

Nonoccupational and Occupational Injuries to US Workers With Disabilities

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In the United States, persons with disabilities constitute 12.0% of the population.¹ Both the World Health Organization and the US surgeon general have released reports addressing disparities in the health of persons with disabilities.^{2,3} These reports identify community participation and health promotion as societal priorities. According to the 2008 American Community Survey, about 4.6 million adults (aged 16–64 years) with disabilities are employed in the United States, and the number of workers with disabilities is expected to increase in the coming years as the workforce ages.⁴ A public health concern is that workers with disabilities may be at high risk of occupational injuries.^{5–8} Reducing the proportion of individuals with disabilities who report non-fatal injuries is among the objectives of *US Healthy People 2020*.⁹

A number of studies have shown that adults with disabilities are more vulnerable to injuries than nondisabled adults.^{10–14} Studies using nationally representative data sets have found that the odds of injury increased with increasing severity of disability^{10,12} and with the number of disabilities.¹³ The settings and external causes of these injuries differed between individuals with and without disabilities.^{11,12} Falls, for example, were a leading mechanism of injury reported more frequently among those with disabilities.^{10–12}

Occupational injuries among workers with disabilities have also been previously studied.^{5,15–19} A number of studies from the 1990s showed an elevated risk of injury among workers with disabilities.^{5,15–17,19} However, much of the prior research examined only those with specific types of disabilities.^{15–19} For example, older workers with poor hearing and poor vision were shown to have an elevated risk for occupational injuries.¹⁷ By contrast, recent research based on workers' compensation insurance claims found that workers with cognitive disabilities sustained

Objectives. We examined medically treated injuries among US workers with disability.

Methods. Using 2006–2010 National Health Interview Survey data, we compared 3-month rates of nonoccupational and occupational injuries to workers with disability ($n = 7729$) and without disability ($n = 175\,947$). We fitted multivariable logistic regression models to calculate odds ratios and 95% confidence intervals of injuries by disability status, controlling for sociodemographic variables. We also compared leading causes of injuries by disability status.

Results. In the 3-month period prior to the survey, workers with disability were more likely than other workers to have nonoccupational injuries (odds ratio [OR] = 2.35; 95% confidence interval [CI] = 2.04, 2.71) and occupational injuries (OR = 2.39; 95% CI = 1.89, 3.01). For both groups, the leading cause was falls.

Conclusions. Disability status was strongly associated with risk of nonoccupational and occupational injuries among US workers. The safety issues facing US workers with disability in the workplace warrant future research. Federal agencies with an interest in the employment of workers with disability and their safety in the workplace should take a lead in further assessing injury risk and in promoting a safe working environment for workers with disability. (*Am J Public Health*. 2012;102:e38–e46. doi:10.2105/AJPH.2012.300888)

fewer injuries and experienced fewer absences due to injury than workers without cognitive disabilities.¹⁸

Previous work has also been critiqued because of the conceptualization and definition of disability⁵ and because environmental factors or work accommodations for workers with disability could not be taken into account.^{20,21} Zwerling et al. found that approximately 12% of workers with impairments reported receiving some type of workplace accommodation.²² Recent work by Leff et al. explored the role of environmental factors (e.g., societal attitudes, the natural environment, and policies) in the functioning and societal participation of people with disabilities.¹⁴ Environmental factors were found to be independently associated with injury regardless of disability status; however, disability status remained a risk factor for injury, although environmental factors attenuated the association. One current conceptualization of disability, the World Health Organization's International Classification of

Functioning, Disability and Health (ICF), emphasizes environmental factors and has been used in recent studies to evaluate injury risks of persons with disabilities.^{10,12,23} The ICF defines disability as physical impairments, activity limitations, and participation restrictions that affect one's interaction with the physical and social environment.²⁴ However, the impact of this refined definition on the number of injuries to workers with disabilities has yet to be determined.

Given the significant number of US workers with disabilities and the advancements in disability and injury definitions,²⁵ we compared medically attended nonoccupational and occupational injuries among workers with and without disabilities, using data from the 2006–2010 National Health Interview Survey (NHIS). Our current study improves on previous studies by our team and other researchers by examining both nonoccupational and occupational injuries to workers with disabilities using a single data source and a newer definition of disability based on the ICF.

METHODS

We analyzed data from the 2006–2010 NHIS, conducted by the National Center for Health Statistics.²⁶ This survey provides cross-sectional health information on the civilian, noninstitutionalized population in the United States. Through use of a complex survey design, a sufficient sample size for each demographic subgroup is obtained by stratification, clustering, and oversampling of certain population subgroups (e.g., ethnic/racial minorities).

The NHIS uses computer-assisted personal interviews to collect information on all members of selected households who are at home at the time of the interview; for those who are not, information is provided by a knowledgeable adult family member residing in the household. The overall response rate for the survey years was approximately 84%. The last general revision of the NHIS occurred in 2006, so from 2006 to 2010 there were no major changes in the questionnaire or in the weighting structure. This allowed us to calculate nationally representative estimates using the combined multiple-year data. The NHIS is divided into sections based on which respondent was interviewed. In this study, we used the person file (which included persons of all ages) for demographics, including disability information, the family file for personal income, the adult file (which included only persons aged 18 years and older) for occupation, and the injury episode file for injury characteristics. Results were weighted to produce national estimates for the US civilian, noninstitutionalized population.

Identification of Workers

In the NHIS person file, the question “What were you doing last week?” was asked of adults aged 18 years or older. Adults were classified as “workers” if the response was “working for pay at a job or business,” “with a job or business but not at work,” or “working, but not for pay, at a family-owned job or business.” This is the standard definition of a worker in the NHIS and other national surveys, such as the American Community Survey. To verify the employment status of those respondents included in the adult sample survey, we compared these responses with responses to a similar question in the sample adult file. Only workers were included in this study.

Definition of Disability

Disability questions in the NHIS survey were based on the disability classification of the ICF.²⁴ Respondents were asked about physical impairments, activity limitations, and participation restrictions. The duration of disability was also asked. The specific disability questions in the NHIS included the following:

1. “Are you limited in any way in any activities because of physical, mental, or emotional problems?”
2. “Are you limited in any way because of difficulty remembering or because you experience periods of confusion?”
3. “Are you limited in the kind OR amount of work you can do because of a physical, mental, or emotional problem?”
4. “Because of a health problem, do you have difficulty walking without using any special equipment?”
5. “Because of a physical, mental, or emotional problem, do you need the help of other adults with PERSONAL CARE NEEDS, such as eating, bathing, dressing, or getting around inside the home?”
6. “Because of a physical, mental, or emotional problem, do you need the help of other adults with ROUTINE NEEDS, such as everyday household chores, doing necessary business, shopping, or getting around for other purposes?”

Respondents were categorized as having a disability if they answered yes to any of these questions.

This classification of disability is consistent with the ICF’s bio-psycho-social conceptual model of disability and has been used in previous studies.^{10,24,27} Because disability might be the result of an injury, only those workers who reported a disability prior to the 3-month injury recall period were defined as workers with disabilities. This allowed us to investigate injuries among workers with preexisting disabilities.

Definition of Injuries

The NHIS collects specific data about medically treated injuries that occurred during the 3 months prior to the interview. Interviews are conducted year-round, thereby eliminating

seasonal influence. Details about the injury include diagnosis, cause of injury, and activity at the time of injury. Injury information is then verified and coded with the *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)*²⁸ codes for nature/diagnosis (N code) and external cause (E code) of injuries. Each respondent is allowed to record up to 10 injury and poisoning episodes. In our study, every injury occurrence reported by a respondent was counted as a separate injury episode. One injured person may have had multiple injury episodes. We defined injury cases as occupational if “Working at a paid job” was recorded for the question “What activity were you involved in at the time of the injury?” We defined all other injuries as non-occupational injury cases.

Sociodemographic Variables

We included age, gender, race/ethnicity, marital status, education, working hours, self-employment, health insurance coverage, nationality, and occupation as variables that could potentially affect the association between disability and injuries. Questions about demographic information were asked in the sample person file, and the responses were obtained from one member of the household for all members of the household. We obtained information about occupation from the sample adult file. NHIS public use data files contain 2-digit industry and occupation recodes based on census codes.²⁶ We classified construction, extraction, maintenance, production, transportation, moving materials, farming, forestry, and fishing occupations as “labor-related.” Non-labor occupations included the following: management, business, and financial operations; professional and related occupations; service, sales, and related occupations; office and administrative support; military-specific occupations; and unclassifiable occupations. In our study, we defined part-time working status as working less than 32 hours a week.

Statistical Analysis

We conducted data analyses using SAS 9.2 (SAS Institute, Cary, NC) and SUDAAN 9.0.1 (Research Triangle Institute, Research Triangle Park, NC). Our data analyses accounted for the complex survey design of the NHIS. We used 3 SAS procedures to analyze the

data: SURVEYFREQ, SURVEYMEANS, and SURVEYLOGISTIC. All these procedures incorporated the weight, cluster, and strata information provided in the NHIS public use data files. We first compared the socioeconomic and demographic characteristics of workers without disabilities and those with disabilities and calculated a weighted proportion of workers with disabilities in the United States. Using the self-reported working hours per week and working weeks per year, we estimated the annual injury rate of occupational injuries per 100 full-time equivalent workers. We estimated the annual rate of nonoccupational injuries per 100 workers by subtracting working hours from total hours per year. We then calculated the 3-month injury rates of nonoccupational and occupational injuries to workers with and without disabilities by the sociodemographic variables given in the previous section. We conducted χ^2 statistical analyses to determine if the 3-month injury rate was significantly higher ($P < .05$) among workers with disabilities than among workers without disabilities. To control for confounding effects of sociodemographic variables on injury risk, we fitted 2 logistic regression models: 1 for nonoccupational injuries and 1 for occupational injuries. We considered the following variables in the models: disability status, gender, age, marital status, race/ethnicity, education, occupation, hours worked in the previous week, self-employment, health insurance coverage, and nativity. We calculated adjusted odds ratios and 95% confidence intervals of injuries by disability status, controlling for sociodemographic variables and occupation (labor vs nonlabor occupation). Finally, we compared leading causes of nonoccupational and occupational injuries by injured workers' disability status.

RESULTS

We excluded 490 workers from our analysis because their disability status was unknown ($n = 150$) or the disability occurred during the study reference period ($n = 340$). A total of 183 676 workers aged 18 years and older from the 2006–2010 NHIS were included in our final analysis. Among the 175 947 workers without disabilities, 2426 reported medically treated nonoccupational injuries, 944 reported occupational injuries, and 25

reported both types of injury. Among the 7729 workers with disabilities, 274 reported nonoccupational injuries, 101 reported occupational injuries, and 1 worker reported both types of injury in the 3 months prior to the interview.

Injury Rates and Sociodemographics

Rates of nonoccupational and occupational injuries were 16.4 and 6.0 per 100 workers per year for workers with disabilities and 6.4 and 2.3 per 100 workers per year for workers without disabilities, respectively (Figure A, available as a supplement to the online version of this article at <http://www.ajph.org>).

Table 1 shows selected sociodemographic characteristics of US workers with and without disabilities. According to the NHIS, 4.6% (95% confidence interval [CI] = 4.4%, 4.7%) of US workers had disabilities. The proportion of workers with disabilities increased with age, equaling 9.0% among workers older than 55 years, compared with 2.5% for those aged 18 to 34 years and 4.3% for those aged 35 to 54 years. There was a much higher proportion of workers with disabilities working part-time (< 32 hours a week) than full-time (≥ 32 hours a week; 8.5% vs 3.6%). A much higher proportion of divorced, widowed, and separated workers had disabilities than did married workers (8.6% vs 3.8%). A significantly higher proportion of workers born in the United States had disabilities than did workers born outside the United States (5.0% vs 2.3%).

Injury Rate and External Causes of Injury

Tables 2 and 3 show the 3-month rates of medically attended nonoccupational and occupational injuries to workers with and without disabilities by select sociodemographic characteristics. Overall, the rate of nonoccupational injuries among workers without disabilities was 1.5% (95% CI = 1.5%, 1.6%) compared with 3.9% (95% CI = 3.3%, 4.4%) among workers with disabilities, yielding a rate ratio of 2.5 ($P < .001$). The rate of occupational injuries among workers without disabilities was 0.6% (95% CI = 0.5%, 0.6%) compared with 1.4% (95% CI = 1.1%, 1.6%) among workers with disabilities, for a similar rate ratio of 2.4 ($P < .001$). This rate ratio was generally consistent across the sociodemographic variables.

Table 4 presents the adjusted odds ratios and 95% confidence intervals of nonoccupational and occupational injuries from the logistic regression models. Only the variables listed in Table 4 were considered for inclusion in the models. Each of these variables was statistically significant in the univariate models, with the following exceptions: gender was not significant in the univariate model for nonoccupational injuries, and race/ethnicity and self-employment income were not significant in the univariate models for occupational injuries. All variables were included in the final multivariable models. Compared with workers without disabilities, workers with disabilities had more than twice the rate of nonoccupational injuries (adjusted odds ratio [AOR] = 2.35; 95% CI = 2.04, 2.71) and occupational injuries (AOR = 2.39; 95% CI = 1.89, 3.01). Those with significantly higher odds of occupational injury included the following: male workers; workers who were separated, divorced, or widowed; and workers born in the United States. Workers in labor-related employment sectors had significantly higher rates of occupational injuries (AOR = 1.89; 95% CI = 1.52, 2.36) than did workers in nonlabor sectors. Low education level was a significant risk factor for occupational injuries but not for nonoccupational injuries. Among all variables examined in the logistic regression models, disability status had the highest adjusted odds ratio for nonoccupational and occupational injuries.

We also analyzed the leading external causes of nonoccupational and occupational injuries among US workers by disability status. Falls and transportation were 2 leading mechanisms of both occupational and nonoccupational injuries regardless of disability status. However, falls comprised a higher proportion of injuries among workers with disabilities than among workers without disabilities, for both nonoccupational injuries (36.9% vs 28.6%) and occupational injuries (37.5% vs 21.5%; Table A, available as a supplement to the online version of this article at <http://www.ajph.org>).

DISCUSSION

Using a large, nationally representative data set, our study demonstrated that disability status was strongly associated with injury risk

TABLE 1—Selected Sociodemographic Characteristics of US Workers, by Disability Status: National Health Interview Survey, United States, 2006–2010

	No. Without Disabilities		No. With Disabilities		Weighted Proportion With Disabilities, % (95% CI)
	Sample ^a	Weighted ^b	Sample ^a	Weighted ^b	
Total	175 947	135 162 609	7729	6 450 354	4.6 (4.4, 4.7)
Gender					
Male	92 891	72 329 181	3783	3 246 042	4.3 (4.1, 4.5)
Female	83 056	62 833 428	3946	3 204 312	4.9 (4.7, 5.0)
Age, y					
18–34	61 635	47 468 614	1410	1 193 329	2.5 (2.3, 2.6)
35–54	84 717	64 067 444	3529	2 907 897	4.3 (4.2, 4.5)
≥ 55	29 595	23 626 550	2790	2 349 128	9.0 (8.6, 9.5)
Marital status					
Married	103 838	79 706 804	3798	3 188 378	3.8 (3.7, 4.0)
Single or never married	46 022	35 494 337	1741	1 456 480	3.9 (3.7, 4.2)
Separated, divorced, or widowed	24 771	18 975 525	2158	1 780 348	8.6 (8.2, 9.0)
Unknown	1316	985 942	32	25 148	2.5 (1.6, 3.4)
Race/ethnicity					
Non-Hispanic White	98 096	92 791 347	5239	5 024 338	5.1 (5.0, 5.3)
Non-Hispanic Black	24 223	15 211 424	1103	669 473	4.2 (3.9, 4.5)
Hispanic	39 881	19 500 942	1028	533 215	2.7 (2.5, 2.8)
Others	13 747	7 658 896	359	223 328	2.8 (2.5, 3.2)
Education					
< 12 y (no high school diploma)	23 154	14 052 332	1056	768 359	5.2 (4.8, 5.6)
High school graduate or GED	97 721	76 123 254	4891	4 124 090	5.1 (5.0, 5.3)
≥ bachelor's degree	51 152	42 294 855	1696	1 487 201	3.4 (3.2, 3.6)
Unknown	3920	2 692 167	86	70 704	2.6 (1.9, 3.2)
Occupation					
Not labor-related	53 214	42 989 554	3080	2 637 423	5.8 (5.5, 6.0)
Labor-related	14 906	11 451 788	845	732 849	6.0 (5.6, 6.5)
Unknown	107 827	80 721 267	3804	3 080 082	3.7 (3.5, 3.8)
Hours worked last wk					
Part-time (1–31)	29 164	22 842 133	2526	2 113 975	8.5 (8.1, 8.8)
Full-time (≥ 32)	140 559	107 675 466	4850	4 048 225	3.6 (3.5, 3.8)
Unknown	6224	4 645 010	353	288 154	5.8 (5.2, 6.5)
Self-employment income					
Yes	20 085	16 379 024	1248	1 070 648	6.1 (5.7, 6.5)
No	153 210	116 720 598	6424	5 339 164	4.4 (4.2, 4.5)
Unknown	2652	2 062 987	57	40 542	1.9 (1.4, 2.5)
Health insurance coverage					
Not covered	35 480	23 819 243	1404	1 105 202	4.4 (4.2, 4.7)
Covered	138 784	110 176 026	6288	5 319 150	4.6 (4.5, 4.8)
Unknown	1683	1 167 339	37	26 002	2.2 (1.4, 3.0)
Born in US					
Yes	132 097	111 005 141	6790	5 899 381	5.0 (4.9, 5.2)
No	43 340	23 822 887	937	549 836	2.3 (2.1, 2.4)
Unknown	510	334 581	2	... ^c	

Note. CI = confidence interval; GED = General Equivalency Diploma.

^aNumber of individuals in the National Health Interview Survey.

^bEstimated number of individuals in the United States.

^cUnreliable estimate not shown (relative standard error ≥ 0.30).

TABLE 2—Three-Month Rate of Nonoccupational Injuries Among US Workers, by Disability Status: National Health Interview Survey, United States, 2006–2010

	Without Disabilities		With Disabilities		Rate Ratio	P ^b
	Injured, No.	Injured, Weighted % ^a (95% CI)	Injured, No.	Injured, Weighted % ^a (95% CI)		
Total	2426	1.5 (1.5, 1.6)	274	3.9 (3.3, 4.4)	2.5	< .001
Gender						
Male	1289	1.6 (1.5, 1.6)	113	3.2 (2.6, 3.8)	2.1	< .001
Female	1137	1.5 (1.4, 1.6)	161	4.6 (3.8, 5.3)	3.0	< .001
Age, y						
18–34	958	1.8 (1.7, 1.9)	50	3.6 (2.6, 4.6)	2.0	< .001
35–54	1053	1.4 (1.3, 1.4)	135	4.0 (3.3, 4.8)	3.0	< .001
≥ 55	415	1.5 (1.3, 1.7)	89	3.8 (3.0, 4.7)	2.6	< .001
Marriage status						
Married	1231	1.3 (1.2, 1.4)	123	3.7 (3.0, 4.4)	2.8	< .001
Single or never married	768	1.9 (1.8, 2.1)	59	3.5 (2.6, 4.5)	1.8	< .001
Separated, divorced, or widowed	422	1.9 (1.7, 2.1)	92	4.6 (3.6, 5.6)	2.4	< .001
Race/ethnicity						
Non-Hispanic White	1704	1.8 (1.7, 1.9)	204	4.1 (3.5, 4.7)	2.3	< .001
Non-Hispanic Black	302	1.3 (1.2, 1.5)	37	3.4 (2.1, 4.6)	2.5	< .001
Hispanic	304	0.8 (0.7, 0.9)	21	2.5 (1.3, 3.6)	3.0	< .001
Others	116	1.0 (0.8, 1.2)	12	... ^c		
Education						
< 12 y (no diploma)	189	1.1 (0.9, 1.2)	19	2.4 (1.2, 3.6)	2.2	.002
High school graduate or GED	1374	1.5 (1.5, 1.6)	172	3.5 (3.0, 4.0)	2.3	< .001
≥ bachelor's degree	848	1.8 (1.7, 1.9)	81	5.7 (4.3, 7.0)	3.2	< .001
Occupation						
Not labor-related	965	1.9 (1.8, 2.1)	131	4.7 (3.8, 5.6)	2.4	< .001
Labor-related	198	1.5 (1.3, 1.8)	28	3.1 (1.9, 4.4)	2.1	.001
Hours worked last wk						
Part-time (1–31)	474	1.9 (1.7, 2.0)	95	3.8 (3.0, 4.5)	2.0	< .001
Full-time (≥ 32)	1873	1.5 (1.4, 1.6)	168	4.0 (3.3, 4.7)	2.7	< .001
Self-employment income						
Yes	335	1.7 (1.5, 1.9)	56	4.9 (3.6, 6.3)	2.9	< .001
No	2073	1.5 (1.5, 1.6)	217	3.7 (3.1, 4.2)	2.4	< .001
Health insurance coverage						
Not covered	343	1.1 (1.0, 1.3)	41	3.2 (2.2, 4.2)	2.8	< .001
Covered	2071	1.6 (1.6, 1.7)	232	4.0 (3.5, 4.6)	2.5	< .001
Born in US						
Yes	2128	1.7 (1.6, 1.8)	259	4.1 (3.6, 4.6)	2.4	< .001
No	298	0.8 (0.7, 0.9)	15	1.8 (0.7, 2.9)	2.2	.007

Note. CI = confidence interval; GED = General Equivalency Diploma.

^aWeighted to represent total percentage in the United States.

^bP value from significance test comparing injury prevalence between workers with and without disabilities.

^cUnreliable estimate not shown (relative standard error ≥ 0.30).

among US workers. Compared with workers with no disability, workers with disabilities were significantly more likely to experience both nonoccupational and occupational injuries. We found that workers with disabilities, however, were more likely to be injured away

from work than in the workplace. Occupational injuries were approximately 27% of the total injury burden among workers in this study, a proportion slightly lower than the 38% of injuries occurring at work seen in a previous study using 1997–1999 NHIS data.²⁹ Our

data captured both occupational and nonoccupational poisonings not included in that earlier study. Our study also included workers older than 65 years. The previous study was limited to those aged 18 to 64 years. Additionally, we excluded 490 workers when it was not clear

TABLE 3—Three-Month Rate of Occupational Injuries Among US Workers, by Disability Status: National Health Interview Survey, United States, 2006–2010

	Without Disabilities		With Disabilities		Rate Ratio	P ^b
	Injured, No.	Injured, Weighted % ^a (95% CI)	Injured, No.	Injured, Weighted % ^a (95% CI)		
Total	944	0.6 (0.5, 0.6)	101	1.4 (1.1, 1.6)	2.4	< .001
Gender						
Male	613	0.7 (0.7, 0.8)	57	1.5 (1.1, 2.0)	2.1	< .001
Female	331	0.4 (0.4, 0.4)	44	1.2 (0.8, 1.6)	3.0	< .001
Age, y						
18–34	366	0.7 (0.6, 0.7)	22	1.6 (0.9, 2.3)	2.4	< .001
35–54	450	0.6 (0.5, 0.6)	43	1.4 (1.0, 1.8)	2.5	< .001
≥ 55	128	0.5 (0.4, 0.6)	36	1.3 (0.9, 1.7)	2.7	< .001
Marriage status						
Married	493	0.5 (0.4, 0.6)	47	1.3 (0.9, 1.7)	2.6	< .001
Single or never married	276	0.7 (0.6, 0.8)	21	1.3 (0.7, 1.9)	2.0	.003
Separated, divorced, or widowed	175	0.7 (0.6, 0.9)	32	1.6 (1.0, 2.1)	2.1	< .001
Race/ethnicity						
Non-Hispanic White	579	0.6 (0.5, 0.6)	69	1.4 (1.0, 1.7)	2.3	< .001
Non-Hispanic Black	136	0.6 (0.5, 0.7)	11	... ^c		
Hispanic	194	0.5 (0.5, 0.6)	17	2.1 (1.0, 3.3)	3.9	< .001
Others	35	0.3 (0.2, 0.5)	4	... ^c		
Education						
< 12 y (no diploma)	132	0.6 (0.5, 0.8)	11	... ^c		
High school graduate or GED	649	0.7 (0.7, 0.8)	74	1.6 (1.2, 2.0)	2.2	< .001
≥ bachelor's degree	156	0.3 (0.3, 0.4)	16	1.0 (0.5, 1.6)	3.2	< .001
Occupation						
Not labor-related	244	0.5 (0.4, 0.5)	35	1.2 (0.8, 1.5)	2.4	< .001
Labor-related	184	1.3 (1.1, 1.5)	21	2.4 (1.3, 3.6)	1.9	.011
Hours worked last wk						
Part-time (1–31)	121	0.4 (0.3, 0.5)	34	1.4 (0.9, 1.8)	3.1	< .001
Full-time (≥ 32)	802	0.6 (0.6, 0.7)	64	1.4 (1.0, 1.8)	2.3	< .001
Self-employment income						
Yes	97	0.5 (0.4, 0.6)	11	... ^c		
No	842	0.6 (0.5, 0.6)	90	1.5 (1.1, 1.8)	2.5	< .001
Health insurance coverage						
Not covered	196	0.7 (0.6, 0.8)	20	1.5 (0.8, 2.3)	2.3	.002
Covered	746	0.6 (0.5, 0.6)	81	1.4 (1.1, 1.6)	2.4	< .001
Born in US						
Yes	770	0.6 (0.6, 0.7)	92	1.4 (1.1, 1.7)	2.3	< .001
No	174	0.4 (0.4, 0.5)	9	1.1 (0.3, 1.9)	2.6	.01

Note. CI = confidence interval; GED = General Equivalency Diploma.

^aWeighted to represent total percentage in the United States.

^bP value from significance test comparing injury prevalence between workers with and without disabilities.

^cUnreliable estimate not shown (relative standard error ≥ 0.30).

whether disability preceded the injury seen in the study period.

Our results correlate well with previous research on the increased risk of injury among persons with disabilities.^{5,7,11,12,14,17,23,30} In

a study using NHIS data, Brophy et al.¹² reported injury odds ratios of 1.68 and 2.98 for moderate and severe disability, respectively, which is comparable to our study's adjusted odds ratio of 2.35 for workers with disabilities

for nonoccupational injuries. Furthermore, our data show a higher rate of occupational injuries among workers with disabilities than workers without disabilities. Similar findings were reported by Zwerling et al., who found that

TABLE 4—Multivariate Logistic Regression Models of Nonoccupational Injuries and Occupational Injuries in Past 3 Months Among US Workers: National Health Interview Survey, United States, 2006–2010

	Nonoccupational Injuries, AOR (95% CI)	Occupational Injuries, AOR (95% CI)
Disability status		
Workers without disabilities (Ref)	1.00	1.00
Workers with disabilities	2.35 (2.04, 2.71)	2.39 (1.89, 3.01)
Gender		
Female (Ref)	1.00	1.00
Male	1.09 (1.00, 1.19)	1.60 (1.37, 1.86)
Age, y		
35–54 (Ref)	1.00	1.00
18–34	1.26 (1.12, 1.41)	1.19 (1.00, 1.42)
≥ 55	0.98 (0.86, 1.12)	0.88 (0.72, 1.07)
Marriage status		
Married (Ref)	1.00	1.00
Single or never married	1.33 (1.17, 1.52)	1.14 (0.94, 1.38)
Separated, divorced, or widowed	1.48 (1.30, 1.68)	1.39 (1.13, 1.70)
Race/ethnicity		
Non-Hispanic White (Ref)	1.00	1.00
Non-Hispanic Black	0.77 (0.66, 0.88)	0.99 (0.82, 1.20)
Hispanic	0.66 (0.54, 0.80)	0.96 (0.76, 1.22)
Others	0.76 (0.59, 0.96)	0.81 (0.47, 1.39)
Education		
≥ bachelor's degree (Ref)	1.00	1.00
High school graduate or GED	0.83 (0.75, 0.91)	1.93 (1.57, 2.37)
< 12 y (no high school diploma)	0.75 (0.62, 0.91)	1.67 (1.25, 2.24)
Occupation		
Not labor-related (Ref)	1.00	1.00
Labor-related	0.84 (0.70, 1.00)	1.89 (1.52, 2.36)
Unknown	0.79 (0.73, 0.87)	1.11 (0.94, 1.31)
Hours worked last wk		
Full-time (≥ 32; Ref)	1.00	1.00
Part-time (1–31)	1.16 (1.04, 1.30)	0.78 (0.61, 0.98)
Self-employment income		
No (Ref)	1.00	1.00
Yes	1.18 (1.05, 1.34)	0.91 (0.71, 1.17)
Health insurance coverage		
Covered (Ref)	1.00	1.00
Not covered	0.76 (0.66, 0.87)	1.00 (0.82, 1.22)
Born in US		
Yes (Ref)	1.00	1.00
No	0.65 (0.54, 0.78)	0.74 (0.57, 0.96)

Note. AOR = adjusted odds ratio; CI = confidence interval; GED = General Equivalency Diploma. AORs were obtained from logistic regression analyses with all the variables in the table included in the models.

workers with disabilities had injury odds ratios ranging from 1.10 (if the worker had a back impairment) to 3.21 (if the worker was blind).⁵

However, there is a difference between these 2 studies. Whereas our study included any injury that required medical attention in the 3 months

prior to the survey, Zwerling et al. only included injuries that left the person with a residual impairment at the time of the survey.

The most frequent cause of injuries among workers with disabilities was falls, which represented a higher proportion of injuries among workers with disabilities than workers without disabilities. This has been shown in numerous other studies.^{10–12,31–33} Other studies have shown the benefits of accommodation for disability in the workplace,^{34–36} and greater understanding of the causes of injuries among workers with disabilities may lead to more effective accommodations. For example, Willgoss et al. provide a review of risk factors and prevention efforts for fall injuries among those with intellectual disabilities.³² A recent *Morbidity and Mortality Weekly Report* describes injuries among older workers and lists potential fall prevention practices such as ensuring that floor surfaces are clean, dry, well lit, and free of tripping hazards.⁶

Strengths and Limitations

Unlike the authors of previous studies,^{5,7,12,14} we investigated nonoccupational and occupational injuries among workers with disabilities using a single data source. Workers with disabilities represented only a small portion (4.6%) of our sample of workers from NHIS. Disability prevalence estimates can vary given the considerable variation in survey question language.³⁷ According to 2007 American Community Survey data, persons with any disability comprise 6.3% of all employed persons, but this estimate includes those with vision or hearing impairments who may not report any limitations.³⁸ When only those reporting activity limitations or participation restrictions are included (a closer conceptual match to the NHIS disability definition), the proportion of workers with disabilities is 4.5%.

One other strength of our study is our ability to use a conceptualization of disability based on an overall assessment of physical impairments, activity limitations, and participation restrictions. However, this conceptualization does not provide information about workplace accommodations or specific environmental conditions that could be the focus of injury prevention interventions. Unfortunately, this information is not available in the NHIS. Leff

et al. report that injured persons, both with and without disabilities, say that environmental factors such as the natural environment, social attitudes, and policies are risk factors for injuries.¹⁴

Other limitations in the NHIS and our study must be considered when interpreting our results. First, injuries were included only if they were serious enough to require medical attention. People with disabilities in specific populations have been shown to access medical services more often, but it is not known if this is because of injuries.^{39,40} Workers with disabilities may be more likely than workers without disabilities to seek medical care for the same type of injury; this potential reporting bias could have confounded the association between disability status and the increased odds ratio of nonoccupational and occupational injuries in our study. Second, fatal injuries are not included in the NHIS. It is difficult to determine whether people with disabilities are more likely to sustain fatal injuries in the workplace, as no previous research has compared fatal injuries to persons with and without disabilities. Third, because of the relatively small sample size of workers with disabilities, there was insufficient power for comparing differences in injury characteristics, such as place of injury and activity at the time of injury, among this population. External cause of injury, place of injury, and activity at the time of injury could provide important evidence for designing intervention programs targeting workers with disabilities. Fourth, disabled persons are more likely than nondisabled persons to be obese, to smoke, and to be physically inactive, but we did not include these variables in our logistic models.⁴¹ Finally, only adults who worked during the previous week were included in the study. For this reason, our study is limited to those potentially less severe injuries occurring during the 3-month injury recall period that allowed the individual to return to work the week before the survey.

Implications for Injury Prevention in Workplace

Results from this study and previous research do not suggest that workers with disabilities should be excluded from the workforce.⁵ First, safety improvements aimed at workers with disabilities may also improve

safety for nondisabled workers.⁴² Second, the Americans With Disabilities Act prohibits discrimination in privileges of employment and requires that employers make reasonable accommodations for known physical or mental limitations of otherwise qualified individuals with disabilities. It is important to note that workers with disabilities reported more injuries away from work than in the workplace.

Third, according to the results reported here and data from the American Community Survey, there are more than 6 million US workers with disabilities in almost all industry sectors, a number likely to increase as the population ages.⁴ Previous research suggests that people with disabilities can work safely and effectively if reasonable accommodations are provided and their needs are built into the health and safety planning of the organization.⁴³ A study conducted by the DuPont company suggests that most workers with disabilities do not require any special arrangements.⁴⁴ For those who need special accommodations, often only minor adaptations are needed.⁴⁴ Furthermore, expenditure data from several companies that implemented accommodations for individuals with disabilities show that the expenses for accommodations are not high.⁴⁵

Fourth, many people in the disability advocacy community are understandably concerned that highlighting the increased risk of occupational injuries among workers with disabilities may discourage employers from hiring these individuals. In addition to safety concerns, employers also have expressed concerns about productivity, absenteeism, turnover, interpersonal situations on the job, and fears about costs, either from implementing accommodations or increases in insurance rates.⁴⁴ Some of these expressed issues may be misconceptions in that they are from employers who may not have had direct experience working with or supervising workers with disabilities. Previous studies have shown that, relative to other employers, those who have had previous experience hiring individuals with disabilities reported more favorable attitudes toward employing persons with disabilities.⁴⁴ A series of investigations conducted by DuPont concluded that hiring workers with disabilities did not contribute to an increase in compensation costs or lost-time injuries.⁴⁴ A 2006 special report to the National Institute for

Occupational Safety and Health (NIOSH) by Dewey recommended that occupational safety issues among workers with developmental disabilities should be proactively addressed by assisting employers in “building safety support systems that protect the individual needs of employees, that encourage communications between all parties, and that include appropriate and tailored health and safety training.”^{46(p7)}

Conclusions

Few researchers, agencies, or organizations in the United States have examined the occupational safety of workers with disabilities, and there is a serious lack of data regarding occupational injuries in this group.^{8,46,47} Findings reported in this study fill some of the data gaps, but they are not enough. By demonstrating the increase in occupational injuries to workers with disabilities, this study shows the need for better accommodation and safety programs in the workplace. Similar to the pleas from the World Health Organization² and the US surgeon general,³ the 2006 special report to the NIOSH recommended that federal agencies with an interest in the employment of workers with disabilities and their safety and health in the workplace should take the lead in further assessing the health and safety issues facing US workers with disabilities and in funding more research.⁴⁶ The report also calls for funding of educational and outreach programs that teach US workers with disabilities occupational safety and health skills. ■

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Contributors

J. Price performed preliminary analysis and wrote the first draft. J. Shi refined and completed the final analyses. B. Lu provided advice about the study design and the

data analysis. G. A. Smith interpreted findings and assisted with the writing. L. Stallones and H. Xiang conceptualized the study, interpreted findings, and reviewed drafts. K. K. Wheeler assisted with the study design, interpretation of the findings, and the writing. H. Xiang supervised the study.

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Human Participant Protection

The data analyzed in this study are de-identified publicly accessible data. The institutional review board of Nationwide Children's Hospital determined that approval was not needed for this study.

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