WASHINGTON STATE DEPT. OF LABOR AND INDUSTRIES
SHARP PROGRAM

SOII Undercount Research: Washington SOII-WC Record Linkage, 2000 - 2011

FINAL REPORT

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EXECUTIVE SUMMARY

Objectives

This study examines the trend in unreported WC claims to the BLS Survey of Occupational Injuries and Illnesses (SOII) between 2002 and 2011 to assess patterns in underreporting by industry and injury characteristics over time, adding context to the recent declines observed in the BLS SOII data.

Methods

Using the UI account and reporting unit numbers provided in the SOII establishment file, we identified BLS sampled establishments within Washington's UI data from the quarter the SOII sample was drawn. The sampled establishments were mapped through successive quarters within the UI data to identify changes in ownership, physical location, or a break in liability. We then identified individuals employed by SOII respondents during the survey year using the UI account information current at the time of the survey. Using the social security numbers reported in UI data among SOII-participating UI accounts to identify the surveyed workforce, we extracted WC claims among the sampled workforce with an injury date in the survey year in which the establishment participated. Research staff developed SAS code to deterministically link records through an iterative process, linking SOII cases to WC claims based on: worker first name, last name, date of birth or age at injury, and date of injury.

When the sampled establishment represented one of many reporting units within a UI account, unlinked claims among non-sampled units were identified based on discordance between UI and WC employer location data. These claims were excluded from the group of unlinked claims and considered not reportable to SOII. For sampled establishments that represented the entirety of a UI account, we retained all claims among workers whose SSNs were reported in UI for the sampled UI account.

To reduce claims to injuries that resulted in one or more days of missed work, thus meeting the SOII DAFW case criteria, we used WC indemnity payment information. State funded claims that received payments for missed work, or self-insured claims classified as eligible for time loss payments were considered to have met the missed work criterion to be recordable as a DAFW case. We then used claim event dates to indicate whether the missed work occurred within the survey year.

Generalized linear models were used to assess the trend in reporting over time. Logistic regression methods were used to isolate the effect of establishment and injury characteristics on underreporting.

Results

Between 2002 and 2011, underreporting ranged from a low of 30.6% of SOII-eligible WC time loss claims in 2006 to a high of 38.9% in 2010. During the first five years of the study period (2002 – 2006), underreporting was found to decrease annually by an estimated 0.8%. The decrease was followed by an increase in underreporting, between 2007 and 2011, of an estimated annual increase of 2.1%. Despite the observed increase in underreporting, the total estimated number of SOII-eligible WC time loss injuries (based on reported and unreported claims) decreased over the ten year span.

Claims from establishments in Health Services, Public Administration, Transportation, Educational Services, Agriculture, Forestry, Fishing, Construction, Services (other than health, educational and social), and Communications, Electric, Gas, Sanitary Services were less likely to be reported compared to claims among Manufacturing establishments. Underreporting increased most among Educational Services, Transportation, and Health Services. In Wholesale Trade, Manufacturing, and Agriculture, Forestry, and Fishing the rate of underreporting did not change over the ten year period. In Retail Trade, underreporting decreased.

Claims for injuries from bodily reaction and exertion were more likely to be unreported compared to injuries resulting from falls or injuries from contact with objects and equipment. Underreporting was found to increase over time among both injuries from bodily reaction and exertion and injuries for contact with objects and equipment, and remained constant for injuries from falls.

Claims for sprains, strains, tears were more likely to be unreported compared to most other traumatic injuries. Non-traumatic diseases, conditions, or disorders were more likely to be unreported compared to sprains, strains, tears. Underreporting increased among: Sprains, strains, tears; non-specified traumatic injuries; non-traumatic diseases, conditions, disorders. Underreporting increased slightly among Fractures and Multiple traumatic injuries in the same ten year time period and did not change for Bruises and contusions.

INTRODUCTION

The US Bureau of Labor Statistics (BLS) provides annual national and state estimates of nonfatal occupational injuries and illnesses based on approximately 230,000 employer reports of OSHA recordable cases collected through the Survey of Occupational Injuries and Illnesses (SOII) (US Department of Labor, 2012). According to the BLS, SOII is the nation's largest occupational injury and illness surveillance system.

Increasingly, evidence suggests that the BLS does not accurately estimate the true burden of occupational injuries and illnesses through the annual survey of employers, although estimates of the BLS undercount vary widely (Boden and Ozonoff, 2008; Leigh et al., 2004; Oleinick and Zaidman, 2010; Rosenman et al., 2006). In response to the most recent concerns of underreporting injuries and illnesses on employer OSHA logs and in the SOII, the federal government undertook efforts to better understand employer recordkeeping. The US Government Accountability Office evaluated OSHA's audit procedures used to verify the workplace injury and illness data collected through OSHA's Data Initiative (US Government Accountability Office, 2009); OSHA initiated a national emphasis program for recordkeeping (US Department of Labor, 2009); and BLS supported both intramural and extramural research projects to examine the nature of the observed undercount (Ruser, 2010).

As part of the BLS-sponsored undercount research, the Safety and Health Assessment and Research for Prevention (SHARP) Program at the Washington State Department of Labor and Industries (L&I) received funding to explore injury and illness reporting through a data linkage project to match twelve years of Washington SOII data to Washington workers' compensation (WC) claims data.

Research aims of record linkage

In 2009, BLS funded research to link 2007-2008 SOII data for California establishments and 2006 – 2008 SOII data for Washington establishments to the respective state's WC claims data in order to investigate the underreporting of cases in SOII compared to WC claims data. Both studies found underreporting in SOII compared with state workers' compensation claims data although the estimated magnitude of the undercount is difficult to compare due to differences in data availability and the methods used to estimate the undercount. Among SOII-eligible Washington WC claims with key claim event dates in or shortly after the survey year, an estimated 70% were captured by SOII. One question that remained was whether the trend in underreporting was consistent from year to year – and especially salient issue in light of the observed trend in declining BLS estimates of occupational injuries and illnesses over time. In other words, an increasing undercount from year to year may explain the declining BLS rates.

To evaluate the trend in reporting, BLS funded an additional study in Washington State to link twelve years of Washington SOII data to the Washington WC claims data. The aims of the study are to:

1. Assess annual reporting of injuries and illnesses in SOII compared with WC;
2. Evaluate whether the trends in reporting differ over time; and
3. Identify establishment or case characteristics associated with differences in reporting trends.

METHODS

Data Sources

BLS SOII Case and Demographic Data

BLS administers SOII annually in partnership with participating states to estimate the incidence of nonfatal OSHA-recordable work-related injuries and illnesses. SOII includes both public and private sector employment except for federal employees, private household workers, farms with fewer than 11 employees, and the self-employed. Each year, establishments are randomly sampled from the Longitudinal Establishments Database (LDB) which consists of unemployment insurance (UI) account information collected by state employment security agencies.[1]

Prior to the survey year, BLS mails a letter to sampled establishments instructing them to record all injuries and illnesses that occur during the survey year in accordance with OSHA recordkeeping regulations. Establishments otherwise exempt from OSHA recordkeeping requirements based on industry or employment size are eligible for participation in SOII and are required to maintain OSHA injury and illness recordkeeping forms, like the non-exempt establishments, for the duration of the survey year. After the survey year has ended, participating establishments provide the BLS with two types of injury and illness data: 1. aggregate numbers of OSHA recordable cases and 2. detailed worker and incident information on injuries and illnesses occurring in the survey year that resulted in one or more calendar days away from work (DAFW) beyond the day of injury. Case reports are then coded to classify the event, source, body part, and nature of the reported injury or illness. Based on these employer reports, BLS publishes estimates of the total numbers and rates of occupational injuries and illnesses.

To link SOII and WC records, two types of SOII data were obtained:

1. Establishment files that include characteristics such as industry, size, address, and aggregate totals of OSHA recordable injuries that occurred during the survey year; and
2. The case and demographic data for DAFW injuries and illnesses that includes worker name, date of injury, description of the injury, number of days of missed and restricted work, and other case characteristics.

BLS supplied data for Washington establishments for survey years 2000 – 2011.

Washington Workers Compensation Data

Washington mandates workers' compensation insurance for all employers operating in the state except those covered by an alternative workers compensation system (e.g. Harbor and Longshore worker, Federal workers – Office of Workers Compensation Programs)[2] or are specifically exempt from requirements for mandatory insurance as listed in state statute.[3] Elective workers compensation insurance is available for self-employed workers.

Washington employers are required to purchase workers' compensation insurance from the Washington State Fund unless they are able to self-insure. The Washington State Fund is administered

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[1] Mining and railroad establishments are not sampled from the LDB; instead, injury and illness data in these industries are submitted to BLS by MSHA and FRA, respectively.

[2] See Revised Code of Washington, Title 51.12 'Employments and Occupations Covered' http://apps.leg.wa.gov/rcw/default.aspx?cite=51.12

[3] Employments excluded from mandatory workers compensation coverage include: the self-employed; family members younger than 18 working on family farms; domestic servants; sole proprietors, partners or corporate officers; jockeys; newspaper vendors or delivery persons; contract musicians, and insurance brokers. See Revised Code of Washington, Title 51.12.020 'Employments excluded' http://apps.leg.wa.gov/rcw/default.aspx?cite=51.12.020

by L&I. Of the approximately 160,000 Washington employer workers' compensation accounts, 99.75% are insured through the State Fund, covering approximately 70% of all workers in the state. The remaining workers' compensation accounts (approximately 400) are self-insured and typically represent large employers (e.g. Boeing, Microsoft). Companies must meet specific requirements to self-insure and the self-insurance program has significant oversight and reporting requirements to L&I.[4]

Each employer in Washington State has a workers' compensation policy. The policy may cover one or more accounts, and each account may comprise one or more business locations. Workers compensation accounts are associated with the employer's Uniform Business Identifier (UBI). The UBI is a Washington State specific employer identifier that links an employer across state government administrative databases (e.g. the Washington State Department of Labor and Industries, the Washington State Employment Security Department, and the Washington State Department of Revenue). A workers' compensation policy, account and business location each has an assigned address within the workers' compensation system.

In Washington, a workers' compensation claim is initiated by an injured or ill worker seeking medical care from a health care provider. The injured worker and health care provider complete a report of accident form which is sent to either the state fund or the self-insured employer or the self-insured employer's third party administrator. Differing from many WC systems operating in other states, the employer does not initiate a workers compensation claim in Washington, and while a worker is required to report an injury to his employer, he may not do so. Regardless, the employer is always notified by L&I of a workers compensation claim. The statute of limitations for filing a workers' compensation claim for an occupational injury is one year after the injury.[5] For an occupational disease the statute of limitations is two years after the written notification from a health care provider for eligibility to file a claim.[6]

Workers compensation claims are accepted and rejected as work-related by trained claims adjudicators in accordance with Washington State statutes, rules, and case law. Every filed claim is retained in the L&I database, whether eligible for wage replacement, accepted for medical-aid only, or rejected. Medical treatment, wage replacement benefits and all other billed services are linked to the claim identification number and maintained in L&I databases. In Washington, the waiting period for wage replacement eligibility is three calendar days after the date of injury. The date of injury is not counted towards any part of the waiting period for wage replacement eligibility. If the worker remains disabled at 14 days, the first three days of time loss are paid. The number of time loss days paid is captured in these databases as are employer protests, formal legal appeals by the employer, timing of claim adjudication processes (e.g. disability determination, assignment of total permanent disability), and employer apportionment of occupational disease.

Claimant (worker) identifiers include name, date of birth, sex, and social security number. Each claim has a date of injury and a date in which the department received the claim (claim established date). Claims may be assigned a date of injury based on adjudication and legal proceedings associated with the claim. State funded claims also have the date of the first medical visit, the date the claimant was first unable to perform the job of injury (disability date), and the date the department made the initial payment for wage replacement (first time loss payment date). All compensable claims (State Fund and self-insured) are coded for nature of injury, body part, event or exposure, and source according to the Occupational Injury and Illness Classification System 2007 (OIICS). Accepted non-compensable State Fund claims are also coded; accepted non-compensable self-insured claims are not.

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[4] See Revised Code of Washington, Title 51.14 'Self-Insurers' http://apps.leg.wa.gov/RCW/default.aspx?cite=51.14

[5] See Revised Code of Washington, Title 51.28.050 – 'Time limit for filing application or enforcing claim for injury' http://apps.leg.wa.gov/RCW/default.aspx?cite=51.28.050

[6] See Revised Code of Washington, Title 51.28.055 – 'Time limitation for filing claim for occupational disease ' http://apps.leg.wa.gov/RCW/default.aspx?cite=51.28.055

Washington Unemployment Insurance Data

The Washington State Employment Security Department (ESD) collects and maintains unemployment insurance (UI) data on Washington employers subject to UI coverage. Employers are assigned an account, which may be divided into individual locations or 'units' designated by a reporting unit number. UI data contains physical location address data for reporting units.

Employers are required to file employment and wage information for their UI account with ESD. For each active UI account, employers submit quarterly reports that include the name, social security number, total hours worked, and wages paid for each individual employed that quarter. Note that worker data are reported at the level of the UI account and not the more granular reporting unit. ESD also assigns industry codes based on the establishment's primary economic activity.

UI data bridges the SOII and WC data. UI data, submitted to BLS for the Quarterly Census of Employment and Wages, is used to populate the LDB which serves as the sample frame for SOII. UI data can be linked to WA WC data through the Washington State UBI number. WC claims among a SOII sampled workforce can be identified by linking WC claims data to UI data through worker names and social security numbers.

Washington UI data are available to SHARP researchers through an agreement with ESD.

Changes in data from 2000 – 2011:

Effective January 1, 2002, OSHA's Recordkeeping Rule underwent significant revisions. Because BLS relies on the OSHA case definition to determine which workplace injuries and illnesses are SOII reportable, these revisions to the OSHA recordkeeping regulations changed the types of cases required to be reported in SOII. Thus, data recorded prior to 2002 is considered not readily comparable to data recorded under the new rules and constitutes a break in SOII injury and illness data. Relevant WC regulations remained unchanged from 2000 through 2011, however, changes in the OSHA recordkeeping rules impact the comparability of SOII data with WC claims data.

Specific changes to the rule impacting recordability criteria for determining DAFW cases and inclusion in the SOII case and demographic file or comparability to WC claims are:

- Counting calendar days instead of workdays
  {The OSHA counting convention adopted as part of the 2002 changes is more closely aligned with WA WC guidelines for measuring duration of missed work – as of 2002, both use calendar days to count missed work. Prior to the 2002 changes, it is possible that an injury eligible for wage replacement in WC would not meet the OSHA recordable case criteria, and thus not included in the SOII case and demographic data, because time loss occurred when the worker was not scheduled to work. However, given the three-day waiting period for time loss eligibility in WA, prior to 2002, the worker would need to have been off the schedule for more than three days to be eligible for wage replacement yet not classifiable as DAFW; simply missing work over the weekend would not be sufficient to be eligible for wage replacement payments.}
- Requiring a significant degree of aggravation for a preexisting injury or illness to be considered work-related
  {Prior to 2002, any new event or exposure was considered a new OSHA recordable case. WA WC defines aggravation as "a worsening of a once-fixed and stable occupational injury or disease that leads to temporary or permanent increase in disability". When the preexisting injury or illness is work-related, a closed claim will be opened provided there is proof of aggravation or worsening of the condition. But "the worsening cannot be due to an unrelated condition, natural progression, or a new injury." When the preexisting injury or illness is not work-related, L&I will pay for medical treatment if the condition was worsened or aggravated by a work-related exposure or injury. The pre-2002 OSHA definition may lead to multiple exposure-based cases that link to a single claim from an earlier date. The 2002 OSHA definition narrows the criteria,

stipulating a "significant degree of aggravation" for the case to be recordable, and providing employers with justification for not recording a particular case. Again, the 2002 change may align the OSHA definition more closely to the WA WC practices.}

- Extending exceptions to the definition of work-relatedness to cases involving the eating and drinking of food and beverages, common colds and flu, blood donations, exercise programs, mental illness
  {Similar to the OSHA recordkeeping changes adopted in 2002, mental illness caused by stress, common colds and flu, and voluntary blood donations are not covered by WA WC. WC coverage also does not extend to: participation in social activities, recreational or athletic activities, event or competitions, and parties or picnics unless participation occurs during work hours, the employer paid the worker to participate, or the employee was ordered or perceived to be ordered to participate by the employer. Again, the 2002 change may align the OSHA definition more closely to the WA WC practices.}
- Excluding motor vehicle accidents occurring on a company parking lot or company access road while the employee is commuting to or from work
  {Parking lot injuries are viewed similarly in WA WC, excluding from coverage "parking areas" and time spent going to or coming from the employer's place of business (however, coverage includes time spent going to and from work on the jobsite).}
- Requiring employers to establish procedure for employees to report injuries and illnesses
  {Establishing an employee reporting system may increase the number of cases recorded on the OSHA log in two ways: 1. employee reporting would increase the number of injuries made known to recordkeepers that, prior to implementation of such a system, recordkeepers would not have known about, or 2. recordkeepers may have had knowledge of all injuries and illnesses, if only through notification from L&I after a worker had filed a claim, but recorded on the OSHA log only injuries reported internally. Increasing internal reports of injuries may have increased the number of cases meeting a recordkeeper's [erroneous] case recording criteria.}
- Enhancing employee privacy
  {The 2002 OSHA rules prohibit employers from recording the names of workers on the 300 log for certain types of injuries and illnesses. Complicating the attempt to match SOII cases lacking worker names to WC claims, this may result in more unmatched injuries. However, we encountered this issue in the 2006 – 2008 data match and were able to identify matches using other data elements.}

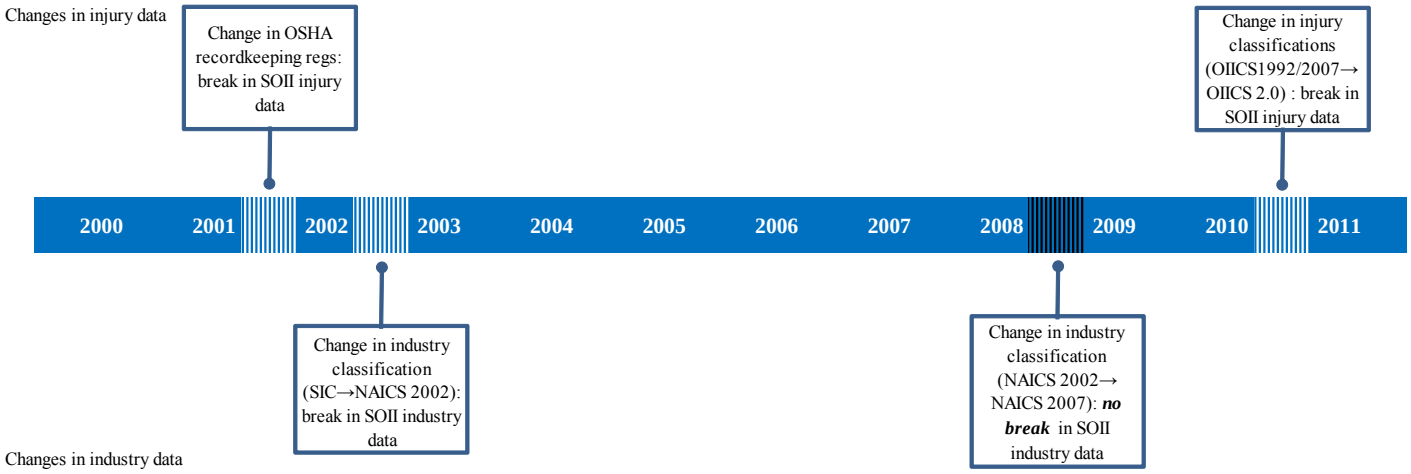
Several other OSHA recordkeeping changes were effective January 1, 2002. It is unclear to what degree, if any, they impact SOII inclusion and/or comparability to WC claims. These include:

- Introducing new forms to the replace the OSHA No. 200 form: the OSHA Form 300, Log of Work-Related Injuries and Illnesses; OSHA Form 300A, Summary of Work-Related Injuries and Illnesses; and the OSHA Form 301, Injury and Illness Incident Report.
- Clarifying recordable injuries and illnesses as those resulting in: death, days away from work, restricted work or transfer to another job, medical treatment beyond first aid, loss of consciousness, or diagnosis of a significant injury or illness by a physician or other licensed health care professional.
- Requiring the same recording criteria (listed in previous bullet point) of both injuries and illnesses whereas prior to 2002, all illnesses were recordable.
- Including new definitions of medical treatment, first aid, and restricted work.
- Clarifying the recording of "light duty" or restricted work cases as restricted from "routine job functions", defined as work activities the employee regularly performs at least once weekly.

- Requiring the recording of all needlestick and sharps injuries involving contamination by another person's blood or other potentially infectious material.
- Allowing employee access to individual 301 forms.
- Requiring certification of summary (300A form) by company executive.

Changes to OSHA recordable case criteria are necessarily reflected in SOII data, dictating which injuries and illnesses are to be included in or excluded from the survey. There were additional changes in SOII data that were unlikely to impact case reporting or matching to WC claims but do affect the comparability of data over time, namely changes in the injury classification and industry coding systems that were adopted between 2000 and 2011 (see figure below).

Changes in SOII data, 2000 - 2011



Record Linkage

Establishments excluded from the study

Not all establishments that participated in SOII were included in the linkage study. Establishments were excluded for one of three reasons: establishments were present in the SOII file but without UI account information; establishments with SOII-provided UI account information could not be found within the WA UI data; and establishments were not covered by the WA Industrial Insurance (i.e., WC) system. Railroad and mining establishments are not sampled from the LDB and their UI account information is not recorded in SOII data. Industry classifications, available in UI as either SIC codes (for all years) or NAICS codes (for years 2002 – 2011) were used to identify the water transportation, ship and boat building, seafood product preparation and packaging, and fishing establishments that have workers' compensation covered through either the Longshore and Harbor Workers Compensation Act or the Jones Act. The ownership code in UI was used to identify establishments owned by tribes – as sovereign tribes they are not required to participate in Washington's Industrial Insurance system.

Identifying BLS participants in Washington workers' compensation data

Using the UI account and reporting unit numbers provided in the SOII establishment file, BLS sampled establishments were identified within Washington's UI data from the quarter when the sample

was drawn, i.e., seven quarters prior to the beginning of the survey year. The sampled establishments were mapped through successive quarters within the UI data to identify changes in ownership, physical location, or a break in liability (e.g., a quarter in which there was no employment reported).

Next, we identified individuals employed by SOII respondents during the survey year using the UI account information current at the time of the survey. Worker identifiers for individuals reported in at least one of the four quarters of the survey year among SOII-participating UI accounts were extracted from the Washington UI database. These SOII-participating UI accounts were either a. sampled in their entirety or b. limited to a reporting unit. When a SOII establishment represented a report unit, rather than the entire UI account, the workforce identified from the UI account data was greater than the workforce sampled, since workers are reported at the UI account level. Establishment characteristics were used later in the record linkage process to limit workers to those employed at the sampled reporting unit. A discussion of this process occurs later in this section (see section titled *Identification of WC claims that meet SOII case criteria*)

Using the social security numbers reported in UI data among SOII-participating UI accounts to identify the surveyed workforce, we extracted WC claims among the sampled workforce with an injury date in the survey year in which the establishment participated. All workers' compensation claims for individuals with identified SSN were extracted regardless of claim liability status, meaning rejected claims, claims for medical-aid only, and indemnity claims were extracted for linking to SOII cases.

Linking BLS cases and Washington workers compensation claims data

Record linkage to WC claims was attempted for all cases reported in SOII by included establishments. To allow for differences between SOII and WC in the characterization of missed work, no restrictions were made to the WC claim population prior to linking. This approach identified more claims than are likely eligible for reporting in SOII (similar to extracting all claims for an entire UI account when SOII participation was limited to a reporting unit). Record level exclusions were applied after the linkage process was complete.

Research staff developed SAS code to deterministically link records through an iterative process, altering the linking criteria of one or more variables in each successive attempt. SOII cases linked to WC claims based on the following data elements: worker first name, last name, date of birth or age at injury, and date of injury. First and last names were allowed to match identically or phonetically; on later attempts, first name was also allowed to match on first initial or not at all. Over the course of the multiple record linkage attempts, the matching requirement for date of birth was broadened iteratively from exact match between SOII and WC to within 7 days, 31 days, 65 days, 365 days, 3,660 days, and finally 7,220 days. For cases where date of birth was not provided, the age at injury was allowed to vary from exact, to within 1 year, then within 10 years. After each iteration, potential links were manually reviewed by research staff to confirm that the new criteria identified true matches.

Linking iterations followed a hierarchy so that links to the more relevant claims preceded other attempts. Links to claims with wage replacement were attempted prior to links among medical only claims, with all other variables being equal. Linkages were first attempted among the SOII cases in the 'final cases' file and then followed by an attempt to link cases in the 'unusable case' file. Once linked, both cases and claims were removed from the group of records available for subsequent linkage attempts.

Record linkage procedures resulted in three groups of records: linked SOII-WC cases, unlinked SOII cases, and unlinked WC claims. As noted above, more WC claims were extracted than were expected to meet the SOII case reporting criteria because they were either a. employed by the sampled employer some location other than the sampled reporting unit or b. filed for an injury that did not result in missed work (e.g. rejected claims). This necessitated reducing claims to those eligible for SOII as a DAFW case.

Claims among workers employed at a location other than the sampled unit were identified using employer and establishment identifiers. When the sampled establishment represented one of many reporting units within a UI account, unlinked claims were removed based on discordance between UI and WC data on: employer UBI; employer city, and employer street. When the UBI, city, or street of the WC business location associated with the unlinked WC claim differed from the UBI, city, or address of the physical location data for the sampled reporting unit or from the reporting unit associated with the majority of linked SOII-WC cases, the unlinked claim was considered to be associated with a reporting unit other than the sampled unit. These claims were excluded from the group of unlinked claims and considered not reportable to SOII. For sampled establishments that represented the entirety of a UI account (defined as a reporting unit='00000' and a reporting unit description='All WA State Employees'), all claims were retained since these workers were reported in UI data as working for the sampled UI account.

Workers with multiple employers in the quarter of injury required an additional step to link the unmatched claim to the appropriate employer. Identifying workers from the UI data among sampled employers established a link between the worker and the sampled employer, but not necessarily between the claim and the sampled employer. For workers with multiple employers, the unmatched claim may have been assigned in WC to a SOII establishment or to an employer not participating in SOII. To link the unmatched claims to the sampled establishment, claims were retained when the claim UBI matched the establishment UBI, or, in the case of non-matching UBI, when the name of the company assigned the claim in WC was more similar to the name of the SOII-sampled company than the name of the worker's additional employer(s) as documented in UI.

To identify claims for injuries that resulted in one or more days of missed work (thus meeting the SOII DAFW case criteria), we used WC indemnity payment information. State funded claims that received payments for missed work, or self-insured claims classified as eligible for time loss payments[7] were considered to have met the missed work criterion to be recordable as a DAFW case. Claims limited to payments for medical-aid only, rejected claims, and claims classified as eligible for some other indemnity payment (such as loss of earning power, kept on salary) lack conclusive evidence of missed work and were therefore removed from the pool of unlinked claims. Once we limited unlinked claims to injuries resulting in missed work, we used claim event dates to indicate whether the missed work occurred within the survey year. When the WC date for first medical treatment, claim establishment, disability, or initial time loss payment occurred after the survey year, records (both linked and unlinked WC claims) were excluded from further analyses. Although these injuries occurred during the survey year and eventually resulted in missed work, the claim data suggested the missed work did not occur until after the survey year concluded and thus, would not have been recordable as a DAFW case during the survey year.

We used the WC injury date to remove unlinked claims outside of the BLS subsample instructions. For establishments asked to report on a subsample of cases based on the injury date (e.g. injuries that occurred in the first three months of the year, or injuries that occurred on the 15th day of the month), any unlinked claim with an injury date outside the subsample timeframe was removed from the group of unlinked claims.

All records in the BLS 'unusable' case file – both linked and unlinked – were excluded from analyses. Linking claims to cases reported in the 'unusable' file identifies claims that may otherwise have been considered unlinked or unreported.

The linking procedures allowed for a WC claim to be associated with more than one sampled establishment. This occurred when a claimant worked for a UI account with multiple sampled reporting

[7] No lost time payment information, such as total days missed or total amount awarded for missed work, is captured for self-insured claims, only their status as eligible for time loss payments.

units and few differences among the units' physical location data. When available, the accident city documented in the WC claim data as used to link the claim to the appropriate reporting unit. If the WC accident city was a location other than the physical location city of the sampled report unit, the claim was considered outside the scope of the sampled workforce and excluded from the analysis. In some cases, the data available were insufficient to assign a claim to a single reporting unit. Whenever possible, distinct claims were analyzed to avoid "double counting" unlinked claims. For example, a single claim associated with three grocery store establishments located in the same city would be considered as one unlinked claim and not three.

SOII case weights were applied to both linked and unlinked WC claims. Unlinked claims were assigned the case weight associated with the establishment determined to be responsible for reporting the claim. When an unlinked WC claim was associated with more than one sampled establishment, the weights were averaged into one case weight.

Analysis

Reporting patterns over the twelve year period are described by industry, injury type, and event or exposure leading to injury or illness. Generalized linear models were used to estimate the change in underreporting over time. Logistic regression models were used to test the association between the survey year and underreporting, as well as between establishment or case characteristics and the probability of a claim being unreported.

Establishments were grouped into the following 14 categories based on the SIC codes assigned in UI data:

Industry description	**SIC codes**
Agriculture, Forestry, and Fishing	0
Construction	15-17
Manufacturing	2-3
Transportation	40-47
Communications, Electric, Gas, Sanitary Services	48-49
Wholesale Trade	50-51
Retail Trade	52-59
Finance, Insurance, and Real Estate	60-67
Health Services	80
Educational Services	82
Social Services	83
Services other than hlth, ed, soc	70-79, 81, 84-89
Public Administration	9
Unclassified	blank

We used to following event or exposure and nature of injury groupings to assess reporting trends in injury characteristics. OIICS division groupings were used to assess event or exposure. Nature of injury or illness codes were grouped based on frequency rankings, following the hierarchical structure of the OIICS system. The Washington State Dept. of Labor and Industries developed a crosswalk between the ANSI and OIICS codes, allowing us to use OIICS (2007) codes for the full ten years of the study period.

Event or exposure description	2007 OIICS code
Assaults and violent acts	6
Bodily reaction and exertion	2
Contact with objects and equipment	0
Exposure to harmful substance or environment	3
Falls	1
Fires and explosions	5
Other events or exposures	9
Transportation accidents	4
Nonclassifiable	9999

Nature of injury description	2007 OIICS codes
Sprains, strains, tears	021
Fractures	012
Bruises, contusions	043
Multiple traumatic injuries and disorders	08*
Nonspecified injuries and disorder	097*
All other traumatic injuries	All other 0* codes
Nontraumatic/nonacute injuries	1*, 2*, 3*, 4*, 5*, 8*
Nonclassifiable + Missing	9999, Blank

The research study was approved by the Washington State Institutional Review Board.

RESULTS

Linkage Results

Of the 58,835 establishment records from 2000 – 2011 Washington SOII data, 5,382 establishments (7.3%) were excluded because they: lacked UI identifiers in SOII data (4,279 railroad and mining establishments not sampled by BLS); were not identified in WA UI data using SOII UI identifiers (28 establishments); or were not covered under the WA WC system (1,075 establishments identified through industry classification codes or UI ownership codes). A total of 53,453 establishment records over twelve years of survey data were included in the record linkage study; the percent included ranged from 89.8% in 2006 to 91.8% in 2011. See Figure 1 for percent of SOII establishments meeting the exclusion criteria by year.

Case reports among included establishments totaled 94,123. After executing the linking algorithm, 91,678 cases (97.4%) matched a WA WC claim.

Limiting records (linked cases and unlinked claims) to those with WC evidence of work absence in the survey year, and removing rejected claims, claims for medical-aid only which may have resulted in 0 or up to three days of missed work, indemnity claims awarded for something other than missed work, and lost time claims for work absence that first occurred after the survey year brought the total number of records to 47,985 linked records and 23,759 unlinked WC claims. Annual SOII-eligible WC claims ranged from 5,011 records in 2001 to 7,762 records in 2006 (See Figure 2).

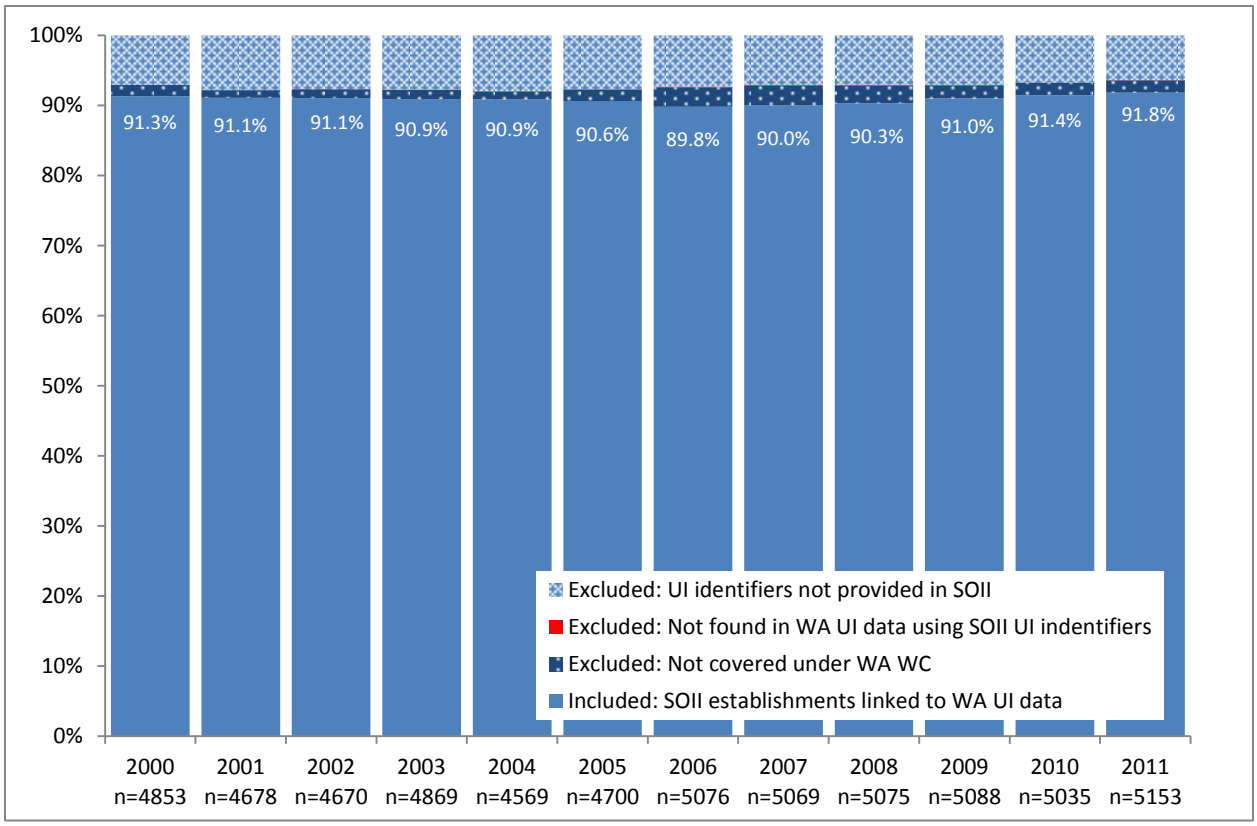


Figure 1. SOII-participating WA establishments by inclusion, exclusion criteria for linking to WA WC data, 2000 - 2011

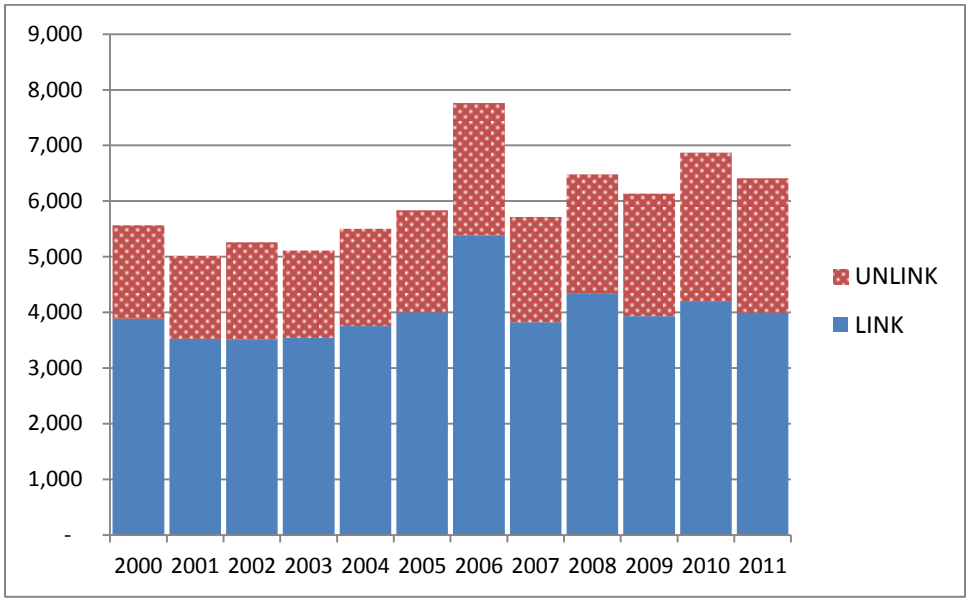


Figure 2. Number of SOII-eligible WA WC time loss claims by year and record linkage results.

Trends in Reporting

Among SOII-eligible WC claims, the percent of unlinked (or unreported) claims increased over time, from a low of 29.7% of SOII eligible claims in 2001 to a high of 38.9% in 2010 (Figure 3). In the years following the 2002 OSHA recordkeeping regulation changes, the least amount of unlinked claims occurred in 2006, with 30.6% of SOII-eligible claims not linked to a SOII case. The largest year-to-year increase in unreported claims occurred between 2008 and 2009, when the percent of total claims unreported increased 3.0%. Over the ten year period, underreporting increased each year by an estimated 0.8% ($p<.0001$). However, there were two distinct patterns: between 2002 and 2006, underreporting decreased slightly (0.4% per year, $p=0.02$), and between 2007 and 2011, underreporting increased by an estimated 2.1% ($p<.0001$).

Between 2002 -2011, approximately half of all unlinked claims were associated with UI accounts sampled in their entirety and half were associated with establishments sampled at a UI reporting unit. The greatest difference in the proportion was observed for 2009, where 58% of unlinked claims were associated with a sampled reporting unit, compared with 42% from sampled UI accounts (data not shown).

For each survey year from 2002 through 2011, rates of underreporting were lower among sampled UI accounts compared with sampled reporting units (Figure 4). Among UI accounts sampled in their entirety, unreported claims made up as little as 24.1% of all SOII-eligible WC claims in 2003 and as much as 32.1% of all SOII-eligible WC claims in 2010. Among sampled reporting units, unlinked claims ranged from 38.1% of SOII-eligible claims in 2006 to 46.1% of SOII-eligible claims in 2010. On average, the percent of claims unlinked among sampled reporting units was 15% greater than the portion of unlinked claims among UI accounts.

Between 2003 and 2011 among sampled UI accounts, the percent of unreported SOII-eligible claims either increased or experienced no change from the previous year. In the same time period, underreporting decreased among report units in 2006 and again in 2008. In general, the change in underreporting from one year to the next was usually greater among sampled report units than sampled UI accounts. For example, between 2008 and 2009, unreported claims increased from 40.6% to 45.3%

among sampled report units and from 27.8% to 28.0% among sampled UI accounts. For sampled reporting units, the greatest one year increase in the percent of claims unreported was observed in 2009 (a 4.7% increase); for sampled UI accounts, the greatest one year increase occurred the following year in 2010 (a 4.1% increase). For both sample units, underreporting peaked at the end of the ten year study period (32.1% of SOII-eligible claims among sampled UI accounts in 2010 and 2011 and 46.1% among sampled reporting units in 2010).

Applying the SOII case weights to the SOII-eligible WC claims, both linked and unlinked, produced estimates of unreported claims that ranged from a low in 2007 of 28.9% to a high in 2002 of 42.8% (Figure 5). The pattern of underreporting for both claim counts and estimated injuries was similar, especially in years 2008 – 2011, where the patterns converged; both the magnitude of underreporting and the year over year trend in underreporting were similar for claim counts and weighted estimates.

Using the survey weights to estimate the total number of time loss injuries, both reported and total injuries decreased between 2002 and 2011 (Figure 6). Note that based on the study case inclusion criteria, these injuries are defined as 'injuries with work absence in the survey year and eligible for WC compensation for missed work' and differ from the SOII DAFW case definition. Also, the figure presents total estimated numbers of injuries and not an injury rate.

Trends in reporting by workers' compensation insurer

Self-insured claims made up a disproportionate share of unreported cases. Between 2002 and 2011, claims from self-insured employers averaged 57.7% of the total number of SOII-eligible claims among sampled establishments and 65.0% of all unreported claims. Claims among state funded employers averaged 42.3% of total claims and 35.0% of unreported claims. In each year, the rate of unreported self-insured claims exceeded the rate of unreported state funded claims (Figure 7), with the greatest difference observed in 2010 (45.2% unreported self-insured claims compared with 28.2% unreported state funded claims). Underreporting increased among both groups, although the rate of change was greater among self-insured claims (annual increase of 2.0% among self-insured claims compared with 0.4% among state funded claims, 2006 – 2011).

Distinguishing between workers' compensation insurer and sampled unit, claims among self-insured establishments sampled as a reporting unit had the highest rates of underreporting (Figure 8). Between 2006 and 2009, underreporting was similar for state funded UI account, self-insured UI accounts, and state funded sampled reporting units. The greatest overall increase in underreporting was observed among self-insured UI accounts (annual increase of 1.5%) and the lowest among state funded UI accounts and self-insured reporting units (an annual increase of 0.1% for each).

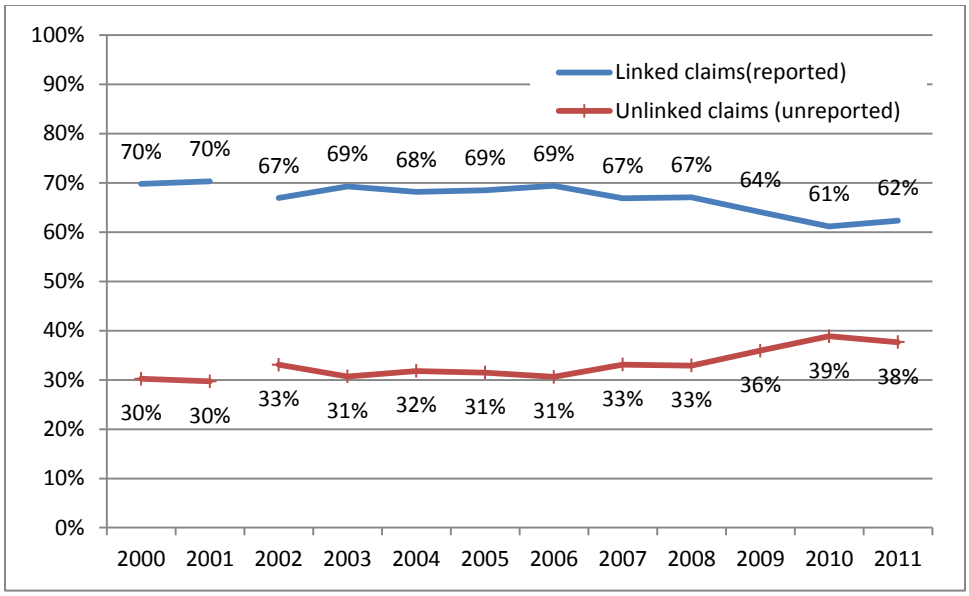


Figure 3. Percent of SOII eligible WA WC time loss claims by record linkage result, 2000 – 2011.

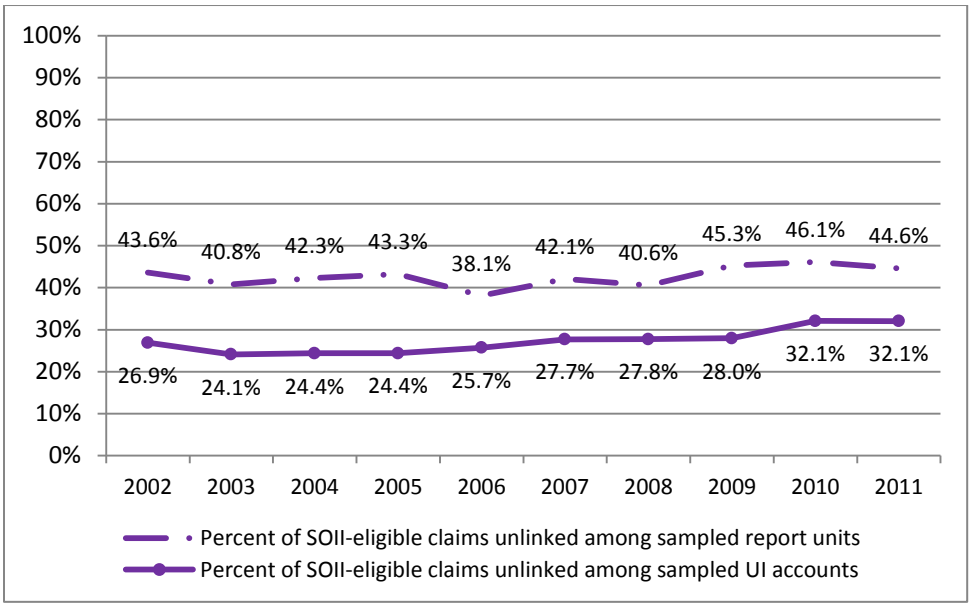


Figure 4. Annual percent of SOII-eligible WA WC time loss claims unlinked among sampled unit, 2002 – 2011.

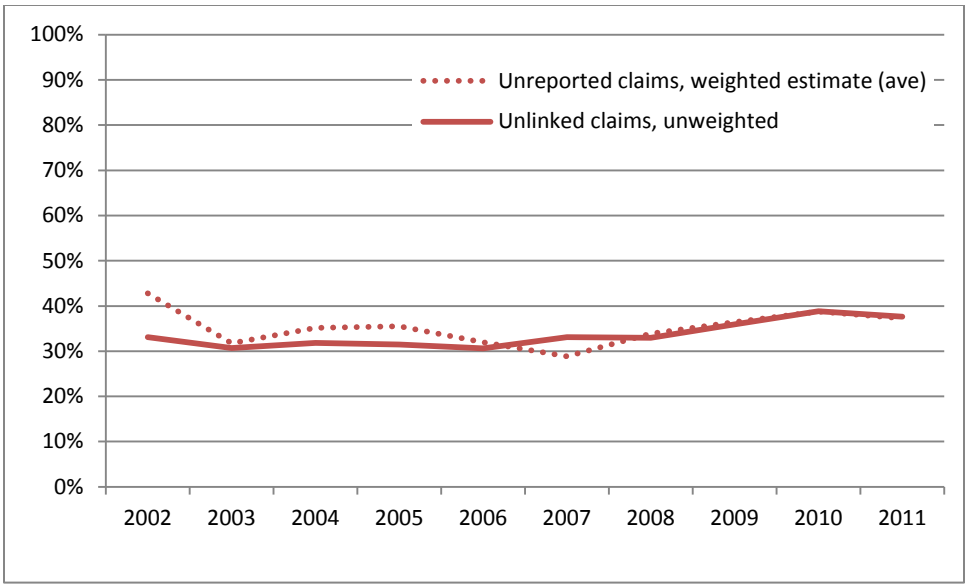


Figure 5. Annual percent of SOII eligible WA WC time loss claims unlinked, based on unweighted case counts and weighted estimates, 2002 – 2011.

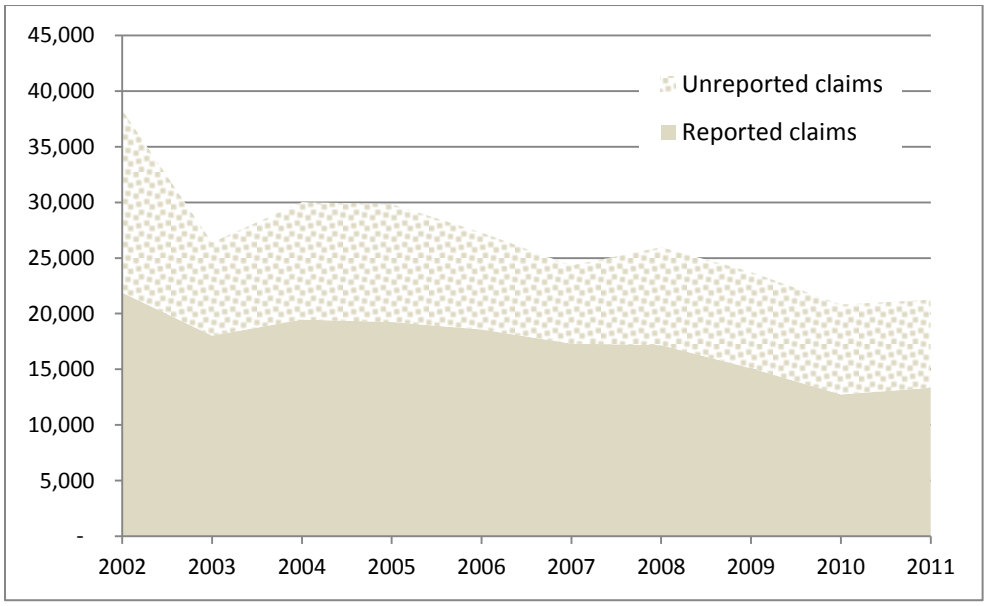


Figure 6. Total estimated SOII-eligible WA WC time loss injuries based on SOII case weights, by report status, 2002 – 2011.

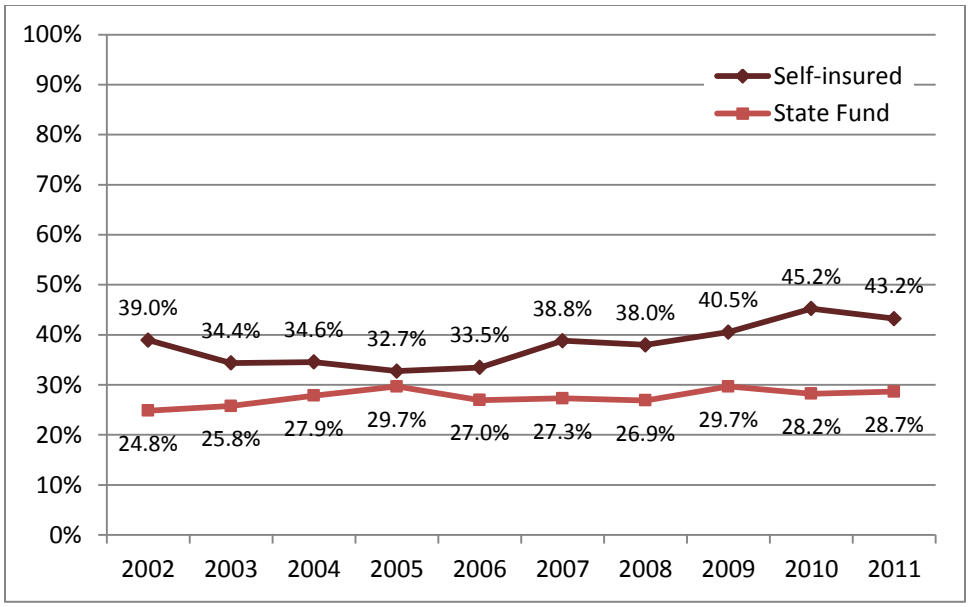


Figure 7. Annual percent of SOII-eligible workers' compensation time loss claims unlinked among establishments self-insured for workers' compensation insurance and establishments insured through the Washington State Fund, Washington, 2002 – 2011.

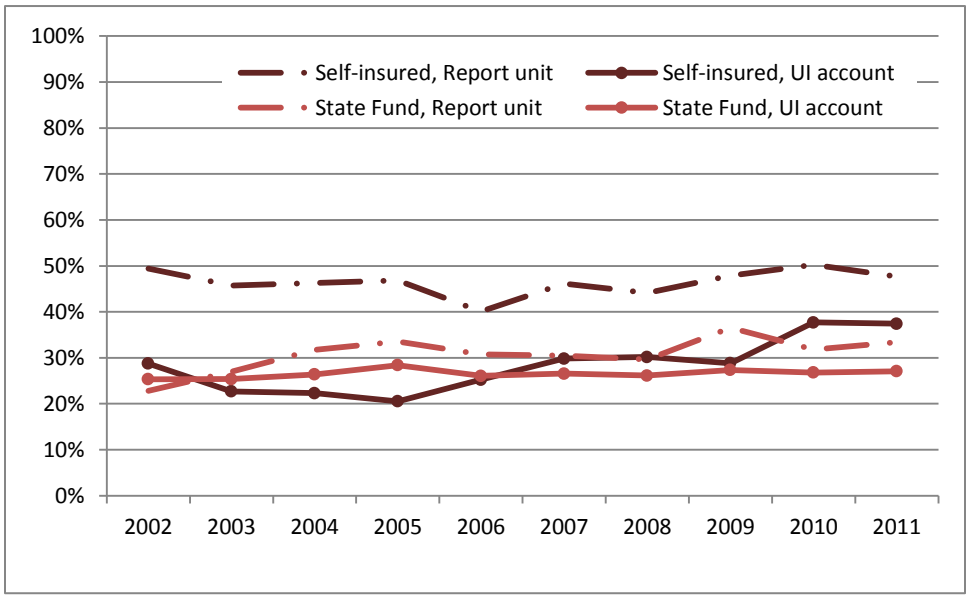


Figure 8. Annual percent of SOII-eligible WA WC time loss claims unlinked among sampled unit and workers' compensation insurer, 2002 – 2011.

Trends in reporting by establishment size

Adopting the five size categories used by BLS, on average the smallest establishments accounted for 1% of the unlinked claims and 15% of the weighted estimate of unreported claims between years 2002 through 2011. The largest two size classes (establishments with 250 or more employees) accounted for more than 60% of all unreported claims (claim counts) but just over 20% of the weighted estimate of unreported claims (Table 1).

The rate of underreporting differed by establishment size (Table 2). Compared to establishments with 1,000 or more employees, claims among smaller establishments (1 – 49 employees), were more likely to be unreported and claims among establishments with 50-249 employees were less likely to go unreported.

Between 2002 and 2006, controlling for size class, the rate of underreporting did not change over the five year span (p=0.3). Between 2006 and 2011, underreporting increased in each of the five size classes (Figure 9). The greatest increase in underreporting during that time period occurred among establishments with 11-49 employees (an annual increase of 2.9%), followed by establishments with 1,000 or more employees (annual increase of 2.6%, 2006 - 2011). Underreporting fluctuated greatest among establishments with 10 or fewer employees; however between 2003 and 2011, these rates were based on fewer than 100 total claims annually.

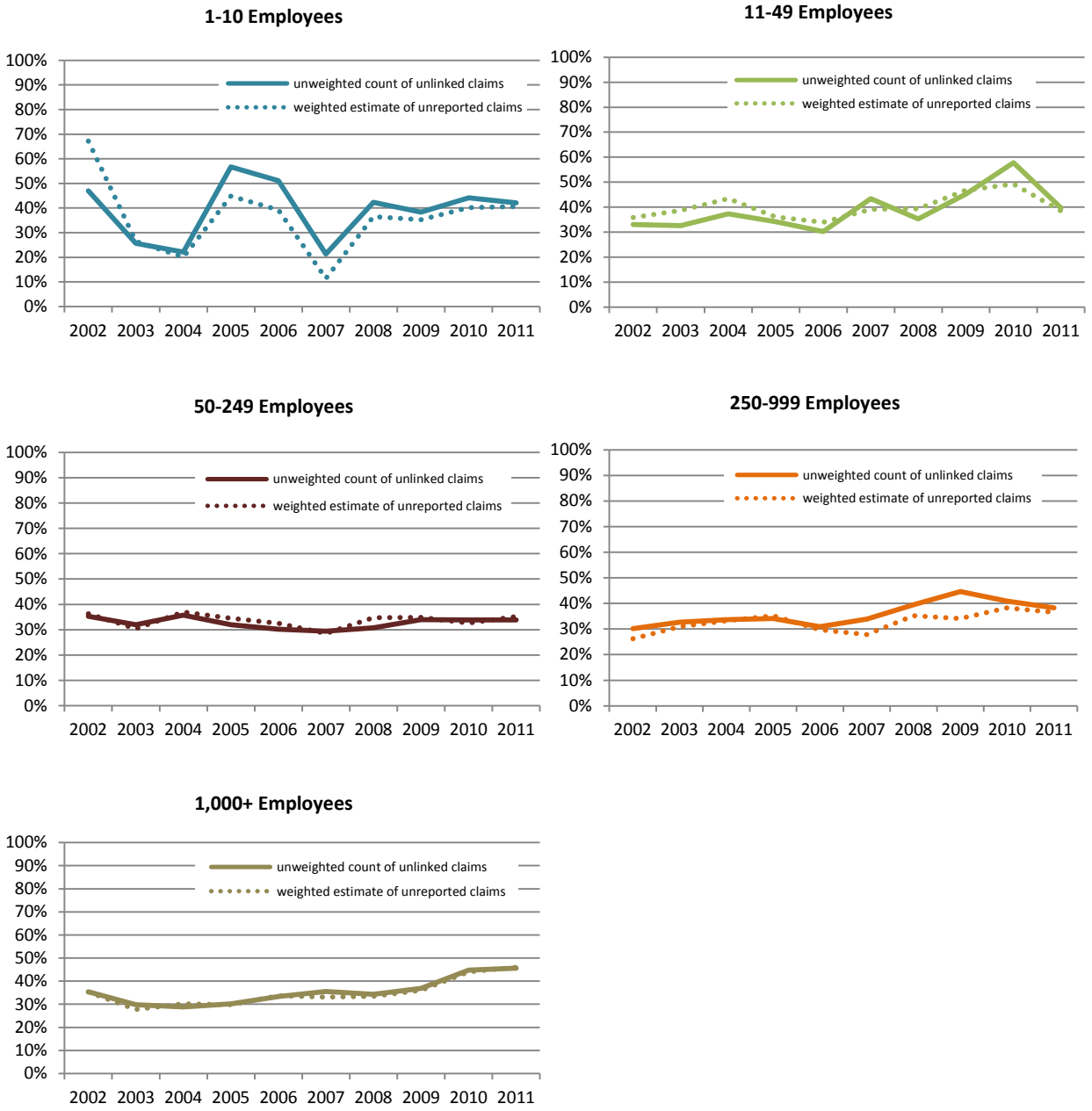
Table 1. Unlinked SOII-eligible WA WC claims by establishment size.

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Mean, 2002-2011
Unweighted claim counts											
1-10 employees	4%	1%	1%	3%	2%	1%	2%	1%	1%	1%	1%
11-49 employees	9%	10%	9%	8%	7%	13%	8%	10%	13%	6%	9%
50-249 employees	27%	27%	32%	26%	32%	31%	31%	31%	24%	28%	29%
250-999 employees	23%	29%	26%	24%	30%	32%	36%	36%	35%	34%	31%
1000+ employees	37%	33%	32%	40%	29%	24%	23%	22%	28%	31%	30%
Total unlinked claims	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Weighted estimate of unreported claims											
1-10 employees	45%	9%	5%	21%	13%	6%	15%	11%	7%	16%	15%
11-49 employees	17%	35%	30%	25%	31%	42%	28%	37%	40%	27%	31%
50-249 employees	24%	34%	43%	32%	36%	32%	35%	32%	26%	31%	33%
250-999 employees	10%	14%	15%	14%	12%	13%	15%	14%	16%	15%	14%
1000+ employees	5%	8%	7%	8%	9%	6%	6%	6%	10%	10%	7%
Total unlinked claims	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 2. Probability of unlinked WA WC claims by survey year and establishment size, 2002 – 2011.

	Odds ratio	95% CI	
Survey year	1.04	1.04	1.05
Establishment size			
1-10 employees	1.24	1.09	1.42
11-49 employees	1.17	1.10	1.24
50-249 employees	0.89	0.86	0.93
250-999 employees	1.02	0.98	1.06
1000+ employees	Referent		

Figure 9. Annual percent of SOII eligible WA WC time loss claims unlinked, based on unweighted case counts and weighted estimates, by establishment size, 2002 – 2011.



Trends in reporting by industry

Between 2002 and 2011, claims among establishments partially exempt from OSHA recordkeeping requirements based on SIC codes (not number of workers) averaged 8% of the annual total number of SOII-eligible WC claims, and 8% of the annual number of unreported claims. Little difference was observed between the annual rates of underreporting among establishments required to maintain OSHA injury and illness records and the rates among establishments partially exempt from recordkeeping (Figure 10). The greatest difference in rates was seen in 2011 where underreporting among partially exempt establishments was 5% higher than the rate among non-exempt establishments.

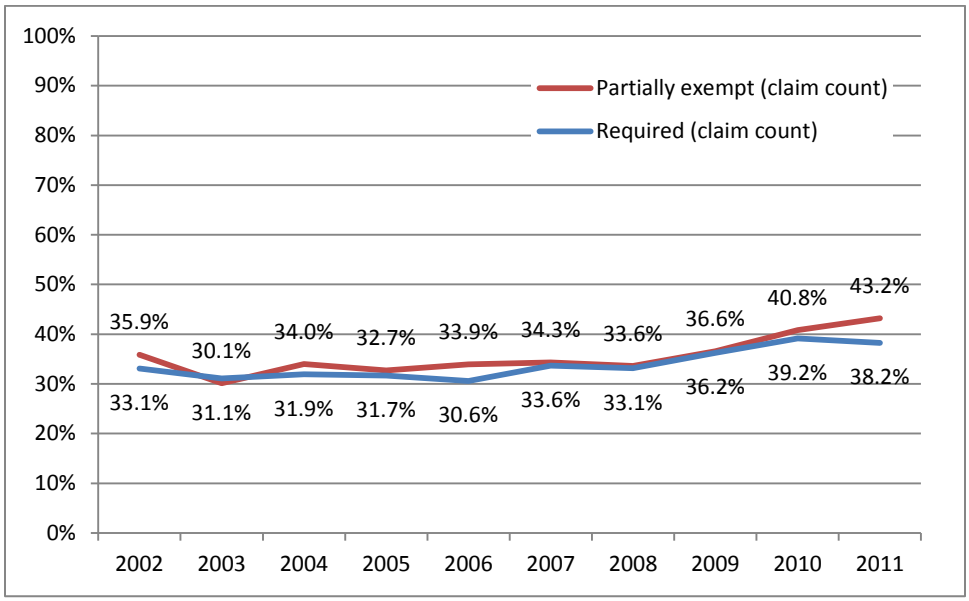


Figure 10. Annual percent of SOII-eligible workers' compensation time loss claims unreported among establishments required to maintain annual OSHA injury and illness records and establishments required to maintain recorded only when instructed by BLS or OSHA (known as partially exempt), Washington, 2002 – 2011. Exemption status based on SIC codes listed in WA State statute and not number of employees.

Establishments were grouped into one of fourteen industry categories based on the SIC code assigned in the UI data. Between 2002 and 2011, the three industries contributing the greatest number of unlinked claims to the total unweighted claim count were: Manufacturing (16%); Retail Trade (15%); and Health Services (12%) (Table 3). Based on the weighted estimate, the greatest percent of unreported claims came from Retail Trade (22%), Transportation (13%), and Manufacturing (10%).

Table 3. SOII-eligible WA WC claims unlinked by industry and year.

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Mean, 2002-2011
Unweighted claim counts											
Agriculture, Forestry, and Fishing	2%	2%	4%	2%	2%	3%	3%	5%	3%	3%	3%
Construction	5%	4%	5%	4%	5%	9%	9%	5%	3%	3%	5%
Manufacturing	21%	21%	16%	15%	17%	19%	18%	11%	7%	9%	16%
Transportation	7%	5%	9%	5%	8%	8%	8%	7%	6%	15%	8%
Communications, Electric, Gas, Sanitary	12%	15%	10%	12%	9%	16%	7%	6%	13%	5%	11%
Wholesale Trade	4%	5%	5%	6%	4%	4%	3%	5%	3%	3%	4%
Retail Trade	12%	16%	13%	14%	17%	15%	11%	17%	16%	15%	15%
Finance, Insurance, and Real Estate	1%	1%	1%	2%	1%	1%	0%	0%	0%	0%	1%
Services other than hlth, ed, soc	10%	7%	9%	9%	7%	6%	7%	7%	7%	6%	7%
Health Services	12%	10%	8%	7%	11%	9%	12%	14%	17%	20%	12%
Educational Services	7%	6%	8%	9%	5%	5%	16%	17%	13%	13%	10%
Social Services	1%	1%	2%	3%	2%	2%	2%	2%	3%	3%	2%
Public Administration	5%	6%	6%	9%	10%	2%	3%	3%	9%	6%	6%
Unclassified	0%	0%	5%	2%	1%	2%	1%	0%	0%	0%	1%
Total unlinked claims (counts)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Weighted estimate of unreported claims											
Agriculture, Forestry, and Fishing	2%	4%	3%	2%	4%	3%	2%	5%	3%	2%	4%
Construction	5%	6%	10%	12%	11%	10%	12%	12%	5%	4%	8%
Manufacturing	8%	12%	10%	10%	11%	10%	15%	10%	6%	9%	9%
Transportation	44%	7%	19%	7%	8%	10%	13%	8%	7%	8%	10%
Communications, Electric, Gas, Sanitary	2%	4%	3%	10%	6%	7%	3%	12%	21%	3%	6%
Wholesale Trade	2%	7%	8%	6%	6%	5%	4%	6%	2%	13%	5%
Retail Trade	16%	31%	23%	25%	20%	22%	16%	21%	19%	25%	21%
Finance, Insurance, and Real Estate	1%	5%	1%	2%	3%	2%	1%	0%	1%	1%	2%
Services other than hlth, ed, soc	7%	6%	9%	11%	10%	13%	11%	7%	11%	9%	11%
Health Services	5%	6%	4%	5%	10%	7%	7%	8%	11%	10%	8%
Educational Services	2%	2%	2%	5%	2%	2%	6%	4%	5%	8%	3%
Social Services	2%	1%	5%	1%	3%	6%	3%	4%	2%	3%	3%
Public Administration	3%	8%	2%	4%	7%	3%	6%	3%	6%	5%	8%
Unclassified	0%	0%	2%	0%	1%	2%	2%	0%	0%	0%	1%
Total unlinked claims (weighted est)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Rates of underreporting varied by industry and by year (Table 4). Compared to Manufacturing, underreporting was less likely in Finance, Insurance, and Real Estate. The likelihood of unreported claims was similar in Manufacturing, Social Services, Educational Services, Agriculture Forestry Fishing, Wholesale Trade, and Public Administration. Compared to Manufacturing, underreporting was greater in Health Services, Construction, Retail Trade, Transportation, and Other Services, and greatest among establishments in Communications, electric, gas, sanitary services, where the odds of underreporting were more than five times the odds of underreporting in Manufacturing.

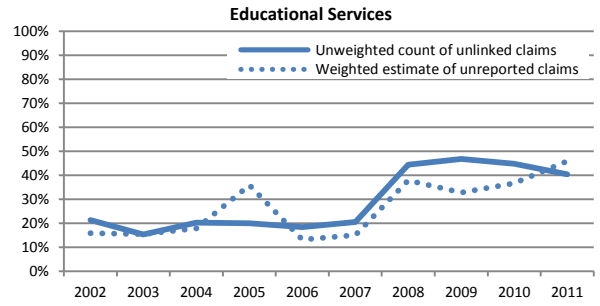
The greatest increase in underreporting was observed among Educational Services (from a low of 15% in 2003 to a high of 47% in 2009), Transportation (from a low of 27% in 2003 to a high of 56% in 2011), and Health Services (from a low of 21% in 2004 to a high of 46% in 2011) (Figure 11-a). For establishments in Wholesale Trade, Manufacturing, and Agriculture, Forestry, and Fishing the rate of underreporting did not change over the ten year period. Underreporting in Retail Trade decreased by an estimated 0.6% each year over the ten year period ($p<.01$). Between 2002 and 2011, the annual average number of unreported claims was less than one in three SOII-eligible claims in each of the fourteen industries except: Communications, Gas, Electric, and Sanitary Services (annual average of 70% of SOII-eligible claims unreported); Other Services (annual average of 41% of SOII-eligible claims unreported); Retail Trade (annual average of 37% of SOII-eligible claims unreported); and Transportation (annual average of 35% of SOII-eligible claims unreported).

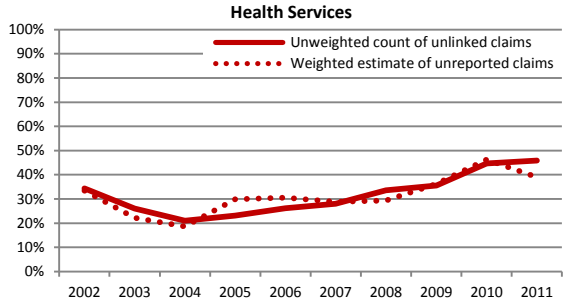
Figure 11-b presents the difference in reporting trends by industry for all establishments compared with those sampled at the UI account. The greatest impact is seen in Educational Services, where no increase in underreporting is observed among the Educational establishments sampled at the level of the UI account. There is also a large difference between sample units in Communications, Electric, Gas, and Sanitary Services, but the trend for sampled UI accounts is similar to that for all establishments in the industry grouping.

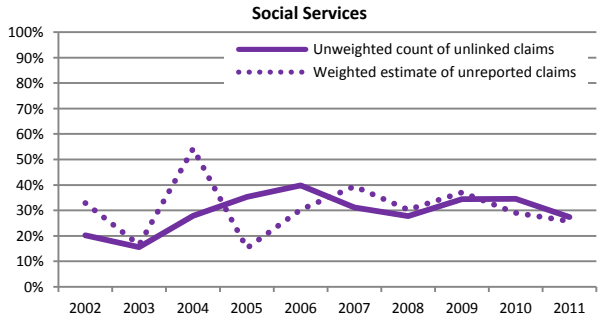
Table 4. Probability of unlinked WA WC claims by survey year and industry, 2002 – 2011.

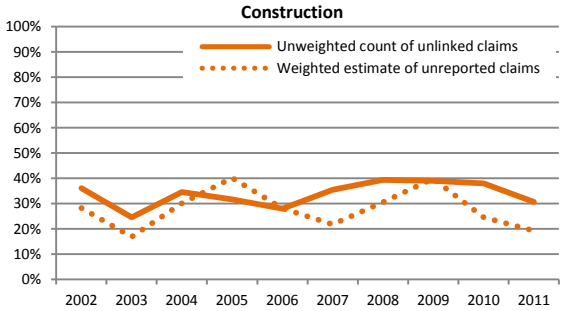
	OR	95% CI	
Survey year	1.05	1.04	1.05
INDUSTRY (SIC)			
Manufacturing	Referent		
Finance, Insurance, and Real Estate	0.81	0.68	0.97
Unclassified	0.92	0.79	1.07
Social services	0.95	0.85	1.07
Educational services	0.99	0.93	1.06
Agriculture, Forestry, and Fishing	1.01	0.91	1.12
Wholesale trade	1.03	0.94	1.13
Public administration	1.05	0.97	1.14
Health services	1.11	1.04	1.18
Construction	1.17	1.08	1.28
Retail trade	1.24	1.17	1.32
Transportation	1.27	1.19	1.37
Services other than hlth, ed, soc	1.57	1.45	1.69
Communications, electric, gas, sanitary	5.67	5.20	6.19

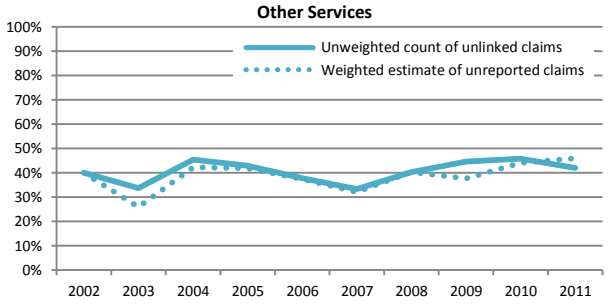
Figure 11-a. SOII-eligible Workers' Compensation time loss claims by industry, Washington 2002 – 2011.

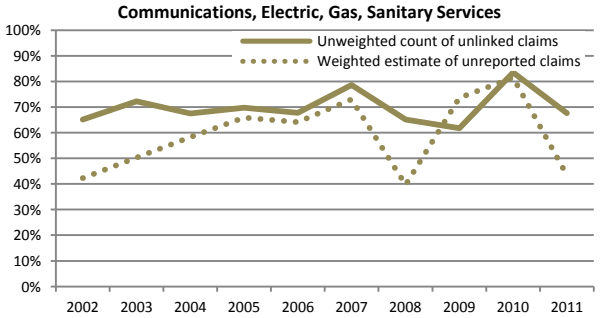


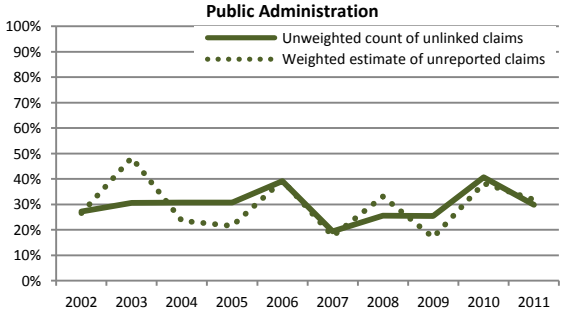


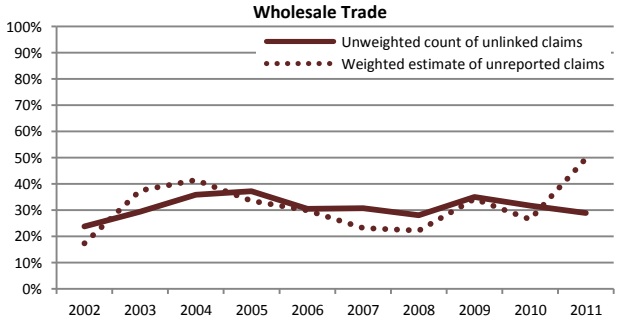


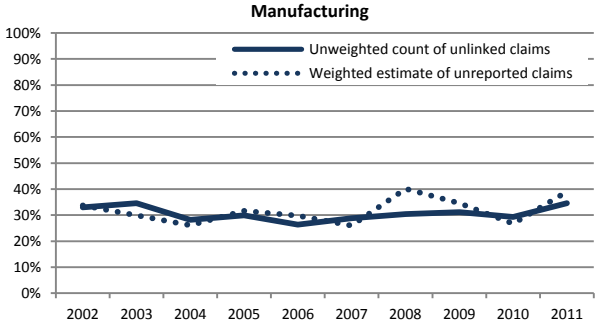


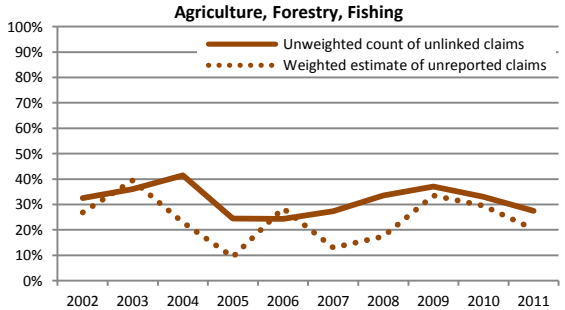












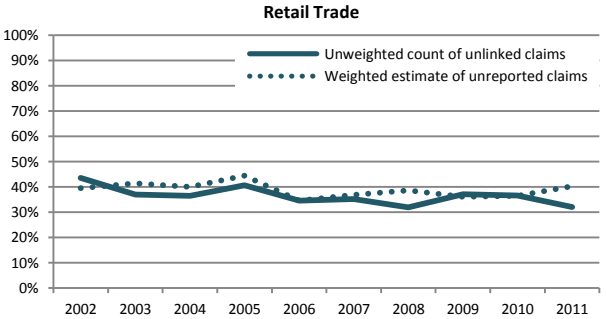
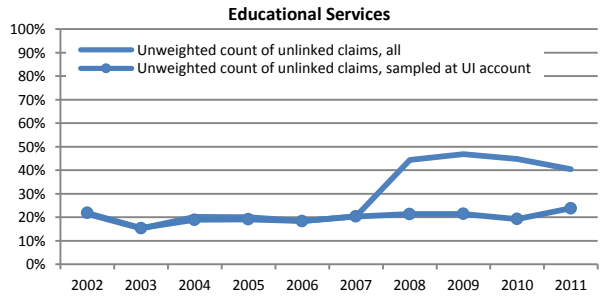
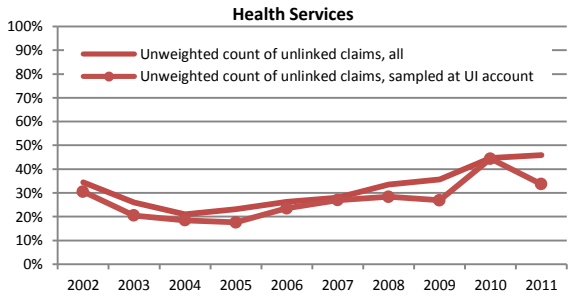
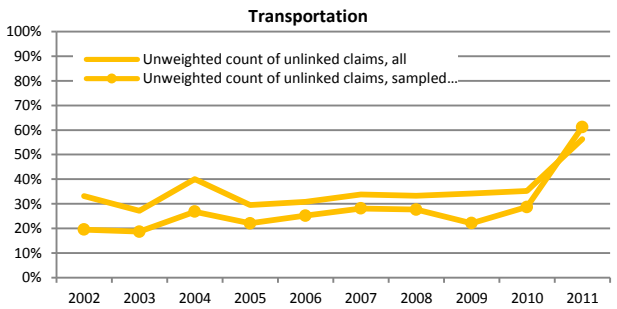
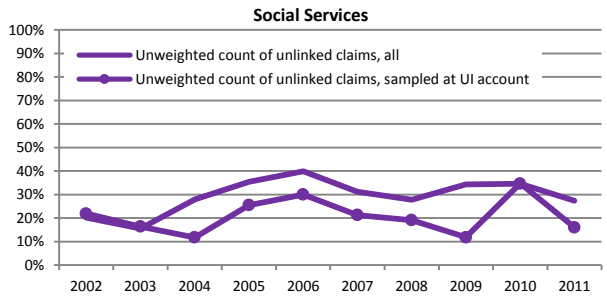


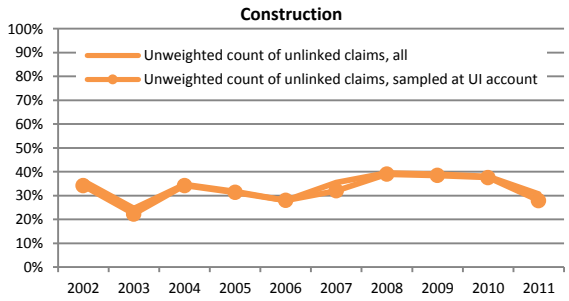
Figure 11-b. SOII-eligible Workers' Compensation time loss claims by industry among all establishments and those sampled at UI account, Washington 2002 – 2011.

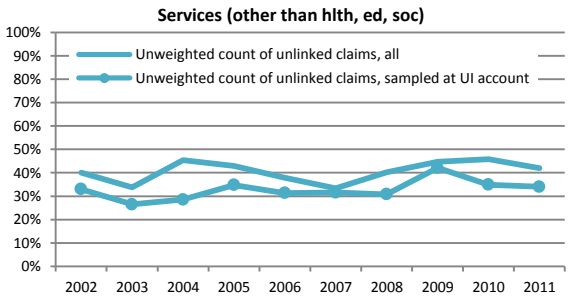


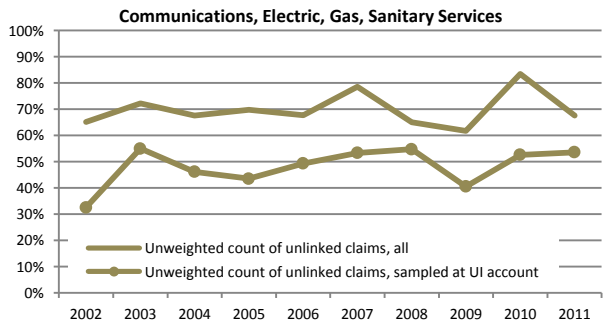


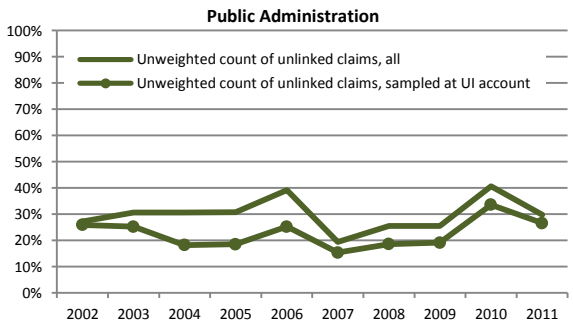


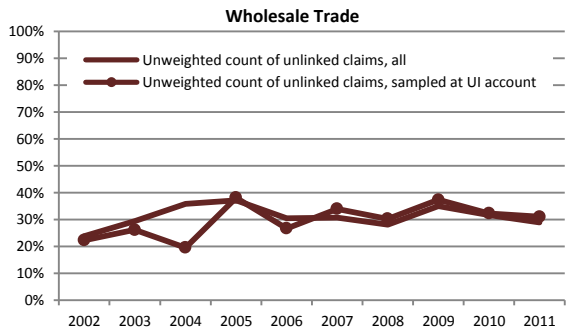


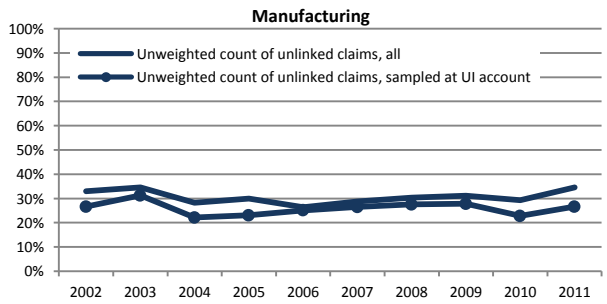


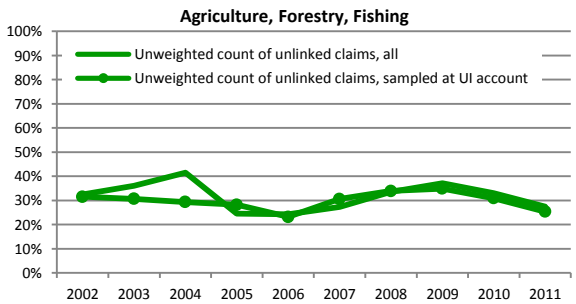


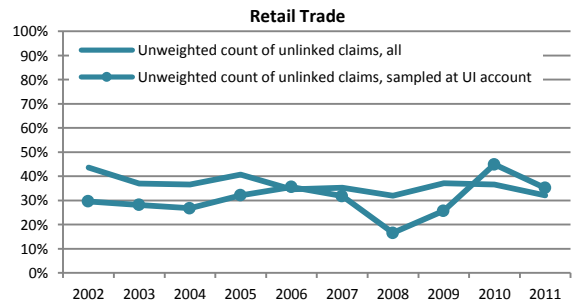












Trends in reporting by injury characteristics

Event or exposure leading to the injury

Eighty-three percent of all SOII-eligible claims (linked and unlinked) resulted from one of three event or exposure divisions: bodily reaction or exertion (51.7%), contact with objects and equipment (15.9%), and falls (15.4%). The rate of underreporting was similar among injuries arising from contact with objects and equipment and injuries resulting from falls, and elevated among injuries from bodily reaction or exertion (Figure 12). Controlling for survey year, injuries from bodily reaction or exertion had a 31% increased odds of being underreported compared to injuries from falls and a 23% increased odds of underreporting compared to injuries from contact with objects and equipment (Table 5). The rate of underreporting of injuries from bodily reaction or exertion was estimated to increase each year by 0.9% ($p<.0001$), of injuries from contact with objects and equipment by 0.8% ($p<.0001$), and remain constant among injuries from falls.

The remaining 15% of claims resulted from one of five events or exposures: transportation accidents (2.8%); assaults and violent acts (1.8%); exposure to harmful substances or environments (1.6%); fires and explosions (0.1%); and other events or exposures (8.3%). An additional 2.3% of claims were missing an event or exposure code. Injuries from exposure to harmful substances or environments, assaults and violent acts, and transportation accidents experienced an increase in unreported claims of approximately 20%, from their lowest rate of unreported claims to their highest during the ten year time period (Figure 13).

Table 5. Probability of unlinked WA WC claims by survey year and event or exposure, 2002-11.

	OR	95% CI	
Survey year	1.04	1.03	1.04
EVENT OR EXPOSURE			
Bodily reaction and exertion	Referent		
Falls	0.76	0.73	0.80
Fires and explosions	0.77	0.40	1.46
Assaults and violent acts	0.80	0.70	0.91
Contact with objects and equipment	0.81	0.77	0.85
Exposure to harmful substances or environments	0.84	0.73	0.96
Transportation accidents	1.01	0.91	1.11
Other events or exposures	1.26	1.18	1.33

Figure 14 presents reporting trends for the three most common events within the six industries with the greatest numbers of estimated injuries (based on linked and unlinked claims). More than two out of three estimated injuries were among Construction, Manufacturing, Transportation, Retail Trade, Health Services, and Services other than health, education, or social services.

Within Construction, the rate of unreported injuries from bodily reaction and exertion was greater in almost every year than the rate among injuries from contact with objects and equipment and injuries from falls. The rate of unreported injuries from falls was the lowest of the three events in almost every year. Higher rates of unreported injuries from bodily reaction and exertion were also observed within Manufacturing, although the difference between the rates for each event or exposure was not as great as seen in Construction. Few differences among the three events were observed for the other four industries. All three events appear to decrease between 2002 and 2011 within Retail Trade, and increase within Health Services.

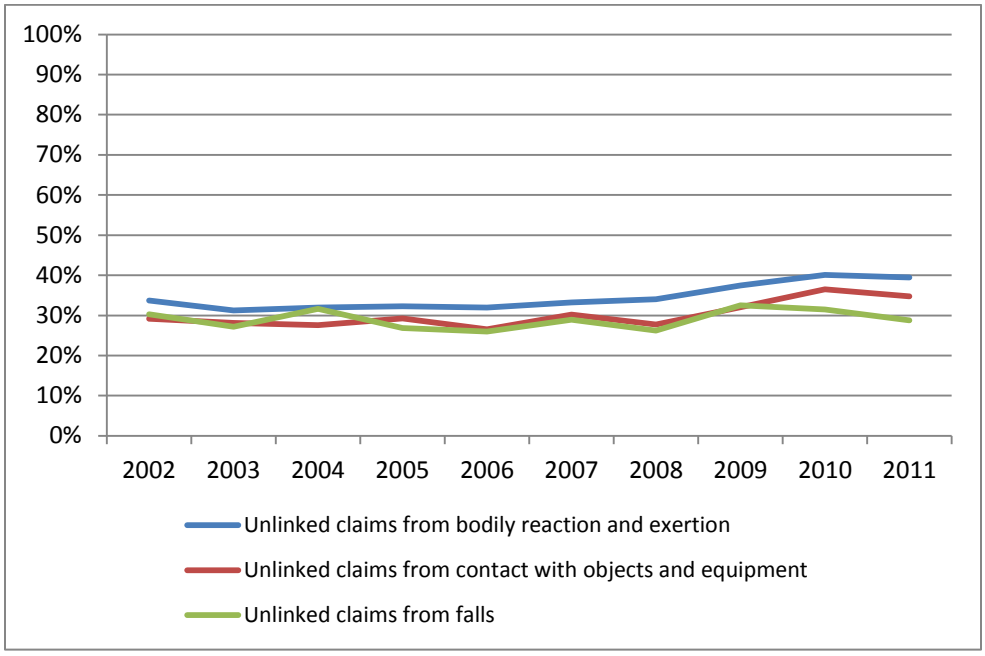


Figure 12. SOII-eligible WA WC time loss claims by select event or exposure resulting in injury or illness: contact with objects and equipment, falls, bodily reaction and exertion, 2002 – 2011.

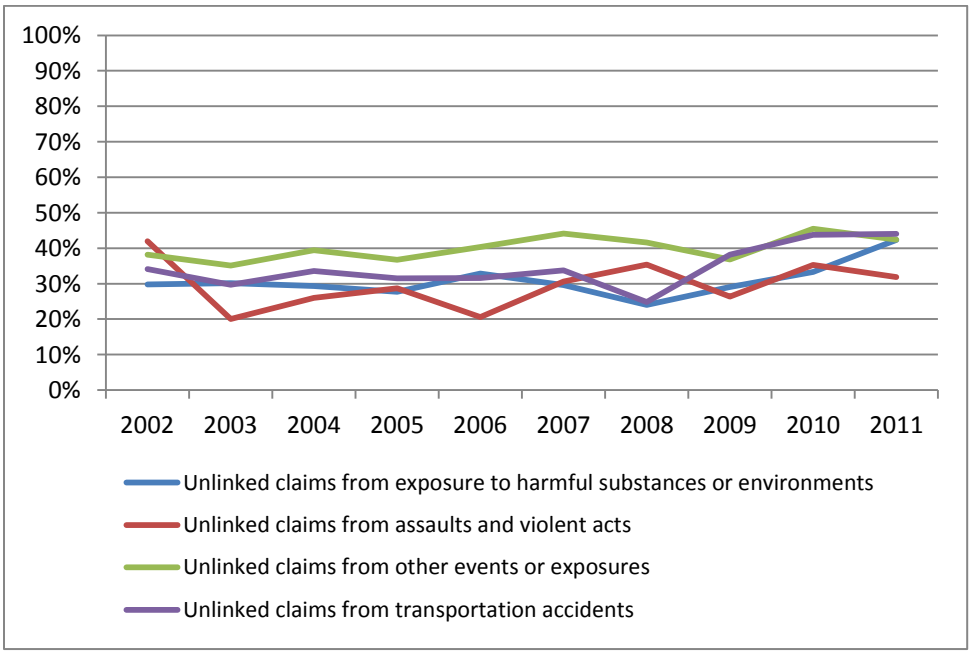
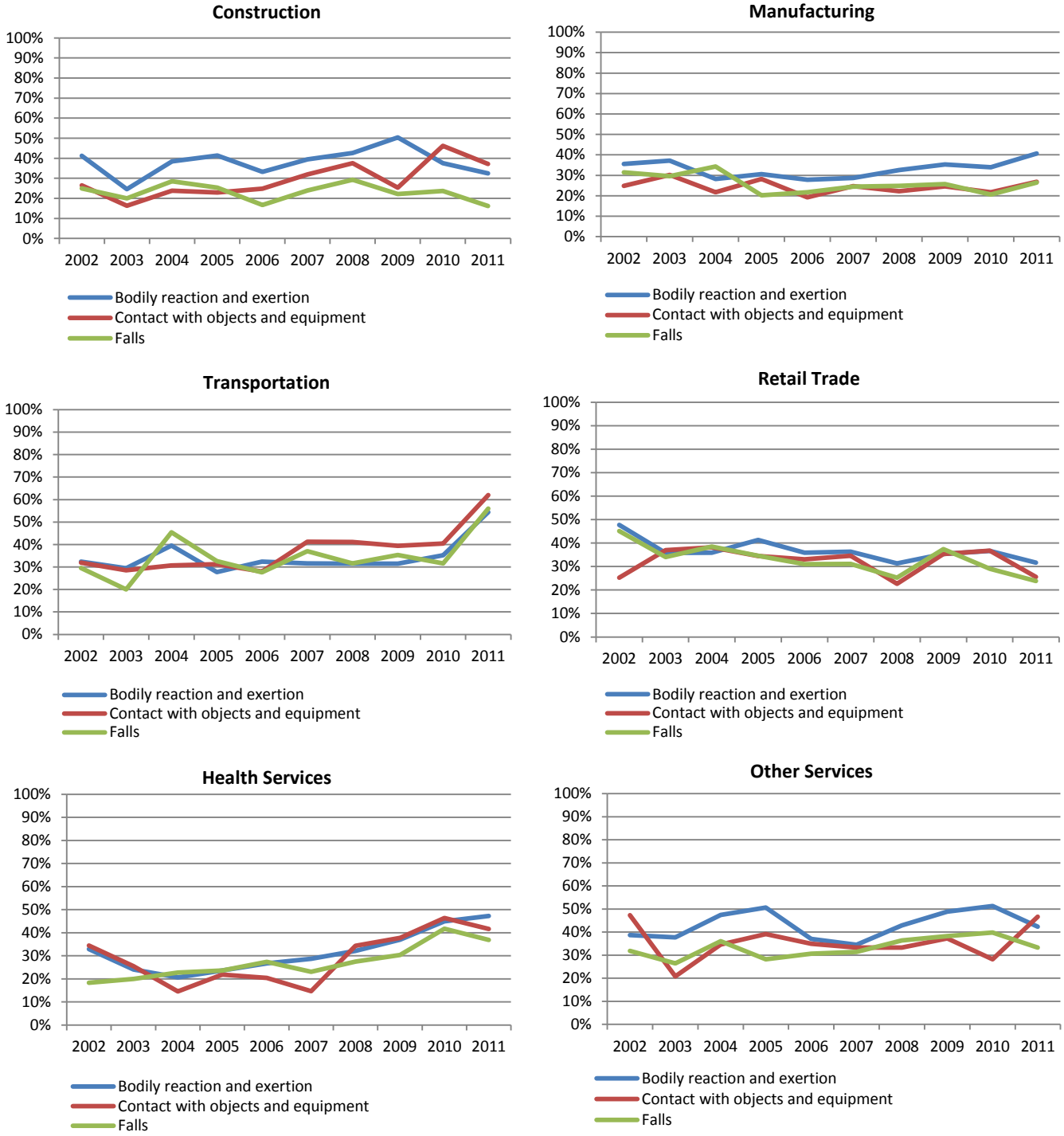


Figure 13. SOII-eligible WA WC time loss claims by select event or exposure resulting in injury or illness: exposure to harmful substances or environments, transportation accidents, assaults and violent acts, and other events or exposures, 2002 – 2011.

Figure 14. SOII-eligible WA WC time loss claims for select industries by three most common events or exposures, 2002 – 2011



Nature of injury

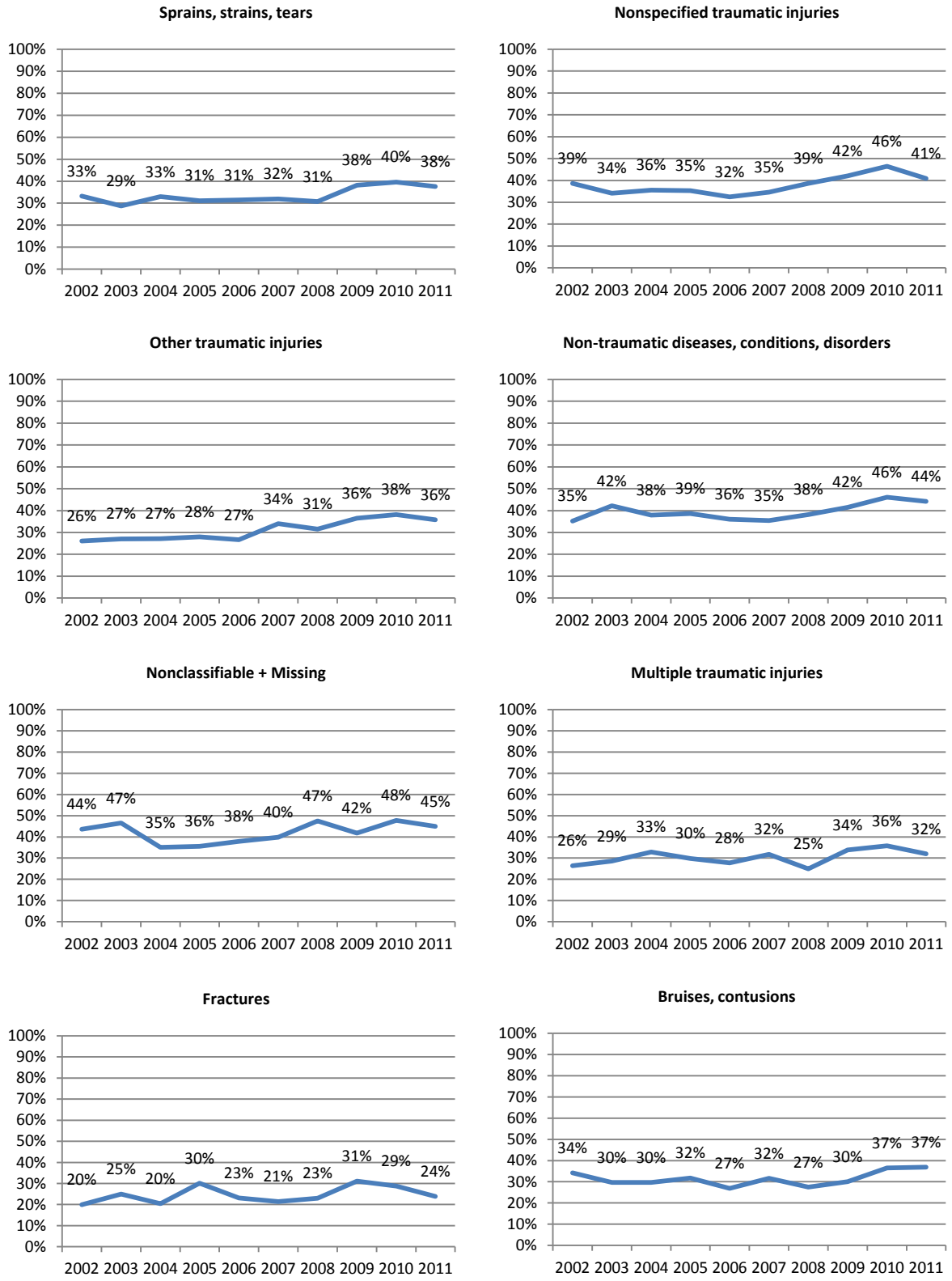
Controlling for survey year, underreporting varied by nature of injury. Fractures, Multiple traumatic injuries and disorders, Bruises, contusions, and Other traumatic injuries were more likely to be reported compared with Sprains, strains, tears (Table 6). Non-specified traumatic injuries, Non-traumatic diseases, conditions, disorders, and Non-classifiable conditions were less likely to be reported compared with Sprains, strains, tears.

Between 2002 and 2011, underreporting increased among: Sprains, strains, tears; Non-specified traumatic injuries, Other traumatic injuries; Non-traumatic diseases, conditions, disorders; and Non-classifiable condition. Marginally significant increases were observed among Multiple traumatic injuries and Fractures. Underreporting did not change in the same ten year time period for Bruises and contusions (Figure 15.)

Table 6. Probability of unlinked WA WC claims by survey year and nature of injury.

	OR	95% CI	
Survey year	1.04	1.04	1.05
NATURE OF INJURY			
Sprains, strains, tears	Referent		
Fractures	0.65	0.60	0.71
Multiple traumatic injuries and disorders	0.84	0.77	0.91
Other traumatic injuries	0.91	0.86	0.96
Bruises, contusions	0.91	0.84	0.99
Non-specified traumatic injuries and disorders	1.23	1.16	1.30
Non-traumatic diseases, conditions, disorders	1.28	1.20	1.36
Non-classifiable + missing	1.37	1.31	1.44

Figure 15. Annual percent of SOII eligible workers' compensation time loss claims unreported among select nature of injury types or injury groups, Washington 2002 – 2011.



Multivariate regression

Including all establishment and injury characteristics in a multivariable logistic regression model, survey year was still found to be significantly associated with increased underreporting for years 2002 – 2011 (Table 7).

Table 7. Probability of unreported WA WC time loss claim by survey year, establishment and injury characteristics, 2002 – 2011.

	OR	95% CI		Pr > ChiSq
Survey year	1.04	1.03	1.05	<.0001
SAMPLED UNIT				
UI account	Referent			
Reporting unit	2.08	2.01	2.17	<.0001
SIZE				
1-49 employees	1.24	1.17	1.32	<.0001
50+ employees	Referent			
INDUSTRY				
Manufacturing	Referent			
Finance, Insurance, Real Estate	0.90	0.76	1.08	0.2661
Retail Trade	0.91	0.86	0.97	0.0044
Social Services	0.92	0.82	1.04	0.1666
Wholesale Trade	0.98	0.90	1.08	0.7345
Health Services	1.08	1.02	1.16	0.0163
Public Administration	1.09	1.01	1.18	0.0339
Transportation	1.15	1.07	1.24	0.0003
Educational Services	1.18	1.10	1.26	<.0001
Agriculture, Forestry, Fishing	1.20	1.08	1.33	0.0009
Construction	1.42	1.30	1.55	<.0001
Services (other than health, educational, social)	1.57	1.45	1.70	<.0001
Communications, Electric, Gas, Sanitary Services	4.16	3.80	4.56	<.0001
NATURE OF INJURY				
Sprains, strains, tears	Referent			
Fractures	0.73	0.66	0.80	<.0001
Multiple traumatic injuries and disorders	0.91	0.84	1.00	0.0381
Other traumatic	0.92	0.87	0.98	0.0111
Bruises, contusions	1.01	0.92	1.11	0.8864
Non-specified traumatic injuries and disorders	1.10	1.04	1.16	0.001
Non-classifiable + missing	1.13	1.08	1.19	<.0001
Non-traumatic diseases, conditions, disorders	1.26	1.18	1.34	<.0001
EVENT OR EXPOSURE				
Bodily reaction or exertion	Referent			
Falls	0.84	0.80	0.89	<.0001
Contact with objects and equipment	0.90	0.86	0.96	0.0004
Fire, toxics, assaults, motor vehicle accidents	0.99	0.92	1.06	0.7415
Other events or exposures	1.17	1.10	1.24	<.0001

KEY FINDINGS

Between 2002 and 2011, underreporting ranged from a low of 30.6% of SOII-eligible WC time loss claims in 2006 to a high of 38.9% in 2010. Underreporting was found to decrease annually between 2002 and 2006, by an estimated 0.8%. The decrease was followed by an increase in underreporting, between 2007 and 2011, of an estimated 2.1% annually. Despite the observed increase in underreporting, the total estimated number of SOII-eligible WC time loss injuries (based on reported and unreported claims) decreased over the ten year span.

Between 2002 and 2011, underreporting increased most among Educational Services, Transportation, and Health Services. Among Retail Trade, underreporting decreased. In Wholesale Trade, Manufacturing, and Agriculture, Forestry, and Fishing the rate of underreporting did not change over the ten year period. Based on a multivariate logistic regression model controlling for survey year, sampled unit, establishment size, and injury characteristics, claims from establishments in eight industry groupings were more likely to be unreported compared to claims from manufacturing establishments: Health Services; Public Administration; Transportation; Educational Services; Agriculture, Forestry, Fishing; Construction; Services (other than health, educational and social); and Communications, Electric, Gas, Sanitary Services.

Claims for injuries from bodily reaction and exertion were more likely to be unreported compared to injuries resulting from falls or injuries from contact with objects and equipment. Underreporting was found to increase over time among both injuries from bodily reaction and exertion and injuries for contact with objects and equipment, and remained constant for injuries from falls.

Claims for sprains, strains, tears were more likely to be unreported compared to most other traumatic injuries. Non-traumatic diseases, conditions, or disorders were more likely to be unreported compared to sprains, strains, tears. Underreporting increased among: Sprains, strains, tears; non-specified traumatic injuries; non-traumatic diseases, conditions, disorders. Underreporting increased slightly among Fractures and Multiple traumatic injuries in the same ten year time period and did not change for Bruises and contusions.

AREAS FOR FUTURE RESEARCH

This study found an increase in unreported WC claims in SOII between 2002 and 2011. Additional research is needed to identify the reasons for the observed increase in underreporting, e.g. economic forces; changes in WC claim filing propensity; or is the increase an artifact of the linking procedures, reflecting shifts in business structures to something more difficult to reconcile across data systems. One approach might be to replicate the study in other states to see if results are consistent.

To further explore trends in underreporting, one could follow firms that participate in SOII every year (or almost every year) and evaluate the completeness of their reporting compared with WC claims data to assess patterns in their reporting.

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