

Associations Between Employees' Work Schedules and the Vocational Consequences of Workplace Injuries

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Published online: 12 October 2007
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Abstract *Introduction* This study examines the effect of long-hour work schedules and nonstandard shift work (e.g., night and evening shifts) on the ability of injured workers to maintain productive employment following a workplace injury. *Methods* Analyses were based on 13 years of data from the National Longitudinal Survey of Youth. Multivariate logistic regression analyses were performed with one of ten nonstandard schedules as the independent variable and a particular vocational consequences as the dependent variable. Vocational consequences included being unable to perform normal job duties, temporary job reassignment, working less than full time, filing a workers' compensation claim, and quitting or being fired because of the injury. Covariates in the regression model included age, gender, occupation, industry, and region. *Results* The most prominent effects of working a nonstandard schedule were a increased risk of being fired (OR = 1.81; 1.15–2.90 CI 95%), quitting (OR = 1.68; 1.20–2.36 CI 95%), or being unable to work full time (OR = 1.33; 1.08–1.64 CI 95%) following an injury, compared to injured workers in conventional schedules. Schedules involving overtime and long working hours generally had a greater impact on vocational consequences following a workplace injury than did schedules involving night, evening, and other nonstandard shift work. *Conclusions* Occupational rehabilitation professionals need to consider the specific type of work schedule when developing effective return-to-work plans for injured workers. Special precautions need to be taken for workers returning to schedules that involve more than 12 h per day, 60 h per week, and long commutes.

Keywords Shift work · Overtime · Long hours · Return to work · Rehabilitation · Vocational consequences

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Introduction

Nonstandard work schedules, such as night or evening shifts or shifts involving long work hours, have been linked to stress, fatigue, cardiovascular disease and other adverse health effects [1–6]. Recent studies also have documented an increased risk for occupational injuries and illnesses among employees working nonstandard schedules [7–14]. In one study, work schedules involving overtime hours were found to have the highest risk of injury among nonstandard schedules, with an 81% increased chance for occupational injuries (a shorthand expression for both injuries and illnesses) compared to schedules without overtime [8]. Nonstandard shift work also has been shown to increase the risk of occupational injuries compared to standard day shifts. A recent study found that evening shift work carried a 43% increased risk, night shift work a 30% increased risk, and rotating shift work a 36% increased risk of injury compared to standard day shifts, after controlling for employees' occupation, type of industry, gender, region and the total number of hours spent "at risk" of injury in a particular job during the course of a year [9]. Some authorities believe that the increased risk of injury in nonstandard shifts is the result of disrupted circadian rhythms, endocrine system disturbances, physical exhaustion, and other biological effects [15–18].

It has also been suggested that working nonstandard schedules makes it more difficult for injured employees to resume regular job activities after an injury [19–21]. The increased fatigue or stress inherent in working long hours and nonstandard shift schedules, for example, might place special demands on injured workers, especially if the worker's physical capacities are still diminished from a recent injury. Moreover, working long hours or night shifts can induce fatigue, disrupt sleep, impair cognitive functioning, and make affected workers more prone to errors, thereby jeopardizing successful return to productive employment following injury. We hypothesize that the stresses imposed by nonstandard work schedules play a dual role: they both increase the likelihood for people working nonstandard schedules to suffer an injury compared to people working conventional schedules, and then, once an injury occurs, make it more difficult for injured individuals working in nonstandard schedules to successfully return to productive employment (see Fig. 1 below). Although previous research has provided evidence indicating which particular types of nonstandard schedules are most strongly related to injury risk (e.g., overtime and evening shifts), the existing evidence is not sufficient to predict, a priori, which types of nonstandard schedules will be most strongly associated with adverse return-to-work outcomes.

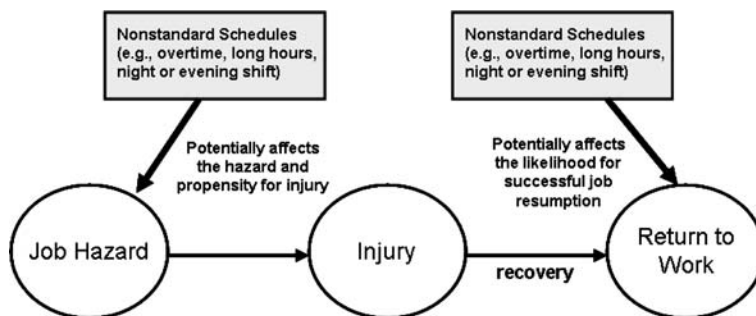


Fig. 1 The hypothesized dual role of nonstandard schedules in increasing the risk of injury and making successful return to work for injured workers more difficult

This study is the first that specifically analyzes the relative effects of different types of work schedules on the likelihood for injured workers to resume work successfully following an injury. Our analyses used 13 years of longitudinal employment and health data to examine associations between ten types of nonstandard work schedule and a variety of return-to work indicators including days of missed work, lost wages, workers' compensation claims, resumption of normal duties, job-reassignment, job disruptions, inability to work full time, quitting work, taking another job, and being laid off or fired. Results of this study will be important for occupational rehabilitation professionals, who need to be attuned to considering the distinctive effects of different types of job schedules, varieties of shift work, and shift durations, when developing appropriate return-to-work plans for injured employees.

Material and Methods

This study is based on data from the National Longitudinal Survey of Youth, 1979 (NLSY). The NLSY is sponsored by the U.S. Bureau of Labor Statistics and administered by the Center for Social and Economic Research at the Ohio State University. The NLSY cohort is comprised of a nationally representative sample of 12,686 individuals who were 14–22 years of age when first surveyed in 1979. Interviews with cohort members were conducted annually from 1979 through 1994 and biennially since 1996. NLSY collects a wide range of self-reported information including participants' demographic characteristics, educational experiences, detailed employment and job histories, wage and income levels, and health indicators including occurrences of work-related injuries and illnesses. Since 1998, chronic disease information for cohort members over 40 years old has also been obtained.

Our analyses used data from the NLSY surveys conducted in 1988 through 2000, a period during which cohort members were 22–43 years of age. An analytical record was created for each job held by cohort members for each survey period. There were a total of 110,236 job records available for analysis, covering the employment history of 10,793 cohort members who reported working at least one job during the study period. Respondents were asked to provide detailed information on the start and end dates for each job in which they were employed, and the time they usually started and finished work each day.

The occurrence of occupational injuries and illnesses was determined by respondents' answer to the question, "Since (the date of the last interview), have you had an incident at any job that resulted in an injury or illness to you?" During the 13-year study period, 5,313 work-related injuries and illnesses were reported.

For the purposes of this study, ten types of *nonstandard* work schedules were identified: There were five types of *extended work hour* schedules: (1) *extended hours per day*, defined as working at least 12 h per day, (2) *extended hours per week*, defined as working at least 60 h per week, (3) *overtime*, defined by the respondents' self-identification of the job as involving overtime work (1988–1993) or "overtime pay" (from 1994 onward), (4) *extended commute time*, defined as commuting at least 2 h per day, and (5) a summary category of *any type of extended hour schedule*, defined as any of schedules #1–4 above. Each person's job was classified according to these categories, based on respondent-supplied information about the usual start and end times of each work day (for types #1–2), and self-reported information about commuting times (type #3) and overtime status on their jobs (type #4).

In addition, the shift involved with each job was categorized based on the following NLSY question; "Which of the following categories best describes the hours you work at this job?" The potential responses included *regular day shift* and five types of *nonstandard shift work*: (1) *regular evening shift*, (2) *regular night shift*, (3) *rotating shift* (changes periodically from days

to evenings or to nights), (4) *irregular shift* (no set schedule), and (5) a summary category of any type of nonstandard shift schedule other than day shift (i.e., #1–4 above). Conventional day shift jobs were considered as the comparison group for analyses involving nonstandard shift schedules. NLSY also contained another possible response category of “split shift” (consists of two distinct periods each day). However, because of the small number of jobs that were categorized as split shifts, we did not include those jobs in the analysis. *Conventional* schedules were considered to be a summary category of any job schedule that did not involve extended work hours or nonstandard shift work.

The primary dependent variables in this study were 13 indicators of vocational consequences following an injury. The NLSY questions involving vocational consequences were asked only to respondents who reported a work-related injury or illness during the applicable survey period. Eight of the 13 indicators were based on questions that asked, “Did (the reported injury or illness) cause you to: (1) miss one or more scheduled days of work, (2) be assigned to another job on a temporary basis, (3) work at your regular job less than full time, (4) work at your job but be unable to perform all the normal duties of the job, (5) be laid off, (6) to quit, (7) to be fired, and (8) to change occupations.” Another question (indicator #9) asked “Did you lose any wages because of (the reported injury or illness)?” Three additional indicators were based on responses to questions which asked the respondent whether (10) “a workers’ compensation (WC) claim was filed because of the reported injury or illness,” (11) “any WC benefits were received,” and (12) “whether a WC claim was pending.” A final summary indicator (#13) was defined by us as an affirmative answer to any of the three “job disruption” questions mentioned above concerning temporary assignment to another job, working less than full time, or being unable to perform normal duties (indicators #2–4).

Our analyses were based on logistic regression models in which the independent variable was a particular type of nonstandard work schedule and the dependent variable was one of the 13 indicators of vocational consequences following a work injury. Covariates in the regression model included worker age, worker gender, worker occupation, employer’s industry sector, and region in which the employer was located.

Odds ratios and 95% confidence intervals were calculated using SAS (version 8.0) statistical software. The level of statistical significance was set at $p \leq 0.05$. NLSY provided sampling weights for each response to reflect the national distribution of Americans in the NLSY target age range as of 1979. Calculations in this study were performed using weighted data. To account for survey sampling effect, we estimated 95% confidence intervals around the odds ratios by applying Taylor approximation techniques using SUDAAN (version 7.5) analytical software. Additional details concerning the methodology used in this study have been published elsewhere [8, 9].

Results

Basic demographic information for workers reporting injuries or illnesses is summarized in Table 1. Table 2 presents a breakdown of the types of injuries and illnesses reported. The vast majority of them were musculoskeletal disorders (34.7% of the total) or traumatic injuries such as cuts, bruises, and fractures.

Our analyses indicated (Table 3) that injured workers in nonstandard schedules were considerably more likely to be fired, to quit their jobs, and to return to work at less than full time capacity following an injury than were injured workers having conventional work schedules. Employees working nonstandard schedules were also more likely to lose wages as a result of their injury than were those in conventional schedule jobs. Interestingly, workers in

Table 1 Characteristics of workers reporting a work-related injury or illness, weighted data, $n = 5,313$

Age (mean years)	31.7
Male (%)	61.1
Black race (%)	11.2
Hispanic ethnicity (%)	6.8
Family income (mean dollars)	\$33,419
Annual wages (mean dollars)	\$21,265
Schooling completed (mean years)	12.6
<i>Region (%)</i>	
Northeast	16.6
North Central	31.0
South	31.8
West	20.6
<i>Occupation classification (%)</i>	
Professional & technical	11.0
Managers, officials, proprietors	9.8
Sales workers	2.4
Clerical	11.1
Craftsmen, foremen	19.6
Machine operators	20.0
Laborers, except farm	9.3
Service workers	15.1
Other	1.7
<i>Industry classification (%)</i>	
Agriculture, forestry, & fisheries	3.7
Mining	1.1
Construction	11.6
Manufacturing	23.3
Transportation & communication	7.7
Wholesale and retail trade	18.5
Finance, insurance, real estate	2.2
Business & repair services	6.3
Personal Services	3.1
Entertainment & recreational	1.5
Professional & related services	14.6
Public administration	6.3
<i>Work schedule when injured (% of injuries)</i>	
Extended hours per day (≥ 12)	9.5
Extended hours per week (≥ 60)	8.7
Overtime	29.8
Long commute time (≥ 2 h)	1.7
Any type of extended hour schedule	39.8
Night shift	5.4
Evening shift	8.3
Rotating shift	5.6
Irregular shift	9.7
Any type of nonstandard shift work	29.1

Note: Some individual workers reported more than one injury and thus their characteristics are counted more than once in this table

Table 2 Types of reported injuries and illnesses, weighted data, $n = 5,313$

Type of injury or illness	Percent distribution
Musculoskeletal conditions	34.7
Fractures	7.6
Cuts and bruises	25.0
Burns	3.3
Other traumatic injuries	11.9
Peripheral nervous system diseases	2.8
Other occupational diseases	9.6
Miscellaneous	5.1

Table 3 Percentage of workers experiencing a vocational consequence after injury, and the relative risk and 95% confidence intervals for vocational consequences among injured workers in nonstandard schedules compared to injured workers in conventional schedules, 1988–2000, NLSY

Vocational consequence	Percent of injured workers with consequence	Relative risk, 95% CI
Missed work	57.8	0.99, 0.87–1.12
Lost wages	29.7	1.19, 1.01–1.40
Filed a WC claim	56.0	0.78, 0.67–0.89
WC claim pending	29.4	1.19, 0.82–1.67
WC benefits collected	46.2	1.08, 0.87–1.32
Job disruption ^a	39.2	1.08, 0.93–1.25
Assigned temporarily to another job	11.9	0.74, 0.54–1.01
Worked less than full time	15.8	1.33, 1.08–1.64
Unable to work normal duties	29.3	1.03, 0.87–1.22
Laid off	6.5	1.35, 0.97–1.86
Quit	5.0	1.68, 1.20–2.36
Fired	2.5	1.81, 1.15–2.90
Changed occupations	6.3	1.25, 0.89–1.76

^a A summary variable that includes assigned temporarily to another job, worked less than full time, or unable to work normal duties

Bolded values are statistically significant at $p < 0.05$

“Nonstandard Work Schedules” include night, evening, rotating, and irregular shifts, “extended hour” (≥ 12 h per day, ≥ 60 h per week, ≥ 2 h commute time per day) and overtime schedules. “Conventional” schedules are those which are not “nonstandard”

nonstandard schedules were much less likely than workers in conventional schedules to file a workers’ compensation claim following an injury.

The association between nonstandard schedules and the risk of suffering vocational consequences following a workplace injury or illness was found to vary considerably by type of nonstandard schedule. For example, among extended hour schedules (Table 4), the greatest risks of quitting the job after an injury or working less than full time following an injury were seen in jobs involving long hours per day and long hours per week. Employees working overtime schedules experienced the greatest risks of being temporarily assigned to another job, being unable to perform normal duties, and facing any kind of job disruption following injury. Employees with long commuting schedules by far had the greatest danger of being fired or

Table 4 Relative risks and 95% confidence intervals for vocational consequences of a work-related injury, by type of extended work hour schedule, 1988–2000, NLSY

	Extended hours per day	Extended hours per week	Overtime	Long commute time	Any type of extended hour schedule
Missed work	0.99 0.88–1.12	0.99 0.87–1.12	1.00 0.93–1.07	1.02 0.73–1.35	0.94 0.89–1.00
Lost wages	1.12 0.96–1.31	1.19 1.01–1.40	1.05 0.95–1.16	0.96 0.63–1.44	1.14 1.01–1.29
Filed a WC claim	0.840 0.73–0.96	0.78 0.67–0.89	1.12 1.05–1.20	1.06 0.76–1.41	1.02 0.97–1.09
WC claim pending	1.10 0.79–1.50	1.19 0.82–1.67	1.25 1.06–1.49	1.49 0.73–2.67	1.09 0.94–1.26
WC benefits collected	0.98 0.80–1.19	1.08 0.87–1.32	1.04 0.94–1.15	1.08 0.66–1.63	0.97 0.88–1.06
Job disruption ^a	1.01 0.87–1.17	1.08 0.93–1.25	1.13 1.04–1.22	1.12 0.78–1.56	1.12 1.05–1.20
Assigned temporarily to another job	0.81 0.61–1.08	0.74 0.54–1.01	1.26 1.10–1.46	1.05 0.55–1.98	1.14 1.01–1.29
Worked less than full time	1.25 1.01–1.53	1.33 1.08–1.64	1.07 0.95–1.22	0.98 0.54–1.75	1.13 1.02–1.27
Unable to work normal duties	0.96 0.81–1.13	1.04 0.86–1.22	1.20 1.10–1.31	1.13 0.75–1.64	1.15 1.07–1.25
Laid off	1.11 0.80–1.56	1.35 0.97–1.86	1.10 0.89–1.39	1.51 0.70–3.26	0.87 0.72–1.04
Quit	1.41 1.00–2.00	1.70 1.20–2.36	0.66 0.50–0.90	1.91 0.70–5.38	0.72 0.58–0.91
Fired	1.44 0.89–2.35	1.81 1.15–2.90	1.04 0.73–1.56	4.77 1.94–12.86	1.01 0.77–1.35
Changed occupations	1.13 0.80–1.59	1.25 0.89–1.76	1.10 0.89–1.37	2.27 1.10–4.70	0.97 0.81–1.17

^a A summary variable that includes assigned temporarily to another job, worked less than full time, or unable to work normal duties

Bolded values are statistically significant at $p < 0.05$

changing occupations following an injury compared to injured workers in other kinds of extended hour schedules. Workers in extended hour per day or extended hour per week schedules were the most likely not to file a workers’ compensation claim following injury. Surprisingly, workers in schedules requiring overtime were found to have a significantly lower likelihood of quitting their jobs following injury than workers in conventional schedules.

In general, nonstandard shift work had less of an effect on the vocational consequences following workplace injuries were than did schedules involving extended working hours (Table 5). The only statistically significant effects observed were an elevated risk of being

fired among evening shift workers, an elevated risk of working less than full time among irregular shift workers, and a decreased likelihood of filing a workers' compensation claim among irregular shift workers, compared to employees in conventional shifts. Among workers in every type of nonstandard shift, there was a higher risk of being assigned temporarily to another job following a workplace injury than there was among injured workers in conventional schedules. That effect was not statistically significant for any *particular* type of nonstandard schedule but it was statistically significant when aggregating across all the nonstandard shifts. Similarly, when considering all the nonstandard shifts collectively, significantly elevated risks were observed in the likelihood of being unable to work normal duties, of suffering any form of job disruption, and of being fired following an injury compared to employees working conventional schedules.

Discussion

To the best of our knowledge, this is the first study that has analyzed the effect of shift work and long work-hour schedules on the likelihood for injured workers to experience vocational problems that might jeopardize their successful return to work. Our findings support the view that job re-entry following an occupational injury is more difficult for workers returning to nonstandard schedules, especially schedules involving overtime and long working hours. Our analyses also suggest that the adverse vocational consequences are not uniform across work schedules, but rather vary considerably by type of schedule.

This means that physical and occupational therapists, medical providers, and other professionals involved in rehabilitation and return-to-work planning need to tailor their approach to the particular type of work schedule to which the injured employee will be returning. For example, rather than returning directly to a schedule that requires more than 12 h per day or more than 60 h per week, workers may need to re-enter their long-work hour schedule in a phased manner to avoid reinjury and decrease the likelihood for them to quit or be fired because of inability to meet the special demands imposed by those schedules. Other types of considerations may be required in other situations. For example, management may need to be alerted to the potential for people recovering from an injury to have special problems in making long commutes from home (exceeding 2 h per day), so that occasional late arrivals will not result in their being fired.

Existing occupational rehabilitation literature rarely mentions the worker's job schedule as a salient factor in determining a work resumption plan. Traditional return-to-work planning tends to focus on assessment of an individual's functional capacities and limitations, and ability to perform specific tasks. It is common for return-to-work plans also to include suggestions for part-time hours and modified duty. But consideration of the long-term effects of nonstandard shift scheduling, overtime assignments, and extended-hour schedules on the patient's ability to maintain productive employment have received scant attention in the occupational rehabilitation literature.

An unexpected finding in this study was the discrepancy in the risk of vocational problems (especially quitting or being fired following injury) between long-hour per day and long-hour per week schedules on the one hand, and overtime schedules on the other. The anomalous finding of a lower risk of quitting the job following injury among people in overtime shifts than among injured workers in conventional schedules (OR = 0.66, CI: 0.50–0.90) might be related to higher average hourly wages in overtime assignments that might create an incentive to remain employed. Workers who volunteer for overtime assignments are often in need of the extra money and therefore may perceive a bigger economic barrier for quitting. Additionally,

Table 5 Relative risks and 95% confidence intervals for vocational consequences of a work-related injury, by type of shift work schedule, 1988–2000, NLSY

	Night shift	Evening shift	Rotating shift	Irregular shift	Any type of nonstandard shift work ^b
Missed work	0.98 0.82–1.15	1.01 0.88–1.14	1.20 0.45–2.05	0.96 0.85–1.08	1.01 0.94–1.08
Lost wages	1.07 0.86–1.33	1.04 0.87–1.24	1.23 0.26–2.20	0.94 0.79–1.11	1.05 0.95–1.15
Filed a WC claim	1.13 0.96–1.31	0.94 0.81–1.07	1.01 0.33–1.90	0.88 0.77–1.00	0.98 0.91–1.05
WC claim pending	1.09 0.74–1.55	1.13 0.82–1.54	1.01 0.04–4.38	1.12 0.82–1.52	1.07 0.90–1.28
WC benefits collected	0.96 0.75–1.21	0.92 0.74–1.12	0.96 0.24–2.05	1.00 0.82–1.21	1.00 0.90–1.10
Job disruption ^a	0.96 0.78–1.16	1.07 0.92–1.25	1.41 0.50–2.76	1.12 0.98–1.28	1.14 1.05–1.23
Assigned temporarily to another job	1.32 0.97–1.78	1.08 0.83–1.42	1.77 0.48–5.92	1.03 0.80–1.33	1.22 1.07–1.41
Worked less than full time	0.76 0.54–1.07	1.01 0.79–1.29	1.40 0.49–3.21	1.28 1.04–1.56	1.10 0.97–1.25
Unable to work normal duties	0.89 0.71–1.13	1.05 0.88–1.24	1.73 0.61–4.00	1.13 0.96–1.32	1.11 1.01–1.21
Laid off	0.56 0.30–1.05	1.10 0.76–1.59	1.10 0.89–1.39	0.81 0.55–1.20	0.86 0.69–1.07
Quit	0.70 0.35–1.42	0.86 0.52–1.45	1.25 0.38–3.46	1.34 0.91–1.99	1.04 0.81–1.36
Fired	1.19 0.56–2.55	1.76 1.06–2.99	0.50 0.06–3.80	1.14 0.64–2.05	1.53 1.13–2.15
Changed occupations	1.29 0.81–2.03	0.95 0.62–1.45	1.03 0.28–3.33	1.08 0.75–1.57	1.19 0.97–1.48

^a A summary variable that includes assigned temporarily to another job, worked less than full time, or unable to work normal duties

^b Includes night, evening, rotating, irregular, and split shifts. Split shift results are not reported separately in this table because there were only a small number of individuals who reported working those shifts

Bolded values are statistically significant at $p < 0.05$

overtime workers might be concentrated in critical public service occupations such as health care workers, police officers, and fire fighters, which might also discourage them from quitting their jobs after an injury. They may also be working a mandatory overtime assignment, that is, overtime work required by employer, often under the threat of job loss or other penalty if the worker fails to comply [21–25]. It has been estimated that 31.8% of overtime work involves mandatory overtime [23]. The compulsory nature of mandatory overtime assignments might also serve to discourage workers from quitting their jobs following an injury. The data in this

study did not allow for identifying mandatory overtime assignments or for fully analyzing why injured overtime workers were much less likely to quit their jobs than other injured workers, including those in schedules requiring long-hours per day or long-hours per week.

A similar discrepancy was observed in the propensity to file a workers' compensation claim following an injury. Overtime workers were more likely to file a claim than injured workers in conventional schedules. By contrast, workers in schedules requiring long hours per day or long hours per week were actually less likely than injured workers in conventional schedules to file a claim. Further investigation is needed to better understand the factors underlying these findings.

Limitations

The study was based on a secondary analysis of existing self-reported data from the NLSY. We were thus limited to considering the information about work schedules and vocational consequences of workplace injuries contained in that database. Other details pertaining directly to occupational rehabilitation—such as the injured worker's specific impairments and functional limitations, work restrictions, and job accommodations and modifications upon return—were not available. We also did not have information about the precise reasons for the observed effects after injury (e.g., temporary reassignment, working less than full time, being fired), other than the respondent's perspective that the workplace injury "caused" the effect, based on the wording of the survey questions. As with any retrospective survey, respondents might have been unable to recall needed information accurately. However, there is no reason to think that any recall problems among injured workers in this study would be systemically biased according to type of work schedule.

A strength of this study was its ability to control for the potential confounding effects of age, gender, occupation, industry, and region in the analysis. However, other potential covariates including wage rates, family considerations, return-to-work policies, availability of modified work, job performance indicators, and hours worked upon return to the job, were not considered. Future studies are planned that will examine how the effect of job schedules on vocational consequences of injury vary among different types of workers (e.g., by gender and by age), occupations, and industries.

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