

# Identifying patterns in employer reporting errors in the BLS Survey of Occupational Injuries and Illnesses November 2016

Sara Wuellner<sup>1</sup> and Polly Phipps<sup>2</sup>

<sup>1</sup>Washington State Department of Labor & Industries, PO Box 44330, Olympia, WA 98502

<sup>2</sup>Bureau of Labor Statistics, 2 Massachusetts Ave N.E., Washington DC 20212

## Abstract

The Bureau of Labor Statistics (BLS) estimates of non-fatal work-related injuries and illnesses are based on employer reported data. Collected through the Survey of Occupational Injuries and Illnesses (SOII), these data are used to estimate and characterize work injury and illness for the US and most states. Increasingly, research suggests that employers underreport injuries in SOII, and that underreporting varies by establishment and injury characteristics, as well as by state. A follow-back telephone survey was conducted with SOII respondents in four states to gather data on workplace injury and illness recordkeeping and reporting practices. Using the multi-state telephone survey data, we sought to identify within and between state differences in compliance with and knowledge of injury recordkeeping requirements. Patterns in occupational injury and illnesses recordkeeping were explored through regression models. We identified common recordkeeping errors and establishment characteristics associated with such errors.

**Key words:** workplace injuries and illnesses; administrative data; underreporting; measurement error

## 1. Background

Data that quantify and characterize work-related injuries and illnesses are fundamental to workplace injury prevention efforts by informing the prioritization, implementation, and evaluation of such efforts. The Bureau of Labor Statistics (BLS) provides an important source of occupational health and safety data, publishing annual estimates of nonfatal work-related injuries and illnesses for the US and most states.

BLS estimates are based on employer-reported data, collected from a sample of establishments through the Survey of Occupational Injuries and Illnesses (SOII). Sampled employers are instructed to submit data based on their OSHA injury and illness records, with detailed worker and injury data collected on more serious injuries, defined as those involving one or more days of missed work (Wiatrowski, 2014). Research suggests that, compared to other sources of occupational injury data, employers underreport cases in SOII (Boden and Ozonoff, 2008; Rosenman et al., 2006). Additional studies have identified systematic biases in reporting, with greater underreporting found for difficult to diagnosis non-acute conditions (Nestoriak and Pierce, 2009), Hispanic workers (Dong et al., 2011), and larger establishments in high hazard industries as well as smaller establishments in less hazardous industries (Wuellner et al., 2016). Finally, based on the findings from a study comparing SOII cases to workers' compensation claims in six states (Boden, 2014), and another study comparing nonfatal SOII data to fatal workplace injury data for all SOII

---

<sup>1</sup> The views expressed here are those of the authors and do not necessarily represent the policies of the Bureau of Labor Statistics.

participating states (Mendeloff and Burns, 2013), underreporting of SOII eligible cases may be greater in some states than others.

In an effort to better understand the injury and illness data submitted by employers for SOII, recent studies have focused on the workplace injury recordkeeping practices of SOII respondents to explore whether respondents follow the OSHA injury and illness recording regulations as instructed for SOII. Interviews with SOII respondents have identified recordkeeping practices noncompliant with the OSHA regulations including: use of case definitions other than the OSHA recordable case criteria; failure to accurately assess and document case severity and update records to reflect changes in the case; and an absence of workplace injury and illness records in any form (Phipps and Moore, 2010; Rappin et al., 2016; Wuellner and Bonauto, 2014). Although these studies identified recordkeeping errors that impact the accuracy of SOII data, they were not designed to estimate the extent of such practices, nor were they designed to identify trends in recordkeeping errors by establishment characteristics.

This study, building on previous research into the workplace injury recordkeeping practices of SOII respondents, aims to:

1. Estimate state-wide occurrence of correct and erroneous OSHA injury and illness recordkeeping knowledge and practices
2. Identify establishment and record-keeper characteristics associated with noncompliant practices
3. Assess patterns in recordkeeping practices by state independent of establishment characteristics

To address these aims, we analyzed follow-back telephone survey data collected from SOII respondents in several states. Survey questions assessed workplace injury recordkeeping knowledge and practices among establishments whose data are used in BLS estimates of occupational injuries and illnesses.

## **2. Methods**

### **2.1 Survey design**

In collaboration with the Bureau of Labor Statistics, occupational safety and health researchers from the Minnesota Department of Labor and Industry, New York State Department of Health, Oregon Department of Consumer and Business Services, and Washington Department of Labor and Industries developed a telephone questionnaire to assess workplace injury recordkeeping knowledge and practices among SOII respondents. Largely patterned after similar survey tools used in semi-structured interviews (Phipps and Moore, 2010; Wuellner and Bonauto, 2014), the 30-minute telephone questionnaire was adapted for quantitative survey data collection and covered topics related to: establishment processes for reporting workplace injuries and illnesses and hypothetical recordkeeping scenarios to assess record-keeper knowledge of reporting requirements.

### **2.2 Sample and data collection**

Establishments were selected to allow for inference to each state's SOII-eligible population while accommodating state-specific research aims. Each state stratified the SOII establishment micro data by ownership, NAICS industry sector, and size group.<sup>2</sup>

---

<sup>2</sup> There were slight differences in how each state grouped ownership, industry, and size class, (e.g., Ownership=two groups: 1. Private; 2. State + local government combined, or three

Washington oversampled small establishments in high hazard industries; the other three states sampled proportionally from the strata. Minnesota and Oregon selected respondents from the 2010 and 2011 establishment data, New York and Washington limited selection to the 2011 establishment data. Establishments were randomly selected from each sample cell, and weighted to be proportional to the state distribution. Final survey weights were adjusted for non-response, and, in Washington, for oversampling.

Sample selection, participant recruitment and survey administration procedures were developed jointly but executed independently by each state. The survey was conducted with the individual listed in the SOII contact data as the SOII respondent or, if unavailable, the person currently responsible for the establishment's occupational injury and illness recordkeeping. Study participants were informed that participation was voluntary, and consent was obtained verbally in three states; in Minnesota, the IRB determined that the study was exempt and informed consent was thus not required. In addition to approval from the Washington State IRB (which approved both the Washington and Oregon study sites) and the New York State IRB, study approval was also obtained from the Office of Management and Budget.

Telephone interviews were conducted in 2013-2014. Survey responses collected by each state were aggregated at BLS for analysis.

### **2.3 Analysis**

Logistic regression models were used to identify associations between recordkeeping practices and establishment characteristics, and were estimated using the SAS surveylogistic procedure to account for the complex sampling design. Classification trees were developed using the rpart program in R to create groups of establishments with similar recordkeeping practices.

Establishment characteristics evaluated for associations with recordkeeping practices included: state, ownership, industry, number of employees, number of worksites, OSHA total recordable injury and illness rate (as reported in SOII), workers' compensation insurer, unionized workforce, and OSHA recordkeeping exemption status. Record-keeper characteristics included: SOII experience, years of OSHA recordkeeping experience, and whether or not the record-keeper had been trained on OSHA recordkeeping regulations. Establishment uses of OSHA injury and illness data included: as a measure of the participant's job performance; as a measure of supervisors' job performance; as a measure of worker performance in workplace safety incentive programs; and a component of competitive bid packages for contract work.

The survey included several skip patterns (e.g., some study participants did not maintain OSHA injury and illness records and were therefore skipped out of the section related to OSHA recording practices). Certain analyses were limited to subpopulations of participants to account for the skip patterns. "Don't know" responses were grouped with incorrect or non-compliant responses.

---

ownership groups: 1. Private; 2. State government; 3. Local government). Details can be found in the state reports, available at: <http://www.bls.gov/iif/undercount.htm#p2>

### 3. Results

#### 3.1 Response rates

Response rates were calculated as the percent of establishments that participated in the telephone survey among the total number of sampled establishments still in business at the time of contact. There were significant differences in participation by state, size class, industry class, and reported cases of occupational injuries. Among the four states, Oregon saw the highest participation (70%). Among the remaining three states, approximately 50% of establishments participated. Larger establishments were more likely to participate compared with smaller establishments. By industry, participation was lower among Retail Trade and higher among state and local government. Establishments that reported any cases in SOII were more likely to participate compared with establishments that reported zero total cases, or zero cases with days away from work (DAFW). Patterns of participation by establishment characteristics were similar across the four states.

#### 3.2 Participant recordkeeping experience

Table 1 presents participant recordkeeping experience by state. For many study participants, the survey year from which the sample was drawn (i.e., 2010 or 2011, depending on the state) was the first time they participated in the SOII: in Minnesota, Oregon, and Washington, over 40% of establishments were represented by a first-time SOII respondent. In New York, approximately 24% of establishments had first time respondents. Study participants who had participated in SOII in multiple years ranged from 15% of Oregon establishments to 23% of Washington establishments. In one-third to half of all establishments by state, participants did not know if they were first-time or repeat respondents, or did not complete the SOII (generally, these participants were new hires and had not been responsible for recordkeeping during SOII data collection).

**Table 1:** Workplace injury and illness recordkeeping experience by state. Data shown are % of estimated establishments (SE) unless otherwise noted.

	MN	NY	OR	WA	p-value
Study establishments	581	690	1368	701	
Estimated establishments	179,391	342,596	216,152	131,395	
<b>SOII experience</b>					
First time	41.8 (5.6)	23.8 (4.8)	40.8 (3.6)	44.4 (5.3)	0.0048
Repeat	18.8 (3.6)	21.1 (4.3)	14.5 (2.5)	22.7 (3.7)	
No SOII/DK/Other	39.4 (5.6)	55.2 (6.0)	44.7 (3.6)	32.9 (4.8)	
<b>Years of OSHA recordkeeping experience</b>					
≤1 year	53.0 (5.5)	67.4 (5.4)	33.0 (3.5)	48.0 (5.3)	<.0001
2 - 9 years	23.3 (4.0)	21.3 (5.0)	28.1 (3.3)	23.5 (3.5)	
10+ years	23.7 (4.2)	10.9 (2.5)	32 (3.3)	23.5 (4.1)	
DK	. (.)	0.5 (0.3)	7.0 (2.0)	5.0 (1.9)	
<b>Participant formally trained in OSHA recordkeeping</b>					
Yes	26.5 (4.6)	18.7 (4.3)	24.8 (3.1)	20.4 (3.6)	0.1922
No	64.5 (5.3)	66.7 (6.3)	71.0 (3.3)	71.6 (4.3)	
DK	9.0 (3.5)	14.6 (5.9)	4.2 (1.6)	8.0 (2.5)	

The percentage of establishments with a record-keeper formally trained in OSHA recordkeeping was similarly low across states, at approximately 20% to 25% of establishments. The years of recordkeeping experience differed by state, although percentages suggested limited experience among most respondents, with approximately

half of all establishments represented by respondents with no OSHA recordkeeping experience (in 98% of these establishments, either no logs were maintained, or it was unclear whether logs were maintained).

### **3.3 Compliance with OSHA injury and illness recording regulations**

Compliance with four aspects of the OSHA injury and illness recording regulations were assessed: whether the establishment 1) maintained OSHA injury records (also referred to as 300 logs) as required when participating in SOII; 2) used the OSHA case definition or employed some other case definition to determine which incidents would be recorded in the OSHA log; 3) recorded cases within the seven-day period as prescribed by the OSHA regulation or a longer time period; and 4) counted calendar days of missed work resulting from an injury or illness as opposed to scheduled days or shifts missed.<sup>3</sup>

Table 2 presents compliance with the four aspects of OSHA recordkeeping by state. OSHA 300 logs were maintained in less than half of establishments in any of the four states. Among establishments with logs, compliance was greatest for recording cases within the seven-day requirement (59-85% of establishments by state), and less so for use of the OSHA case definition to determine eligibility (30-58% of establishments by state) and counting calendar days an injured worker was unable to work (29-58% of establishments by state). While New York had the lowest percent of establishments that maintained OSHA logs, New York log-maintaining establishments reported the highest percent of compliant recording practices.

Table 3 presents odds ratios for establishment and record-keeper characteristics and failure to maintain OSHA logs. Based on a multivariable regression model controlling for establishment and record-keeper characteristics, the following were found to be associated with failure to maintain OSHA logs: employing  $\leq 10$  workers, establishments in the leisure and hospitality industry, establishments with private or state-funded workers' compensation insurance, employers operating a single worksite, first time SOII respondents, and establishments that reported zero work-related injuries or illnesses in SOII. Additionally, Washington and Oregon establishments usually exempt from annual OSHA recordkeeping were less likely to maintain logs than same-state non-exempt establishments, whereas no difference in logs was observed by exemption status among Minnesota and New York establishments.

Limited to establishments where the participant was involved in maintaining OSHA logs, the logistic regression models suggested that different establishment and record-keeper characteristics were associated with different aspects of OSHA recordkeeping compliance (table 4). Controlling for establishment and record-keeper characteristics, the factor most strongly associated with compliant case definition was the practice of including OSHA injury and illness data in competitive bids for contract work – establishments that disclosed OSHA injury and illness data in bid packages were almost four times more likely to use the OSHA case definition than non-bidding establishments. Repeat SOII respondents, the industry group Wholesale Trade/Transportation, Warehousing/Utilities, and establishments that reported one or more cases in SOII were more likely to use the OSHA case definition. In Minnesota and New York, and Washington, trained record-keepers were more likely to use the OSHA case definition, while in Oregon, there was no difference by training. Controlling for establishment and record-keeper characteristics, factors associated with compliant practices of counting days of missed work included: large establishments

---

<sup>3</sup> Occupational Safety and Health Act, 29 CFR §1904.7 (2001).

(250+ employees); unionized workforce; establishments self-insured for workers' compensation; multi-site establishments; trained injury record-keepers; and two or more years of OSHA recordkeeping experience. No differences by state were observed for compliance with counting days of missed work.

**Table 2:** Workplace injury and illness recordkeeping practices by state. Data shown are % of estimated establishments (SE) unless otherwise noted.

	MN	NY	OR	WA	p-value
Study establishments	581	690	1368	701	
Estimated establishments	179,391	342,596	216,152	131,395	
<b>Logs maintained for the establishment</b>					
Logs maintained by study participant <sup>a</sup>	45.2 (5.1)	29.0 (4.9)	48.5 (3.5)	37.6 (4.5)	<.0001
Logs maintained by others <sup>a</sup>	1.6 (0.8)	1.7 (0.6)	1.5 (0.4)	7.6 (2.5)	
No logs maintained for establishment	49.6 (5.2)	37.2 (6.0)	40.8 (3.6)	43.4 (5.5)	
Unknown if logs maintained	3.6 (1.4)	32.0 (6.4)	9.3 (2.1)	11.5 (2.9)	
<b>Among establishments with logs maintained, at least in part, by study participant</b>					
Study establishments	473	490	1087	539	
Estimated establishments	81,111	99,422	104,766	49,376	
<b>Case definition used to determine eligibility for log</b>					
OSHA definition <sup>a</sup>	38.1 (6.7)	58.1 (9.1)	50.5 (4.9)	29.8 (5.0)	<.0001
Medical treatment	30.9 (6.4)	4.5 (1.7)	20.9 (4.4)	22.3 (4.0)	
Injuries (regardless of severity)	15.1 (3.6)	30.3 (9.8)	15.5 (3.4)	17.9 (5.4)	
Claims	2.6 (1.1)	1.6 (0.7)	5.7 (2.0)	9.8 (2.3)	
DK/Other	13.2 (3.6)	5.5 (2.5)	7.3 (2.3)	20.2 (6.5)	
<b>When cases are recorded on log</b>					
Week <sup>a</sup>	79.2 (3.8)	85.0 (3.7)	77.6 (4.4)	59.4 (6.1)	<.0001
Monthly or Quarterly	7.4 (2.0)	2.3 (0.9)	5.4 (1.3)	6.7 (1.7)	
End of year	6.2 (1.9)	3.9 (1.3)	11.5 (4.3)	10.3 (2.4)	
Upon receipt of WC documentation	0.5 (0.4)	0.4 (0.2)	1.1 (0.4)	0.5 (0.2)	
DK/Other	6.7 (2.1)	8.4 (3.0)	4.5 (1.7)	23.1 (6.4)	
<b>How days are counted</b>					
Calendar days <sup>a</sup>	39.7 (6.0)	58.0 (7.9)	28.6 (4.1)	31.1 (5.6)	0.0004
Scheduled work days or shifts	51.0 (6.6)	37.5 (7.4)	60.4 (4.7)	48.3 (6.1)	
DK/Other	9.3 (2.8)	4.4 (2.2)	11.0 (3.0)	20.6 (6.4)	

<sup>a</sup>OSHA-compliant practice

**Table 3:** Adjusted odds ratio (95% confidence intervals) for failing to maintain OSHA log, four states combined (n=3342).

	Adjusted OR (95% CI)
<b>Establishment size (vs. 250+ workers)</b>	
1-10 workers	3.87 (1.57 - 9.53)*
11-49 workers	1.38 (0.64 - 2.96)
50-249 workers	0.40 (0.19 - 0.83)*
<b>Industry (vs Manufacturing)</b>	
Construction/Agriculture, Forestry, Fishing Hunting	1.09 (0.43 - 2.77)
Wholesale Trade/Transportation, Warehousing/Utilities	1.18 (0.46 - 3.02)
Retail Trade	1.86 (0.69 - 4.98)
Information/Financial/Real Estate/Professional Mgmt	2.14 (0.72 - 6.35)
Admin, Support, Waste Mgmt, Remediation/Other Svc	1.00 (0.34 - 2.94)
Education/Health Care, Social Assistance	0.63 (0.19 - 2.05)
Leisure and Hospitality	3.06 (1.04 - 8.99)*
State and Local Government	0.88 (0.28 - 2.82)
<b>Union presence</b>	
No vs Yes	1.46 (0.52 - 4.12)
<b>Workers' compensation insurer</b>	
Private + State Funded vs. Self-insured	4.94 (2.29 - 10.7)*
<b>Number of worksites operated by employer</b>	
Single worksite vs multiple sites	3.27 (2.03 - 5.28)*
<b>SOII experience (vs Repeat Respondent)</b>	
First time SOII respondent	2.49 (1.32 - 4.70)*
Did not complete SOII/DK/Other	5.47 (2.9 - 10.35)*
<b>Injury and illness rate (total OSHA recordable cases)</b>	
0 vs 1+	3.7 (1.71 - 8.00)*
<b>State*exempt interaction</b>	
MN exempt N vs Y	0.43 (0.14 - 1.31)
NY exempt N vs Y	0.45 (0.20 - 1.02)
OR exempt N vs Y	0.36 (0.17 - 0.77)*
WA exempt N vs Y	0.11 (0.03 - 0.38)*

Adjusted for all variables in tables. \*Significant at p<0.05.

**Table 4:** Adjusted odds ratio (95% confidence intervals) for noncompliant OSHA recordkeeping practices (separate multivariable regression model for each aspect of recordkeeping) among establishments where OSHA logs maintained by study participant, four states combined (n=2589).

	Case definition	Timing of recording	Counting days
<b>State (vs MN)</b>			
NY	State*trained	0.59 (0.31-1.12)	0.66 (0.34-1.30)
OR		1.16 (0.61-2.21)	1.93 (0.99-3.76)
WA		2.62 (1.38-5.00)*	1.15 (0.50-2.63)
<b>Establishment size (vs. 250+ workers)</b>			
1-10 workers	1.08 (0.55-2.10)	0.42 (0.22-0.77)*	1.36 (0.66-2.81)
11-49 workers	1.64 (0.96-2.79)	0.74 (0.44-1.24)	1.78 (1.04-3.06)*
50-249 workers	1.15 (0.74-1.79)	0.99 (0.65-1.51)	2.72 (1.59-4.65)*
<b>Industry (vs Manufacturing)</b>			
Construction/Ag, Forestry, Fishing Hunting	0.85 (0.35-2.07)	2.94 (1.24-6.99)*	0.85 (0.32-2.27)
Wholesale Trade/Transp, Warehousing/Utilities	0.36 (0.16-0.81)*	2.09 (0.88-4.95)	0.90 (0.35-2.30)
Retail Trade	1.33 (0.52-3.38)	1.02 (0.36-2.88)	0.65 (0.24-1.73)
Information/Financial/Real Estate/Prof Mgmt	0.46 (0.17-1.23)	1.84 (0.68-4.94)	2.96 (0.99-8.92)
Admin, Support, Waste Mgmt, Remed/Other Svc	2.05 (0.60-6.98)	1.66 (0.58-4.70)	0.80 (0.27-2.34)
Education/Health Care, Social Assistance	0.46 (0.19-1.09)	1.65 (0.62-4.40)	1.10 (0.40-3.02)
Leisure and Hospitality	1.03 (0.39-2.71)	1.87 (0.72-4.85)	2.15 (0.71-6.55)
State and Local Government	0.52 (0.22-1.23)	1.87 (0.73-4.78)	2.11 (0.78-5.73)
<b>Union presence</b>			
No vs Yes	1.21 (0.64-2.28)	1.00 (0.52-1.93)	2.42 (1.16-5.04)*
<b>Workers' compensation insurer</b>			
Private + State Funded vs. Self-insured	0.92 (0.52-1.62)	1.32 (0.74-2.34)	2.06 (1.11-3.84)*
<b>Number of worksites operated by employer</b>			
Single worksite vs multiple sites	1.24 (0.68-2.25)	0.67 (0.41-1.11)	5.09 (2.73-9.49)*
<b>SOII experience (vs Repeat Respondent)</b>			
First time SOII respondent	2.30 (1.27-4.19)*	0.86 (0.42-1.75)	1.30 (0.69-2.45)
<b>Trained on OSHA recording</b>			
No vs Yes	state*trained	1.38 (0.85-2.24)	2.07 (1.24-3.43)*
<b>OSHA experience (vs 2-9 years)</b>			
≤1 year	1.00 (0.43-2.33)	2.61 (1.11-6.15)*	11.04 (3.44-35)*
10+ years	1.22 (0.74-2.01)	1.08 (0.65-1.80)	0.80 (0.49-1.32)
<b>Use of workplace injury and illness data</b>			
In competitive bids for contract work N vs Y	3.89 (1.83-8.26)*	1.4 (0.62-3.13)	1.05 (0.48-2.32)
<b>State*OSHA trained interaction</b>			
MN Trained N vs Y	3.77 (1.32-10.8)*		
NY Trained N vs Y	18.48 (6.3-54.5)*		
OR Trained N vs Y	1.00 (0.40-2.48)		
WA Trained N vs Y	2.32 (1.01-5.32)*		

Adjusted for all variables in tables. Also included in models but not significant: usually exempt from OSHA recordkeeping; injury and illness rate; use of workplace injury data for job performance evaluations.

\*Significant at p<0.05.



### 3.4 Knowledge of OSHA injury and illness recording regulations

Participants were presented with five hypothetical work injury scenarios and asked what recordkeeping decisions they would make for each. All participants were asked the scenarios, regardless of their OSHA recording responsibilities. Three scenarios regarding case definitions were asked: whether injuries resulting in stitches were recordable (they are); whether injuries resulting from horseplay were recordable (they are); and whether cases limited to X-rays confirming no broken bones are recorded (they shouldn't be). Additionally, participants were posed two scenarios regarding documenting case severity as related to days of missed work. One involved updating the log to record days of missed work that did not occur until a week after the initial injury; the other asked about recording missed work that was limited to a weekend when the employee was not scheduled to work.

Based on responses, most participants: considered all incidents recordable even when they did not meet the OSHA case definition; correctly indicated that they would update the OSHA log as a case develops over time; and erroneously would limit the number of days of missed work to scheduled shifts (table 5). There were no significant differences by state at  $p < 0.05$ ; the greatest difference was observed for counting weekend days where the percent of establishments that correctly counted weekend days as missed work ranged from 14% in Washington to 30% in Oregon.

**Table 5:** Responses to hypothetical recordkeeping scenarios by state.

	MN	NY	OR	WA	p-value
Study establishments	581	690	1368	701	
Estimated establishments	179,391	342,596	216,152	131,395	
<b>Scenarios related to case definition</b>					
<b>Records Stitches</b>					
Correct	78.3 (4.7)	69.8 (6.3)	68.7 (3.4)	61.6 (5.4)	0.2665
Incorrect	21.7 (4.7)	30.2 (6.3)	31.3 (3.4)	38.4 (5.4)	
<b>Records Horseplay</b>					
Correct	74.7 (5.2)	63.5 (6.4)	69.2 (3.3)	66 (5.4)	0.4419
Incorrect	25.3 (5.2)	36.5 (6.4)	30.8 (3.3)	34 (5.4)	
<b>Omits Diagnostic</b>					
Correct	24.0 (4.4)	24.8 (4.5)	17.1 (2.2)	17.7 (3.2)	0.281
Incorrect	76.0 (4.4)	75.2 (4.5)	83.0 (2.2)	82.3 (3.2)	
<b>Scenarios related to documentation of severity (counting days)</b>					
<b>Counts Weekend</b>					
Correct	27.5 (4.9)	28.6 (5.1)	30.1 (3.7)	14.3 (2.8)	0.0993
Incorrect	72.5 (4.9)	71.4 (5.1)	69.9 (3.7)	85.7 (2.8)	
<b>Updates Log</b>					
Correct	76.3 (4.9)	65.3 (6.3)	67.7 (3.5)	64.6 (5.3)	0.4057
Incorrect	23.7 (4.9)	34.7 (6.3)	32.3 (3.5)	35.4 (5.3)	

Note: Data shown are % of estimated establishments (SE) unless otherwise noted. Incorrect responses include "Don't Know" responses.

Table 6 presents odds ratios for establishment and record-keeper characteristics and incorrect responses to the five hypothetical recordkeeping scenarios, adjusted for

establishment and record-keeper characteristics (table 6-A presents estimates for the state\*training interaction terms significant for two scenarios).

Incorrect responses to each of the five different recordkeeping scenarios were associated with different combinations of establishment or record-keeper characteristics, although some characteristics were found to be associated with multiple scenarios. The industry category Administrative Support and Waste Management and Remediation Services/Other Services consistently demonstrated limited recordkeeping knowledge; the only scenario in which they were no different than the comparison group (Manufacturing) was in the recording of missed weekend days (where all industries demonstrated equally poor knowledge). Participants with no OSHA training were also more likely to answer incorrectly four of the five scenarios. State, limited OSHA recordkeeping experience, and reporting zero injuries and illnesses in SOII were each associated with three scenarios. Inclusion of injury and illness data in competitive bids for contact work was also associated with better knowledge in three scenarios, including the two scenarios answered incorrectly by most participants (omitting diagnostic evaluation and counting unscheduled weekend days as missed work).

#### **4. Discussion**

While some workplace injury and illness record-keepers at SOII-participating establishments exhibit comprehensive knowledge of the injury and illness recording requirements, many record-keepers possess a limited understanding of those requirements. The prevalence of certain practices and knowledge – namely, recording all injuries regardless of severity and a belief that cases limited to diagnostic evaluation should be reported – suggests that many respondents are likely over-reporting cases. Although these cases by definition are minor (involving no days of job restriction or missed work), many establishments are inflating their rate of total OSHA recordable cases. Reliance on the OSHA case eligibility criteria creates a systematic case definition for SOII; when establishments employ their own case definition, the data cannot be used to compare rates of total recordable cases across establishments.

Perhaps more important is the documentation of severity related to counting days of missed work. Given the number of establishments that undercount days of missed work by counting scheduled shift days instead of calendar days and the overwhelming belief that unscheduled weekend days need not be counted as missed work, employer records of work-related injuries and illnesses are likely under-reporting both the duration of missed work, and the total number of cases involving days away from work (DAFW) by failing to accurately classify the severity of the case. These cases may instead appear on the log as a less severe case such as a job transfer or restriction or other recordable case, if they appear on the log at all. Underreporting DAFW cases is particularly relevant for SOII data as DAFW cases are the basis of injury and illness estimates by worker and injury characteristics (e.g., age of injured worker, nature of injury, body part injured).

Compounding the issue of under-reporting is the evidence that suggests differences in record-keeper and establishment understanding of the reporting requirements may result in differential under-reporting. Respondents with limited exposure to OSHA injury and illness records may be more likely to under-report days of missed work than trained, experienced record-keepers at unionized workplaces or establishments that include their OSHA injury data in bid packages.

**Table 6:** Adjusted odds ratios and 95% confidence intervals for incorrect responses to OSHA recordkeeping scenarios (separate multivariable regression model for each scenario), four states combined (n=3342).

	-----Case-related-----			-----Severity-related-----	
	Stitches	Horseplay	Diagnostic Procedure	Weekend Days	Update Logs
<b>State (vs MN)</b>			state*trained	state*trained	
NY	1.12 (0.50-2.51)	1.44 (0.66-3.15)	See table 6-A	See table 6-A	1.28 (0.61-2.71)
OR	1.91 (0.86-4.26)	1.47 (0.69-3.14)			1.72 (0.81-3.63)
WA	2.60 (1.16-5.86)*	1.72 (0.79-3.75)			2.01 (0.94-4.31)
<b>Trained on OSHA recording</b>					
No vs Yes	2.60 (1.28-5.26)*	1.08 (0.51-2.28)	state*trained	state*trained	2.91 (1.50-5.63)*
<b>Establishment size (vs. 250+ workers)</b>					
1-10 workers	0.51 (0.25-1.06)	1.06 (0.52-2.16)	1.41 (0.73-2.73)	1.71 (0.92-3.19)	0.43 (0.20-0.89)*
11-49 workers	0.40 (0.20-0.81)*	0.74 (0.39-1.39)	1.68 (1.00-2.81)	1.83 (1.09-3.08)*	0.40 (0.20-0.79)*
50-249 workers	0.71 (0.41-1.24)	1.41 (0.73-2.73)	1.60 (0.99-2.59)	3.17 (2.09-4.80)*	0.69 (0.37-1.26)
<b>Industry (vs Manufacturing)</b>					
Construction/Agriculture, Forestry, Fishing and Hunting	1.23 (0.44-3.43)	1.53 (0.55-4.30)	1.32 (0.39-4.42)	0.77 (0.28-2.16)	1.15 (0.43-3.08)
Wholesale Trade/Transportation, Warehousing/Utilities	1.33 (0.45-3.89)	0.83 (0.28-2.46)	1.02 (0.35-3.01)	0.74 (0.28-1.93)	1.32 (0.46-3.77)
Retail Trade	1.75 (0.56-5.47)	2.45 (0.84-7.18)	2.19 (0.68-7.08)	1.05 (0.36-3.03)	2.13 (0.72-6.36)
Information/Financial/Real Estate/Professional, Mgmt	2.08 (0.71-6.12)	2.60 (0.86-7.83)	3.94 (1.30-12)*	1.81 (0.63-5.19)	2.30 (0.80-6.58)
Admin, Support, Waste Mgmt, Remediation/Other Svc	4.01 (1.50-10.70)*	2.84 (1.09-7.38)*	4.25 (1.34-13)*	1.47 (0.57-3.76)	4.21 (1.61-10.98)*
Education/Health Care, Social Assistance	2.59 (0.85-7.89)	1.51 (0.50-4.58)	1.90 (0.62-5.84)	1.30 (0.48-3.53)	2.05 (0.67-6.25)
Leisure and Hospitality	2.12 (0.75-6.03)	0.96 (0.34-2.71)	2.08 (0.69-6.27)	0.90 (0.27-2.99)	1.50 (0.54-4.17)
State and Local Government	1.35 (0.46-3.99)	1.41 (0.43-4.62)	1.74 (0.57-5.29)	0.94 (0.37-2.38)	1.21 (0.42-3.49)
<b>Number of worksites operated by employer</b>					
Single worksite vs multiple sites	1.17 (0.66-2.07)	0.71 (0.43-1.19)	2.39 (1.47-3.88)*	1.01 (0.60-1.70)	1.10 (0.65-1.88)
<b>SOII experience (vs Repeat Respondent)</b>					
First time SOII respondent	1.73 (0.92-3.27)	1.48 (0.73-3.01)	2.11 (1.08-4.13)*	1.78 (0.93-3.42)	2.01 (1.03-3.93)*
<b>Injury and illness rate (total OSHA recordable cases)</b>					
0 vs 1+	2.37 (1.32-4.28)*	1.95 (1.01-3.75)*	1.25 (0.70-2.23)	1.61 (0.94-2.76)	2.47 (1.34-4.53)*
<b>Use of workplace injury and illness data</b>					
In competitive bids for contract work: N vs Y	0.95 (0.20-4.51)	1.26 (0.53-3.02)	2.25 (1.02-4.94)*	2.55 (1.15-5.64)*	2.44 (1.07-5.53)*
In job performance eval of supervisors: N vs Y	3.06 (1.22-7.66)*	1.93 (0.56-6.73)	1.24 (0.50-3.05)	1.34 (0.54-3.32)	2.31 (1.01-5.32)*
In job performance eval of record-keeper: N vs Y	2.73 (0.62-12.02)	4.40 (1.37-14.12)*	1.67 (0.63-4.41)	0.90 (0.37-2.19)	2.37 (0.67-8.47)
In worker safety incentive programs: N vs Y	0.34 (0.12-0.99)*	1.68 (0.60-4.76)	2.72 (1.00-7.37)	0.61 (0.27-1.37)	0.57 (0.18-1.74)
<b>OSHA experience (vs 2-9 years)</b>					
≤1 year	4.40 (2.29-8.43)*	2.65 (1.30-5.39)*	0.76 (0.43-1.34)	0.80 (0.43-1.50)	3.08 (1.58-5.99)*
10+ years	2.86 (1.45-5.64)*	1.32 (0.66-2.67)	0.61 (0.36-1.04)	1.23 (0.71-2.13)	2.54 (1.28-5.03)*
DK	6.51 (2.03-20.84)*	5.94 (2.00-17.59)*	0.88 (0.33-2.36)	1.59 (0.55-4.60)	5.91 (1.80-19.40)*

\*Significant at p<0.05. Adjusted for all variables in table and unionization, workers' compensation insurer, exempt from OSHA recordkeeping.

State differences in recordkeeping practices and knowledge persisted after controlling for establishment and record-keeper characteristics. It is unknown what is driving these differences. Three of the four states operate state-plan OSHA programs, and each may place a different emphasis on recordkeeping, both in terms of enforcement and educational outreach activities. Differences in workers' compensation insurer may play a role that was obscured in the comparison of self-insured against all other insurance arrangements. There may have been regional differences in a tendency to default to a "don't know" response (that was grouped with the incorrect responses) instead of providing an answer. State differences in survey administration may also account for some portion of observed differences. These findings may not reflect the recordkeeping practices in the 46 states that did not participate in the survey; however, the large gaps in recordkeeping knowledge demonstrated across the four states suggest that limited understanding of recordkeeping requirements is pervasive.

Workplace injury and illness recordkeeping is a difficult topic to discuss with employers. For many establishments, injuries are rare and thus, recordkeeping is infrequent. The common response of "don't know" provided little in terms of informative answers and made assessment of practices and knowledge difficult. In grouping "don't know" with incorrect responses (for knowledge), or other (for practice responses), the findings can be viewed as 'worst case' estimates; some participants who answered "don't know" may have or will in the future undertake the appropriate recordkeeping action. Additionally, we were unable to assess the recordkeeping practices of the more than 40% of establishments that did not maintain OSHA logs. Many of these establishments reported zero work injuries and illnesses, suggesting one of two possibilities: either recordkeeping is something establishments undertake only after an injury had occurred, or there are no injuries to report because there is no tracking system in which they are documented. Studies other than telephone interviews with employers may be better suited to exploring this issue.

The observed relationship between establishment characteristics (especially size and industry) and recordkeeping wasn't always as expected; for example, smaller establishments were not always the worst performers. This may arise from non-response bias, whereby only the most engaged and knowledgeable record-keepers among smaller establishments participated in the survey, and a greater range of record-keepers participated from larger establishments.

## **5. Conclusion**

The accuracy of the BLS estimates of nonfatal occupational injuries and illnesses is dependent on the quality of the data reported by employers. BLS data accuracy likely suffers from limited understanding of the reporting requirements among workplace record-keepers. Since study record-keeper characteristics (SOII experience, OSHA recordkeeping experience, and OSHA recordkeeping training) were found to be associated with better practices and knowledge, focusing the individual tasked with reporting the data may be an effective means of improving data accuracy. Approaches to increasing record-keeper engagement include: identification of first time SOII respondents (individuals, not establishments) and increased communication between the SOII data collection staff and all respondents throughout the survey period to facilitate an improved understanding of the reporting requirements as well as the importance of the data; enrollment of establishments in SOII for a multi-year period instead of one year to increase familiarity with recordkeeping; and development and dissemination of effective training materials, in collaboration with OSHA, that address common recordkeeping misperceptions.

**Table 6-A:** Adjusted odds ratios (95% confidence intervals) for incorrect responses to hypothetical recordkeeping scenarios for state\*training interaction terms in table 6.

	Diagnostic Procedure	Weekend Days
MN Trained N vs Y	3.87 (1.58-9.50)*	1.62 (0.66-4.00)
NY Trained N vs Y	4.66 (1.81-12)*	5.83 (2.11-16.07)*
OR Trained N vs Y	0.83 (0.39-1.77)	1.25 (0.57-2.72)
WA Trained N vs Y	0.96 (0.41-2.28)	2.99 (1.17-7.65)*
Untrained NY vs OR	0.72 (0.37-1.44)	1.67 (0.75-3.71)
Untrained NY vs WA	0.69 (0.30-1.59)	0.43 (0.17-1.08)
Untrained NY vs MN	0.65 (0.25-1.68)	1.33 (0.54-3.30)
Untrained OR vs WA	0.95 (0.46-1.97)	0.26 (0.12-0.56)*
Untrained OR vs MN	0.90 (0.38-2.13)	0.80 (0.36-1.76)
Untrained WA vs MN	0.95 (0.37-2.47)	3.12 (1.20-8.07)*
Trained NY vs OR	0.13 (0.05-0.35)*	0.36 (0.13-0.98)*
Trained NY vs WA	0.14 (0.05-0.38)*	0.22 (0.08-0.58)*
Trained NY vs MN	0.54 (0.21-1.41)	0.37 (0.14-0.97)*
Trained OR vs WA	1.11 (0.48-2.58)	0.61 (0.26-1.42)
Trained OR vs MN	4.23 (1.85-9.68)*	1.04 (0.44-2.44)
Trained WA vs MN	3.81 (1.63-8.92)*	1.69 (0.73-3.94)

Adjusted for all variables in table 6 and unionized workforce, workers' compensation insurer, usually exempt from OSHA recordkeeping.

\*Significant at  $p < 0.05$

## References

- Boden, LI. 2014. Capture-recapture estimates of the undercount of workplace injuries and illnesses: sensitivity analysis. *Am J Ind Med* 57: 1090-1099.
- Boden, LI, Ozonoff, A. 2008. Capture-recapture estimates of nonfatal workplace injuries and illnesses. *Ann Epidemiol* 18: 500-506.
- Dong, XS, Fujimoto, A, Ringen, K, Stafford, E, Platner, JW, Gittleman, JL, Wang, X. 2011. Injury underreporting among small establishments in the construction industry. *Am J Ind Med* 54: 339-349.
- Mendeloff, J, Burns, R. 2013. States with low non-fatal injury rates have high fatality rates and vice-versa. *American Journal of Industrial Medicine* 56: 509-519.
- Nestoriak, N, Pierce, B. 2009. Comparing workers' compensation claims with establishments' responses to the SOII. *Monthly Labor Review* 132: 8.
- Phipps, P, Moore, D, 2010. Employer Interviews: Exploring Differences in Reporting Work Injuries and Illnesses in the Survey of Occupational Injuries and Illnesses and State Workers' Compensation Claims, Paper presented at the 2010 Joint Statistical Meetings, Vancouver, BC, Canada.
- Rappin, CL, Wuellner, SE, Bonauto, DK. 2016. Employer reasons for failing to report eligible workers' compensation claims in the BLS survey of occupational injuries and illnesses. *Am J Ind Med* 59: 343-356.
- Rosenman, KD, Kalush, A, Reilly, MJ, Gardiner, JC, Reeves, M, Luo, Z. 2006. How much work-related injury and illness is missed by the current national surveillance system? *J Occup Environ Med* 48: 357-365.
- Wiatrowski, WJ. 2014. The BLS survey of occupational injuries and illnesses: a primer. *Am J Ind Med* 57: 1085-1089.
- Wuellner, SE, Adams, DA, Bonauto, DK. 2016. Unreported workers' compensation claims to the BLS Survey of Occupational Injuries and Illnesses: Establishment factors. *Am J Ind Med* 59: 274-289.
- Wuellner, SE, Bonauto, DK. 2014. Exploring the relationship between employer recordkeeping and underreporting in the BLS Survey of Occupational Injuries and Illnesses. *Am J Ind Med* 57: 1133-1143.