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Work-Related Injuries Among Hispanic Construction Workers—Evidence From the Medical Expenditure Panel Survey

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Background *Although a large number of Hispanic workers have entered the construction industry, few studies have estimated non-fatal work-related injuries for Hispanic construction workers at a national level. This study examines work-related injury conditions among Hispanic construction workers and assesses disparities between Hispanic and white, non-Hispanic workers.*

Methods *Pooled data were analyzed from a large national population survey, the Medical Expenditure Panel Survey (MEPS), between 1996 and 2002. More than 7,000 construction workers were identified from the MEPS data including 1,833 Hispanic workers and 4,533 white, non-Hispanic workers. Univariate and multivariate analyses were conducted using SAS-callable SUDAAN.*

Results *Hispanic workers differ from white, non-Hispanic workers in demographic and socioeconomic status. After controlling for major risk factors, Hispanic construction workers were more likely than their white, non-Hispanic counterparts to suffer non-fatal work-related injury conditions (OR = 1.28, 95% CI: 1.00–1.64).*

Conclusions *This study provides important evidence concerning Hispanic workers' safety on construction sites. Enhanced safety and health programs for Hispanic construction workers and improved occupational injury data systems are recommended.*
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KEY WORDS: construction worker; Hispanic; work-related injury; workplace safety; underreporting

INTRODUCTION

The demographics of the United States have changed markedly in recent years. The Hispanic population is growing faster than any other population group and is now the largest single minority in the country, followed by African-Americans [U.S. Census Bureau, 2007]. In addition, the construction industry has become the workforce sector with the second highest percentage of Hispanic workers, following agriculture. According to the U.S. Bureau of Labor Statistics [BLS, 2006a], Hispanic employment in construction reached 2.6 million in 2005, increasing by 80% from 2000. In selected occupations such as construction laborers, roofers, and drywall installers, nearly one-half of the workers were of Hispanic origin [CPWR, 2008].

Despite much effort to reduce occupational injuries and illnesses in the construction industry, this industry continues to account for a disproportionate share of work-related injuries and illnesses in the United States. In 2005, construction workers were 8% of the total U.S. workforce, but suffered 22% (1,243) of the nation's 5,734 reported

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work-related deaths [BLS, 2006b]. The rate of non-fatal injuries and illnesses resulting in days away from work was 2.4 per 100 full-time workers for the construction industry in 2005, about 71% higher than the average rate of 1.4 per 100 full-time workers for all industries in the United States [BLS, 2006c]. Individuals affected by safety and health problems often are unable to work or their ability to work is limited due to physical impairments. In addition to the suffering associated with physical disabilities and loss of lives, work-related injuries exert an economic burden on individuals, families, and the nation [Leigh et al., 2000]. A study funded by the National Institute for Occupational Safety and Health (NIOSH) estimated annual direct and indirect costs of occupational injuries and illnesses in the United States to be $171 billion, with $145 billion for injuries and $26 billion for diseases. These costs are much greater than those for AIDS ($33 billion) and even cancers ($170.7 billion) [Leigh et al., 2000].

Although occupational injuries and diseases can affect workers in all racial or ethnic groups and socioeconomic classes, available evidence suggests that Hispanic workers, along with other minority workers and low-income workers in general, are at a higher risk [Bollini and Siem, 1995; Moure-Eraso et al., 1997; Pransky et al., 2002; Moure-Eraso and Friedman-Jimenez, 2003]. Hispanic workers are over-represented in some of the most dangerous industries and have higher rates of fatal occupational injuries than any other racial or ethnic group in the United States [O'Connor et al., 2000; Brown, 2003; Richardson et al., 2003, 2004; Loh and Richardson, 2004; CDC, 2008]. While overall workplace fatalities have declined 20% in the last decade, work-related deaths among Hispanic workers have risen nearly 35% in the same period [Richardson et al., 2003]. For Hispanic construction workers in particular, work-related death rates were consistently higher than their non-Hispanic counterparts [Dong and Platner, 2004].

While it is known that Hispanic workers continue to enter the construction industry and that their occupational injuries are higher than any other ethnic group, construction safety and health research targeting this group is still limited [Brunette, 2004]. Very few studies have focused on non-fatal occupational injuries and illnesses among Hispanic workers. Some earlier studies concerning this issue were limited to a regional area and had no information on injury rates for Hispanic construction workers [Hunting et al., 1994; Anderson et al., 2000]. Traditional data sources of occupational injury statistics—including state workers' compensation data and the BLS' Survey of Occupational Injuries and Illnesses (SOII)—have major limitations that might affect Hispanic workers disproportionately. In particular, neither data system typically contains data on the socioeconomic status of workers. The workers' compensation data also exclude a substantial proportion of workers who are injured on the job but do not file claims for compensation. A host of other factors have limited the assessment of occupational risks for Hispanic workers: lack of surveys designed for construction workers, difficulties accessing this special population, informal worker arrangements and transient employment, concerns about confidentiality, and absence of ethnicity data in workers' compensation records [Pransky et al., 2002]. As a result, there are virtually no reliable statistics currently available that differentiate injuries among Hispanic construction workers from all construction workers nationwide.

METHODS

This study estimates work-related injuries among Hispanic construction workers using data from a large national population survey—the Medical Expenditure Panel Survey (MEPS) between 1996 and 2002. The MEPS is a publicly accessible source without personal identifiers. This protocol was reviewed by the CPWR human research subjects IRB (OHRP#00001202) and found to be exempt under 45CFR§46.101(b)(4).

The MEPS contains a wealth of data on the occupational, social, economic, and cultural backgrounds of workers and their injuries and illnesses. The hypothesis of this study is that workplace risks are different for Hispanic workers than for white, non-Hispanic workers; and demographic and employment factors explain the disparities.

Data Description

The MEPS is a large national population survey conducted annually by the Agency for Healthcare Research and Quality (AHRQ) and the National Center for Health Statistics (NCHS) to provide nationally representative estimates of health care use, expenditures, sources of payment, and insurance coverage for the U.S. civilian non-institutionalized population [Miller et al., 2004]. The MEPS data have been widely used in general health research, but have seldom been applied to occupational safety and health research.

The MEPS has four components: (1) a household survey; (2) a survey of medical providers (e.g., doctors, hospitals, and home health agencies); (3) a survey of health insurance providers (e.g., employers, insurance companies, associations, and unions) and an independent survey of employers; and (4) a periodic survey of nursing home residents. The Household Component (HC) is the core survey of the MEPS and serves as the basis for selecting the sample for the Medical Provider Component (MPC) and part of the Insurance Component (IC). The sampling frame for the MEPS-HC is drawn from respondents to the National Health Interview Survey (NHIS). The NHIS provides a nationally representative sample of the U.S. civilian

non-institutionalized population with an over-sampling of Hispanic and black populations.

The MEPS respondents are asked to report current health conditions at every round of data collection. Interviewers record the respondents' verbatim response to each open-ended question, while the computer system generates a health condition roster for every person in the household. Following these health condition questions, respondents are asked the reason for a medical provider visit and about missed workdays. Conditions can be added to the roster if they are not previously mentioned. For example, if a respondent reports an injury in Round 1 and again in Round 2, the interviewer verifies if this is the same injury. If it is a different injury, the condition is entered a second time. Respondents may frequently report several provider visits for the same condition. However, the condition appears only once on the person's health condition roster. For certain types of information that household respondents would have difficulty in reporting (e.g., employer contributions to health insurance premiums or charges for health care services), the MEPS-HC obtains consent and collects information directly from the respondent's employer, health care provider, and insurer.

Study Population and Sample Size

In this study, *Hispanic construction workers* are the MEPS respondents who claimed to be of Hispanic origin, were at least 16 years old, and were employed in the construction industry in at least one of the three waves during a given survey year. The reference group includes the MEPS respondents who self-reported that they were white, of non-Hispanic descent, employed in the construction industry, and in the same age group during the same time period. The MEPS classifies race as white; black/African American; Asian; American Indian/Native American/Alaska Native; other Pacific Islander; and other. ''Hispanic'' refers to any individual whose origin is Mexican, Puerto Rican, Cuban, South or Central American, Mexican American, Chicano, or other Latin American, regardless of racial background and country of birth. For brevity, in this article, the terms *Hispanics* or *Hispanic workers* refer to *Hispanic construction workers*, whereas *whites* or *white workers* refer to *white, non-Hispanic construction workers* in the text.

The construction industry was coded as three in the MEPS during these survey years, corresponding to SIC 15, 16, and 17 by the 1987 Standard Industry Classification (SIC) system [Cohen, 1997]. Using these definitions, 7,025 construction workers were identified from the MEPS 1996–2002 data, including 1,833 Hispanic workers. A reference group of 4,533 white, non-Hispanic workers was established by crossing the race and ethnicity questions, where Race = 1 (white) and Hispanic = 2 (non-Hispanic). Although workers in other racial categories were included in the total, the major comparison was between Hispanic and white, non-Hispanic construction workers.

Terms and Measurements

The MEPS data classify occupations in 14 major categories corresponding to the 1990 Census Occupational Classification System. For analysis purposes, occupations such as carpenters and construction laborers were also grouped together as production workers or blue-collar workers, while managerial, professional, and clerical occupations were grouped as white-collar workers.

- Work-related injury

When a respondent reports a condition resulting from an accident or injury, the respondent is asked whether or not the accident or injury occurred at work. A single injury episode may result in several different conditions. The household respondent identified the date of the injury and the resulting conditions in the Condition Enumeration Section of the MEPS Household Component Questionnaire and identified the number and type of provider visits in the Medical Event Section [AHRQ, 2009]. If a person did not have a medical provider visit and did not miss work because of an injury (such as a pulled muscle), the injury may not have been reported during the MEPS interview. When calculating average health care expenses for work-related injuries, the number of workers who had a work-related injury is counted rather than the number of injuries per se. In this measure, 1 = work-related injury, 2 = other.

- Severity of work-related injury

The MEPS asks the respondents whether they missed any days from their job because of an injury or illness and how many days were lost. If a respondent reported at least one full lost workday, it is counted as a severe injury or lost workday injury in this study.

Data Analysis

Descriptive analysis

The descriptive statistics characterized the study population and magnitude of occupational injuries among Hispanic construction workers. The SUDAAN CROSSTAB, DESCRIPT, and RATIO procedures [Research Triangle Institute, 2004] were used to estimate the variations between Hispanic and white workers. Sample weights, primary sampling unit markers, and strata markers were also used in these analyses according to the special survey design of the MEPS.

Multivariate analysis

After identifying statistically significant variations among different worker groups from the preliminary univariate analyses, a multiple logistic regression model was developed to examine the relationship between the dependent and independent variables. The multiple logistic regression model is given by

$$P = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_k X_k$$

where P is the probability of a work-related injury; α is the intercept; X_1, X_2, $X_3, \ldots, X_k$ are independent variables including demographic, employment, income, and other socioeconomic variables; and β_1, β_2, $\beta_3, \ldots, \beta_k$ are parameters of the relationship between P and X. The SUDAAN RLOGIST procedure [Research Triangle Institute, 2004] was employed to estimate the model parameters, odds ratios (OR), and confidence limits. The null hypothesis was tested at the $\alpha = 0.05$ level.

RESULTS

Demographics

Table I describes data on the demographics of the study population. Hispanic workers were more likely to be male

TABLE I. Demographics of Construction Workers, Medical Expenditure Panel Survey, 1996–2002

	All (N = 7,025)	Hispanic (N = 1,833)			White, non-Hispanic (N = 4,533)		
Characteristics	**Percent**	**Percent**	**Lower 95% CI**	**Upper 95% CI**	**Percent**	**Lower 95% CI**	**Upper 95% CI**
Age*							
16–21	8.4	9.1	7.5	11.1	8.2	7.6	9.2
22–35	36.0	48.8	45.8	51.9	33.6	34.6	37.4
36–45	28.1	27.4	24.8	30.1	28.2	26.8	29.4
46–64	24.9	14.1	12.4	16.0	26.9	23.7	26.1
65+	2.7	0.5	0.3	1.0	3.1	2.2	3.2
Mean age* (years)	38.4	34.4	33.8	34.9	39.1	38.7	39.5
Female worker*	9.5	3.8	2.8	5.0	10.6	9.7	11.6
Education*							
<9 Grade	7.1	29.3	26.5	32.3	2.8	2.4	3.4
9–11 Grade	19.1	25.7	23.2	28.4	17.8	16.5	19.2
12 Grade	44.5	30.7	27.8	33.8	47.1	45.5	48.7
Some college	19.4	10.8	9.0	13.0	21.0	19.6	22.4
College or higher	10.0	3.5	2.5	4.7	11.3	10.1	12.5
Poverty level*							
Under 100%	6.9	14.5	12.3	17.0	5.4	4.7	6.3
100–124%	3.9	8.8	7.3	10.6	3.0	2.4	3.7
125–200%	12.7	23.0	20.4	25.8	10.7	9.7	11.7
201–399%	34.7	37.4	34.4	40.6	34.2	32.7	35.7
400% or more	41.8	16.3	13.9	19.0	46.7	45.0	48.4
Foreign-born*	17.4	68.2	60.2	75.2	5.6	4.1	7.7
Years in U.S.[a]							
≤4 years	—	15.5	9.6	24.1	—	—	—
5–9 years	—	31.6	25.6	38.3	—	—	—
10–15 years	—	18.9	14.4	24.4	—	—	—
15 years+	—	33.9	26.8	41.8	—	—	—
Spanish at home*,[a]	12.3	65.1	56.4	72.8	0.3	0.1	0.4
Uncomfortable to speak English[a]		53.7	53.9	61.0			
Uncomfortable to speak English (10 years in U.S.)[a]		32.0	29.1	34.2			
Total weighted number	100% 10.6 M		100% 1.56 M			100% 8.1 M	

M, million.
*$P < 0.01$.
[a]2002 data only.

and young. Nearly 60% of Hispanics were 35 years old or younger, compared with 42% of white workers in this age group. On average, Hispanic workers were ~5 years younger than whites. Hispanics reported much lower educational levels than their white counterparts. Nearly one-third of the Hispanic workers (95% confidence interval (CI): 26.5–32.3) had fewer than 9 years of education. Overall, more than one-half of Hispanic workers had less than a high school education compared with only 21% of whites. The disparity in family incomes was also substantial. More than 23% of Hispanic workers had family incomes at or below 124% of the poverty level compared with a mere 8.4% among whites. The differences in age, gender, educational attainment, and income were statistically significant ($P < 0.01$) between the two population groups.

More than two-thirds of Hispanic workers were immigrants born abroad (68%, 95% CI: 60.2–75.2) (Table I). Of those who were foreign-born, 65% (95% CI: 56.4–72.8) spoke Spanish at home, and more than one-half of them felt uncomfortable speaking English. Such situations were more frequent among those who came to the United States in recent years. Since the information on immigration was available for only the 2002 data, the related variables were not used for the multiple regression model.

Employment

Compared with white workers, Hispanic workers were found in lower skilled and more dangerous occupations in construction, such as construction laborers and transportation or material moving occupations (e.g., truck driver, crane and tower operator, grader, and scraper operator). For example, one of five (95% CI: 18.3–23.4) Hispanic workers worked as a construction laborer, which was much higher than the 8.4% (95% CI: 7.5–9.3) for white workers (Table II). Overall, 91% (95% CI: 89.1–92.6) of Hispanic workers were employed in production or blue-collar occupations, much higher than the corresponding number of 73% (95% CI: 71.3–74.3) for whites. This difference is statistically significant ($P < 0.05$)

Hispanic workers were less likely to be self-employed and unionized and more likely to be temporary workers. Among wage-and-salary workers, only 10% (95% CI: 8.4–12.6) of Hispanics reported they were union members, which

TABLE II. Characteristics of Construction Employment, Medical Expenditure Panel Survey, 1996–2002

	All (N = 7,025)	Hispanic (N = 1,833)			White, non-Hispanic (N = 4,533)		
Characteristics	**Percent**	**Percent**	**Lower 95% CI**	**Upper 95% CI**	**Percent**	**Lower 95% CI**	**Upper 95% CI**
Blue-collar worker*	75.7	91.0	89.1	92.6	72.8	71.3	74.3
Detailed occupation**							
Professional	4.4	1.5	1.0	2.2	4.9	4.3	5.7
Manager	14.2	4.8	3.6	6.3	15.9	14.7	17.3
Sales	1.5	0.5	0.2	0.9	1.7	1.3	2.2
Clerical	4.2	2.2	1.5	3.3	4.6	3.9	5.3
Craftsman	44.6	45.5	42.0	49.0	44.5	42.8	46.2
Operative	1.5	1.9	1.1	3.1	1.5	1.1	1.9
Transport operative	16.6	20.3	17.1	24.0	15.9	14.6	17.3
Services	2.0	2.2	1.5	3.2	2.0	1.6	2.5
Laborer	10.3	20.8	18.3	23.4	8.4	7.5	9.3
Self-employed*	26.4	15.4	13.1	18.1	28.5	27.0	30.0
Union member**	17.6	10.3	8.4	12.6	19.2	17.5	21.1
Establishment size**							
<20	51.3	54.0	50.1	57.9	50.8	48.7	52.9
20–49	17.2	18.0	15.4	20.8	17.0	15.6	18.6
50–99	11.8	9.0	7.2	11.2	12.4	11.1	13.8
≥100	19.7	19.0	16.3	22.0	19.8	18.2	21.5
Temporary worker[a,**]	7.0	10.6	7.9	14.0	6.1	4.8	7.6
Total weighted number	100% 10.6 M		100% 1.56 M			100% 8.1 M	

M, million.
*$P < 0.01$.
**$P < 0.05$.
[a]2001 and 2002 data only.

TABLE III. Injury Conditions Among Construction Workers, Medical Expenditure Panel Survey, 1996–2002

	All (N = 7,025)	Hispanic (N = 1,833)			White, non-Hispanic (N = 4,533)		
Injury	**Percent**	**Percent**	**Lower 95% CI**	**Upper 95% CI**	**Percent**	**Lower 95% CI**	**Upper 95% CI**
Conditions due to injury*	17.0	19.9	17.8	22.3	16.7	15.7	17.8
Conditions due to work-related injury*	6.8	9.8	8.3	11.7	6.4	5.9	7.1
Conditions with lost workday injury*	4.2	5.3	4.6	6.0	3.0	2.8	3.2
Total weighted number	100% 10.6 M		100% 1.56 M			100% 8.1 M	

M, million.
*$P < 0.05$.

is one-half the number for white workers. Many construction workers were employed by small employers (fewer than 20 employees), and the proportion was slightly higher for Hispanics than for whites.

Work-Related Injury

It was common for construction workers to sustain a significant injury that needed treatment during the study period. Overall, ~17% of construction workers in this sample had a medical condition resulting from work- or non-work-related injuries. Compared with white workers, Hispanics were more likely to have work-related injury conditions resulting in lost workdays (Table III). It would be reasonable to assume that Hispanic workers with less severe conditions were less likely to seek medical care.

When injury rates were stratified by occupation, workers in blue-collar occupations, such as craftsmen, machine operators, construction laborers, and transportation operatives, were more likely to have a work-related injury than those who were employed in white-collar occupations. Overall, Hispanic workers in blue-collar occupations had a higher risk than their white counterparts in a similar occupation (OR = 1.42, 95% CI: 1.14–1.78, see Table IV). Although the OR for most of the occupational categories was >1.0, the 95% CI indicate that the difference between Hispanics and whites was not significant by detailed occupation except for transportation operatives. Perhaps the sample sizes of the subgroups were too small to provide reliable estimates.

Table V presents the results of the multiple logistic regression model. Having medical conditions due to work-related injuries (with and without lost workdays) was coded as 1; otherwise was coded as 0. Hispanic origin is one of the predictors for work-related injuries. Hispanics were 28% more likely to have a work-related injury condition compared with whites (OR = 1.28, 95% CI: 1.00–1.64).

TABLE IV. Rates of Medical Conditions Due to Work-Related Injuries by Major Occupation, Medical Expenditure Panel Survey, 1996–2002

	Hispanic (N = 1,833)		White, non-Hispanic (N = 4,533)			
Occupation	**Percent**	**STD error**	**Percent**	**STD error**	**OR**	**(95% CI)**
Blue collar	10.7	0.95	7.76	0.41	1.42	(1.14–1.78)*
White collar	5.07	1.94	3.55	0.43	1.45	(0.63–3.35)
Detailed occupation						
Professional	2.92	2.57	3.99	1.04	0.72	(0.12–4.51)
Manager	8.39	3.82	3.95	0.64	2.23	(0.79–6.28)
Sales worker	9.35	9.56	1.72	1.06	5.90	(0.47–73.8)
Clerical	1.19	0.98	2.49	0.80	0.47	(0.08–2.73)
Craftsman/foreman	10.3	1.22	8.27	0.58	1.27	(0.94–1.72)
Operative	22.3	10.9	6.64	2.98	4.04	(0.84–19.3)
Transport operative	12.9	2.86	6.28	0.63	2.23	(1.28–3.88)*
Service worker	8.49	4.49	8.66	2.68	0.98	(0.24–4.07)
Laborer	9.02	1.62	7.75	1.14	1.18	(0.70–1.97)
Total weighted number	100% 1.56 M		100% 8.1 M			

STD, standard deviation; OR, odds ratio; CI, confidence interval; M, million.
*$P < 0.05$.

TABLE V. Predictors for Work-Related Injuries Among Construction Workers, Medical Expenditure Panel Survey, 1996–2002

Independent variables and effects	Odds ratio	Lower 95% OR	Upper 95% OR
Ethnicity			
Hispanic	1.28	1.00	1.64
White, non-Hispanic	1.00	1.00	1.00
Age			
16–21	2.97	1.32	6.66
22–35	3.98	1.94	8.15
36–45	4.62	2.33	9.16
46–64	2.47	1.24	4.93
65 and up	1.00	1.00	1.00
Gender			
Male	7.46	3.82	14.59
Female	1.00	1.00	1.00
Education			
<9 years	3.52	1.38	8.95
9–11 years	4.10	1.72	9.80
12 years	3.78	1.62	8.80
Some college	3.51	1.49	8.27
College and up	1.00	1.00	1.00
Occupation			
Blue collar	1.31	1.00	1.71
White collar	1.00	1.00	1.00
Establishment size			
<20	1.23	0.91	1.64
20–49	1.16	0.83	1.62
50–99	1.17	0.77	1.76
100 or more	1.00	1.00	1.00
Type of worker			
Self-employed	0.89	0.69	1.14
Wage-salary	1.00	1.00	1.00
Union			
Yes	1.05	0.80	1.38
No	1.00	1.00	1.00

Of the variables included in the model, gender, education, and age significantly contributed to the outcome. Male workers had a much higher risk than female workers (OR = 7.46, 95% CI: 3.82–14.59). Non-college educated workers had significantly higher odds of injury than those with a college education, although there was not a clear trend related to years of education. All age groups younger than 65 years old had a significantly higher risk of work-related injuries than those over 65. Occupation was another major predictor of work-related injuries: blue-collar workers were more likely to have medical conditions due to work-related injuries compared with white-collar workers when other factors were controlled (OR = 1.31, 95% CI: 1.00–1.71). The effects of establishment size, class of workers, and unionization were not significant.

DISCUSSION

Results from this study provide important evidence on workplace risks faced by Hispanic construction workers. During the study period, Hispanics were nearly 30% more likely to have medical conditions due to work-related injuries than white, non-Hispanics, after controlling for occupation, gender, age, and education. Also, when measured in terms of lost workdays, injuries were more likely to be greater in severity for Hispanics compared with whites. Since cases without medical treatments were not reported by the MEPS data, the number of work-related conditions reported in this study could be underestimated, especially for Hispanic workers.

The results provided information on occupational morbidity in addition to what is already known about occupational mortality for Hispanic workers. Prior studies failed to provide consistent evidence for non-fatal occupational injuries. Analyses of the National Longitudinal Survey of Youth (NLSY) found that injured Hispanic men missed more days of work than non-Hispanic white men [Dembe et al., 2004; Strong and Zimmerman, 2005]. However, none of these studies focused on Hispanic construction workers. More specific to the construction industry, a study found that Hispanic construction workers had a non-fatal injury rate 8% below the industry's average using the BLS' SOII [CPWR, 2008].

While it is possible that Hispanics are more at risk for severe injuries than for less severe ones, or that lack of health care access or other factors lead to more frequent fatalities, it seems more likely that the disproportionately reported non-fatal injury rate is inaccurate and driven by underreporting, as it is much easier to avoid reporting non-fatal injuries than fatalities. Studies suggest that as many as two-thirds of non-fatal occupational injuries and illnesses may be missed in the nation's main survey, the SOII [Oleinick et al., 1995; Leigh et al., 2004; Rosenman et al., 2006]; underreporting could be worse among construction workers due to construction-specific factors, such as temporary jobs, multiple employers, and frequent mobility [Welch et al., 2007]. Data from the construction of Denver International Airport (DIA) show that DIA's overall total injury rates were more than twice those published by the BLS for the construction industry for each year of DIA construction [Glazner et al., 1998]. Moreover, the SOII, the only ongoing national survey of non-fatal occupational injuries and illnesses, intentionally excludes a large portion of the workforce, including self-employed workers in the private sector and all public sector employees. Other segments of the labor force (e.g., part-time, temporary, disabled, and immigrant workers) are not a focus of existing surveillance or research programs [NIOSH, 2004].

Given these concerns, the MEPS data contribute to evaluating the probable underreporting of injuries in the

SOII. By controlling for occupation, this study shows that the elevated rate among Hispanics is affected by the high prevalence of production workers in the Hispanic workforce. Similarly, controlling for education helps assure that the difference seen is related to the lower educational attainment levels of Hispanic workers. Although studies have been mixed about the effects of age on occupational injury risks [Laflamme and Menckel, 1995; Pransky et al., 2002], the results from this study suggest that age is an important contributor to work-related injuries.

The nearly 30% increased risk of work-related injuries for Hispanic construction workers indicates that there is a significant gap in the nation's primary surveillance system for non-fatal injuries and illnesses. Unreported cases generally lead to the underestimation of risks at worksites, which reduces the urgency to improve workplace safety. Clearly, this study points to the need to improve the existing occupational injury and illness surveillance system, especially for the construction industry and other industries where Hispanic and new immigrant workers are concentrated. At a minimum, in addition to the existing surveillance data system (e.g., the BLS' SOII), a second estimation using multiple data sources is needed. Adjustments, based on additional data sources, need to be made to arrive at the total counts of occupational injuries and illnesses for the entire workforce.

Due to immigrant status, limited education, and economic necessity, Hispanic workers are disproportionately employed in informal and transient positions or more marginal and day labor jobs, in which employer knowledge of reporting requirements may be especially low, or there is not a primarily responsible employer to report such injuries [Azaroff et al., 2002, 2004; Pransky et al., 2002]. Some employers may have concerns that reporting workplace injuries could lead to increased Occupational Safety and Health Administration (OSHA) enforcements, or reveal that they employ undocumented workers, or both. Considering the continuous increase in Hispanic employment in the construction industry, OSHA should enhance its enforcement effort, targeting construction companies with a large proportion of Hispanic employment.

At the same time, it is essential to provide proper safety and health training programs to all workers. The high and rapidly growing fraction of Hispanic workers in construction poses a formidable challenge to construction safety and health, given their entry into risky jobs, inadequate safety equipment, and limited literacy and English-speaking proficiency that can hamper safety and job training and increase problems in on-the-job communication for safety [Anderson et al., 2000; Pransky et al., 2002; Walter et al., 2002; Brunette, 2005; CPWR, 2008]. At present, standards and programs are generally written and delivered in English, which creates a problem for Hispanic workers who read or speak little English. Even when materials are available in Spanish, the technical jargon that is typical in the content is difficult to grasp due to many Hispanics' limited literacy and education. Hispanic construction workers may receive safety papers but often have no idea what they are reading, which means that protective equipment and procedures can be futile if workers do not understand how to use them. Thus, safety training and related materials should accommodate workers with varying degrees of education and language skills, and have a genuine outreach for field workers.

Because of these factors, improving the safety and health protection for Hispanic and other immigrant workers is a daunting task. Therefore, OSHA, NIOSH, BLS, and other related agencies should collaborate to improve the current occupational safety surveillance system and promote safety and health for vulnerable groups by focusing on research, interventions that include inspections and enforcements, and communication efforts to prevent occupational injuries and illnesses.

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