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Fatal falls among Hispanic construction workers

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ABSTRACT

This study evaluated occupational deaths resulting from fall injuries among Hispanic construction workers using data from the Census of Fatal Occupational Injuries and the Current Population Survey. The demographics and characteristics of fatal falls among Hispanic workers were examined and compared with that of their white, non-Hispanic counterparts. The results show that fatal injuries among Hispanic construction workers were more likely to be caused by a fall than their white, non-Hispanic counterparts (OR = 1.48, 95% CI: 1.05–2.10) after controlling for possible confounders. The rate of fatal falls for foreign-born Hispanic construction workers was 5.5 per 100,000 FTE, which is significantly higher than 4.1 per 100,000 FTE for Hispanic workers who were born in the U.S. (OR = 1.36, 95% CI: 1.08–1.67). The disparities in fatal injuries from falls were found in age groups, job tenure, occupations, and types of construction projects. This study also found that about every two of three fatal falls in construction occurred in establishments with 10 or fewer employees. More prevention, intervention, and training measures must be applied to Hispanic workers, especially those who are new immigrants. OSHA enforcements should target small construction establishments in order to lower overall fatality rates, costs, and unnecessary losses of life.

1. Introduction

In the United States, there are a large number of Hispanic workers who are rapidly growing by an influx of recent immigrants. According to the U.S. Census Bureau (2008), between 2000 and 2006, Hispanics accounted for one-half of the nation's growth. Hispanics' growth rate (24.3%) was almost 4 times the growth rate of the total U.S. population (6.1%). Construction is currently the workforce sector with the highest percentage of Hispanic workers (CPWR, 2008). The number of Hispanic workers in construction tripled from a decade ago to nearly 3 million in 2006, comprising more than one-fourth of this industry (CPWR, 2008; Pew Hispanic Center, 2008). Hispanic construction workers are typically young, lack English-speaking abilities, not highly educated, and employed in low-skill and high-risk occupations (CPWR, 2008; Jorgensen et al., 2007; Dong and Platner, 2004; Kouyoumdjian et al., 2003; Anderson et al., 2000). These factors have made Hispanic workers more vulnerable when they are employed in construction, one of the most dangerous industries in the United States. From 1992 to 2005, the death rate for Hispanic construction workers has been consistently higher than the rate for white, non-Hispanic workers (CPWR, 2008).

Among the numerous dangers and risks construction workers face, falls are a common hazard and the leading cause of death in construction (Sokas et al., 2009, 2007; CPWR, 2008; Derr et al., 2001; Becker et al., 2001; Lipscomb et al., 2000; Cattledge et al., 1996a). The greatest cause of work-related deaths was falls to a lower level. Even if a fall is not fatal, it can still result in a severe injury (Courtney et al., 2002; Cattledge et al., 1996b). In 2006, work-related falls were the second leading cause of nonfatal injuries in construction (U.S. Bureau of Labor Statistics, 2007). In addition to workers' mortality and mobility, falls also pose monetary costs and bring financial burdens to workers, their families, employers, and society. Bunn et al. (2007) found that falls in construction incurred the highest workers' compensation and hospitalization costs. The average lost work days for workers suffering from falls from heights was 44 days (Gillen et al., 1997). Also, after severe fall injuries, injured workers had difficulties returning to their normal duties (Gillen, 1999). Combined direct and indirect costs such as lost productivity and grief to workers' families can only be estimated as enormous (Leamon and Murphy, 1995).

Given the severity of construction falls and a great number of fatal injuries among Hispanic workers in construction, this research endeavor focuses on fatal falls among Hispanic construction workers by examining the demographics and employment of the fall decedents, analyzing types of falls, and the odds ratios of fatal falls for Hispanic workers and their white, non-Hispanic counterparts. The study's hypotheses concerning fatal falls are

(1) Fall hazards are greater in specific trades (e.g., roofers) with large proportions of Hispanic workers.

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(2) Immigrant or foreign-born workers face a higher risk of falls due to language, literacy, and communication problems.
(3) Fall hazards are greater in smaller companies due to limited human resources as they are less likely to have safety and health experts on staff.
(4) Workers with short job tenures have a higher risk of falls due to lack of experience and training.
(5) Risk of falls is various among age groups: older workers have a higher risk of falls due to decreased balance capabilities.
(6) Risk of falls differs among geographical areas.

2. Method

Death numbers were taken from the Census of Fatal Occupational Injuries (CFOI) conducted by the U.S. Bureau of Labor Statistics (BLS). The CFOI is a federal-state cooperative program that has been implemented in all 50 states and the District of Columbia (U.S. Bureau of Labor Statistics, 2004). The CFOI data are compiled from a multitude of sources including death certificates, workers' compensation reports, medical examiners' reports, reports from the U.S. Occupational Safety and Health Administration (OSHA), and several other references. Both the death and the work-relatedness of the fatality must be corroborated by at least two sources, or one source verified by surveying the employer. The CFOI data are released annually and revised within 1 year to correct for errors.

The CFOI data from 1992 to 2006 were used for analyzing fatal falls in the construction industry overall. From 1992 to 2002, the CFOI codes for the construction industry used the 1987 Standard Industrial Classification (SIC) system categories numbered 1500–1799 and included "CCCC" for construction subsectors that could not be categorized in any SIC code (Office of Management and Budget, 1987). Starting in 2003, the CFOI coded the construction industry as 23 using the North American Industry Classification System (NAICS). Detailed construction subsectors are coded as NAICS 236000 through 238999 (Office of Management and Budget, 2002). Due to these significant changes in industrial and occupational classifications used by the CFOI since 2003, only the CFOI data from 2003 to 2006 are pooled together for the subgroup analyses. Deaths reported in this study include both public and private sectors and the self-employed in construction, which may differ from some publications that include only the private sector.

Fatality rates are expressed as full-time equivalents or FTEs. A FTE is defined as 2000 h worked per year (50 weeks $\times$ 40 h). This measure facilitates comparison of workers in different population groups by standardizing the length of exposure to workplace hazards since some construction workers may work part-time or overtime. Employment data were obtained from the Current Population Survey (CPS). The CPS is a national monthly household survey conducted by the U.S. Census Bureau for the U.S. Bureau of Labor Statistics. Estimates from the CPS are based upon a probability sample of about 60,000 housing units. Interviewers contact the sampled units to obtain basic demographic information (such as age, gender, race, Hispanic ethnicity, etc.) about all persons residing at the address as well as detailed labor force information (such as occupation, industry, hours worked, etc.) for all persons aged 16 years and older. The CPS respondents are also interviewed in Spanish when necessary. The construction industry is coded as 0770 in the CPS data, corresponding to the NAICS 23 code.

In these two data sources, Hispanic ethnicity (regardless of country of birth) includes a diverse population of all races such as Mexican-American, Chicano, Mexican, Puerto Rican, Cuban, and other Spanish-speaking countries in Central or South America. Indications of Hispanic ethnicity in the CFOI data are evaluated by various data sources, while Hispanic ethnicity is self-reported in the CPS data. When assessing Hispanic construction workers, white, non-Hispanic workers were used as the comparison group. Workers who were classified in another racial group (e.g., black) were excluded from the comparison group, but were included when the construction industry was reported as a whole.

Odds ratios (ORs) were used to compare the risk of fatal falls for different population groups. A logistic regression analysis assessed critical predictors (e.g., ethnicity, age, employment, and occupation) on fatalities caused from falls versus fatal injuries resulting from other causes (not falls). Confidence intervals (95%) of ORs and p-values were calculated through these analyses. All statistical analyses were performed with SAS version 9.2 (SAS Institute, 2008).

3. Results

From 1992 to 2006, fatal injuries in the U.S. construction industry totaled 17,350, of which 5512 (32%) deaths were caused by injuries from falls (Table 1). Among the fall decedents, 1240 were identified as Hispanic. In 2006 alone, 142 Hispanic construction workers died from falls. Although the death numbers in the construction industry before and after 2003 may not be directly comparable due to the changes in the industrial classification system, the statistics indicate that fatal falls as a proportion of the total deaths in construction grew from 31% in 1992–2002 to 33% in 2003–2006. Particularly, Hispanic workers constantly experienced a greater proportion of fatal falls than their non-Hispanic counterparts. The proportion of fatal falls among Hispanic workers increased over-time from an average of 37% annually during 1992–2002 to 40% in 2006, while it was stable for non-Hispanic workers during this period.

The demographics of Hispanic construction workers that died from fall injuries were quite different than their white, non-Hispanic counterparts. More than 30% of the Hispanic fall decedents were aged 25–34 in 2003–2006, while it was less than 15% in the

Table 1
Deaths and fatal falls by ethnicity in construction, 1992–2006.

Year	Ethnicity	Total fatal falls	% of fatal falls	Total deaths
2006	Hispanic	142	40%	354
	White, non-Hispanic	251	31%	807
	All construction	431	34%	1,282
2003–2006 combined	Hispanic	499	39%	1,256
	White, non-Hispanic	1,002	31%	3,221
	All construction	1,641	33%	4,974
1992–2002 combined	Hispanic	747	37%	2,028
	White, non-Hispanic	2,526	31%	8,275
	All construction	3,872	31%	12,376
1992–2006 combined	Hispanic	1,240	38%	3,284
	White, non-Hispanic	3,530	31%	11,496
	All construction	5,512	32%	17,350

corresponding age group for white, non-Hispanic workers (Table 2). Overall, nearly half of the Hispanic fall decedents (48.5%) were under 35 years old, which is more than 2 times the proportion of white, non-Hispanic fall decedents (21.1%). By contrast, fall decedents who were white, non-Hispanic workers were much older. About 27% of fatal falls occurred for white, non-Hispanic workers aged 55 years or older, which is nearly 3 times of that for Hispanic workers (10.3%). This pattern of fatal falls mirrors the two divisions in construction demographics. On one hand, there are a large number of young Hispanic workers who have recently entered the industry, and on the other hand, there is the existing construction workforce that is aging (CPWR, 2008).

It is notable that nearly 80% (396 of 499) of the Hispanic decedents who died from falls in 2003–2006 were foreign-born, and about 70% of these foreign-born workers were from Mexico (Table 2). Regardless of ethnicity, most fall decedents were male, reflecting the reality that the construction industry is still dominated by men.

Additionally, a substantial proportion of deaths occurred among workers who had been employed for 1 year or less, 64.7% and 52.9% for Hispanic and white, non-Hispanic workers, respectively (Table 2). Among Hispanic fall decedents under 35 years old, more than 75% had been employed 1 year or less. This finding highlights that training and fall prevention measures are extremely important to new workers, especially new immigrant workers.

Table 2
Characteristics of fatal falls by ethnicity in construction, 2003–2006.

Characteristics	% Hispanic	% White, non-Hispanic	% All construction
Age			
16–19	5.1%	1.5%	2.7%
20–24	13.2%	5.0%	7.4%
25–34	30.2%	14.6%	19.1%
35–44	26.6%	23.6%	24.5%
45–54	14.6%	28.4%	24.3%
55–64	8.3%	18.1%	15.4%
65+	2.0%	8.8%	6.5%
Gender			
Male	99.4%	99.5%	99.5%
Female	0.6%	0.5%	0.5%
Foreign-born	79.4%	NA	29.9%
Foreign country of birth[a]			
Mexico	69.5%	NA	56.2%
Central America	18.5%	NA	15.1%
South America	9.5%	NA	9.3%
Caribbean	1.5%	NA	2.7%
Other	1.0%	NA	16.7%
Years employed[b]			
≤1 year	64.7%	52.9%	57.5%
2 years	11.8%	5.9%	7.7%
3–5 years	9.8%	9.5%	9.8%
>5 years	13.7%	31.6%	25.1%
Establishment size[b]			
1–10 employees	65.9%	65.5%	65.1%
11–19 employees	9.23%	9.9%	9.0%
20–49 employees	1.4%	11.9%	11.3%
50–99 employees	5.3%	6.9%	5.5%
100+ employees	8.1%	10.4%	9.2%
Region			
Northeast	14.2%	18.7%	17.4%
Midwest	8.2%	23.7%	17.6%
South	50.7%	42.8%	46.7%
West	26.9%	14.9%	18.3%
Total	100% (499)	100% (1,002)	100% (1,641)

[a] Only workers with "foreign-born" status were included.
[b] "Not Reported" were excluded.

Table 2 also shows that most of the fatal falls occurred in small establishments. Among establishments with information on size, about two of three fatal falls occurred for those employed in small establishments with 10 or fewer employees, which is disproportionately high given that about 30% of the construction workforce is employed in such establishments (CPWR, 2008). By geographic region, Hispanic decedents who died from falls were primarily concentrated in the South (51%) and West (27%), which highly exceeded the percentages found for white, non-Hispanic workers and all construction workers in those regions (Table 2). The regional differences partly reflected the employment distribution of Hispanic construction workers in the United States. Nevertheless, the percentage of fatal falls for Hispanic workers in the South was disproportionately high given that less than 47% of Hispanic workers were employed in that region.

Table 3 indicates that occupational and industrial distributions are quite different between Hispanic and white, non-Hispanic fall decedents. About one-third of the Hispanic workers were construction laborers, while 16% of the white, non-Hispanic workers were in this occupation. This finding is consistent with occupational disparities identified in previous research (CPWR, 2008; Anderson et al., 2000).

After examining detailed construction subsectors, roofing contractors (NAICS 23816) and residential construction (NAICS 23611) ranked the highest in fall fatalities (Table 3). During 2003–2006, 531 (32%) construction workers died in roofing and residential building construction subsectors. The number of Hispanic fall fatalities among roofing contractors is striking. Nearly one in four Hispanic fall decedents were employed with roofing contractors, while less than 14% of white, non-Hispanic victims were in this industry. Despite the lack of data to measure risk at the detailed industry level, the remarkable proportion of Hispanic fall fatalities among

Table 3
Fatal falls by employment and ethnicity in construction, 2003–2006.

Employment	% Hispanic	% White, non-Hispanic	% All construction
Selected occupation			
Laborer	33.1%	16.4%	22.7%
Carpenter	17.0%	15.6%	15.9%
Roofer	16.8%	12.1%	13.7%
Painter	6.1%	6.9%	6.6%
Drywall	3.8%	1.2%	2.2%
Electrician	3.2%	4.7%	3.9%
Foreman	3.2%	8.2%	6.5%
Ironworker	3.2%	5.4%	4.8%
Welder	2.0%	1.6%	1.7%
Brickmason	1.4%	2.1%	2.0%
Selected industry sector			
Roofing contractors	23.9%	13.9%	17.4%
Residential building construction	12.0%	16.5%	15.0%
Framing contractors	8.1%	3.9%	5.2%
Drywall and insulation contractors	7.1%	2.1%	4.0%
Commercial and institutional building construction	5.9%	5.4%	5.6%
Painting and wall covering contractors	5.3%	6.7%	6.2%
Structural steel and precast concrete contractors	4.5%	5.5%	5.4%
Electrical contractors	3.9%	6.6%	5.3%
Masonry contractors	3.7%	3.4%	3.7%
Heavy and civil engineering construction	2.4%	6.9%	5.1%
Plumbing, heating, and air-conditioning contractors	1.8%	5.7%	4.2%
Total	100% (499)	100% (1,002)	100% (1,641)

Table 4
Types of fatal falls by ethnicity in construction, 2003–2006.

Type	% Hispanic (*n*)	% White, non-Hispanic (*n*)	% All construction (*n*)
Fall from roof[a]	35.1% (173)	28.8% (289)	33.6% (551)
Fall from scaffold/staging	20.1% (99)	14.9% (150)	16.8% (275)
Fall from ladder	15.4% (76)	18.0% (181)	16.8% (275)
Fall to lower level, n.e.c.	9.3% (46)	11.1% (111)	10.4% (170)
Fall from building girders	5.9% (29)	5.4% (54)	5.6% (91)
Fall from nonmoving vehicle	4.1% (20)	5.7% (57)	5.0% (81)
Other	–	–	–
Total	100% (499)	100% (1,002)	100% (1,641)

n.e.c.: not elsewhere classified.
[a] Includes falls from roof edge, roof unspecified, and skylight - data that do not meet publication criteria.

roofing and residential construction deserves considerable attention.

In terms of types of falls, about 99% of fatal falls in construction were caused by falls to a lower level during 2003–2006. More than one-third (551) of the fatal falls in construction were due to falls from roofs, including roof edges, roofs unspecified, and skylights. When ethnicity was stratified, causes of fatal falls for Hispanic and white, non-Hispanic construction workers are somewhat different. While falls from roofs ranked the highest for both ethnicities, falls from scaffold/staging ranked the second-highest for Hispanic construction workers, whereas falls from ladders was the second-highest cause of fatal falls for white, non-Hispanic workers (Table 4). Additionally, working activities when fatal falls occurred were diverse. More than 60% of Hispanic fall decedents were assembling or dismantling when they fell, and 8% were climbing or descending a ladder or scaffold.

When assessing the rate of fatal falls during 2003–2006 for all construction on average, the rate was 3.8 per 100,000 full-time workers (FTE). The odds ratio indicates that Hispanic construction workers were 1.54 times (95% CI = 1.38–1.72) more likely to die, on average, from a fall than their white, non-Hispanic counterparts. The rate of fatal falls for Hispanic workers who were foreign-born was 5.5 per 100,000 FTE, which is significantly higher than 4.1 per 100,000 FTE for Hispanic workers who were born in the U.S. (OR = 1.36, 95% CI = 1.08–1.67; Table 5).

Multiple logistic regression analysis revealed that deaths among Hispanic construction workers were significantly more likely to be caused by a fall (OR = 1.48, 95% CI: 1.05–2.10; Table 6). However, when adding the foreign-born variable into the model, Hispanic ethnicity was no longer significant (OR = 1.04, 95% CI: 0.84–1.28, $p = 0.724$) but foreign-born was (OR = 1.31, 95% CI: 1.05–1.62, $p = 0.015$). This suggests that Hispanic ethnicity itself may not make as much of a difference as foreign-born status does. Other factors contributing to fatal falls include age, tenure, establishment size, type of project, and occupation. Older workers (55+ years) had a higher risk of a fatal fall than younger workers under 25 years old (OR = 2.44, 95% CI: 1.36–4.37). When it came to job experience, workers who were employed for a year or less had a greater risk of a fall, as did those who were employed in small establishments (1–10 employees). Workers working at residential sites or on private projects had a higher risk of falls than other construction sites or public projects. Compared with all construction workers on average, roofers were at the greatest risk of a fatal fall than other occupations (OR = 9.19, 95% CI: 4.33–19.52). However, after controlling for possible confounders, differences among geographical regions observed in Table 2 disappeared (Table 6).

Table 5
Numbers, rates, and odds ratios of fatal falls by Hispanic ethnicity and foreign-born status in construction, 2003–2006.

Group	Number	Rate	Odds Ratio (95% CI)
Hispanic	499	5.2	1.54 (1.38–1.72)
White, non-Hispanic	1,002	3.3	
Foreign-born Hispanic	396	5.5	1.36 (1.08–1.67)
U.S.-born Hispanic	103	4.1	
All construction	1,641	3.8	–

Rate = per 100,000 full-time equivalent workers.

Table 6
Multiple logistic regression on fatal falls in construction, 2003–2006.

Variable	Odds ratio	95% CI		*P* Value
		Lower	Upper	
Ethnicity				
Hispanic	1.484	1.050	2.098	0.025
White, non-Hispanic	1.000	1.000	1.000	–
Age				
25–34 years	1.751	1.058	2.898	0.029
35–44 years	2.253	1.356	3.742	0.002
45–54 years	1.997	1.174	3.397	0.0101
55+ years	2.442	1.364	4.372	0.003
<25 years	1.000	1.000	1.000	–
Job tenure				
≥1 year	1.460	1.060	2.012	0.021
<1 year	1.000	1.000	1.000	–
Establishment size				
1–10 employees	2.171	1.483	3.179	<0.000
11–19 employees	1.794	1.035	3.111	0.037
20–49 employees	1.823	1.135	2.929	0.013
50–99 employees	1.313	0.656	2.628	0.442
100+ employees	1.000	1.000	1.000	–
Employment type				
Self-employed	0.846	0.442	1.617	0.613
Wage-and-salary	1.000	1.000	1.000	–
Project				
Residential	1.856	1.214	2.837	0.004
Private	6.688	1.594	28.056	0.009
All construction	1.000	1.000	1.000	–
Occupation				
Roofer	9.192	4.328	19.521	<0.000
Carpenter	6.252	3.537	11.051	<0.000
Laborer	1.247	0.854	1.820	0.254
Ironworker	4.785	2.455	9.325	<0.000
Painter	8.559	3.360	21.800	<0.000
Brickmason	0.530	0.062	4.541	0.562
All construction	1.000	1.000	1.000	–
Region				
Northeast	1.083	0.566	2.071	0.982
Midwest	0.918	0.558	1.510	0.670
South	1.007	0.735	1.384	0.966
West	1.135	0.633	2.035	0.845
All construction	1.000	1.000	1.000	–

4. Discussion

This study indicates that Hispanic construction workers are more likely to experience fatal falls than their white, non-Hispanic counterparts. The risk of fatal falls is even higher for immigrant Hispanic workers than Hispanic workers born in the U.S. These findings support most of the study's hypotheses and confirm that Hispanic construction workers have a higher risk in the workplace, in particular for those who are immigrants (Sokas et al., 2009; Centers for Disease Control and Prevention, 2008; CPWR, 2008; Dong and Platner, 2004; Richardson et al., 2004; Anderson et al., 2000).

Many immigrant Hispanic workers who died from falls on the job were young and inexperienced. Although more detailed information on such deaths could not be obtained, one could assume that

elements such as a lack of basic knowledge in construction activities/tasks, a lack of ability to understand English, and lack of safety and health training were possible antecedents among these workers since they were new to construction and this country. Given the large proportion of young and inexperienced Hispanic workers in construction, providing enhanced safety and health training programs is extremely important. Instruments must be reliable and accommodate Spanish-speaking construction workers in order to empower them and improve safety climates (Sokas et al., 2009; Jorgensen et al., 2007). Supporting safe work practices and skill-specific training would not only highlight critical safety measures, but could also lead to changes in worker behavior thus reducing the possibility of a fall, perhaps even a deadly fall (Becker et al., 2001).

While it is a priority to reduce fatal falls for new immigrant workers in construction, the safety and health of older construction workers should not be neglected. This study found that older construction workers are at a greater risk of fatal falls than younger ones regardless of ethnicity. This result is consistent with previous findings that fatal falls and injury severity increase with age (Grandjean et al., 2006; Agnew and Suruda, 1993). Since the construction workforce is aging and skill shortages are a major problem in the U.S. construction industry, the number of older workers (who have a high fall risk) is expected to expand in the next decade. Given the aging construction workforce, safety and health programs focusing on older workers should be developed and implemented. Additionally, job redesign and work-scheduling strategies for older construction workers should be considered. Further research into safety and health problems of the aging workforce is also needed.

The staggering number of fall fatalities among small construction establishments implies that work organization factors play an important role in construction safety and health. These small employers tend to lack the manpower, funding, and operational capabilities found in larger establishments. Such deficiencies could lead to "cutting corners" when it comes to safety and health training, and safety equipment installation and usage. In addition to enhancing safety and health educational and training programs, fall injuries could have been avoided if safety standards and regulations were enforced (Lipscomb et al., 2003b; Okun et al., 2001; Rivara and Thompson, 2000). Nelson et al. (1997) found that when employers were inspected and evaluated, fall rates declined. The large portion of fatal falls among small establishments suggests that small employers should be targeted for inspection, especially those who primarily employ Hispanic immigrant workers.

Despite the fact that falls are a general danger in the construction industry, this study demonstrates that some occupations and construction subsectors have a much higher risk of falls, such as roofers and ironworkers, and workers employed in roofing and residential construction. Environmental, task-related, and individual factors must be explored in order to fully capture the causes of work-related falls (Hsiao and Simeonov, 2001).

The patterns of falls found in this study are consistent with previous studies. Falls from greater heights and impact on concrete surfaces are more likely to result in serious injuries and death (Gillen et al., 1997). Ladder instability and lost footing may also contribute to such fatal falls (Smith et al., 2006). Recognized fall protection strategies, such as guardrails, toe boards, tying off to appropriate anchors, guarding openings, and using the correct equipment for the task would have prevented many fatal falls (Lipscomb et al., 2000, 2003a; Simeonov et al., 2003).

This study profiles fatal falls among Hispanic construction workers, but several issues are identified for further research. The rate of fatal falls for Hispanic construction workers reported in this study could be either underestimated or overestimated due to possible undercounting and misclassification in Hispanic employment reported in the data sets (Centers for Disease Control and Prevention, 2008; CPWR, 2008). Additionally, a large proportion of Hispanic workers are undocumented immigrants. Little is known about the characteristics of these workers and the employers (i.e., construction contractors) who employ them, or about the construction owners who hire such employers to build their projects. It is a reasonable hypothesis that undocumented workers are more likely to be employed by risk-taking employers, and that such employers are more likely to be hired by construction owners who are willing to take shortcuts that may place workers at greater risk. This is an area that requires more research. Moreover, prior research shows that a large proportion of falls occurred when fall protection devices were not used or personal fall protective equipment was not worn appropriately (Kines, 2002; Becker et al., 2001; Cattledge et al., 1996b). To conduct such studies, more detailed information on fatal falls should be collected, such as whether the victim had received safety training, fall protection equipment was provided and used properly when the incident occurred, and other work organizational factors (e.g., supervision, safety climate, unionization, etc.). Clearly, improved safety surveillance systems and further investigations concerning construction falls are urgently needed.

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