

Factors Influencing the Duration of Work-Related Disability: A Population-Based Study of Washington State Workers' Compensation

ABSTRACT

Objectives. The purpose of this study was to examine factors predictive of duration of work-related disability.

Methods. Multivariate survival analysis techniques were used to conduct a population-based, retrospective cohort study on a random sample of 28 473 workers' compensation claims from Washington State filed for injuries occurring in 1987 to 1989. The principal outcome measure was length of time for which compensation for lost wages was paid, used as a surrogate for duration of temporary total disability.

Results. The findings suggest that, even after adjusting for severity of injury, older age, female gender, and a diagnosis of carpal tunnel syndrome or back/neck sprain significantly predict longer duration of disability. Other predictors that were stable and significant, but involved lower magnitudes of effect included divorced marital status, firm size of fewer than 50 employees, higher county unemployment rates, and construction and agricultural work.

Conclusions. Greater disability prevention efforts targeting these higher risk subgroups could have significant economic and public health effects. The greatest impact may be on claimants who remain disabled at 6 months after an injury that did not require hospitalization. (*Am J Public Health.* 1994;84:190-196)

Allen Cheadle, PhD, Gary Franklin, MD, MPH, Carl Wolfhagen, MPA, James Savarino, PhD, P. Y. Liu, PhD, Charles Salley, MS, and Marcia Weaver, PhD

Introduction

Disability associated with work-related injuries is an increasingly serious problem in workers' compensation. Among work-related injuries, the small fraction of disabilities that are of long duration account for a large fraction of workers' compensation costs.¹ More important, if an injured worker has not regained satisfactory work status 2 years after the injury, his or her chances of doing so thereafter are very low.² Given the high costs to society of lost productivity and the high human costs of disability to an injured worker, long-duration work-related disability is a serious public health concern.

Although many studies have investigated factors that predict disability after work-related injuries,³⁻¹⁷ most have been limited to specific types of injury; have used relatively small, non-population-based samples; or have not adjusted for severity of injury. This paper reports on analyses conducted on a random sample of all workers' compensation claims from Washington State filed for injuries occurring in 1987 to 1989. Because Washington is one of six states where employers are required to obtain workers' compensation insurance exclusively through a state fund (or to self-insure), the sample is broadly representative of work-related injuries occurring in the state for that time period. Survival analysis techniques were used to predict duration of disability as a function of injury nature and severity and a variety of worker, firm, and industry characteristics.

Methods

Sampling Frame and Study Design

All workers' compensation claims filed between January 1, 1987, and De-

ember 31, 1989, were identified through the extensive claims and medical bill payment databases of the Washington State Department of Labor and Industries. For the purposes of this study, only employees with claims involving at least 4 days of time lost from work (compensable claims) were considered to be at risk for long-term disability (Figure 1). Exclusions from the baseline population were as follows: (1) claims involving 3 or fewer days lost from work as a result of occupational injury or illness (noncompensable claims) and (2) claims from self-insured employers (approximately 350 employers, representing one third of covered workers), whose reporting requirements are inadequate for research purposes.

A random sample of 10 000 compensable claims was drawn in each of the 3 years. Claims with missing information for one or more independent variables ($n = 1527$; 5.1%) were deleted from the sample, leaving a final incidence cohort of 28 473 claims. A total of 592 claims (2.0%) lacked the worker's monthly wage; an-

Allen Cheadle, James Savarino, and Marcia Weaver are with the Department of Health Services, University of Washington, Seattle. Gary Franklin, Carl Wolfhagen, and Charles Salley are with the Washington State Department of Labor and Industries, Olympia. Gary Franklin is also with the Department of Environmental Health, University of Washington. P. Y. Liu is with the Fred Hutchinson Cancer Research Center, Seattle.

Requests for reprints should be sent to Allen Cheadle, PhD, Department of Health Services, JD-43, University of Washington, Seattle, WA 98195.

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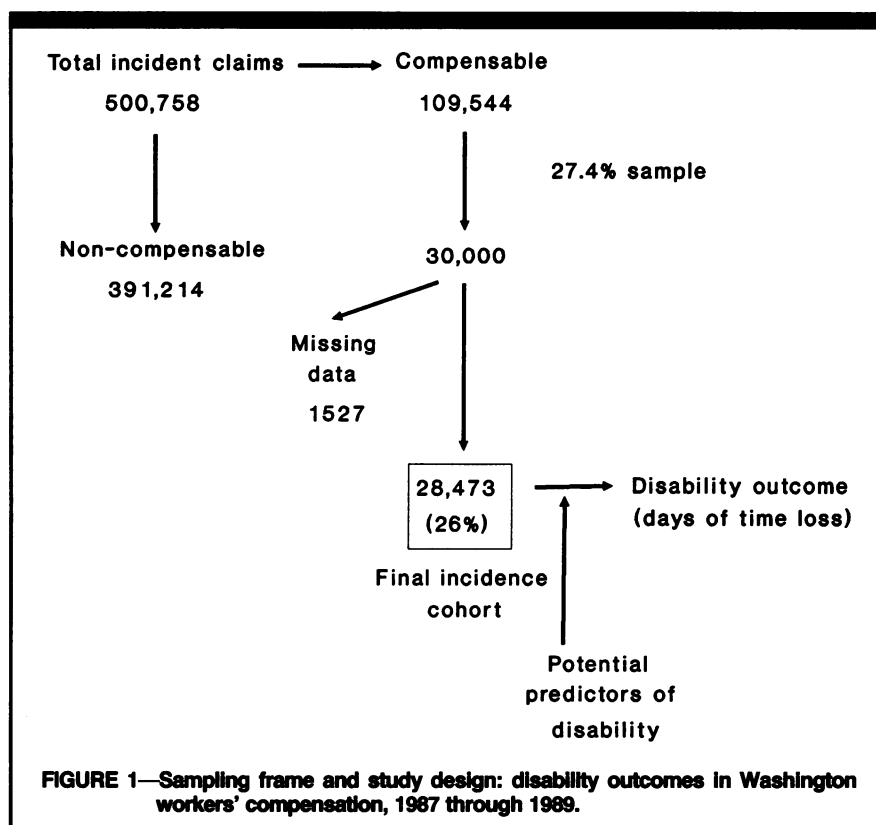
Note. The opinions and conclusions are the authors' and do not necessarily reflect the views of the Washington State Department of Labor and Industries.

other 935 (3.1%) had missing data on other covariates. Duration of disability and most of the demographic variables were not significantly different between included and excluded claims; when there were significant differences, the magnitudes were small. This 26% sample of the total compensable claim population represents the work-related disability experience of two thirds of the nonfederally covered workers in Washington State (approximately 900 000 full-time equivalent workers).

The study involved a population-based, retrospective cohort design¹⁸ (Figure 1), with duration of disability serving as the principal outcome measure. Time-loss data were extracted in June 1991; the mean duration of follow-up for the cohort was 35.4 months. All known or suspected predictors of disability duration (Table 1) were obtained from (1) computerized claim data collected from the initial accident report (gender, age, marital status, dependents, benefit rate [from baseline wage], type of injury, injury date, county of injury, type of firm ownership [public or private], and Standard Industrial Classification code); (2) medical bill payment data (the injury severity marker was hospitalization within 28 days of injury); (3) state unemployment surveys (county unemployment rate); (4) work hours reported by the employer, measured in the number of full-time equivalent workers employed (firm size); and (5) computerized codes relevant to premium rating (experience vs retrospective rating).

The US Department of Labor Z16.2 codes developed by the American National Standards Institute were used in categorizing the nature of injuries. These codes have wide use in workers' compensation systems. Although carpal tunnel injuries involved a body part code of upper extremity, wrist, or hand and were classified as nervous system condition/disease or bursitis, the Department of Labor and Industries specifically coded for this condition during the time period under study.

The state workers' compensation fund has two ratings that adjust the premium costs paid by employers to reflect their accident costs: experience rating and retrospective rating. Time-loss and medical costs are experience rated for all employers based on a 3-year average of past costs. Retrospective rating is an optional incentive system available to state fund employers. Employers with a rating better than the average of those for their job classifications and better than their own past ratings receive a refund of the difference; those whose ratings decline pay the dif-



ference to the state. Firms in the retrospective rating program have disability prevention incentives similar to those of the self-insured firms excluded from our sample of claims.

The last set of variables shown in Table 1 was included to capture the effect of the benefit structure on duration of disability. The basic benefit rate in Washington is 60% of the monthly wage at the time of injury. The rate increases on the basis of marital status (workers with a spouse receive an additional 5% benefit) and number of dependents (2% per dependent, up to a maximum of 10%). The maximum benefit rate, regardless of monthly wage, is 75% of the state average weekly wage prior to July 1, 1988, and 100% of the average weekly wage after July 1, 1988. The minimum monthly benefit of roughly \$200 also varies on the basis of marital status and number of dependents.

Since the benefit rate for most workers in our sample was determined by their marital status and number of dependents, we could not separate out the independent effect of the benefit rate on return to work. However, for workers with a monthly wage above that yielding the maximum benefit amount (maximum benefit/.6), the benefit rate did not depend on either marital status or number of dependents. In preliminary analyses, we included a dummy variable equal to 1 when the wage

was above this maximum amount, as well as a term for the interaction between this dummy variable and the benefit rate. The coefficient for this interaction variable, approximating the "pure" effect of the benefit rate for a select sample of high-income workers, was not statistically significant. Therefore, we used only the simpler specification shown in Table 1 to control for the effect of workers' compensation benefits on duration of disability.

In another preliminary analysis, we linked the 1980 census occupational codes recorded on the claim form to a file containing a variety of job characteristics, including educational requirements, prestige, and income.¹⁹⁻²¹ These indirect measures of socioeconomic status were generally insignificant or inconsistent predictors of disability duration; consequently, only the benefit rate variables were included in the final analysis.

All of the variables included in the model are categorical. For continuous variables (age, benefit rate, firm size), the analysis was also performed with a continuous specification (including a quadratic term). In all cases, the results were very similar regardless of specification, and categorical results are reported here for ease of interpretation.

The claim rather than the worker was the unit of analysis, and a small percentage of workers in our sample (2.8%) had mul-

TABLE 1—Definitions and Descriptive Statistics for Independent Variables, 1987–1989 Combined Sample (n = 28 473)

	Employees, %	Mean Duration of Disability, d ^a
Gender		
Male	74	112.7
Female	26	134.9
Age, y		
<30	42	83.5
30–44	41	136.6
45	17	160.8
Marital status		
Never married	35	86.3
Married	50	132.9
Divorced	14	146.6
Widowed	1	169.2
Dependents		
No	66	107.1
Yes	34	141.3
Type of injury^b		
Fracture	11	126.0
Sprain, back/neck	34	145.6
Sprain, other	20	110.4
Carpal tunnel	2	159.9
All other	34	91.4
Hospitalized within 28 days		
No	94	110.4
Yes	6	257.4
County		
King	35	97.7
Pierce	11	112.0
Snohomish	7	123.8
Spokane	6	157.7
Other: east	22	132.5
Other: west	19	130.6
Year of injury		
1987	34	... ^c
1988	33	... ^c
1989	33	... ^c
Unemployment rate, %		
<5	27	90.3
5–7	36	112.6
>7	37	145.1

multiple claims during the 3-year study period. Theoretically, all of these multiple claims, if given a separate identifier, should have involved new injuries and therefore could be regarded as independent events. However, individual characteristics probably influenced the duration of disability for all injuries for a particular worker, however dissimilar the injuries. To examine the impact of these claims on the results, one claim was selected at random from all workers with more than one claim, and the analyses reported below were rerun. The results were virtually

TABLE 1—Continued

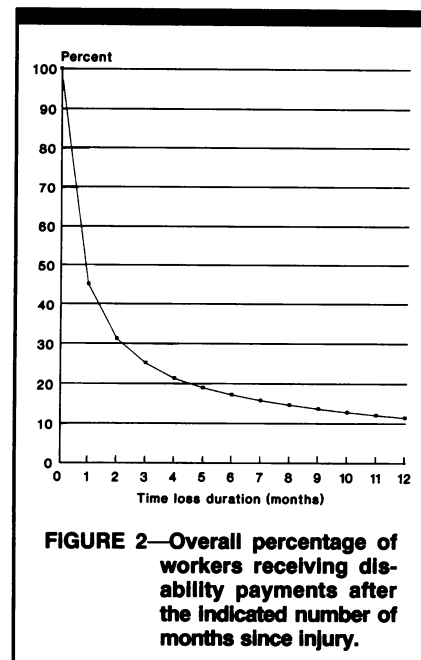
	Employees, %	Mean Duration of Disability, d ^a
Industry^d		
Agricultural General	7	130.2
construction	2	157.4
Heavy construction	10	125.1
Special trade construction	9	140.0
Wood products	4	131.1
Trucking	7	96.3
Wholesale trade	7	81.1
Restaurant service	11	122.6
Health services	3	105.6
Auto dealers	4	152.8
All other	37	113.2
Firm size		
<50 employees	57	128.0
≥50 employees	43	106.2
Ownership		
Private	95	119.3
Government	5	106.9
Retrospective rating program		
At time of injury		
No	79	122.4
Yes	21	104.6
Participation over 4 years (1986–1989)		
Not participating	70	122.5
In entire period	10	98.1
Came in and stayed	9	102.5
In and out of program	12	124.4
Benefit rate, % of wage		
<60	15	145.7
60–65	46	100.8
>65	39	129.1
Overall	100	118.6

Note. All variables are categorical.
^aMean duration of disability (days) for each category, including censored observations, unadjusted for covariates.
^bNature of injury and body part involved (from Z16.2 codes).
^cNot shown because of the effect of censoring on the results.
^dStandard Industrial Classification codes.

identical to those reported here, and it was concluded that any potential nonindependence effect due to multiple claims was relatively minor.

Statistical Analysis

Survival analysis techniques were used to model duration of disability as a function of the independent variables. Cox regression models,^{22,23} which make relatively few assumptions about the shape of survival curves, were used in



these analyses. The principal assumption of the Cox model is that the relative “hazard” (in this case, the likelihood of returning to work at a given point in time) is constant over time for each categorical variable. For example, if men are twice as likely as women to return to work at 30 days, they should also be twice as likely to do so at 90 days, 180 days, and so forth. To verify that the proportional hazard assumption underlying the Cox model was met, we plotted the relative hazards over time for each categorical variable. All of the variables included met the proportional hazard assumption.

Because of the large number of claims in our sample, it was common for the coefficients to be highly significant but small in magnitude. Therefore, we imposed the additional criterion of “stability” in determining which results to give emphasis. In particular, we ran the survival analysis for each calendar year sample separately and compared the resulting coefficients across years. Results were classified as stable and significant if, in each of the 3 years, they (1) were statistically significant and (2) had the same sign and roughly the same magnitude (within a band of 50% of the average coefficient value).

Results

Figure 2 shows a survival curve (Kaplan-Meier) of the percentage of claims in the sample by duration of disability, unadjusted for covariates. The figure demonstrates that most disability du-

rations were short term; by 1 month, more than half of the employees had returned to work. Table 1 provides descriptive statistics for the variables used in the multivariate analysis. Of those filing claims, three quarters were men, only 17% were older than 45 years of age, and half were married at the time of the injury. The largest single category of injury was back sprains (34%), followed by other sprains and strains (20%). Six percent of the claims involved a hospitalization in the first 28 days after the date of injury. Slightly more than one third of the claims were filed in King County (Seattle metropolitan area), and 57% were filed by workers in small firms (fewer than 50 employees).

The mean disability durations for each category shown in Table 1 are included for purposes of illustration only. Censored claims were included in the calculations, and, since categories with claims of longer duration will also have more censored claims, the true differences in duration across categories (e.g., across age groups) are probably understated. Given this caveat, the unadjusted differences in duration across categories ranged from a few days to nearly 5 months in the case of injuries with and without hospitalization.

Table 2 presents results from a Cox proportional hazards regression that included all of the independent variables in Table 1 for the 1987 to 1989 combined sample. For each variable, the coefficient and standard error are shown, as well as the relative hazard (exponent of the coefficient) and its confidence interval. For example, women were only 84% as likely as men to return to work at any given point in time. As noted above, we distinguished between effects found to be stable and significant over the 3-year period from other effects that were either insignificant in some years or had large changes in sign and/or magnitude. The largest effects involved injuries requiring hospitalization (relative hazard = 0.48), carpal tunnel injuries (relative hazard = 0.55), and older workers (relative hazard = 0.67). The coefficients on the other stable and significant variables, while smaller in magnitude, indicate that workers with a longer duration of disability were more likely (1) to be women, older, and divorced; (2) to have dependents; and (3) to work in smaller firms. In addition, workers in counties with high unemployment rates and those in general construction were more likely to have claims of longer duration. Workers in wholesale trades were the least likely to have such claims.

	Relative Hazard ^a	95% CI ^b
Stable and significant effects		
Gender		
Male	1.00	Reference
Female	0.85	0.82, 0.88
Age, y		
<30	1.00	Reference
30–44	0.78	0.76, 0.81
45+	0.67	0.64, 0.69
Family status		
Never married	1.00	Reference
Married	0.99	0.94, 1.04
Divorced	0.90	0.86, 0.94
Widowed	0.87	0.76, 1.00
Dependents		
No	1.00	Reference
Yes	0.88	0.85, 0.91
Type of injury		
Fracture	0.88	0.84, 0.92
Sprain, back/neck	0.79	0.77, 0.82
Sprain, other	0.87	0.84, 0.90
Carpal tunnel	0.55	0.50, 0.60
All other	1.00	Reference
Hospitalized		
No	1.00	Reference
Yes	0.48	0.46, 0.51
Firm size		
<50 employees	1.00	Reference
≥50 employees	1.08	1.05, 1.11
Unemployment rate, %		
<5	1.00	
5–7	0.99	0.95, 1.04
>7	0.88	0.82, 0.95

Some other results were noteworthy, even though they did not meet our criteria of stable and significant. Workers at firms participating in the retrospective rating program over the entire period had a significantly greater chance of returning to work (relative hazard = 1.14), although the effect of participation at the time of injury was insignificant. None of the benefit-rate variables were significant at $P = .01$, even in the combined sample of claims.

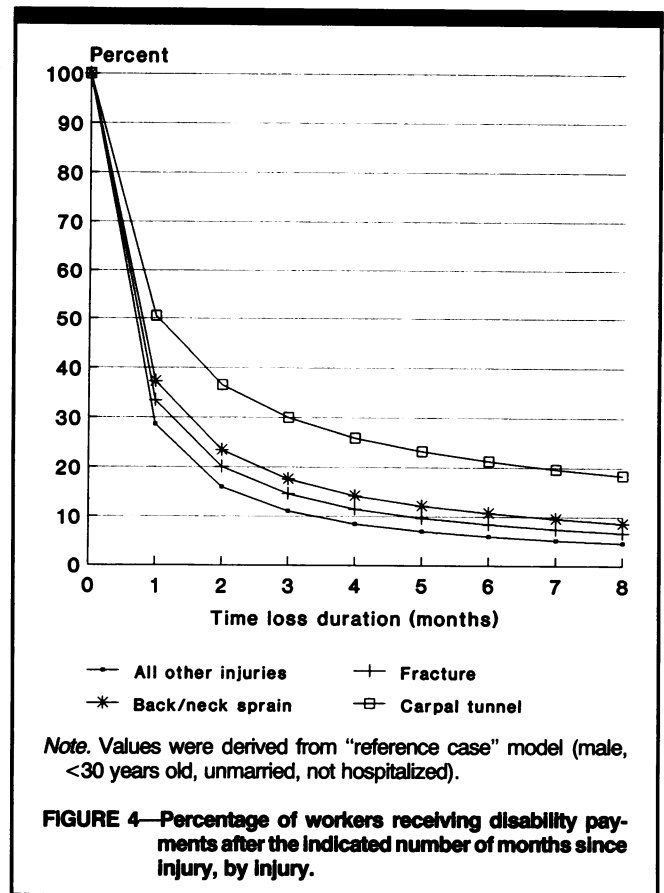
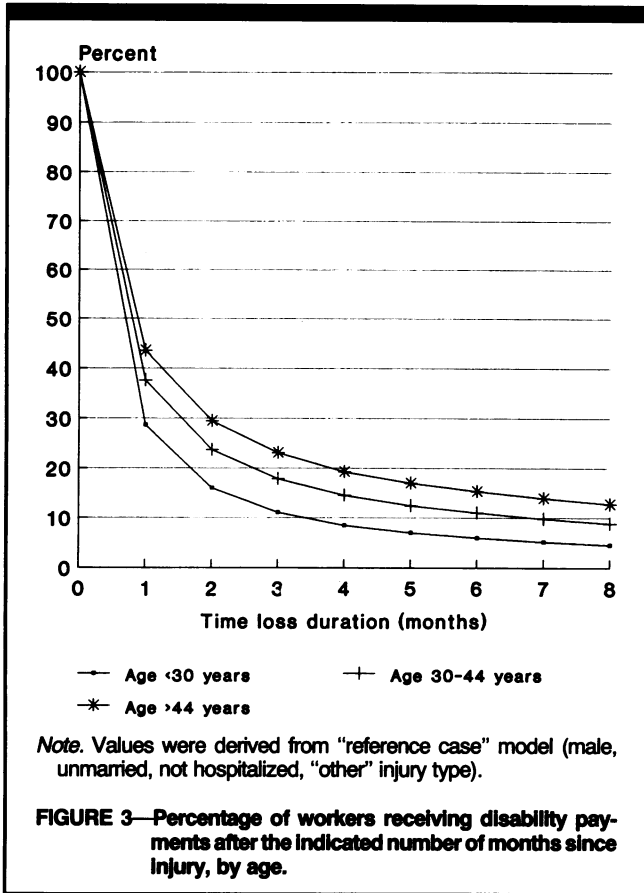
Figures 3 and 4 present results from the Cox regressions in an alternative, perhaps easier to interpret, form. The survival curves show the estimated disability survival probabilities (in percentage points), based on the model in Table 2, evaluated at durations of 1 to 8 months. The lower curve in each figure is the “reference” case, with values of 0 for all of the independent variables. In particular, the reference case model is male, under 30

	Relative Hazard ^a	95% CI ^b
Other effects		
County		
King	1.00	Reference
Pierce	0.99	0.94, 1.05
Snohomish	0.91	0.86, 0.95
Spokane	0.84	0.79, 0.90
Other: east	0.97	0.92, 1.03
Other: west	1.02	0.96, 1.09
Year of injury		
1987	1.00	Reference
1988	0.99	0.96, 1.03
1989	1.03	0.99, 1.07
Industry		
Agricultural	0.88	0.83, 0.93
General construction	0.83	0.76, 0.90
Heavy construction	0.93	0.88, 0.97
Special trade		
construction	0.91	0.86, 0.95
Lumber products	0.91	0.86, 0.97
Trucking	1.09	1.04, 1.15
Wholesale trade	1.23	1.17, 1.29
Restaurant service	1.05	1.00, 1.10
Health services	1.02	0.95, 1.11
Auto dealers	0.90	0.84, 0.97
All other	1.00	Reference
Firm ownership		
Private	1.00	Reference
Government	1.06	1.00, 1.13
Retrospective rating program		
At time of injury		
No	1.00	Reference
Yes	1.00	0.95, 1.06
Participation over 4 years		
Not participating	1.00	Reference
In entire period	1.14	1.06, 1.22
Came in and stayed	1.08	1.02, 1.15
In and out of program	1.02	0.97, 1.07
Benefit rate, %		
<60	1.00	Reference
60–65	1.05	1.00, 1.10
>65	1.02	0.97, 1.06

^aConditional probability of returning to work relative to reference group.

^bFor relative hazard, confidence intervals (CI) containing 1.0 represent effects not significant at $P = .05$.

years old, and unmarried; has no dependents; and has an injury other than sprains, fractures, and carpal tunnel syndrome that did not require hospitalization in the first 28 days after occurrence. The other curves show the effect of changing *only* the indicated variable. For example, the effect of being in the 30- to 44-year-old age range raises the estimated proportion of claims involving 6 months or more of disability from roughly 5% to 10%. The cumulative effect of changing several cat-



egories at once (not shown) can be quite large; for example, a married man more than 45 years old with dependents and an injury requiring hospitalization raises the proportion of claims involving at least 6 months of disability from 6% to 45.3%.

Discussion

Using a large random sample of all incident disability claims from the Washington State workers' compensation system, this investigation has shown that, after adjusting for initial hospitalization, factors that predicted longer duration of disability included older age, female gender, and a diagnosis of carpal tunnel syndrome or back/neck sprain. Other stable and significant predictors with lower magnitudes of effect included divorced marital status, firm size of fewer than 50 employees, higher county unemployment rates, and construction and agricultural work. Workers from wholesale trades were at decreased risk for longer term disability. Wage replacement had no significant effect on duration of disability.

This population-based study suggests that 17.5% of all initial disability claims involved at least 6 months of lost time, 12% involved 1 year of lost time, and 7.4%

involved at least 2 years of lost time (see Figure 1). Only 12.1% of those claims in which at least 6 months of lost time accumulated involved injuries requiring hospitalization within 1 month of occurrence.

Before comparing our results with other studies, we should note that we defined disability as the loss of capacity to meet occupational demands as opposed to loss of personal or social functioning. The studies cited below share this focus on work-related impairment.

Many studies have focused on a specific type of injury and therefore have not been able to isolate the impact of injury type on duration. Studies including injury type have also found sprains and fractures to be associated with longer duration.⁸ The most interesting injury-type finding here is the long duration of carpal tunnel claims, a result that was consistent across years and not apparently due to outliers. The carpal tunnel results should be viewed as preliminary given the small number of claims in this category (2%) and the relative crudeness of the method for identifying such claims (use of Z16.2 codes). Franklin et al.²⁴ found some misclassification even with more detailed medical information about the injury and more stringent

criteria for classifying claims as carpal tunnel injuries.

Injury severity is another variable that has not been widely used in other studies. Our ability to characterize the nature and severity of the injury was limited by the quality of the medical billing database. We chose 1 month as the cutoff interval as a compromise between (1) ensuring that there was adequate time for the appropriate injury treatment to be chosen and (2) ensuring that the hospitalization shown in the billing record was primarily due to the particular work-related injury. Other studies that have used hospitalization as a proxy for severity¹⁰ have also found it to be correlated with disabilities of longer duration. In our data, a hospitalization within the first 28 days was the strongest and most consistent correlate of longer term disability.

A number of worker and family characteristics, of which older age is the most important and consistent, have been found to influence duration of disability.^{2,8-11} The age effect is due both to the reduced ability of older workers to recover from injuries and to the reduced likelihood of finding employment once they have recovered. Gender has not figured prominently in previous studies, partly because a much

smaller proportion of women file workers' compensation claims. In our analysis, women had disabilities of longer duration, as has been found in other studies in which gender has been included as a variable.¹¹ Divorced workers have also been found in other studies to have longer term disabilities.^{3,4}

Several personal characteristics not available on the Washington database have been identified as correlates of disability duration, particularly indicators of socioeconomic status. Higher socioeconomic status is expected to be associated with fewer claims and shorter duration.^{3,4,12} Manual labor occupations have also been associated with disabilities of longer duration when other factors have been controlled.^{10,11} A number of studies have found that higher workers' compensation benefits result in longer duration.^{5,7,9,10} We did not find an association between the wage replacement rate and duration; however, as noted above, the replacement rate was confounded with marital status and number of dependents. Also, because of the confounding problem, we did not pursue other, perhaps more accurate measures of the income replacement rate such as after-tax income.

Three British studies and one American study^{9-11,14} have also reported finding a longer duration (or higher incidence) of disabilities in areas with high unemployment rates. This indicates that duration of disability may be sensitive to the prospects for employment in the immediate area. This result should be viewed with caution given the difficulties involved in estimating the effect of aggregate variables on individual-level behavior.²⁵

Industry results are scarce in the literature,^{6,9} and few consistent patterns have emerged. As noted above, the industry effects in our analysis were also not significant or consistent across years. In the combined sample, workers in construction and agriculture tended to have disabilities of longer duration, while disabilities in trade and services were of shorter duration.

Size was the single firm characteristic that was a stable and significant predictor of duration, with larger firms having shorter durations of disability. This result is consistent with other studies.^{5,17} Drury¹⁷ has suggested a number of reasons for smaller firms having more disability claims and longer durations of disability: the ability of larger firms to employ specialists in disability management, exemption of smaller firms from laws requiring disability benefits, and high turnover and

less access to information about disability prevention in smaller firms. Another factor providing large firms more incentive to shorten claims is their greater experience ratings in standard premium calculations.²⁶ This predicted effect of experience rating is consistent with our finding that participants in the retrospective rating program (in which the experience rating is more complete) had claims of shorter duration. Finally, larger firms may have greater flexibility in allowing workers to return to modified jobs.

There are some qualifications and limitations to our results that should be noted. First, the data were from an administrative database and therefore subject to a certain amount of entry errors, miscoding, and misclassification.^{24,27} Much of the information used was from the claim form filled out by the physician and coded by the state at the time of injury. Those fields required for billing and claims administration (e.g., marital status, company identifier, hospitalization records) are closely monitored; fields not directly related to billing the state and the firm may be subject to greater error (e.g., injury type). In general, the effect of coding and data-entry errors will be to attenuate the relationships examined in the survival analysis.

The results are obviously specific to Washington State, and caution should be exercised in extrapolating them to other states. Washington does have a relatively diverse set of industries, including resource-based (logging, agriculture), heavy and light manufacturing, and trade and services industries. However, a number of the largest employers—350 representing one third of covered workers—were self-insured and therefore excluded from the study. Firm size and the retrospective rating program were included in the analysis, so some of the effects of size and presence of disability prevention incentives similar to being self-insured were at least partially controlled. Other factors specific to Washington include the claims-handling procedure and system of vocational rehabilitation. A substantial revision of claims handling in early 1989 was intended to reduce the number of long-duration claims, although an effect of this change on disability duration was not found in our sample (Table 2).

A final limitation is that these independent variables measured worker, firm, and industry characteristics only at the time of injury. Other factors related to medical management and vocational rehabilitation were highly correlated with

duration of disability; thus, their effects could not be estimated independently within our study design.

This study is subject to a number of limitations; however, its strength was that it (1) was population based, (2) allowed for a mean follow-up of nearly 3 years, and (3) adjusted for hospitalization within 28 days of injury (used as a proxy for injury severity). The principal findings suggest that older workers, women, and patients with carpal tunnel syndrome or low-back/neck sprains are all at a disadvantage in regard to the risk for longer term disability, even after adjustment for hospitalization. Greater disability prevention efforts targeted at these subgroups could have significant economic and public health effects. □

Acknowledgments

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