Return to Work Following Injury: The Role of Economic, Social, and Job-Related Factors

ABSTRACT

Objectives. This study examined factors influencing return to work (RTW) following severe fracture to a lower extremity.

Methods. This prospective cohort study followed 312 individuals treated for a lower extremity fracture at 3 level-1 trauma centers. Kaplan-Meier estimates of the proportion of RTW were computed, and a Cox proportional hazards model was used to examine the contribution of multiple risk factors on RTW.

Results. Cumulative proportions of RTW at 3, 6, 9, and 12 months post-injury were 0.26, 0.49, 0.60, and 0.72. After accounting for the extent of impairment, characteristics of the patient that correlated with higher rates of RTW included younger age, higher education, higher income, the presence of strong social support, and employment in a white-collar job that was not physically demanding. Receipt of disability compensation had a strong negative effect on RTW.

Conclusions. Despite relatively high rates of recovery, one quarter of persons with lower extremity fractures did not return to work by the end of 1 year. The analysis points to subgroups of individuals who are at high risk of delayed RTW, with implications for interventions at the patient, employer, and policy levels. (*Am J Public Health.* 1998;88:1630–1637)

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Injury is well recognized as a leading contributor to work disability. Estimates of the economic costs associated with lost work days following injuries occurring in a single year exceed $95 billion (1995 dollars).[1,2] Despite these high costs, there have been few attempts at delineating the factors associated with delayed return to work after injury (RTW). The few studies that have examined this issue have shown that the correlation between physical impairment and the rate of RTW is weak, suggesting that other factors explain important differences in the extent and rate of RTW.[3–18] These factors likely include personal characteristics of the injured person and his or her family, the injured person's social and economic environment and job characteristics, and the extent to which disability compensation is received.[19,20] The relative importance of these factors in explaining RTW, however, has not been well characterized owing to a singular focus in most studies on only 1 factor at a time and a failure to incorporate objective measures of impairment in the analysis.

This study was designed to address these limitations while examining factors influencing RTW for severe fractures to the lower extremity. Injuries to the lower extremities constitute the leading cause of all trauma admissions among adolescents and young adults, accounting for an estimated 235 000 hospitalizations each year.[21] In addition to their high incidence, lower extremity injuries result in significant impairment and loss of function.[4,22]

The underlying hypothesis of the study is that while a strong correlation may exist between physical impairment and the rate of RTW, other factors related to the injured person and his or her environment are equally important in explaining variations in RTW.

Methods

Study Population

Study patients were recruited from 3 level-1 trauma centers: Harborview Medical Center (Seattle, Wash); the R. Adams Cowley Shock Trauma Center (Baltimore, Md); and Vanderbilt University Medical Center (Nashville, Tenn). All patients were 18 to 64 years old, worked full-time before being injured, and were admitted for treatment of a blunt, unilateral lower extremity fracture distal to or including the acetabulum, excluding patellar fractures and minor (metatarsal and phalangeal) foot fractures. Patients were excluded if they (1) received definitive care outside the trauma center; (2) had a major

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neurologic injury (i.e., a Glasgow Coma Scale score of 14 or below 3 days after admission[23]), an unstable spinal cord injury, or an upper extremity injury that precluded use of crutches or walker; or (3) had a psychiatric illness or lower extremity fracture secondary to another illness. Also excluded were patients who did not speak English, did not live in the trauma center's catchment area, or were on active military duty. A total of 341 patients met the study criteria; 29 of these were lost to follow-up, leaving 312 who form the basis of this analysis.

Nearly three quarters of all injuries resulted from motor vehicle crashes; an additional 17% resulted from high falls.[4,24] One half of the patients sustained injuries to the lower extremity alone, while the remaining half sustained associated injuries to other body systems. The presence of multiple injuries resulted in injury severity scores[25,26] of 16 or above in 24% of the patients. It should be noted, however, that owing to study exclusions, all patients with significant injuries to either the head, spine, or upper extremity were excluded from the study. Length of stay in the hospital averaged 12 days.

Procedures

Patient interviews were administered prior to hospital discharge and at 3, 6, and 12 months after the injury. The 3-month interview was administered by telephone; patients were offered $50 to return to the hospital at 6 and 12 months. To determine levels of physical impairment, patients were evaluated by a physical therapist before hospital discharge and again at 6 and 12 months.

A total of 111 patients (35.6%) were unable to return to the hospital at 6 and/or 12 months (38 at 6 months only; 33 at 12 months only; 40 at both 6 and 12 months). For 82 of these individuals, interviews were conducted by telephone and RTW status was determined. A total of 29 patients, however, were not interviewed in person or over the phone at 6 and/or 12 months. All available data on these 29 patients are used in the analysis, but observations regarding RTW were censored at either 3 months (14 patients) or 6 months (15 patients). For those unable to return to the hospital for assessment by a physical therapist, impairment scores were imputed (see below).

Measuring Impairment

Lower extremity impairment was measured by determining range of motion and muscle strength of the hip, knee, and ankle joints. Range of motion was determined in the basic planes by standard goniometric techniques.[27] Muscle strength was measured with the FET5000 dynamometer (Force Evaluation and Testing System; Hogan Health Industries, Inc, Draper, Utah). To control for effects of tester strength and variations in strength by age, gender, and size, strength was expressed as a ratio of the involved to uninvolved leg. Assessments of range of motion and strength across joints and muscle groups were summarized into an overall score by using the American Medical Association's *Guides to the Evaluation of Permanent Impairment.*[28] When multiplied by 100, these scores represent the average percentage of leg function lost. Previous studies have demonstrated the validity of the American Medical Association's approach for measuring lower extremity impairment resulting from injury.[22]

Lower extremity impairment scores were estimated for the 111 individuals with incomplete data (i.e., those who could not return to the center for a physical therapist's assessment at 6 and/or 12 months after the injury). Data from patients with complete assessments at 6 and 12 months were used to model scores at month X as a function of the score at months other than X, of the location and severity of the lower extremity fracture(s), and of the interactions between impairment scores and lower extremity fractures. The resulting model was then used to estimate missing scores on the basis of known covariates.

General bodily pain (not necessarily specific to the lower extremity) was measured with a visual analog scale.[29] Before starting the clinical examination, patients were asked to place a mark on a 10-cm line that best described their present level of pain; the distance of the mark from the lower end of the scale provided a continuous pain score.

Measuring Risk Factors Associated With Return to Work

Characteristics of the patient and his or her environment hypothesized to influence RTW are listed in Table 1, together with a description of the specific measures used in this study. Information necessary for deriving measures was obtained as part of the hospital discharge interview. In completing this interview, respondents were asked to think of themselves before the injury. Where possible, standard measures of known reliability and validity were used.[30–40] To further assess their applicability to the present study population of lower extremity fracture patients, α coefficients were derived for every scale (and subscale) and principal components analysis was used to verify the constructs for positive and negative affect, social support, and motivation to work. The α reliability coefficients were consistently high (above .70) with 1 exception (α coefficient for the external motivation subscale was only .38).

Analysis

The main dependent variable in the analysis is the time (in days) from injury to the first time the study patient returned to work. Kaplan-Meier estimates of the cumulative proportion of patients returning to work were computed.[41] These estimates take into account how long patients were followed as well as when they returned to work. A log-rank test was used to test the association between the cumulative probability of RTW and each of the risk factors considered one at a time.[41]

A Cox proportional hazards regression model was used to estimate the combined effect of multiple risk factors while accounting for the effect of impairment and pain.[42] Since their values change over time, both lower extremity impairment scores and pain were included as time-dependent covariates. Since the model assumes that the effect of any given covariate on the rate of RTW remains constant over time, covariate effects that appeared to violate this assumption were estimated for each of 3 periods (0–3, 3–6, and 6–12 months) separately. In addition, the extent to which the effect of patient and job characteristics on RTW differed for injuries resulting in minor vs severe impairments was examined, and appropriate interaction terms were tested for significance. Specifically, it was hypothesized that characteristics of the patients and of the preinjury job would be more important in explaining RTW for injuries resulting in minor to moderate versus severe impairments. The size and statistical significance of the effects are reported as rate ratios and 95% confidence intervals. The rate ratio provides an estimate of the relative likelihood of RTW at any given time after the injury. The proportional hazards model was first fitted with the entire study population, with missing impairment scores imputed as described above; it was then repeated with the subset of patients for whom complete impairment data were available.

An important and difficult issue in the data analysis is the interrelatedness of multiple covariates. For instance, people with higher education are less likely to be poor and more likely to have jobs with fewer physical demands. Our strategy for handling this issue was to use the Cox multivariable regression method and carefully enter and

TABLE 1—Measures Used to Explain Extent and Rate of Return to Work After Injury

Factor	Description of Measure[a]	Reference
Age, gender, education, marital status	Standard questions	. . .
Poverty status of household	Household income as % of federal poverty levels (adjusting for household size)	US SSA[30]
Job characteristics		
Occupation	Standard occupational classification codes	US Dept of Labor[31]
Physical demands	Score (5–15) summarizing how often one does the following activities on the job: walk, use stairs/inclines, stand, stoop/crouch/kneel, lift 50 lb.	SSA Survey of Disability[34]
Tenure at present job	Years at present job	QES[32]
Benefits	No. (0–6) of selected job benefits	QES[32]
Flexibility	Score (1–4) summarizing how hard it would be to change days, hours, duties of job	QES[32]
Satisfaction	Score (1–5) measuring worker's general affective reaction to current job	QES[32]
Personality/motivation to work		
Positive/negative affect	Two scores (10–50) measuring positive and negative affect, respectively	PANAS[33]
Job motivation	Two scores (1–4) measuring internal motivation (the extent to which person is involved in the general work role) and external motivation (the extent to which person works principally for money)	QES,[32] SSA Survey of Disability[34]
Social support	Three scores summarizing the likelihood someone would provide practical assistance (7–28), emotional support (8–32), and directive guidance (14–56)	ISSB[35–37] modified to assess available vs actual or enacted support
Health status	Two scores (0–100) that summarize physical and psychosocial health status	SIP[38]
Drinking behavior	Score (0–13) derived from 13 questions regarding use of alcohol	SMAST[39]
Compensation	Questions regarding if, and what type of, compensation was received and whether legal services were used	RAND Survey[40]

Note. SSA = Social Security Administration; QES = Quality of Employment Survey; PANAS = Positive Affect and Negative Affect Scales; ISSB = Inventory of Socially Supportive Behaviors; SIP = Sickness Impact Profile.
[a]Numbers in parentheses refer to ranges in score.

interpret sets of interrelated covariates in constructing a final model. The Cox regression model assumes that multiple covariates modify the (hazard) rates of RTW multiplicatively. Under this assumption, the effects of interrelated covariates can be decomposed into each covariate effect and estimated simultaneously, adjusting for one another.

Results

Estimates of the cumulative proportion of patients who had returned to work at 3, 6, 9, and 12 months postinjury are 0.26, 0.49, 0.60, and 0.72, respectively. Of those returning to work, 60% returned with some limitation in the amount or type of work they did. Eight percent returned to a different job owing to residual leg problems. Of those who had not returned to work by 12 months postinjury, 19% were looking for work and 29% were managing the household; the remaining 52% were doing something other than looking for work, keeping house, or going to school. Only 1 individual retired because of the injury.

Figure 1 summarizes the strong relationship between physical impairment (averaged over the year) and the rate and extent of first RTW. RTW was also significantly correlated with subjective assessments of pain. For those with average pain scores of <10, 10–19, and ≥30, the percentages of RTW within 12 months of injury were 85%, 73%, and 51%, respectively. The extent and rate of RTW were also examined as a function of commonly used measures of injury severity, such as the maximum Abbreviated Injury Scale score per body region and the Injury Severity Score.[25,26] Correlations between these 2 scores and RTW were low, however, reflecting the emphasis of these scales on threat to life vs impairment as the criterion.

Patient characteristics significantly associated with higher rates of RTW ($P < .05$) include higher levels of education, family incomes above 125% of the federal poverty level, high levels of social support (particularly in terms of available practical assistance), absence of alcoholism, job stability, job flexibility, white-collar employment, and employment in jobs with low physical demands and good benefits (Table 2). Job satisfaction, affective personality traits, and motivation to work did not correlate strongly with the rate of RTW. Both the receipt of workers' compensation and involvement with the legal system, however, were associated with lower rates of RTW. There were no significant differences across hospitals.

Results of the Cox regression analysis are summarized in Table 3. Impairment remained a strong predictor of RTW. Pain, however, was not a significant factor after controlling for impairment. After impairment levels were accounted for, several personal factors remained significant predictors of RTW, including age, education, poverty status, and availability of practical support. The effects of these predictors were consistent across all levels of lower extremity impairment. Persons employed in white-collar jobs

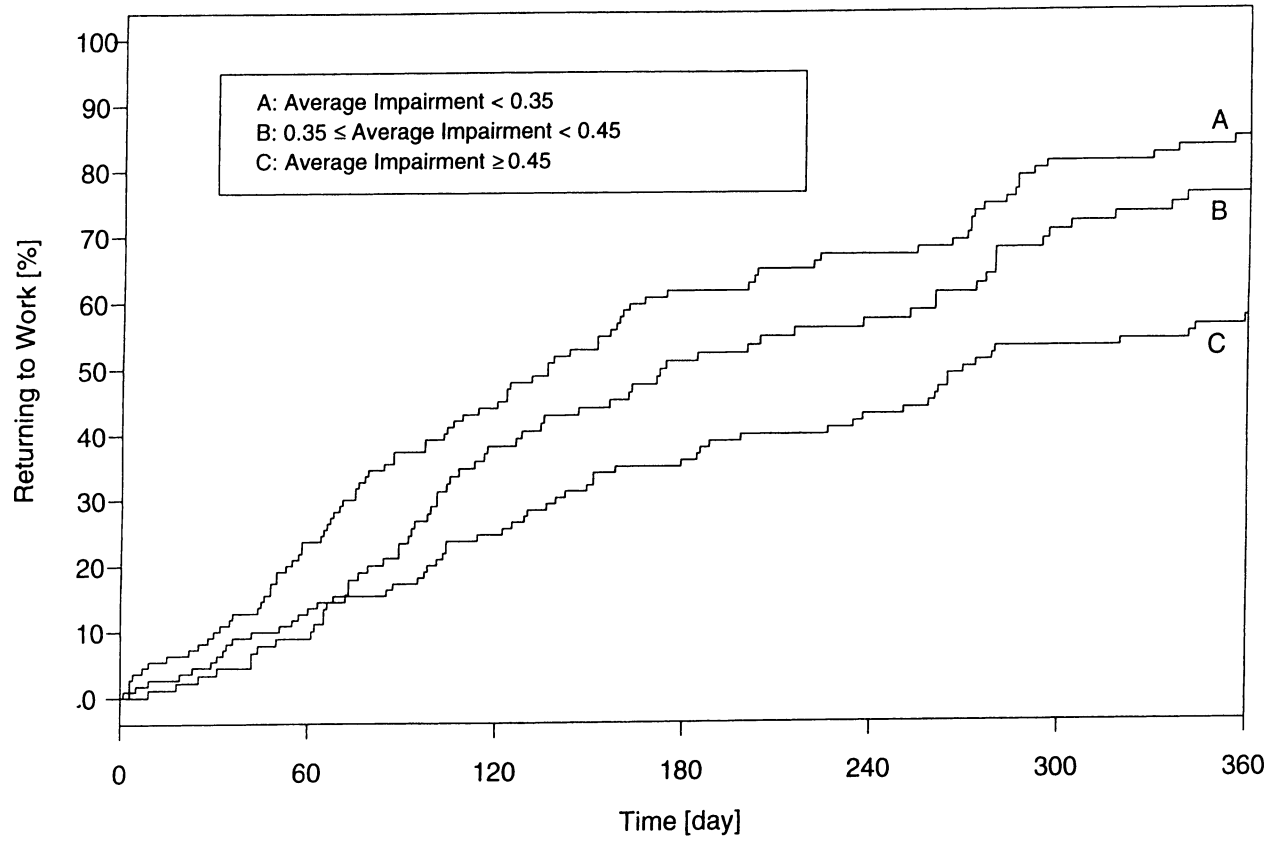

FIGURE 1—First return to work after injury, as a function of impairment level.

and jobs that were not physically demanding were also more likely to return to work. The effects of both the type of job and its demands, however, were statistically significant only in the first 3 months.

The negative effect of compensation on RTW remained significant, but only in the first 6 months. Furthermore, the effect was stronger for workers' compensation than for other types of compensation. It should be noted that in the Kaplan-Meier analysis (Table 2), the cumulative proportions of RTW for those with other types of compensation were similar to, if not somewhat better than, those for persons with no compensation. However, persons receiving other types of compensation also tended to have higher incomes, confounding the relationship between compensation and RTW.

The final model does not include the effects of hiring a lawyer and preinjury alcoholism. While hiring a lawyer negatively affects the likelihood of RTW, its effect is modest and only marginally significant ($P = .10$) when estimated in the context of other variables (rate ratio = 0.60). Preinjury alcoholism does not appear in the final regression model because it is strongly correlated with other factors, including poverty status, education, and occupation.

When the same analysis is conducted for the subset of patients with complete follow-up, results are nearly identical, although the effect of impairment is magnified while the effect of hiring a lawyer is further dampened.

Discussion

Concerns regarding increasing costs of illness have largely focused on the amounts expended for acute and long-term health care. While concerns about rising health care expenditures are well founded, these direct expenditures represent only a small percentage of the total costs associated with injury and illness. As early as 1976, Cooper and Rice showed that the indirect costs of lost productivity were nearly twice the direct health care costs.[43] These findings have been replicated for injuries in more recent studies.[1,2] Thus, if we are to have an impact on the overall societal costs of injury, we must develop a better understanding of the factors that contribute to high productivity losses among survivors.[19]

The present study was designed to delineate the predictors of delayed RTW following lower extremity fracture severe enough to require admission to a trauma center. The results show that 72% of patients who were working before being injured returned to work within 1 year. These results are encouraging given the complex nature of the study injuries. They generally support those of other studies that conclude that survivors of serious trauma can achieve good functional outcomes and return to their preinjury levels of activity.[17,44-46]

Despite relatively high overall rates of recovery, over one quarter of the study participants had not returned to work within 1 year. This percentage is significantly higher than prevailing rates of unemployment at the time of the study (5% to 7%). An additional 25% of the patients took longer than 6 months to return to work. The present analysis points to subgroups of patients who are at particularly high risk of delayed RTW.

One of the most important factors influencing RTW is the extent of lower extremity impairment. Although this study did not specifically examine the influence of physical therapy on recovery, it is reasonable to assume that the level of lower extremity impairment is strongly related to the amount and quality of care after an acute injury. It will be important in future studies to examine this assumption and investigate the relative effectiveness of specific rehabilitation

strategies. These studies are critical for the development of guidelines for ensuring optimal physical restoration.

The patient's age is also an important predictor; patients aged 18 to 24 were nearly 3 times more likely to return to work than patients with similar impairments who were 45 years old or more. A negative correlation between recovery and age has been documented by others and may reflect not only increased difficulty in recovering from a major physical insult but also increased difficulty in securing a job after a long absence from work.[14]

After taking lower extremity impairment and age into account, however, several other patient characteristics are important in explaining RTW. Both education and poverty status significantly influence RTW, and although these variables are correlated, each appears to add to the explanatory model. Several studies have emphasized the importance of both factors on recovery following injury.[3,5,9,11,13,17,47,48] Lower incomes are associated with inadequate health insurance coverage, which often restricts access to and appropriate use of rehabilitation. Indeed, 62% of patients living in poor households had no health insurance. Education, in addition to being correlated with income, may reflect the individual's level of understanding about the consequences of the injury, expectations for recovery, or ability to adapt to changing circumstances. In particular, people who are more highly educated may have more job mobility when their residual impairment precludes return to a physically demanding job.

It is important to note that although the presence of alcoholism is not in the final regression model, this is largely because its effect on RTW is confounded by other predictors such as education and poverty status. When adjusting for the effects of lower extremity impairment alone, high scores on the Short Michigan Alcoholism Screening Test (SMAST), indicative of likely alcoholism, are significantly and negatively correlated with RTW. In this analysis it was not possible to tease out the independent effects of alcoholism. Its role in returning people to work after an injury should not be underestimated, however, especially in light of the large percentage of study patients (35%) who were screened as likely alcoholics. While this percentage is comparable to that found in other studies of trauma patients,[49] it is considerably higher than the generally accepted rate of alcohol abuse and dependence among US adults (10%–14%).[50]

Persons employed in physically demanding jobs are also at higher risk of not returning to work. However, after taking into

TABLE 2—Kaplan-Meier Estimates of the Cumulative Proportion of Patients Returning to Work, by Characteristics of the Patient and Preinjury Job

Characteristic	n	RTW at— 3 mo	6 mo	9 mo	12 mo
Socioeconomic characteristics					
Age					
18–24	60	0.22	0.57	0.66	0.77
25–34	109	0.21	0.42	0.58	0.73
35–44	84	0.31	0.48	0.57	0.77
45–64	59	0.33	0.56	0.65	0.65
Gender					
Male	242	0.22	0.46	0.60	0.72
Female	70	0.39	0.60	0.64	0.75
Education**					
Less than high school	68	0.06	0.33	0.46	0.59
High school graduate	132	0.19	0.43	0.52	0.65
Some college	112	0.46	0.66	0.79	0.90
Poverty status**					
Poor (<125% of poverty level)	94	0.08	0.31	0.41	0.55
Near poor (125%–200% of poverty level)	69	0.30	0.54	0.63	0.81
Not poor (>200% of poverty level)	149	0.36	0.58	0.72	0.81
Marital status					
Married	132	0.34	0.54	0.65	0.77
Widowed/Separated/Divorced	65	0.27	0.44	0.48	0.64
Never married	115	0.16	0.46	0.62	0.73
Social Support					
Practical assistance[a]*					
Low (7–24)	91	0.22	0.40	0.52	0.61
Moderate (25–27)	95	0.28	0.57	0.64	0.75
High (28)	120	0.28	0.52	0.65	0.81
Emotional support[a]					
Low (8–27)	65	0.21	0.42	0.54	0.65
Moderate (28–31)	97	0.29	0.55	0.61	0.75
High (32)	144	0.29	0.52	0.64	0.77
Guidance[a]					
Low (14–44)	78	0.28	0.52	0.62	0.70
Moderate (45–55)	142	0.20	0.43	0.56	0.70
High (56)	86	0.35	0.59	0.68	0.81
Problem with alcohol*					
None (0)	144	0.31	0.55	0.67	0.80
Possible (1–2)	60	0.22	0.54	0.59	0.71
Likely (3–13)	108	0.21	0.39	0.52	0.64
Preinjury job characteristics					
Occupation					
Manager/professional	41	0.49	0.80	0.90	0.98
Technical/sales/administration	69	0.52	0.67	0.71	0.79
Service	41	0.12	0.52	0.61	0.72
Farming/forestry/fishing	16	0.06	0.40	0.40	0.60
Production/repairs	72	0.13	0.32	0.45	0.61
Operators/laborers	73	0.12	0.31	0.51	0.66
Physical demands**					
Low (5–10)	95	0.48	0.72	0.78	0.86
Medium (11–13)	120	0.20	0.45	0.57	0.71
High (14–15)	97	0.12	0.32	0.46	0.62
Tenure at present job*					
≤1 y	88	0.14	0.42	0.50	0.63
1–4 y	114	0.28	0.51	0.63	0.73
≥5 y	110	0.34	0.53	0.69	0.80
Number of benefits[a]***					
0–1	111	0.12	0.33	0.48	0.65
2–4	88	0.26	0.47	0.58	0.66
5–6	99	0.41	0.69	0.77	0.89
Flexibility**					
Low (1)	152	0.23	0.46	0.57	0.71
Medium (2)	79	0.35	0.63	0.73	0.86
High (3–4)	81	0.24	0.47	0.54	0.63

(Continued)

TABLE 2—*Continued*

Characteristic	n	RTW at— 3 mo	6 mo	9 mo	12 mo
Preinjury job characteristics (*continued*)					
Satisfaction					
Low (1–2)	42	0.21	0.47	0.58	0.67
Medium (3)	112	0.23	0.44	0.58	0.71
High (4–5)	158	0.30	0.54	0.63	0.76
Personality and motivation to work					
Positive affect					
Low (10–33)	73	0.20	0.45	0.60	0.72
Medium low (34–39)	100	0.29	0.50	0.58	0.74
Medium high (40–44)	75	0.28	0.54	0.64	0.73
High (45–50)	64	0.22	0.46	0.60	0.72
Negative affect					
Low (10–15)	113	0.22	0.49	0.59	0.73
Medium low (16–20)	70	0.22	0.54	0.62	0.76
Medium high (21–25)	57	0.39	0.45	0.60	0.74
High (26–50)	72	0.24	0.46	0.60	0.67
Internal work motivation					
Low (1)	103	0.24	0.52	0.61	0.74
Medium (2)	105	0.25	0.49	0.59	0.73
High (3–4)	104	0.30	0.47	0.62	0.71
External work motivation					
Low (1)	35	0.20	0.50	0.63	0.77
Medium (2)	196	0.23	0.44	0.57	0.70
High (3–4)	81	0.36	0.61	0.68	0.79
Compensation					
Receipt during year**					
None	173	0.32	0.51	0.62	0.72
Workers'	41	0.05	0.18	0.29	0.49
Other	98	0.25	0.59	0.70	0.83
Lawyer hired[a]***					
No	110	0.19	0.43	0.51	0.66
Yes	159	0.33	0.55	0.68	0.78
Trauma center					
Center A	76	0.22	0.41	0.50	0.66
Center B	116	0.22	0.54	0.64	0.76
Center C	120	0.32	0.50	0.63	0.74

[a]Numbers do not add up to 312 because of missing data.
*$P \leq .05$; **$P \leq .01$.

account physical demands of the job (as well as education and income), the rate of RTW in the first 3 months for persons in white-collar jobs is still 4 times the rate for persons in blue-collar jobs. Job classification may be a surrogate for job facets not directly measured in this study. Limited research has shown that the social structure of a job (e.g., level of discretion over job activities, supervisory status, and psychological demands of the job) plays an important role in predicting work disability among persons with chronic health conditions.[19,51] In light of the size of the occupation effect, future studies should give priority to explicating the sources of this effect.

Satisfaction with the preinjury job and motivation to work were not significant predictors of RTW. These results stand in contrast with other studies that have focused on the likelihood of continued employment or work-loss days accrued after the onset of a chronic disabling condition such as low-back pain or arthritis.[12,48,51,52] The extent to which these factors are important in explaining RTW following an acute injury is not well understood. This study suggests they play a less important role after the severity of the lower extremity impairment, personal resources, and preinjury job characteristics are taken into account.

Previous studies have also noted the important role of social support in RTW following injury and illness.[3] This study shows that while all aspects of social support appear to influence the rate and extent of RTW, the most important aspect of this support is practical assistance in contrast to emotional support or directive guidance. This result suggests that providing practical assistance may be as important, if not more important, than providing such general emotional support as might be available through general support and self-help groups.

One of the strongest correlates of RTW is the receipt of compensation, especially workers' compensation. The effect of compensation on the extent and duration of work disability has received considerable attention in the literature.[14,15,53,54] Although conclusions vary, most studies suggest a negative relationship between receipt (and amount) of compensation and the likelihood and rate of RTW. What is not clear, however, is whether delayed RTW is justified or not. Much of the literature suggests that compensation provides inappropriate disincentives. It is equally important to acknowledge, however, that compensation often affords the opportunity for more complete recovery and minimizes the potential for reinjury, subsequent work-loss days, or failure at the job owing to residual limitations not yet resolved at the time of reentry into the workforce.

In interpreting the significance of the compensation effect, it is important to note that because of the small number of patients who actually received workers' compensation in the study, it was difficult to examine some of the more complex relationships among the independent variables. For instance, it is possible that persons injured on the job sustained more severe injuries or were in jobs that were more physically demanding. Although an attempt was made to adjust for these factors, measurement error could contribute to the observed relationship between compensation and RTW. In addition, this study did not obtain information on the amount of compensation received. Future studies should look more specifically at the relationship between the amount of income replacement (as a percentage of preinjury income) and rates of RTW. More broadly, this study and others underscore the need to develop a more detailed understanding of the factors involved in the disability determination and award process to ensure that both public and private entitlement programs are structured to ensure timely and appropriate return to work.[55]

Additional limitations of the study must be taken into account in interpreting the results. First, although the overall rate of follow-up is high (8.5% of patients were completely lost to follow-up), RTW observations were censored for 29 patients and impairment ratings were incomplete for 111 patients. It is important to note, however, that an analysis restricted to only those with complete data produced similar results.

Additional limitations of the study include its primary focus on the first time people return to work as an outcome and the relatively short follow-up of 1 year. In addition, the generalizability of the study's results is somewhat limited. The study

TABLE 3—Relative Odds Ratio of Return to Work After Injury

Variable	Relative Rate Ratio	95% Confidence Interval[a]
Impairment score		
≤10	3.5	1.5, 8.1
11–20	2.6	1.2, 5.5
21–30	1.6	0.8, 3.5
31–60	0.9	0.4, 1.9
≥60	1.0	Reference
Age, y		
18–24	2.8	1.6, 4.6
25–34	1.5	1.0, 2.4
35–44	1.0	0.6, 1.6
≥45	1.0	Reference
Education		
Some college	1.8	1.2, 2.9
High school graduate	0.8	0.5, 1.2
Less than high school	1.0	Reference
Poverty status		
Not poor	3.1	2.1, 5.1
Near poor	3.3	2.0, 4.8
Poor	1.0	Reference
Occupation in months 0–3		
White collar	4.1	2.3, 7.1
Blue collar	1.0	Reference
Occupation in months 3–6		
White collar	1.3	0.7, 2.3
Blue collar	1.0	Reference
Occupation in months 6–12		
White collar	0.8	0.4, 1.7
Blue collar	1.0	Reference
Physical demands of job in months 0–3		
Low	2.6	1.3, 5.2
Medium	1.1	0.6, 2.4
High	1.0	Reference
Physical demands of job in months 3–6		
Low	2.1	1.0, 4.2
Medium	1.2	0.6, 2.3
High	1.0	Reference
Physical demands of job in months 6–12		
Low	1.9	0.8, 4.1
Medium	1.4	0.8, 2.6
High	1.0	Reference
Practical support available		
Strong	1.7	1.2, 2.5
Moderate	1.2	0.8, 1.8
Weak	1.0	Reference
Compensation in months 0–3		
Workers'	0.1	0.0, 0.5
Other	0.5	0.3, 0.8
None	1.0	Reference
Compensation in months 3–6		
Workers'	0.4	0.1, 0.9
Other	1.0	0.6, 1.9
None	1.0	Reference
Compensation in months 6–12		
Workers'	0.8	0.4, 1.5
Other	1.2	0.6, 2.2
None	1.0	Reference

[a]Derived from proportional hazards regression.

included only patients treated at level-1 trauma centers with nationally recognized musculoskeletal trauma programs. Therefore, the type and severity of lower extremity fractures are not likely to be representative of those treated at non–trauma center hospitals. Furthermore, the clinical outcomes may not have been as positive with a broader sample of patients. In addition, the study focused on a relatively young age group and those with unilateral fractures only. Also excluded from the study were individuals with serious injuries to the central nervous system and upper extremities. Finally, only outcomes of people working full time before being injured were examined. While this group comprised over three quarters of the original study cohort, they may have been at lower risk of adverse outcomes than those who were not working or were working only part-time before being injured.

In conclusion, this study has shown that the causal pathway from injury to impairment and work disability is complex. While impairment is a significant determinant of RTW, many nonmedical factors influence the translation of an impairment into poor vocational outcome. Increased understanding of this causal pathway is essential if we are to reduce the high societal costs associated with injury and improve the overall well-being of those who are injured. □

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