Injury Underreporting Among Small Establishments in the Construction Industry

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Background *There is convincing evidence that occupational injury and illness rates, particularly those reported by employers in the BLS' Survey of Occupational Injuries and Illnesses (SOII), substantially underestimate the true magnitude of injury and illness in the construction industry.*

Methods *Fifteen years of data from five large nationally representative data sources were analyzed, including SOII, CFOI, CBP, CPS, and MEPS. Regression trends and ratio analyses were conducted, and stratified by establishment size and Hispanic ethnicity.*

Results *Small construction establishments were most likely to underreport injuries. The SOII data only captured 25% of severe injuries among Hispanic workers, and 60% among white workers in small construction establishments.*

Conclusions *Underreporting is pervasive in the construction industry for small establishments and Hispanic workers. Given that small establishments are predominant in the U.S. construction industry, they should be the focus of a larger effort to identify the true extent of construction-related injuries.* Am. J. Ind. Med. 54:339–349, 2011.

KEY WORDS: underreporting; occupational injuries and illnesses; OSHA; construction; small employers/establishments; Hispanic workers; BLS

INTRODUCTION

Accurate safety and health surveillance is fundamental to the recognition, treatment, and prevention of occupational injuries and illnesses. Yet academic studies, media reports, and worker testimonies have provided evidence that the major data source for nonfatal injuries and illnesses—the Survey of Occupational Injuries and Illnesses (SOII) conducted by the U.S. Bureau of Labor Statistics (BLS)—underestimates work-related injuries and illnesses [Rosenman et al., 2006; Ruser, 2008; The Committee on Education and Labor, 2008]. Estimates of the SOII undercount range widely. To begin with, the survey excludes Federal employees and self-employed workers, which translates to about 20% of the nation's labor pool [The Committee on Education and Labor, U.S. House of Representatives, 2008] and over 25% of the construction labor force. Capture–recapture studies report undercounting of work injuries in the SOII to be 25–68% for all industries, depending on the state [Oleinick and Zaidman, 2010]. According to other analyses across all industries, the SOII also missed 67% of injuries in Michigan alone [Rosenman et al., 2006], more than 340,000 cases in a handful of states [Boden and Ozonoff, 2008], and a minimum of about 25% of all injuries [Leigh et al., 2004]. Considering that SOII is based on logs required by the U.S. Occupational Safety and Health Administration (OSHA), Friedman and Forst [2007] found that 83% of the decline in occupational injuries corresponded directly with significant changes in OSHA recordkeeping rules in 1995 and 2001. These changes relaxed the documentation required by employers and reduced the

CPWR—The Center for Construction Research and Training, Silver Spring, Maryland
Contract grant sponsor: National Institute for Occupational Safety and Health (NIOSH); Contract grant number: U60OH009762.
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Accepted 24 November 2010
DOI 10.1002/ajim.20928. Published online 18 January 2011 in Wiley Online Library (wileyonlinelibrary.com).

categories of ''reportable'' events. But even after accounting for such factors, Boden and Ozonoff [2010] found that substantial underreporting still exists.

Underreporting research also points to small establishments as major culprits. Small establishments are likely to underreport or not report at all [Leigh et al., 2004]. Fabiano et al. [2004] found that not only did small firms have a higher incidence and severity of injuries than medium or larger firms, but also demonstrated poor recordkeeping. Larsson [2003] discovered a systematic underreporting of minor-medium claims from small businesses, finding that those occupations in high-risk sectors, such as construction, tend to underestimate while willingly bearing the serious inherent health risks of their trade. In Michigan alone, it was estimated that the BLS undercounted 45,000 injuries in establishments with 1–19 employees and 9,000 injuries in establishments with 20–49 employees [Oleinick et al., 1995].

Construction is an industry composed of predominantly small establishments. Among construction establishments with payroll, more than 80% are establishments with fewer than 10 employees [U.S. Census Bureau, 2009]. Construction is also a dangerous industry, faced with rapidly changing occupational hazards, complex and fluid organizational structures, hard physical labor with extended work hours, and tight production schedules. Although the industry makes up less than 8% of the total U.S. workforce, work-related deaths in construction steadily account for about 22% of all occupational fatalities [CPWR, 2008]. Studies of the construction industry in particular have revealed injury underreporting by the SOII. Using data from the construction of the Denver International Airport (DIA), Glazner et al. [1998] found that for each year of the DIA construction, the overall total injury rates were over twice those published by the BLS for the entire construction industry. Small firms were found to have injury rates that were higher or comparable to firms of other sizes, a finding which differed from the pattern found by the BLS [Glazner et al., 1998]. Previous research has also revealed data inconsistencies between fatal and nonfatal injury statistics, suggesting that the apparent decline in nonfatal injuries may be partially due to underreporting [Dong et al., 2005; Welch et al., 2007; CPWR, 2008]. These studies also found that Hispanic construction workers, especially immigrant Hispanic workers, had a higher risk of fatal injuries than other ethnicities [Dong et al., 2009; Loh and Richardson, 2004]. Hispanic construction workers were also more likely to have medical conditions from work-related injuries in excess of their white counterparts, which is contradictory to the results from the SOII [Dong et al., 2010].

Despite the relatively large number of studies relevant to underreporting in the literature, research focusing on small construction establishments is scarce. Given the large proportion of small establishments in the construction industry, and the severity of the underreporting problem among such establishments as suggested by the existing research, it is essential to explore underreporting among small construction establishments and estimate the extent of the problem in the construction industry.

METHODS

This study hypothesized that small construction establishments (1–10 employees) are more likely than larger establishments to underreport work-related injuries, and that this under-reporting is going to be more severe for Hispanic workers than for non-Hispanic workers. This hypothesis was tested through trend analyses and ratio analyses.

For the *trend* analyses, 15 years of data between 1992 and 2006 from three large-scale, nationally representative data sources were used:

- Numerators:
  - Fatalities: the Census of Fatal Occupational Injuries (CFOI)
  - Injuries: the Survey of Occupation Injuries and Illnesses (SOII)
- Denominators: the Current Population Survey (CPS).

The total numbers of nonfatal injuries, fatal injuries, and employment in construction during this study period were used as outcome measures in linear regressions. For these analyses we assumed that the trends of nonfatal and fatal injuries are analogous and run in similar directions.

For the *ratio* analyses two additional data sources, the County Business Patterns (CBP) and the Medical Expenditure Panel Survey (MEPS), were used; here the proportion of work related injuries (fatal data from the CFOI or nonfatal data from the SOII) was compared to the proportion of employment (data from the CBP or MEPS) within the same establishment size. Due to the lack of reliable data sources for denominators to calculate injury rates by establishment size and Hispanic ethnicity, *ratio* instead of *rate* was used to measure injury risk for workers in small construction establishments.

The BLS' SOII data from 1992 to 2006 provided the basis for study comparisons of occupational injuries. The SOII is an annual establishment survey with a sample of approximately 176,000 private establishments selected from a universe of establishments that report on unemployment insurance [Nestoriak and Pierce, 2009]. The SOII excludes the self-employed; farms with fewer than 11 employees; private households; and Federal government workers [U.S. Bureau of Labor Statistics, 2009]. Despite a large proportion of self-employed workers and a substantial informal workforce in construction, this study focused only on the populations covered by the SOII. Detailed injury data were tabulated from the SOII confidential data through an

agreement with the BLS. Less than 20% of the SOII cases had no ethnic identifier, and were excluded from the ethnic analysis.

Numbers of fatal injuries were tabulated based on the CFOI research files during the same period (1992–2006). The CFOI data are considered comparatively complete and reliable, since the information on work-related deaths is verified from multiple data sources and a follow-up questionnaire from the employer. To match the SOII data, decedents who were self-employed or had public sector jobs were also excluded from the establishment estimates. Due to the inconsistency of establishment size categories used by the SOII and the CFOI, matches between fatal and nonfatal injuries by establishment size were limited. Fatalities without establishment size information (about 23% of the total) were not counted in the establishment estimates.

Construction employment was obtained from the CPS data. The CPS is a monthly survey of approximately 60,000 households conducted by the U.S. Census Bureau for the BLS. About 6,000–6,500 CPS respondents were identified as construction workers per the survey, totaling more than 60,000 observations per survey year. The CPS collects information on employment and demographics, such as Hispanic origin, but only ascertains establishment size in supplemental surveys.

The CBP data supplied the number of employees by establishment size. The CBP data are extracted from the Business Register (BR), which contains the Census Bureau's most complete, current, and consistent data for U.S. business establishments. The CBP data have been collected annually since 1964, and are reported for activities taking place during the reference calendar year. The CBP covers nearly all industries coded by the North American Industry Classification System (NAICS) but excludes most government employees and self-employed workers. An *establishment* is defined as ''a single physical location at which business is conducted or services or industrial operations are performed'' [U.S. Census Bureau, 2009]. This CBP definition matches that of the SOII, but the categories for establishment size are not consistent with the SOII.

The CBP does not collect information on worker demographics such as Hispanic ethnicity. To determine whether injuries among Hispanic construction workers employed in small establishments are undercounted, we matched CFOI fatal data and SOII nonfatal injuries data to the MEPS employment data by establishment size. Unlike with the CBP, information on establishment size in the MEPS is self-reported. In each survey wave, the MEPS respondents are asked, ''How many persons are employed by (employer) in a usual week at the location where (the respondent) work/worked?'' If a respondent was not sure, ''Don't know'' was coded. Less than 10% of the MEPS respondents were coded as ''refused'' or ''Don't know'' to this question, and were excluded from the establishment estimates. In addition to employment and demographics, MEPS has collected data on healthcare and expenses from approximately 30,000 Americans annually since 1996 [AHRQ, 2010]. In each survey wave about 1,400–1,700 MEPS respondents were identified as construction workers. Data from 2003 to 2006 MEPS were pooled together for reliable estimates. Respondents who were self-employed or employed in public sectors were excluded in order to match the scope of the SOII. Overall, about 4,500 construction workers were included in the MEPS data pool.

In this study, *small establishments* were defined as establishments with 10 or fewer employees. *Construction workers* refer to those who were employed in the construction industry regardless of occupation. Construction workers identified as black or another racial minority were excluded from the ethnic comparison, but were counted when the construction industry was reported as a whole. Since less than 3% of the SOII cases are illnesses in construction, the term *injury* was used for this study as opposed to *injury and illness*. Given that demographic information is only available for *cases with days away from work*, and severe injuries would be a better comparison with fatal injuries, the study analyses were based on these severe injuries. SAS version 9.2 was used for all data analyses.

RESULTS

Trend Analysis

From 1992 to 2006, employment in construction jumped almost 70% with only a slight dip in 2002. Fatalities in the construction industry increased by 35%, while nonfatal injuries with days away from work decreased by nearly 27% during the same period (Table I). Regression trend lines for employment, fatalities, and injuries in construction are shown in Figure 1. The slope of the regression line for construction employment points steeply upward ($P < .0001$, Adj $R^2 = .97$), and the line for work-related fatalities ($P < .0001$, Adj $R^2 = .76$) is similar in direction but flatter than the trend line for employment. Given the fact that fatality injury data are relatively complete and accurate, the flatter line for construction fatalities suggests that construction safety has improved over the past 15 years. In spite of this, the regression line for nonfatal injuries shows a downward slope ($P < .0001$, Adj $R^2 = .78$) that is extreme and contradictory to both the employment and fatality data. However, the possible effects of changes in OSHA's regulations for nonfatal injury and illness reporting were not taken into account for this analysis.

Trends of construction fatalities varied by establishment size. Small establishments, which comprise the largest segment of the construction industry, suffered a disproportionate share of work-related deaths. From 1992 to 2006, more than 45% of construction fatalities occurred for wage-and-salary

TABLE I. Number of Construction Employment, Fatalities, and Injuries With Days Away From Work, 1992–2006

	Employment[a]		Fatal injuries[b]		Injuries with DAFW[c,d]	
Year	Number (in thousands)	% Change	Number	% Change	Number	% Change
1992	7,020	0.0	963	0.0	209,600	0.0
1993	7,220	2.8	971	0.8	204,800	−2.3
1994	7,560	7.7	1,077	11.8	218,800	4.4
1995	7,721	10.0	1,098	14.0	190,600	−9.1
1996	8,017	14.2	1,095	13.7	182,300	−13.0
1997	8,392	19.5	1,136	18.0	189,900	−9.4
1998	8,648	23.2	1,207	25.3	178,300	−14.9
1999	8,975	27.8	1,228	27.5	193,800	−7.5
2000	9,390	33.8	1,183	22.8	194,400	−7.3
2001	9,536	35.8	1,264	31.3	185,700	−11.4
2002	9,341	33.1	1,153	19.7	163,700	−21.9
2003	10,066	43.4	1,171	21.6	155,400	−25.9
2004	10,741	53.0	1,278	32.7	153,200	−26.9
2005	11,177	59.2	1,243	29.1	157,100	−25.0
2006	11,700	66.7	1,297	34.7	153,200	−26.9

DAFW, days away from work.
[a]Source: 1992–2006 Current Population Survey (CPS).
[b]Source: 1992–2006 Census of Fatal Occupational Injuries (CFOI).
[c]Source: 1992–2006 Survey of Occupational Injuries and Illnesses (SOII).
[d]Only includes injuries among wage-and-salary workers in the private sector.

workers employed in establishments with 10 or fewer employees (Fig. 2). Furthermore, more than 58% of construction deaths took place in establishments with fewer than 20 employees during this study period. According to the U.S. Census Bureau, establishments with 1–19 employees employed about 40% of the wage-and-salary workforce in construction [U.S. Census Bureau, 2009]. The number of deaths in small establishments is thus disproportionately high compared to the number of workers employed by these establishments.

The trends of nonfatal injuries are mixed and in contrast with construction fatality trends (Fig. 3). Nonfatal injury

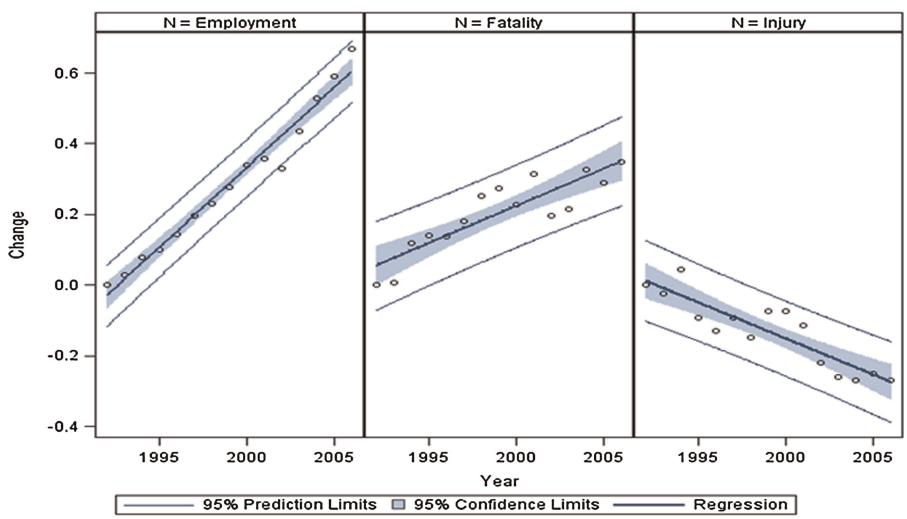

FIGURE 1. Trends of employment, fatalities, and injuries in construction, 1992–2006. Sources: 1992–2006 Survey of Occupation Injuries and Illnesses (SOII), 1992–2006 Census of Fatal Occupational Injuries (CFOI), and 1992–2006 Current Population Survey (CPS). Note: The SOII only includes wage-and-salary workers in the private sector. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

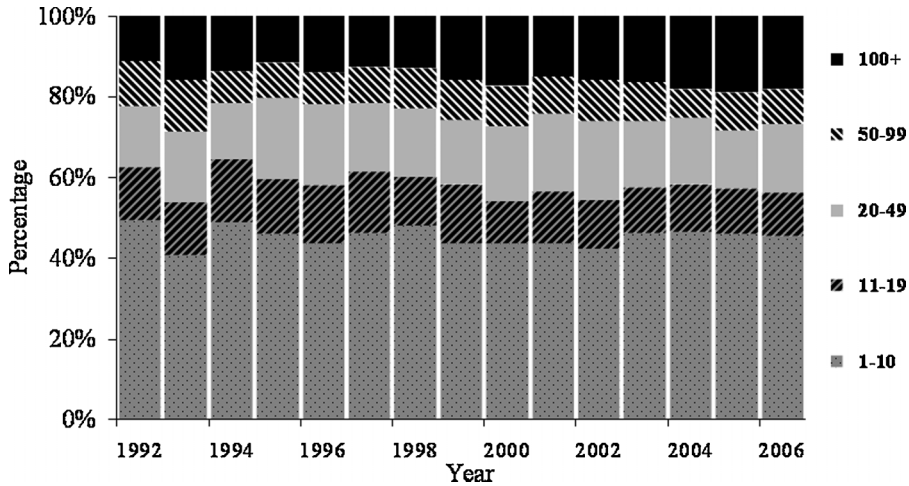

FIGURE 2. Distribution of fatal injuries in construction by establishment size, 1992–2006. Sources: U.S. Bureau of Labor Statistics and 1992–2006 Census of Fatal Occupational Injuries (CFOI).

rates for small establishments (1–10 employees, $P < .0001$, Adj $R^2 = .90$) were consistently lower than the average for the overall construction industry ($P < .0001$, Adj $R^2 = .92$) and medium–size establishments. The injury rates for the largest establishments (1,000 employees or more) were found to be the lowest for all sizes of construction establishments, but the regression line is slightly upward ($P = .058$, Adj $R^2 = .24$).

Such inconsistencies can also be found in the trends among Hispanic construction workers. From 1992 to 2006, the Hispanic workforce in construction increased by over 350%, which was more than five times the growth for all of construction. Along with this employment boom, fatal injuries more than tripled, rising over 225% for Hispanic workers. Nonfatal injuries concurrently rose by 92% for Hispanic workers, disproportionately lower than Hispanic worker fatalities (Table II).

Regression line trends among Hispanic construction workers are displayed in Figure 4. While all five trends share the same upward direction, the slopes are quite different. Similar to the findings for the entire construction industry, Hispanic fatal injuries increased along with employment. The two lines are reasonably parallel, but the trend for fatalities ($P < .0001$, Adj $R^2 = .93$) is not as steep as the trend for Hispanic employment ($P < .0001$, Adj $R^2 = .91$). The trend for fatalities in small establishments has the steepest upward

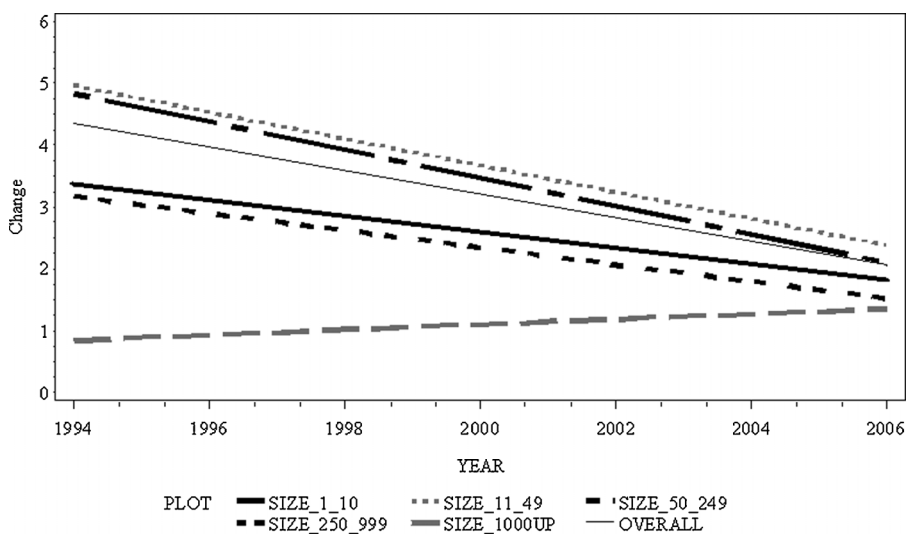

FIGURE 3. Trends of nonfatal injuries in construction by establishment size, 1994–2006. Sources: U.S. Bureau of Labor Statistics and 1994–2006 Survey of Occupation Injuries and Illnesses (SOII).

TABLE II. Trends in Employment, Fatalities, and Injuries With Days Away From Work Among Hispanic Construction Workers, 1992–2006

	Employment[a]		Fatal injuries[b]		Injuries with DAFW[c,d]	
Year	Number (in thousands)	% Change	Number	% Change	Number	% Change
1992	646	0.0	108	0.0	17,715	0.0
1993	675	4.5	109	0.9	18,017	1.7
1994	836	29.4	116	7.4	17,738	0.1
1995	849	31.4	146	35.2	18,995	7.2
1996	881	36.4	137	26.9	19,713	11.3
1997	1,056	63.5	167	54.6	21,342	20.5
1998	1,220	88.9	215	99.1	22,970	29.7
1999	1,283	98.6	225	108.3	28,734	62.2
2000	1,452	124.8	278	157.4	26,450	49.3
2001	1,511	133.9	282	161.1	29,714	67.7
2002	1,552	140.2	245	126.9	26,017	46.9
2003	2,070	220.4	261	141.7	26,750	51.0
2004	2,280	252.9	312	188.9	27,990	58.0
2005	2,577	298.9	321	197.2	32,770	85.0
2006	2,946	356.0	354	227.8	33,930	91.5

DAFW, days away from work.
[a]Source: 1992–2006 Current Population Survey (CPS).
[b]Source: 1992–2006 Census of Fatal Occupational Injuries (CFOI).
[c]Source: 1992–2006 Survey of Occupational Injuries and Illnesses (SOII).
[d]Only includes injuries among wage-and-salary workers in the private sector.

slope ($P < .0001$, Adj $R^2 = .82$), suggesting that deaths among Hispanic construction workers are more likely to occur in small establishments. The nonfatal injury line for all Hispanic workers ($P < .0001$, Adj $R^2 = .87$) is much flatter than the trend for employment and fatalities, and the trend for nonfatal injuries among small establishments is the flattest ($P > .05$, Adj $R^2 = .08$). Although the change in nonfatal injury rates in small establishments was not

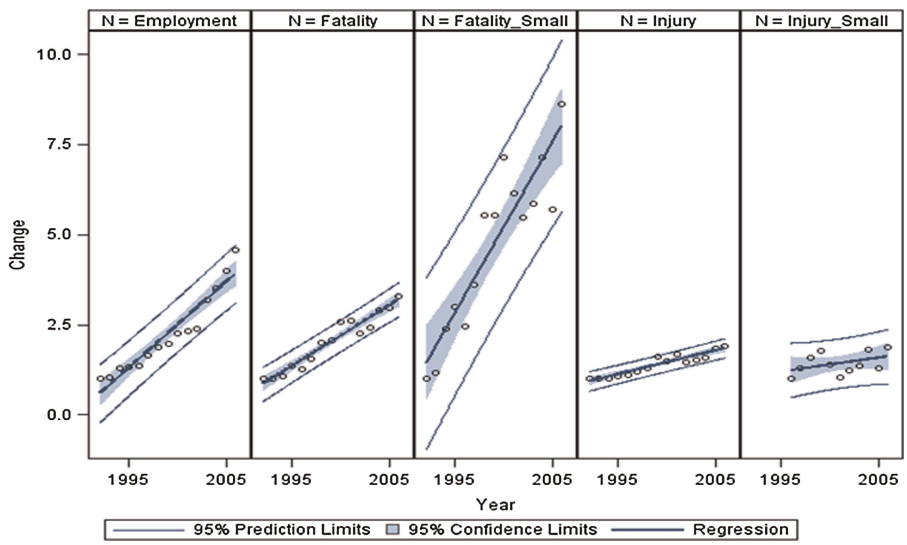

FIGURE 4. Trends of employment, fatalities, and injuries among Hispanic construction workers, 1992–2006. Sources: 1992–2006 Survey of Occupation Injuries and Illnesses (SOII), 1992–2006 Census of Fatal Occupational Injuries (CFOI), and 1992–2006 Current Population Survey (CPS). Note: (1) The SOII only includes wage-and-salary workers in the private sector. (2) Nonfatal injuries among small establishments and only available for 1996–2006. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

TABLE III. Distribution of Injuries With Days Away From Work, Fatalities, and Employment in Construction by Establishment Size, 2006

	Injuries	Employment		Fatalities	Employment		Employment	
Size	SOII (%)	MEPS (%)	Size	CFOI (%)	MEPS (%)	Size	CBP (%)	MEPS (%)
1–10	18.9	36.9	1–10	46.1	36.9	1–9	22.9	34.3
11–49	40.9	30.9	11–19	11.2	14.5	10–49	34.7	33.5
50–249	31.6	19.6	20–49	16.1	16.4	50–249	27.8	19.6
250–999	7.8	12.6	50–99	8.7	11.8	250–999	10.9	12.6
1000+	0.8	0.0	100+	17.8	20.4	1000+	3.7	0.0

Sources: 2006 Survey of Occupation Injuries and Illnesses (SOII), 2006 Medical Expenditures and Panel Survey (MEPS), 2006 Census of Fatal Occupational Injuries (CFOI), and 2006 County Business Patterns (CBP).

statistically significant, the difference in slopes between fatal and nonfatal injuries is striking.

Ratio Analysis

More detailed statistics by establishment size are provided in Tables III–V, in which construction employment was matched to fatal and nonfatal injury distributions according to establishment size. Fatalities and nonfatal injuries could only be matched for establishments with 1–10 employees for the CFOI and the SOII. Almost half of all work-related deaths in construction (46%) occurred in small establishments with 1–10 employees, but only 19% of nonfatal injuries took place in such establishments (Table III). The employment data from the MEPS were also apportioned to match the CBP data by size of establishment (1–9 employees). The employment estimates were found to be significantly different between the MEPS household survey and the CBP establishment survey. According to the MEPS, in 2006 more than one-third of wage-and-salary construction workers were employed in small establishments with fewer than 10 employees, yet the CBP survey showed that employees in such establishments only accounted for less than a quarter for the same year. Even using the CBP data for comparison, the percentage of nonfatal injuries in small establishments reported by the SOII is still the lowest in any comparison.

Fatal injuries were also stratified by Hispanic ethnicity and matched by employment to corresponding establishment sizes (Table IV). Data from 2003 to 2006 were pooled together for this analysis; hence the employment distributions are slightly different from Table III (where only 1 year of data was examined). Almost 40% of all construction workers were employed in small establishments with 1–10 employees. Hispanic construction workers were more likely to be employed in small firms, when compared with non-Hispanic workers (46% vs. 36%, respectively), and also experienced a greater proportion of fatalities (48% vs. 44%, respectively). Although the percentage of fatal injuries from small establishments varied somewhat across population groups, they were, in general, consistent with the proportion of same size establishments.

In contrast to fatality data, the proportion of nonfatal injuries reported by small establishments was exceedingly low for all construction workers, but especially low for Hispanic workers. While almost half (46%) of Hispanic workers were employed in small establishments, a mere 12% of injuries were reported by such establishments, which was significantly lower than for white, non-Hispanic workers (24%, Table V).

Table VI presents the estimated extent of underreporting in small construction establishments (1–10 employees) based on distribution estimates from different data sources.

TABLE IV. Distribution of Fatal Injuries and Employment in Construction by Establishment Size and Ethnicity, 2003–2006 Average

	Hispanic		White, non-Hispanic		All construction	
Establishment size	Fatal injuries[a] (%)	Employment[b] (%)	Fatal injuries[a] (%)	Employment[b] (%)	Fatal injuries[a] (%)	Employment[b] (%)
1–10	48.4	45.9	44.3	35.7	46.1	38.0
11–19	9.5	15.5	11.3	14.9	11.2	15.1
20–49	16.6	13.4	15.3	17.7	16.1	16.8
50–99	8.4	8.9	9.0	10.5	8.7	10.2
100+	17.0	16.3	20.1	21.1	17.8	20.0

[a]Source: 2003–2006 Census of Fatal Occupational Injuries (CFOI).
[b]Source: 2003–2006 Medical Expenditure Panel Survey (MEPS).

TABLE V. Distribution of Nonfatal Injuries With Days Away From Work and Employment in Construction by Establishment Size and Ethnicity, 2003–2006 Average

	Hispanic		White, non-Hispanic		All construction	
Establishment size	Injuries with DAFW[a] (%)	Employment[b] (%)	Injuries with DAFW[a] (%)	Employment[b] (%)	Injuries with DAFW[a] (%)	Employment[b] (%)
1–10	11.9	45.9	23.7	35.7	18.7	38.0
11–49	36.7	28.9	44.9	32.6	41.0	31.8
50–249	38.7	14.2	27.6	21.6	32.0	19.9
250+	11.0	11.0	3.4	10.1	7.6	10.3

DAFW, days away from work.
[a]Source: 2003–2006 Survey of Occupational Injuries and Illnesses (SOII).
[b]Source: 2003–2006 Medical Expenditure Panel Survey (MEPS).

Comparing the percentage of nonfatal injuries by ethnic group obtained from the SOII to the corresponding proportions from the CFOI, MEPS, and CBP, the SOII effectively captured only about 25% of nonfatal injuries in small construction establishments with 1–10 employees for Hispanic workers, and 53–66% for white, non-Hispanic workers. Annually, an estimated 13,400–42,300 nonfatal injuries were missed by the SOII for small construction establishments with 10 or fewer employees alone.

DISCUSSION

This study estimates the extent of underreporting in small construction establishments by analyzing 15 years of data from five large, nationally representative data sources. Although the fatality data suggest that safety and health improvements have increased throughout the construction industry over the last 15 years, the inconsistent results between fatal and nonfatal data cannot be logically explained. It is counterintuitive that nonfatal injury rates have improved disproportionately to fatality rates within the same industry during the same time period. The contradictory pattern found by this study suggests that small construction establishments were more likely than larger establishments to underreport nonfatal injuries. We estimated that a mere 8–16% of injuries among Hispanic construction workers were reported by small employers, even though more than 45% of Hispanic construction workers were employed by them. For white, non-Hispanic workers, about 36% were employed in small establishments, while 21–25% of nonfatal injuries were accounted for within this population. Based on our estimates, the existing BLS injury data captured roughly one quarter of nonfatal injuries for Hispanic workers who were employed by small contractors. We estimated that more than 42,000 injuries resulting in days away from work in small construction companies with 1–10 employees were not reported each year. Although the SOII data do not differentiate between US born and foreign-born workers, it is estimated that in the construction industry more

TABLE VI. Estimated Nonfatal Injuries With Days Away From Work Among Small Construction Establishments (1–10 Employees), Average of 2003–2006

	Estimated injuries in small construction establishments by SOII		Estimated injuries in small construction establishments by other data sources								
			CFOI			MEPS			CBP		
				Missed by SOII			Missed by SOII			Missed by SOII	
Category	% within ethnic group	No.	Estimated no.	%	No.	Estimated no.	%	No.	Estimated no.	%	No.
Hispanic	11.9	3,603	14,600	75.3	10,997	13,845	74.0	10,243	NA	NA	NA
White, non-Hispanic	23.7	20,775	38,913	46.6	18,138	31,359	33.8	10,584	NA	NA	NA
All workers	18.7	28,983	71,304	59.4	42,322	58,776	50.7	29,793	42,381	31.6	13,398

Sources: 2003–2006 Survey of Occupation Injuries and Illnesses (SOII), 2003–2006 Census of Fatal Occupational Injuries (CFOI), 2003–2006 Medical Expenditures and Panel Survey (MEPS), and 2003–2006 County Business Patterns (CBP).

than 70% of Hispanic workers are foreign born [CPWR, 2008]. Thus, the SOII data presented here for Hispanic construction workers most likely understate the underreporting of injuries for foreign-born Hispanic workers.

This study suggests significant differences in employment estimates between household and establishment surveys. The estimated employment in small establishments with fewer than 10 employees, based on the CBP survey, was about two-thirds of the estimate based on workers' self-reports in the MEPS. While reporting bias is possible in the MEPS data, employee misclassification could be reflected in the CBP data. Previous reports found that small businesses appear to be the largest violators of wage compliance regulations; that is, misclassifying wage-and-salary employees as independent contractors or self-employed workers [Carré et al., 2004; Commonwealth of Massachusetts, 2009]. If this is the case, about one-third of wage-and-salary construction workers who were employed in small establishments (1–9 employees) were misclassified as self-employed workers and thus were excluded from the CBP survey based on payrolls and not captured by the SOII.

On top of the possible misclassification problem, other data limitations were identified through this study. For example, the categories of establishment size used by these data sources were inconsistent, which made it more difficult to conduct such studies. Some important information needed for this study (e.g., establishment size, Hispanic ethnicity) was missing or not collected at all for one or more data sources. Due to the lack of demographic and personal identifiers, it was impossible to link these data sources at the individual level. Moreover, the data sources used for this study have undergone several important changes across the study period, such as changes in OSHA's injury and illness reporting requirements, the switch in industrial coding systems from the Standard Industrial Classification (SIC) system to the NAICS, and sampling method changes in the CPS. All of these affect the trend analysis and the overall study.

Data accuracy is extremely important for occupational safety and health surveillance, and this is especially true for an industry with an extremely mobile workforce like construction. Accurate data are essential to implement new data collection initiatives to track the safety and health impacts of emerging technologies, identify the most effective and efficient intervention programs, and support the development and diffusion of those programs throughout the industry. In addition, accurate data provides the basis for policy-making and resource distribution. Although occupational injury surveillance made a large step forward with the advancement of the CFOI in 1992, there are still significant deficiencies in the current systems; these deficiencies must be corrected in order to build a foundation for evidence-based initiatives in worker safety and health.

While OSHA has recognized the importance of data accuracy and established an audit program with on-site audits of employer injury and illness records since 1995, this program has focused solely on nonconstruction establishments. OSHA has improved its Data Initiative (ODI) survey recently, and expanded this program to include the construction industry, but small (<10 employees) construction establishments are still excluded [OSHA, 2009]. Given the considerable proportion of small establishments in the construction industry and the hazardous nature of work performed in construction, the threshold of establishment inclusion in OSHA's ODI is insufficient for the construction industry in particular and will not address the problem described in this paper.

In order to combat underreporting in construction, OSHA should focus more of its efforts on small construction employers. These small employers tend to lack professional manpower, resources, and operational capabilities found within larger establishments where safety programs have proven cost effective while maintaining productivity. Such deficiencies could lead to a general lack of knowledge about safety and health requirements and responsibilities, and also to ''cutting corners'' when it comes to safety and health training, safety equipment installation and usage, and injury recordkeeping and reporting. Small establishments with 10 or fewer employees are also less familiar with OSHA recordable injury and illness logs, because they are exempted in 29 CFR 1904.1 from OSHA requirements to maintain injury logs unless they are among the small sample selected to participate in the SOII [OSHA, 2001]. If annual surveys are subject to budget constraints, it may be practical to conduct a special ODI survey on small construction establishments for selected years. Since OSHA's audit program defines ''high hazard industries'' based only on rates of nonfatal injuries and illnesses, industries that are more likely to underreport injuries and illnesses would be less likely to be selected. Thus, in addition to the current criteria, fatal injury rates should also be taken into account for OSHA's targeting given that fatality data are much more complete and reliable than nonfatal injury data.

It is reported that the BLS is developing its own ''follow-back'' study to ensure that the SOII correctly captures the data recorded by employers in their OSHA logs [U.S. Bureau of Labor Statistics, 2009]. We suggest that the BLS and other agencies collect work-related injury and illness data from employees in a manner that would allow linkage and comparison with reports from employers, and conduct worker interviews concerning a sample of such events.

Given the multi-employer nature of construction, and the fact that safety management and workers' compensation coverage may vary by project site, project based injury data are critical for injury prevention within the construction industry in particular. Many of the data quality and methodological recommendations made by the National

Academies [Kalsbeek et al., 2007] to improve the Survey of Respirator Use and Practices (which used a subset of the SOII), most notably to include an employee-within-establishment component, could be applied to improve the SOII as a whole.

Other improvements are needed to tackle one of the most critical challenges to occupational injury and illness surveillance: nontraditional employment. The number of workers hired as independent contractors continues growing to the extent that there are many large workplaces with only employers and no employees. Such workplaces are generally not covered by traditional employment standards, and are therefore excluded from OSHA's mandate ''to assure safe and healthful working conditions for working men and women'' [OSHA, 1970]. Therefore, it is crucial to expand employment standards to include nontraditional employment, including the collection of nonfatal injury and illness data from samples of self-employed workers for selected years. In addition, more cooperation is needed between data collection agencies and other agencies which use the data in research and policy development (e.g., BLS, OSHA, NIOSH, etc.) in order to enhance data verification, data linkage, and to compile more complete occupational data from multiple sources. Adding data from existing alternative sources would not only be highly cost-effective, but would represent a significant, comprehensive complement of information to improve the current occupational safety and health surveillance systems.

ACKNOWLEDGMENTS

This study was funded by the National Institute for Occupational Safety and Health (NIOSH) grant U60OH009762. The contents of this article are solely the responsibility of the authors and do not necessarily represent the official views of NIOSH. The authors would express thanks to Dr. Christina Daw, CPWR—The Center for Construction Research and Training for her editing assistance.

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