what happened? Da da da.'
> And he'd say, 'yeah, right, I remember that.'
> I'd like to be able to have a conversation with somebody that's in the same place as I am.

Phil also expressed the need for some form of peer support:

> If the union would say, well, come on down here, there's a few other guys that got hurt and if nothing else play cards, something. If you can get around, yeah, its kind of a group therapy thing, without even knowing it is….I don't know if some guy in Seattle got hurt. I'm sure somebody did, and he's probably going through the same thing I am.

Peer support would help meets the needs of carpenters in dealing with the emotions around their injury and life changes while also providing opportunities for sharing information and assistance. Phil described how the union could facilitate a process for injured carpenters to meet:

> But the union, they could get involved. I mean if nothing else, just give these guys a place to go...And it wouldn't cost them anything. They already got a building and it's got a hall... and it might help guys get back...the stronger union feeling. If they got a place to go, it would help. And if you can go to the union hall, that would help better. You're killing two birds with one stone. You've got people that are in the same industry - they got a lot of common things to talk about. And it's to their organization that they're going to go....They always know when somebody gets hurt, I mean just down through the grapevine, or if the members knew there was a place to go. Then they'd go....Everybody knows where the hall is at. And you get laid off, you go down there. So if you get hurt and want some company, it's there.

Peer support groups or peer counselors working with an injured carpenter advocate could go a long way towards addressing emotional needs and could also help injured carpenters find more specific kinds of counseling as described below.

COUNSELING

Two carpenters specifically identified the need for counseling to address the emotional effects of injury and disruption of work. They talked about getting physical rehabilitation and some vocational counseling but not the counseling they needed to deal with the emotional effects of the injury or to make plans for the future. Another identified the importance of having a counselor who understood his working class background in helping him to overcome depression and a desire to commit suicide.

Todd claimed that counseling would have saved his marriage following a knee injury:

> It was very stressful and hard on the family. Everyday work was really hard. I needed someone to help me know what to expect. When my wife hurt her knee, I took care of her. But I took care of myself. I was on crutches. It was hard to sleep - really uncomfortable. My knee pops out a lot. Just a little bit of normal living would be great. I'm sure that counseling would have made a big difference. It probably would have saved my marriage. I work out a lot. I had physical rehabilitation but no counseling.

Phil also expressed a need for help in dealing with emotions of being out of work and feeling unable to do anything.

> The mental thing, that's what bothered me. It bothered me. It would have had an effect on the way I treated the kids and that it's okay....I'm home, I'm eating, but I'm not bringing anything in. I can't. I couldn't do anything. Tried to help out as best I

> could, but it wasn't enough. Because I'm used to eight hours of something and it's just feeling helpless, like you're not carrying your end of something. So that I, if I had to do something, if there'd be anything I could do, that would be one of them....And I was off a year...you know, so I just got depressed, just really depressed.

Art discussed his own experience with counseling and emphasized the need for counselors who understand the experiences and culture of carpenters and who make the process feel like a conversation instead of therapy.

> I went 'cause I just needed to get some sleep. I didn't want to talk. But the doctor was really good. He understood where I was coming from. Didn't try to push me. He respected me. That's why I liked him. He didn't force it out of me...If somebody had been sitting there, going, 'what are you feeling?' - I wouldn't have done it. Basically it was just like sitting down to lunch, having a conversation.

MENTORS FOR WOMEN APPRENTICES

The three women interviewed discussed particular challenges they faced as women in carpentry. Even without injuries, women need to prove themselves in an industry which many characterized as being "macho." Once injured, women must also overcome physical limitations and the attitudes of coworkers.

Sue also highlighted the particular safety hazards that women face. She discussed the need for more social support for women apprentices to avoid physical injury as well as emotional stress. She attributed the circumstances of her own injury to the romantic interest that a man expressed towards her. In trying to impress her with his strength and affection, a male coworker became careless and dropped a plywood panel on her knee, causing permanent injury. At other times, she also experienced malicious harassment that could have led to serious injury.

She argues that a mentor for women apprentices would help alert women to potential safety and health hazards and would provide them with the social support they need to confront harassment.

> When I went through the program there was no one. No one to say hey, do all women get treated like this? So I explained to them what it's like if you're out. Because there's women who are out and the harassment and the abuse, physically and emotionally. The boys demand that they carry three times what the boys themselves carry just because this women thinks she's a man.

CHANGES IN UNION BENEFITS

Six carpenters expressed the need for union benefits that better addressed their circumstances as carpenters. One of the main issues was the gaps in coverage that occur when carpenters get injured and can no longer work regularly. Three men said that their compensation and insurance benefits had run out when they were out of work for a certain length of time. Others worried about losing their pensions because they could no longer do carpentry.

Several also claimed that they needed more adequate time loss compensation. One man advocated raising the amount to be equal to unemployment. Another carpenter argued that there should be compensation for wage differences after an injury. "If you have to go into a low-paying job after an injury, they should compensate you for the difference."

Another area of concern was in pensions and retirement. Gary expressed frustration that the benefit system does not address the fact that most carpenters never make it to retirement.

> I think there should be a way around that. How many sheetrockers, how many people retire as sheetrockers? It's real limited, if at all. We just wear out. I know a lot of people who never will have any benefits from that.

Gary went on to explain what he thought would work better: a system where the union would pay your benefits when you're worn out, not when you reach a certain age. "Even if you're not vested, it should still be your money. It's my blood and sweat, that has nothing to do with the union."

CAREER MOBILITY AND RETRAINING

A number of carpenters expressed the need for more options in changing careers after their injury. For some this meant financial support while going back to school. For others this meant help in thinking through the options and figuring out what would work best.

RETRAINING

Several of those interviewed discussed the need for retraining programs that better meet the needs of working adults, especially carpenters. Frank, 44, did not specifically identify a need for retraining, but he expressed a challenge that many working adults, not just carpenters, face.

> I was working before I went to school. From high school I went out and was working for about 5 years. Tried to go back to school, couldn't handle the adjustment. I had to go back and live with my folks and then I just went back to work. And then I tried

> going back to school while I wasn't working, with my wife working, and that didn't work. And the idea of trying to raise children and go to school and work...Well, you can't give any one of those things the time they need.

Now that he has suffered several injuries and feels his body wearing out, he wishes he had the options that education would have given him. However, current life circumstances make going back to school nearly impossible.

Mark did go through retraining following a shoulder injury and eventually became a computer technician. However, he experienced a great deal of frustration in making the transition.

> I'm 40 years old. And you've been told, 'we're going to retrain you.' I got some counseling around it but it's more like helping you decide what you want to do with the rest of your life. That's what you need. So you give me a book of jobs and then I'll pick one out of there? No. Because I already have a skill. So they're only going to give you so much...and then you don't get trained. They give you a counselor and they give you these tests and say, 'oh yeah, you could be this or that.' I felt so belittled.

As described in other sections, two other men successfully finished retraining programs suggested by their vocational counselors. However, they returned to carpentry work, one because of dissatisfaction with the work he was trained for, the other because of low pay in the new field.

Several saw the need for expanding the scope of time and money available for retraining. Current time and money limitations on L&I covered retraining do not give carpenters a full range of options. One suggestion was to have the union supplement L&I reimbursement for retraining.

MORE OPPORTUNITIES FOR MOBILITY

Several carpenters expressed frustration with the lack of mobility in the industry. For example, Rick suggested that unions should offer an avenue to move into management. Mike suggested that the union find a way to keep older guys working. About carpenters who've made it to retirement Frank said:

> They kind of came from a different era and they were tough and a lot of them were hurting bad when they were getting up too. Is it worth it to go all the way to the finish line to be like that? Every day I count my blessings that I've got all my fingers and toes.

Rick suggested changes in union structure in Western Washington which might make it easier for "old timers" to move into work that uses their skills while not taxing them so much physically. He argued that expanding the brotherhood to include millwrights and other skilled workers would give older workers more mobility.

> Millwright work is a lot more precise where the old timers could probably do a better job than a lot of the kids because they are more accurate. They've learned over the years how to be more accurate....Just about every part of the trades, there's one phase of it is fairly simple which the old timers should be doing....But there's a lot of shops too, like all the cabinetry and millwork seems to have gone to non-union shops....We got to find a way to get it back into the brotherhood.

MORE LEARNING OPPORTUNITIES

Aside from retraining, several of those interviewed mentioned the need for more learning opportunities in general. Such opportunities include health and safety classes, courses provided by L&I, and on-the-job training in carpentry skills. Others highlighted the need for better apprenticeship programs.

For example, Rick lamented the increasing lack of opportunity to learn from other skilled workers on the job. There are no longer many opportunities for old timers to pass skills onto young people.

> The jobs where you can have the old timers and the young kids working together. Eventually they're going to pick up on some of those trade secrets. And that's one thing I hate to see - all the old timers doing one kind of work, all the new people doing another type of work. Because nothing gets passed down that way.

He went on to describe how an old timer taught him how to put base and trim in using a coping saw instead of a miter box. The old way makes it fit square even if the wall isn't square.

> That's what apprenticeship was supposed to be about, but anymore you got the apprenticeship going on in the school. They're doing something totally different from what they're doing in the field, and it doesn't make any sense.

Martin emphasized the importance of accessible training programs that prepare carpenters for career transitions. Such training would allow carpenters to develop skills in drafting, estimating, budgeting, management and other related areas before they become injured. This would prepare them for moving into less physically demanding work as they age or become injured.

SAFETY IMPROVEMENT

Carpenters did not directly discuss improving safety as what they needed following their injury. However, in describing their injuries, sometimes in great detail, most made it clear that improving safety might have prevented their injuries from occurring in the first place.

When asked what the union could do to help, many talked about the importance of improving safety and safety awareness.

TRAINING

Several stressed the importance of providing safety training, especially for new people to orient them to job sites and the safety hazards there. While most carpenters acknowledged that there is a lot of discussion in the union and in many companies about improving safety, more needs to happen in actual practice. As Tom put it: (We) need to improve safety, not just improve safety rhetoric."

Rick elaborates on this sense that while safety gets talked about, it's not taken seriously enough.

> All the companies I work for now have set up a safety program. But they're not serious about it. The way they look at it is. Look we can reduce our insurance costs if we set up a safety program. So they do a generalized safety program once a week. They cover general topics. They're not job specific.

Several carpenters also emphasized the need to make people coming in more aware of cumulative injuries, such as tendonitis, bursitis, carpal tunnel syndrome, torn rotator cuffs. Because they do not happen instantly and are not dramatic like a fall or other accidents they tend to be overlooked. However, as this report shows they can be just as devastating in the lives of carpenters.

UNION INVOLVEMENT

Rick emphasized how important it is for the union to get involved in making sure that safety rules are enforced. Individual workers cannot take on safety issues alone.

> I mean...this employer has a training for lead awareness and that's great and everything but if I go to another job where we're working with lead and that employer doesn't know anything about lead and aren't even aware they're working around lead, you know, I don't have the authority to say hey, this is lead, you need to get out here.

He also stressed the importance of having the union involved in providing training:

> The union should take a bigger responsibility in safety and awareness. See ideally the union would be giving the classes and the training and making it mandatory for everyone who has the union card to take the classes. But then the employers would pitch in and pay for training, so the carpenters who went to the training would get paid for it.

Tom suggested a change in attitude and structure so that good health is actively promoted and rewarded on a job. Carpenters need advocates for good health, so that people don't feel pressured to work through their injuries. People should not feel like they are being penalized for being hurt or for trying to improve safety.

He also suggested that unions be more proactive in showing that good safety and health makes sense economically. The union should be able to make the case to politicians and should sponsor research to show the needs and effectiveness of different programs.

Tom also suggested a system where contractors would be held more accountable for injuries. He described the trend now as making individual workers responsible for injuries that happen to them. Contractors could take more responsibility for providing safe working conditions and if individual workers refuse to work safely remove them from the job.

EDUCATION AND POLITICAL ADVOCACY

Individuals made other general suggestions about what the union could do in its role as a educator and as a policy advocate. Many of those interviewed complained about the lack of sympathy and assistance they got from vocational rehabilitation counselors at the state. Mary describes her experience:

> They're supposed to be helping you find your way back into the job force and talking to somebody who's pretty much staring off into space because they're not comprehending the type of work that you're doing.

Mary suggested that the union lobby for some rehabilitation counselors who better understand the needs of carpenters, including the nature of work that carpenters do, the range of skills carpenters have and how those skills could be applied in different work.

Others suggested that the union help educate companies about the safety and economic benefits of hiring union workers. This could be part of bargaining for management to contribute funds to help cover injuries. Rick stressed the need for companies themselves to make the employee feel more like he's part of the company rather than a piece of equipment. The union could play a role in educating management on the benefits they will gain by making employees feel like part of the company.

Finally, Tom suggested that the union and carpenters themselves should educate the public about the value of what carpenters do. He described with passion how many people do not see any direct connection between themselves and those who build the buildings they shop in, receive education and health care in, watch baseball in, or work in. So when an accident happens they don't see the relation to their own safety. Public education could make these connections more clear and show why it is important to provide safe working conditions for those who build the structures we live, work, shop and play in.

> We're building the places that you live in and it behooves you, it makes sense that you make every contribution you can. Worker safety is an issue that is of prime importance. Directly! Not indirectly. Not gee, somebody died in the stadium, oh shucks, darn, I hate to even think about that when I'm sitting in the sky box.

SUMMARY

The primary needs that respondents identified were for various kinds of information, guidance and social support. Most emphasized that they would prefer to receive their information and support from someone who would best understand their circumstances. Many described the information and support as needing to come from a union representative for injured workers. The desire for receiving even basic information from a sympathetic person who understands injured carpenters reflects the concern shown elsewhere for addressing emotional along with financial, health care and legal needs. This became clearer as individuals discussed their desire for emotional support more directly, in the form of peer contact and counseling. Other needs highlighted were for changes in union benefits to take into account the unique life circumstances of carpenters as they age and become injured, more opportunities for training and mobility, improvements in safety and health, and education and political advocacy to demonstrate the value of carpentry and carpenters to employers and society.

CONCLUSION

Examination of the challenges that carpenters face, the changes they experience in work and other areas, their coping strategies, and their self-identified needs highlights the importance of the following critical issues:

1. Understanding and addressing not only the financial and health care needs of injured carpenters, but also the emotional and mental health effects of injury and subsequent life changes.

2. Addressing the need that injured carpenters have for receiving clear information and social support from those who understand and empathize with their circumstances.

3. Understanding the diverse career and life changes that can occur with aging or following an injury and developing benefits, retraining and career mobility systems that take such changes into account.

Each of these critical issues will be examined in turn, followed by a summary of specific recommendations.

CRITICAL ISSUES

1. Understanding and addressing not only the financial and health care needs of injured carpenters, but also the emotional and mental health effects of injury and subsequent life changes.

This report shows that injured carpenters face not only the challenges of dealing with the physical and economic effects of their injury, but must also with their emotional responses. They may experience temporary or chronic pain, temporary or permanent disability, the routines of healing and rehabilitation, loss of earning power, the need to change work, and social isolation. They respond by expressing anger, hopelessness, worthlessness, or decreasing self-esteem and developing diverse coping strategies ranging from keeping busy to avoiding assistance.

Identification with carpentry work is a key aspect of emotional responses to injury. Many of those interviewed were just as concerned with the quality of their work life following their injury as they were with economic issues. They highlighted their emotional responses to disability at work rather than loss of income per se as their greatest challenge.

Carpenters work in a culture that values speed, toughness and risk-taking, and many take on aspects of this culture as part of their identity and self-esteem. An injury undermines an individual's ability to fit into this culture. Respondents discussed the pressures to keep up with everyone else, the difficulty of asking for help, and the loss of pride and a sense of wholeness. In some cases, those injured felt the greatest pressure from their coworkers rather than from managers. Efforts to hide injuries at work or compensate for them in order to fit into the work culture and avoid layoffs increase chances of re-injury and create stress which can interfere with healing and lead to other social problems. Attempts to hide or compensate for the injury on the job may also make carpenters less likely to seek necessary medical, emotional or vocational assistance.

Emotional responses are not, however, limited to work life. Challenges in family, home and social life such as the inability to participate in leisure activities or divorce lead to anger, frustration and depression. Those injured also highlighted the emotions they feel as they make compensation and benefits claims through Labor and Industries, employers, insurance companies, and the union and as they receive diagnoses and treatment from various doctors. They described feeling "humiliated" or "belittled" by systems which most of those interviewed perceive cynically as being more interested in denying responsibility than providing assistance to those injured. Many also described feeling neglected by the union which provided financial benefits to some but little in the way of social support or even basic information and guidance. The experience of being injured left many with critical attitudes about "the system" which they claimed treated them like "machines" or "pieces of meat." While a few carpenters used their experience in navigating the compensation claims system, health care and labor law as a learning opportunity, most just felt angry and frustrated.

Those injured deal emotionally not only with the immediate aftermath of the injury, but also with some long-term changes. These changes come about because of the nature of the injury which requires new approaches to work or sometimes because they must balance the effects of their injury with other life issues such as the needs of children and spouses. Several case studies show the complex reasons why those injured decide to remain in carpentry, make career changes, or remain out of work. Whatever the reasons for the paths that carpenters take, most expressed the need for varying degrees of social support as they figure out what to do and how to go about doing it.

Individuals developed various ways of coping with the challenges and stresses of healing and of making life changes. Several had to overcome depression and self-blame in order to accept the outcomes of their injury and make short-term and long-term changes in how they go about their personal and work lives. Individuals described how keeping busy or drawing on religious faith or optimistic attitudes contributed to healing and rehabilitation and also allowed them to adapt to life changes. However, some experienced significant anger and frustration about changes in their lives. They drew on their emotions and experiences to develop more critical attitudes about working conditions, labor rights, and the economic system.

In all areas, most of those interviewed made clear that while they needed significant support in practical areas, such as healing and rehabilitation, getting compensation, earning a living, and learning new skills, they needed just as much help in handling their emotional responses to their injury and the changes it caused in their lives.

2. Addressing the need that injured carpenters have for receiving clear information and social support from those who understand and empathize with their circumstances.

Those interviewed made clear that what they needed most following their injury was information and support of various kinds. Many expected that information and support to have come from the union and felt angry when they did not get it. The support desired ranged from a friendly voice inquiring about their needs to someone who could advocate for them and help them understand what they are going through. Although many discussed the need for practical information - how to make L&I claims, how to talk to doctors, where to go if you run into problems making claims or getting clear diagnoses - most highlighted the need for something more. They needed support not only in getting answers but in learning how to formulate questions and present information in language that officials would understand. Moreover, they needed the information to come through someone who was sympathetic to their plight, who would believe and trust them, understand the nature of their work and injuries and have some knowledge about the economic, emotional and spiritual challenges they would encounter in the future. Many wanted to know that they had some value to the union, besides paying dues every month.

Information coupled with social support would enhance the coping mechanisms that participants described. By building on an understanding of the diverse strategies that carpenters use to cope with their injuries and life changes, a social support system could reinforce strategies that lead to successful healing and change and redirect those that lead to avoidance, abuse or victimization. Such a system could also ensure that those who are having the most difficulty making needed changes in their lives receive the information they need in a supportive, sympathetic environment.

Several of those interviewed highlighted the need for a process which helped them meet and share information and experiences with their peers, namely other carpenters who had been injured. Peer support, whether provided by trained peer counselors or through informal group meetings or both, would allow carpenters to address many of the emotional issues described above while also meeting other practical needs. It provides a non-threatening environment for addressing emotional issues for individuals who would most likely shy away from seeking out mainstream sources of emotional support, such as psychotherapy or counseling. By sharing experiences and reactions to them, carpenters who are injured would realize that they are not alone. This can help individuals overcome feelings of self-blame, victimization and use anger to make productive life changes. It also shows individuals ways of coping that are different from their own and allows them to see diverse ways of making changes in their lives.

3. Understanding the diverse career and life changes that can occur with aging or following an injury and developing benefits, retraining and career mobility systems that take such changes into account.

Most of those interviewed saw the need for a benefits and career mobility system which better addressed their circumstances as carpenters. Injuries often lead to gaps in benefits coverage when carpenters can no longer work regularly or must move into other kinds of work. Most referred to their own circumstances or described the experiences of others to point out that few carpenters ever make it to retirement. They questioned the benefits structure of the union which rewards those who make it to a certain age. They expressed a need for an alternative system which could pay benefits based on physical ability rather than age. Those who can no longer physically do the work should be eligible for some retirement benefits.

Those interviewed also expressed concern for more diverse career options which acknowledge their declining physical abilities while also respecting their increasing knowledge and skills. While several carpenters had found new careers following their injuries, most felt like they had few other options and returned to carpentry work despite the risk of re-injury. Individuals perceived limited mobility options for various reasons: including lack of education or other work experience, lack of desire to do other kinds of work, strong family history and identification with the work, economic constraints, and lack of information. Case studies show the diverse histories, circumstances, and attitudes which led individuals to make the decision they did about work following their injuries. While most carpenters returned to carpentry work, many expressed a desire to at least know about other options. Some believed that they were too old to change. They claimed that they needed to begin preparing for other options at a much earlier age. Others expressed a readiness to change but could not see practical ways to get training or enter new fields. One who went through retraining found out he had to begin his new career at entry level wages, became discouraged, and returned to carpentry despite his doctor's advice. Except for one carpenter, who switched into other blue collar work, those few who successfully pursued other careers drew on their educational backgrounds and work experiences other than carpentry.

Going back to school is a challenge for many working adults, including carpenters, because of the need to balance learning with earning an income, caring for children, and maintaining significant relationships. As one man said, "you can't give any of those things the time they need." Expanding the money available for retraining and increasing the flexibility of training programs to accommodate working adults could alleviate some of the challenges faced by those who would like to explore new career options.

Many carpenters also discussed the need for mobility within the field. They saw few options for moving into kinds of work which would allow them to draw on their substantial skills and knowledge in carpentry without having to injure their bodies. Several expressed the desire to move into management but recognized that companies tend to hire those with education rather than experience and that the union itself discourages upward mobility into non-union occupations. One carpenter lamented the fragmentation of the trades in western Washington, where types of work that require precision and accuracy but less physical strength have gone to different unions or to non-union shops. In order to move into such areas, carpenters must leave the union, and sometimes work their way up into a completely separate profession. This means giving up accumulated benefits and starting over.

RECOMMENDATIONS

Participants made the following suggestions about how best to address their needs.

1. **A Union Representative for Injured Workers.** Create a position for a union representative/advocate for injured carpenters or for peer counselors who would provide the following either directly or by making referrals to professionals who have proven their ability to work with injured carpenters:

CONTACT

- Check-in.
- Find out what's needed.
- Provide a friendly voice.
- Show that the union cares.

INFORMATION

- Give advice on making L&I claims.
- Help people formulate and ask questions about what they need.
- Give people tips on how to deal with the health care, L&I, and legal systems.
- Clarify information on union benefits.
- Notify people when they are going to lose union benefits.

GUIDANCE

- Help assess training and career options.
- Match skills to jobs.
- Know the current and future job markets.

ADVOCACY

- Smooth interactions with L&I, employers, insurance companies, or medical professionals.
- Help injured workers find ways to get light duty assignments.
- Help injured workers develop a language to explain their situation to officials and professionals and to ask questions.
- Provide referrals to other resources, such as organizations that advocate for injured workers, vocational rehabilitation counselors who understand carpentry and can provide sympathetic assistance, therapists who have experience in counseling workers and use approaches appropriate to working class culture.

2. **Peer Support.** Provide opportunities for injured workers to meet one another to share experiences, information, and strategies for coping and making changes.

3. **Mentors for Women Apprentices.** Train and provide mentors for women to alert them to potential safety and health hazards that arise from harassment or from work pressures they face as women.

4. **Change the Benefits Structure.** Make changes in the union benefits structure to address the following:

    - Gaps in coverage that occur when carpenters are injured.
    - The loss of pension when permanent disabilities make carpenters unable to continue carpentry work.

5. **Learning Opportunities.** Expand the scope and accessibility of learning opportunities to improve opportunities within and outside of carpentry:

    - Provide financial support for retraining.
    - Provide better vocational counseling to show the options available.
    - Provide vocational counseling based on a better understanding of the skills carpenters have and how they could apply those skills in new fields.
    - Create opportunities for improving carpentry skills, learning from older workers, learning on-the-job rather than in classrooms, taking classes in health and safety and in L&I issues, and taking classes to prepare for career changes (e.g., Budgeting, project management, computers, drafting, estimating, etc.).

6. **Mobility.** Provide more information about and more avenues for moving up within the construction industry or moving into new careers:

    - Recognize that retirement in carpentry will not be an option for many carpenters because of injuries.
    - Create avenues for older and injured carpenters to use existing skills and knowledge to do work that is not as physically demanding.
    - Show how existing skills, knowledge and interests can be adapted to new careers.

7. **Improve Health and Safety.** Find ways to improve health and safety to decrease accidents and cumulative injuries:

    - Provide training on relevant topics and hazards specific to the job site.
    - Have the union and company work together to develop relevant training programs that meet the scheduling needs of workers.
    - Increase awareness of cumulative injuries not just accidents.
    - Increase union involvement in enforcing safety regulations and providing health and safety training.
    - Create an environment or work culture which promotes good health and rewards (rather than penalizes) those who advocate for good health.
    - Hold contractors responsible for injuries.
    - Show economic benefits of good health and safety for employers.
    - Create incentives for creating healthy and safe working environments.

8. **Education and Political Advocacy.** Increase union involvement in educating the public about what carpenters do and advocating for policies which protect and assist injured workers:

    - Advocate for state vocational counselors who understand the work that carpenters do and the nature of the injuries they experience.
    - Educate companies about the health, safety, and economic benefits of hiring union workers.

- Educate companies about the benefits they gain by treating workers with dignity and respect.
- Educate the public about the buildings they use for living, recreation, work, health care, entertainment and the skilled workers who constructed them.