

Racial/Ethnic and Gender Differences in Individual Workplace Injury Risk Trajectories: 1988–1998

Terceira A. Berdahl, PhD

Employers reported 5.2 million nonfatal workplace injuries to the Bureau of Labor Statistics for 2001.¹ Although workplace injuries are common and account for 30% of medically treated injuries in the United States,² few studies have examined racial/ethnic or gender disparities in workplace injury outcomes. Virtually nothing is known about how individual workplace injury risk changes across occupations or how racial/ethnic and gender disparities in risk change over time.

Men and women belonging to a racial/ethnic minority are less likely to hold jobs in professional or managerial occupations, have lower wages,³ and are concentrated in sectors of the economy characterized by more-hazardous working conditions,⁴ such as agriculture, domestic service,^{5,6} and hospital aide work,⁷ compared with their White counterparts. For these reasons, one might expect rates of workplace injury to be higher among these workers and perhaps different across specific racial/ethnic and gender groups. Despite these disparities, few studies have addressed racial/ethnic and gender subgroup differences in workplace injury outcomes. The existing literature on race/ethnicity and workplace injury is inconsistent, sometimes finding a disparity^{5,8} and sometimes finding no disparity between racial/ethnic majority and minority workers.^{9,10} Findings for gender are more conclusive; women consistently report fewer workplace injuries than do men.¹¹

Few studies have examined men and women of color as separate subgroups, even though race/ethnicity and gender jointly determine labor market position. This omission is problematic because previous research has found that race/ethnicity and gender interact to produce different employment outcomes for men and women of color that are not apparent in additive models.¹² The few exceptions that present data jointly by race/ethnicity and

Objectives. I examined workplace injury risk over time and across racial/ethnic and gender groups to observe patterns of change and to understand how occupational characteristics and job mobility influence these changes.

Methods. I used hierarchical generalized linear models to estimate individual workplace injury and illness risk over time (“trajectories”) for a cohort of American workers who participated in the National Longitudinal Survey of Youth (1988–1998).

Results. Significant temporal variation in injury risk was observed across racial/ethnic and gender groups. At baseline, White men had a high risk of injury relative to the other groups and experienced the greatest decline over time. Latino men demonstrated a pattern of lower injury risk across time compared with White men. Among both Latinos and non-Latino Whites, women had lower odds of injury than did men. Non-Latino Black women’s injury risk was similar to Black men’s and greater than that for both Latino and non-Latino White women. Occupational characteristics and job mobility partly explained these differences.

Conclusions. Disparities between racial/ethnic and gender groups were dynamic and changed over time. Workplace injury risk was associated with job dimensions such as work schedule, union representation, health insurance, job hours, occupational racial segregation, and occupational environmental hazards. (*Am J Public Health.* 2008;98:2258–2263. doi:10.2105/AJPH.2006.103135)

gender rely on data from the 1980s⁵ or focus on single industries.^{6,7} As a notable exception, an analysis of National Longitudinal Survey of Youth (NLSY) data revealed that Black men and women missed more days of work after an injury compared with Whites.⁹

Over the course of a working life, workers may be able to move out of risky jobs and, thus, decrease their risk of injury. Because of the strong influence of race/ethnicity and gender on economic outcomes and upward mobility,^{3,13} disadvantaged groups, namely women and minorities, may be less able to move out of risky jobs. Testing this hypothesis was the focus of my analysis.

Analyses of panel data are invaluable in the study of workplace injury disparities and changes over time. Because most previous research was cross-sectional in nature and often relied on officially reported cases or on case studies, it could not address research questions about patterns of change for individuals. Some recent studies used panel data from the NLSY⁹ to examine workplace injury, but none have used trajectory analysis to examine

individual racial/ethnic and gender disparities over time or the effects of job mobility on workplace injury risk.

Characteristics of jobs and occupations that correlate with race/ethnicity, gender, and workplace injuries were control variables in my study. Because minority workers disproportionately work rotating shifts and nonstandard hours,¹⁴ receive lower wages, and work in more-hazardous occupations, these factors may account for potential racial/ethnic and gender differences in workplace injury trajectories. Racially segregated work is a potential risk factor for workplace injury,⁴ although no previous studies of workplace injury included measures of occupational racial segregation as predictors of individual workplace injury. Union representation and health insurance benefits are linked to workplace injury risk, because risky jobs in some sectors are represented by unions organized around health and safety issues. These factors are associated with workplace injury, and changes along these dimensions could account for changes in racial/ethnic or gender differences in workplace injury over time.

I used nationally representative panel data from the NLSY to estimate individual workplace injury and illness risks over time (“trajectories”) during a 10-year period. I sought to answer 2 research questions. First, are individual workplace injury trajectories modified by race/ethnicity or gender? I expected men of color to fare worse and face the highest risk of injury over time, and I expected women of color to have more injuries compared with non-Latino White women. Second, does job mobility account for any observed racial/ethnic and gender differences in individual time trajectories? Because different labor market characteristics are associated with race/ethnicity and gender and with workplace injury, I hypothesized that job mobility would account for racial/ethnic and gender differences in workplace injury trajectories.

METHODS

Individual workplace injury trajectories for 6 groups of workers defined simultaneously by race/ethnicity and gender were analyzed with multilevel models.¹⁵ Because of the binary nature of the outcome, workplace injury status, hierarchical generalized linear models (HGLMs), a version of hierarchical linear models (HLMs) designed for nonlinear outcomes, were used.^{15,16}

Data and Sample

The NLSY cohort survey began in 1979 and is an ongoing nationally representative panel study funded by the US Department of Labor. The NLSY includes extensive questions about the labor market histories of respondents, including questions about job history, wages, occupation, union representation, and work status. The survey also collects demographic information including age, gender, and race/ethnicity. The NLSY oversamples Blacks, Latinos, and low-income Whites to ensure adequate numbers for group comparisons. Beginning in 1988, the NLSY included a workplace injury module. The overall response rate was 91.2% in 1988 and 86.7% in 1998.¹⁷ The sample includes 8770 individuals followed across 5 waves of data collection spanning 10 years (1988–1998) and offers 32 890 person-year observations for analysis. These respondents represent

individuals aged 23 to 31 years in 1988 and 33 to 41 years in 1998.

The analytic sample was based on 1988 employment status and interview completion in that year. Because HGLMs allow for unbalanced panels, the experiences of individual respondents are included in the estimates regardless of their pattern of responses after 1988. It is likely that severely injured workers will not complete the survey and thus, estimates of injury are probably downwardly biased. It is impossible to know for sure whether bias occurred, because the NLSY does not code for workplace injuries as a reason for noninterview or death. However, comparing confirmed deaths after 1988 by race/ethnicity and gender was possible using the reason for noninterview variables. Of the original 1988 analytic sample, 1.7% of White men, 0.8% of White women, 4.1% of Black men, 1.1% of Black women, 1.8% of Latino men, and 0.8% of Latino women left the study because of a confirmed death. The principal findings in my study were not different for people who died after 1988 compared with all other respondents (analysis available from author upon request). Whether these differential death rates reflect patterns of workplace injury severity is impossible to determine.

Measures

In each wave, respondents were asked if they had experienced an incident at work leading to injury or illness in the past year or since the last interview. This indicator formed a dichotomous dependent variable for each wave. To construct the 6 race/ethnicity and gender groups, respondents were coded into 6 groups on the basis of race/ethnicity and gender: non-Latino White (hereafter White) men, White women, non-Latino Black (hereafter Black) men, Black women, Latino men, and Latino women. Stable between-persons independent variables include race/ethnicity, gender, age, education, and immigrant status. Immigrant status (immigrant=1, US born=0), individual age and education in years at the first wave were used as control variables. Time-varying occupation mobility variables included: average hours worked per week, natural log of hourly wages, union representation (yes=1, no=0), years worked in current job, working a fixed shift (1=yes, no=0),

having employer-sponsored health insurance (yes=1, no=0), and the percentage of Black and Latino workers in occupations (measures of occupational segregation from the 1990 1% Census Public Use Microdata Sample¹⁸). Data on levels of environmental hazards and physical demands were merged from the Dictionary of Occupational Titles data set developed by England and Kilbourne¹⁹ on the basis of NLSY respondents’ 3-digit census occupation code.

Data Analysis

HLMs and HGLMs for binary outcomes are used in public health research when the data structure is nested. Also known as multilevel analysis, this method is commonly used to analyze health outcomes from individual and contextual data or individual and repeated observations data.²⁰ For example, a recent study used HGLMs to understand the effects of community ethnic composition on the prevalence of respiratory conditions among Latinos.²¹ In another example, researchers used HLMs to study the effects of individual race/ethnicity and gender on change in sexual risk behaviors over time.²² In both of these examples, HLMs were preferred because they relax the assumption of independence of observations and provide adjusted standard errors for regression estimates. It also allows for the efficient estimation of cross-level interaction effects.

In the current study, HGLMs of the odds of injury at work during 1988 to 1998 were estimated using the HLM program version 6.04 (Scientific Software International, Inc, Lincolnwood, Ill).¹⁵ In the HGLM analysis, an intercept and slopes for each of the 8770 individuals in the NLSY were estimated. Examination of the average slopes allowed determination of whether racial/ethnic and gender groups had differential workplace injury risk over time. Model 1 established baseline workplace injury trajectories by race/ethnicity and gender across a 10-year period (1988–1998). Model 2 estimated workplace injury trajectories by race/ethnicity and gender with additional controls for time-varying job and occupation mobility characteristics. All estimates were weighted with the custom panel weights available for the NLSY. These models provide information on differences across groups in the baseline

odds of having a workplace injury and how those odds change over time. By following the same individuals over time, HGLM trajectory models predict individual change in workplace injury risk and provide a strong test of within-person influences on workplace injury, because they account for unobserved heterogeneity at the individual level.¹⁵

RESULTS

Baseline Characteristics

Of the 8770 individuals followed in the panel, 21% reported a workplace injury at some point across the 10-year observation period. In 1988, at baseline, White and Latino women were less likely than were their male counterparts to report a workplace injury, but no significant gender difference was observed among Blacks (Table 1). Among women, racial/ethnic differences were small and statistically insignificant. Among men, Latino and White men were injured in similar proportions (.093 and .107); Black men were injured in a lower proportion (.052) compared with other men.

The 6 racial/ethnic and gender groups also differed on job and occupational characteristics (Table 1). Men worked more hours on average compared with women, with White men working the most hours (44.28 per week) of all groups. On average, Blacks

and Latinos reported lower wages compared with Whites. Black men and women tended to work in the most racially segregated occupations, followed by Latinos and Whites. Black workers more often had union representation and slightly shorter job tenure compared with the other racial/ethnic groups. There were few racial/ethnic and gender differences in working a fixed schedule. Within gender groups, Blacks worked in occupations with greater environmental hazards and physical demands than did Latinos or Whites. Overall, men were employed in occupations with greater risk compared with women; Black men worked in occupations with the greatest level of environmental hazards and physical demands. All groups of women had lower injury odds compared with men, and there was less variation among women than among men.

Race/Ethnicity and Gender

To answer the first research question, it is necessary to discuss 2 components of HGLM trajectories: baseline status and change from baseline. Unstandardized parameter estimates reported in the first panel of Table 2 (model 1) reflect differences in the odds of injury in 1988 (baseline) for each racial/ethnic and gender group. Four of the 6 groups had lower odds of injury in the first wave (baseline) compared with White men (Table 1, model 1;

Figure 1). All groups of women had lower baseline odds of injury compared with White men. Black women were 45% less likely, Latino women 67% less likely, and White women 54% less likely to report an injury in the first wave than were White men. Black men had a lower odds of injury (52% less likely) compared with White men. Latino men were not statistically significantly different from White men in the first wave.

A more complex picture arises when we move to an examination of the second component of the multivariate HGLM. Differences by race/ethnicity and gender over time are represented by the linear time slope and quadratic time slope cross-level interaction coefficients for each of the 6 groups. These parameter estimates represent different change slopes for each racial/ethnic and gender group. Time trends were plotted in Figure 1 by solving the equation for each group and converting the odds to predicted probabilities (Figure 1). In this unadjusted model, the biggest change across time was the decline in injury risk among White men between 1988 and 1993, a decline consistent with their greater opportunities for job mobility and then increases in the last wave. Latino men displayed a pattern of generally declining risk over time, although they experienced the greatest risk of all racial/ethnic and gender groups at 3 of the 5 time points studied; Latino men shared similar risk of injury with White men in 1998. Black men displayed a pattern of rising and then falling risk of injury. Black and White women's injury trajectories were characterized by a small decline and then an increase in the later waves. Latino women began and ended the study with the lowest injury risk; however, their injury risk increased slightly in later waves.

Job Mobility

To answer the second research question, time-varying job and occupation mobility characteristics were included in model 2 (Table 2; Figure 2). These variables captured dimensions of jobs that are associated with both race/ethnicity and gender and workplace injury. After controlling for job characteristics, I found that differences in baseline status across the groups were still statistically significant but

TABLE 1—Weighted Baseline Descriptive Statistics, by Race/Ethnicity and Gender: National Longitudinal Survey of Youth, 1988

	Non-Latino Whites		Non-Latino Blacks		Latinos	
	Men	Women	Men	Women	Men	Women
Injured, proportion	0.107	0.056	0.052	0.062	0.093	0.036
Health insurance offered, proportion	0.658	0.619	0.586	0.602	0.624	0.546
Fixed work schedule, mean	0.855	0.843	0.834	0.828	0.860	0.867
Hours worked per week, mean no.	44.284	36.985	41.033	37.775	41.798	36.146
Organization tenure, wk, mean	158.752	136.388	117.457	123.701	150.644	130.748
Log hourly wages, mean	2.209	1.952	1.948	1.807	2.097	1.872
Union representation, proportion	0.141	0.096	0.241	0.223	0.180	0.122
Environmental hazards in occupation, proportion	0.706	0.217	0.801	0.318	0.719	0.247
Physical demands in occupation, mean	2.075	1.575	2.171	1.725	2.095	1.639
Percentage Black in occupation, mean	10.648	11.412	14.904	15.205	12.787	12.262
Percentage Latino in occupation, mean	8.308	7.538	10.553	9.012	9.921	8.816
Immigrant, proportion	0.026	0.029	0.018	0.035	0.295	0.214
Education, mean y	13.257	13.360	12.396	13.053	12.028	12.404

TABLE 2—Hierarchical Generalized Linear Model Coefficients for the Odds of Workplace Injury (N = 32 890)

	Model 1			Model 2 ^a		
	b	Odds (SE)	P	b	Odds (SE)	P
Mean Baseline Status						
White men (intercept)	-2.111	0.121 (0.063)	.001	-2.595	0.075 (0.100)	.001
Black women	-0.606	0.545 (0.124)	.001	-0.432	0.649 (0.137)	.002
Latino women	-1.110	0.330 (0.172)	.001	-0.914	0.401 (0.192)	.001
White women	-0.786	0.456 (0.100)	.001	-0.446	0.640 (0.112)	.001
Black men	-0.662	0.516 (0.124)	.001	-0.802	0.449 (0.135)	.001
Latino men	-0.175	0.839 (0.133)	.187	-0.330	0.719 (0.145)	.023
Mean Linear Time Slope						
White men (intercept)	-0.488	0.614 (0.075)	.001	-0.502	0.606 (0.082)	.001
Black women	0.269	1.308 (0.150)	.072	0.238	1.269 (0.161)	.138
Latino women	0.430	1.537 (0.225)	.056	0.422	1.525 (0.247)	.087
White women	0.340	1.404 (0.124)	.007	0.351	1.421 (0.135)	.010
Black men	0.598	1.819 (0.144)	.001	0.612	1.844 (0.154)	.001
Latino men	0.422	1.526 (0.160)	.009	0.418	1.519 (0.174)	.016
Mean Quadratic Time Slope						
White men (intercept)	0.099	1.104 (0.018)	.001	0.102	1.107 (0.020)	.001
Black women	-0.046	0.955 (0.036)	.202	-0.039	0.962 (0.039)	.322
Latino women	-0.074	0.929 (0.054)	.167	-0.074	0.929 (0.059)	.208
White women	-0.061	0.941 (0.030)	.041	-0.063	0.939 (0.033)	.053
Black men	-0.132	0.877 (0.036)	.001	-0.134	0.875 (0.039)	.001
Latino men	-0.095	0.909 (0.039)	.015	-0.096	0.909 (0.042)	.024
Mean hours worked per week				0.014	1.014 (0.002)	.001
Mean log hourly wages				-0.043	0.958 (0.049)	.384
Mean union representation				0.287	1.333 (0.069)	.001
Mean organization tenure				0.000	1.000 (0.000)	.148
Mean health insurance offered				0.552	1.736 (0.065)	.001
Mean fixed work schedule				-0.170	0.843 (0.069)	.014
Mean percentage Black in occupation				0.009	1.009 (0.005)	.041
Mean percentage Latino in occupation				0.013	1.013 (0.006)	.027
Mean environmental hazards				0.255	1.291 (0.044)	.001
Mean physical demands				0.120	1.128 (0.042)	.004

^aModel controlled for baseline immigrant status, education, and age.

smaller for most groups (Table 2, model 2). In Figure 2, predicted probabilities were plotted for this model for each racial/ethnic and gender group across the 10-year period. Job characteristics accounted for a substantial portion of the differences in baseline status for most groups. White men still had the greatest odds of injury, but the differences were smaller for Black, Latino, and White women.

Differences in trajectories. Increases or decreases in the likelihood of workplace injury may emerge over time as individuals move to different jobs, and this job mobility may explain

differences in workplace injury trajectories across race/ethnicity and gender. The parameter estimates in model 2 (Table 2) suggest that job and occupation characteristics do explain some of the racial/ethnic and gender differences. The trajectories for Black women, White women, and White men converge (Figure 2). After controlling for job characteristic, I found that Latino men's increased risk of injury in the middle part of the study was explained by their job and occupational mobility characteristics. Gender differences within racial/ethnic groups diminished over time.

Job characteristics. In addition to examining how job characteristics influence racial/ethnic disparities in workplace injury trajectories, these models also offer an opportunity to examine the direct effects of working in different kinds of jobs. The parameter estimates in Table 2, model 2, for job characteristics represent average changes in the odds of injury associated with a 1-unit change on the variable of interest. Workers who moved into jobs requiring more work hours reported an increased odds of injury (odds 1.01 for each additional hour worked). Working in higher-wage jobs did not protect against workplace injury. Moving to unionized jobs and jobs with health insurance was associated with increased injury odds. Working a fixed work schedule was associated with a 16% decrease in the odds of injury. Working in an occupation with a 10-percentage-point increase in Black workers, on average, increased the odds of injury by 9%. Similarly, working in an occupation with a 10-percentage-point increase in Latino workers resulted in a 13% increase in the odds of injury. Of the 2 measures of occupational hazards and work demands, environmental hazards were associated with an elevated odds of workplace injury (odds=1.29 for each additional hazard), but the level of physical demand was not associated with the odds of workplace injury (odds=1.13 for each additional demand).

DISCUSSION

These findings highlight the dynamic nature of workplace injury disparities. Racial/ethnic and gender groups exhibited differences in overall injury risk in 1988 but had fewer differences in 1998. White men faced the greatest risk of injury in 1988, and their odds of injury exhibited moderate declines over time. Studies of career mobility and earnings trajectories have found that White men's wages increase faster than do other groups,³ indicating that White men experience more upward mobility than do other racial/ethnic groups and women. White men's odds of injury declined most substantially over time, whereas Latino men's odds of injury declined slowly and Black men's odds remained

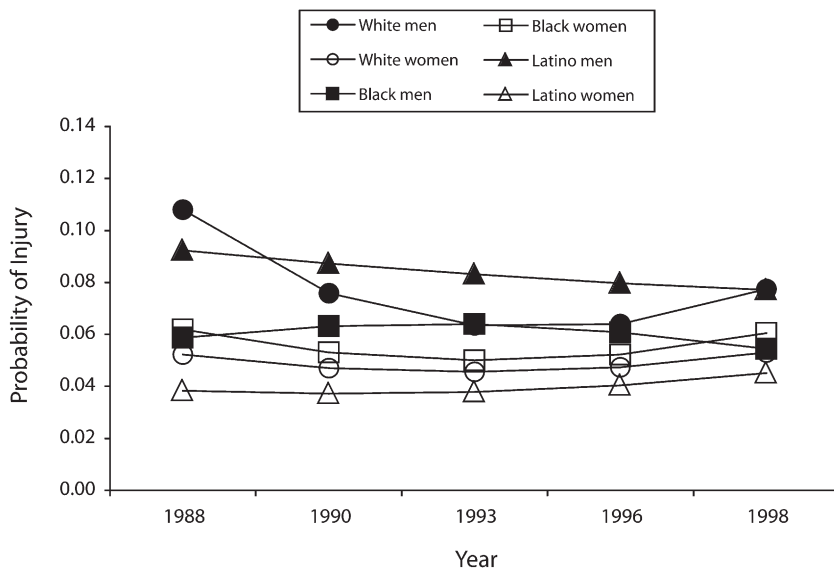


FIGURE 1—Predicted probability of injury over time, by race/ethnicity and gender.

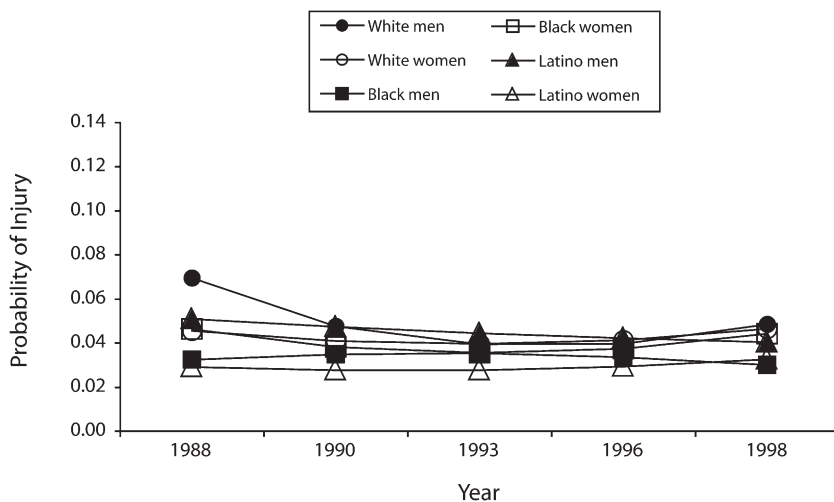


FIGURE 2—Predicted probability of injury over time, by race/ethnicity and gender, after control for job and occupational characteristics.

essentially unchanged. Latino men were initially less likely than were White men to report injury; however, their odds of injury were greatest of any group for 3 of the 5 waves. Controlling for job and occupational mobility characteristics helped to explain some of these differences (Figure 1 and 2). Both gender and racial differences were reduced in model 2, indicating the importance of job-mobility characteristics.

Contrary to my expectations, Black men did not exhibit a disparity compared with White men. Black men did not have elevated odds of workplace injury, although previous research suggests that Black workers have greater exposure to poor work environments and hazardous work places.⁴ The same shortcomings apply to the estimates for Latino men, who exhibited declining odds over time. Lower and declining odds of injury relative to White men occurred

even though Black men and Latino men in the NLSY worked in jobs with similar or greater exposure to environmental hazards and physically demanding work tasks compared with White men (Table 1). One possible explanation for these unexpected findings is injury severity. Previous research on occupational fatalities indicates Black and Latino workers are at a greater risk of fatal injury, especially in the construction²³ and agriculture⁵ industries. If Black and Latino men have more-severe injuries on average compared with other groups of workers, they may be more likely to die or become severely disabled. If this occurs, Blacks and Latinos with severe injuries may be dropping out of the NLSY and thus, the estimates will be downwardly biased. Therefore, my study's findings are conservative in their estimate of risk, among minority workers in particular. Future research should examine and disentangle types of injury, severity of injury, and racial/ethnic and gender disparities in injury.

Gender differences varied across the 3 racial/ethnic groups, highlighting the need to jointly estimate workplace injury trajectories by race/ethnicity and gender. Among Whites, men had greater initial odds of workplace injury, but by the end of the study period were similar to women (Table 2; Figure 2). Control for job mobility characteristics reduced the baseline status differences between White men and women. By contrast, very small differences between Black men and women and greater gender differences for Latinos were observed. Among women, Black women face the greatest odds of injury, and their risk trajectories were not statistically significantly different compared with White men. Black and White women's baseline injury odds were slightly higher than were Latino women's.

Important limitations of this study should be kept in mind. First, although panel attrition in the NLSY is low, minorities were more likely than were Whites to drop out because of death. Minority men, being likely to experience the most-severe injuries, are underrepresented in the NLSY. The NLSY is more generalizable to individuals with stable work histories and less-severe injuries. Second, the self-report measure of injury

assumes that workers recognize the role work plays in their injury or illness experiences. Consequently, the NLSY measure probably underestimates workplace influences on chronic illnesses and injuries that take years to manifest. Repetitive strain injuries and musculoskeletal disorders develop slowly and are more common among women.^{24,25} If measurement of these types of injuries is underestimated by the NLSY measure, women's overall estimates will be downwardly biased. Finally, the NLSY lacks measures of work-related stress or psychological distress. Workers in occupations traditionally held by women may suffer from higher levels of perceived psychological distress or stress and subsequent mental health disorders.²⁶ These issues should be sorted out in future research on different domains of work-related health problems.

Future research should investigate connections between employment conditions and workplace injuries. Workplace conditions are diverse and have implications for physical and mental well-being. Gaps in the research literature indicate a need to understand the multiple domains of workplace injury, specifically chronic illness and psychosocial trauma. My findings indicate that occupational conditions are significant predictors of workplace injury for all workers. Racially segregated workplaces, occupational environmental hazards, and physical demands are independent risk factors for injury. Following these lines of inquiry on career mobility can enhance our understanding of potential mediating processes between workplace conditions and racial/ethnic and gender differences in injury outcomes.

The NLSY offers a unique opportunity to study the occurrence of workplace injuries in the context of individual careers across a broad population over time. Of the NLSY respondents who were employed in 1988 and followed over the 10-year period, 21% reported a workplace injury or illness. My findings suggest that workplace injury is a career dimension with implications for racial/ethnic and gender disparities in health outcomes. ■

About the Author

Terceira A. Berdahl is with the Center for Financing, Access, and Cost Trends at the Agency for Healthcare Research and Quality, Rockville, Md.

Reprint requests should be sent to Terceira A. Berdahl, PhD, Agency for Healthcare Research and Quality, 540 Gaither Rd, Rockville, MD 20850 (e-mail: terceira.berdahl@ahrq.hhs.gov).

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