California Workers' Compensation Surveillance

Robert Harrison, MD, MPH, Co-Principal Investigator
Chief, Occupational Health Surveillance Evaluation Program
Occupational Health Branch
California Department of Public Health
850 Marina Bay Parkway, Building P, 3rd Floor
Richmond, CA 94804
Robert.harrison@ucsf.edu
(510) 620-5757

Glenn Shor, Ph.D., M.P.P., Co-Principal Investigator
Manager, California Census of Fatal Occupational Injuries (CFOI) Program
Division of Occupational Safety and Health (DOSH)
California Department of Industrial Relations
1515 Clay Street, Suite 1700
Oakland, CA 94612
gshor@dir.ca.gov
(510) 286-1095

Co-Investigators: Rebecca Jackson; Matt Frederick; Irina Nemirovsky; John Beckman; Meitong Jin; Nurgul Toktogonova; Liza Dizon; John Gordon

Grant Number: 6 U60OH010895-03
Grant/Cooperative Agreement Project Period: 6/1/2015 – 5/31/2019
Report Date: August 31, 2019

Contents

List of Tables

List of Figures

List of Terms and Abbreviations

ACS – American Community Survey
BLS – Bureau of Labor Statistics
BRFSS – Behavioral Risk Factor Surveillance System
BWF – Base Wage File
CDPH – California Department of Public Health
CHSWC – Commission on Health and Safety and Workers' Compensation
CIC – Census industry code
CPS – Current Population Survey
CSTE – Council of State and Territorial Epidemiologists
DART – Days away from work, restricted work activity, or job transfer
DFR – Doctor's First Report of Occupational Injury or Illness
DIR – Department of Industrial Relations
DWC – Division of Workers' Compensation
EDD – Employment Development Department
EDI – Electronic Data Exchange
FROI – First Report of Occupational Injury
FTE – Full Time Equivalent
IAIABC – International Association of Industrial Accident Boards and Commissions
JCN – Jurisdictional Claim Number
LMID – Labor Market Information Division
MEEI – Multi-establishment Employment Indicator
MEPS – Medical Expenditure Panel Survey
NAICS – North American Industry Classification System
NHIS – National Health Interview Survey
NIOSH – National Institute of Occupational Safety and Health
NOC – Not otherwise classified
NORA – National Occupational Research Agenda
OMB – Office of Management and Budget
OSIP – Office of Self-Insurance Plans
PUMS – Public Use Microdata Sample
QCEW – Quarterly Census of Employment and Wages
SOC – Standard Occupation Classification
SOII – Survey of Occupational Injuries and Illnesses
SROI – Subsequent Report of Occupational Injury
SSN – Social Security Number
UI – Unemployment Insurance
WC – Workers' Compensation
WCIO – Workers' Compensation Insurance Organizations
WCIS – Workers' Compensation Information System

Abstract

Robert Harrison, MD (contact for correspondence)
Chief, Occupational Health Surveillance Evaluation Program
Occupational Health Branch
California Department of Public Health
850 Marina Bay Parkway, P-3
Richmond, CA 94804
Robert.harrison@ucsf.edu
(510) 620-5757

Glenn Shor, PhD
Manager, California Census of Fatal Occupational Injuries (CFOI) Program
Division of Occupational Safety and Health (DOSH)
California Department of Industrial Relations
1515 Clay Street, Suite 1700
Oakland, CA 94612
gshor@dir.ca.gov
(510) 286-1095

Background: In California, when an employee's work-related injury leads to time off after the day of injury or medical treatment beyond first aid, the injured worker is eligible for workers' compensation. Data from all workers' compensation claims are required to be reported to an electronic database. Regular and systematic use of this data for public health surveillance requires the ability to calculate rates of injury by age, industry, and other at-risk groups as a way of establishing relative risk, in addition to the magnitude of the problem. However, workers' compensation claims only count the injured workers, and calculating a rate requires combining workers' compensation data with other data. Calculating rates of injury by industry can help increase public health surveillance capacity, identify industry-specific risk factors, and provide early detection of emerging issues. This calculation can improve the use of the data by policy makers, labor and business leaders, and advocacy and community groups in order to direct resources toward injury prevention.

Methods: Data from 2015-2017 private sector California workers' compensation claims were matched to the Base Wage File to identify the at-injury employer, and matched to the Quarterly Census of Employment and Wages to determine the employer's industry code and number of employees by establishment. Establishment-specific data was used to determine industry codes for multi-establishment employers. The American Community Survey was used to adjust counts of workers to full-time equivalents (FTEs) by industry. Rates were calculated by National Occupational Research Agenda (NORA) sector, four-digit North American Industrial Classification System (NAICS) industry, size of employer, type of injury, and demographic variables. Rates were compared to the Survey of Occupational Injury and Illnesses (SOII) and a "prevention index" was calculated averaging the rank of the number of claims and the rank of the rate of each industry.

Results: From 2015-2017, there were 1,972,328 California workers' compensation claims, of which 1,564,940 were private sector workers. Of these claims, 1,386,949 were matched to an employer and included, resulting in a rate of 3.2 claims per 100 FTE. The sectors with the highest rates of injury were transportation, warehousing & utilities; agriculture, forestry, and fishing; and wholesale and retail trade. The highest four-digit NAICS rates were in interurban and rural bus transportation (13.1 per 100 FTE), building material and supplies dealers (11.9 per 100 FTE) and couriers (11.1 per 100 FTE). Rates in these three industries were higher than the SOII rates for each year in the study. The prevention index identified building material and supplies dealers, couriers, traveler accommodation, grocery stores, and scheduled air transportation as industries with high rates of injury and high counts of injured workers.

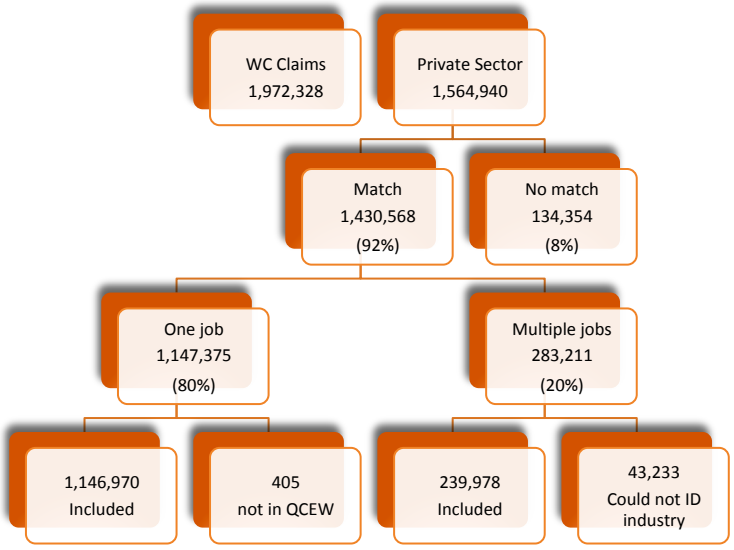
Conclusion: Calculating rates of injury by industry using workers' compensation data increases our understanding of the risk factors for work-related injuries and illness. With additional support these methods of calculating industry-specific rates of workers' compensation claims could be repeated annually, and data could be provided to organizations and individuals involved in work-related injury prevention and occupational safety and health regulation. Incorporating workers' compensation into public health surveillance could lead to preventing work-related injuries in the industries identified.

Section 1 of the Final Progress Report

Significant (Key) Findings

Collaboration: Three California Departments [Department of Industrial Relations (DIR), Department of Public Health (CDPH), and Employment Development Department (EDD)] successfully collaborated to combine their data sources and calculate rates of workers' compensation claims. This involved developing Memorandums of Understanding (MOUs) among the departments that outlined provision and scope of work, multiple cross-department meetings, and two stakeholder advisory meetings that shared the process and products of this project.

Matching Methodology: We developed methods to combine California workers' compensation claims data with Quarterly Census of Employment and Wages (QCEW) data and the American Community Survey (ACS) to calculate accurate rates of occupational injury per full-time equivalent (FTE) by North American Industrial Classification System (NAICS) industries. A total of 1,972,328 claims with an injury date of January 1, 2015 to December 31, 2017 were sent to EDD to match on social security number (SSN) to the base wage file (BWF), a dataset of individuals populated through unemployment insurance records. Of the 1,564,940 private sector claims, we identified a NAICS code for 1,386,948 (89%). Methods for matching are in the flow chart below. Multi-establishment firms were assigned a NAICS code based on their predominant industry activity.



Rates: The overall rate of private sector injury was 3.2 per 100 FTE. The sector with the highest rate of injury was transportation, warehousing, & utilities with 5.8 injuries per 100 FTE, followed by agriculture, forestry, and fishing (4.9 per 100 FTE) and wholesale and retail trade (4.2 per 100 FTE). All three of these industries experienced an increase in the number of claims and the rate of claims over the three-year study period; the largest increase was in transportation, warehousing & utilities where injuries increased 18% over the study period and the rate increased 3.4%. In three 4-digit industries, more than 10 in every 100 FTE workers are injured each year: interurban and rural bus transportation (13.1 per 100 FTE), building material and supplies dealers (11.9 per 100 FTE), and couriers (11.1 per 100 FTE). The ten industries with the highest rates are:

4-digit NAICS	Industry Description	Claims 2015-2016	FTE 2015-2017	Rate per 100 FTE
4852	Interurban and Rural Bus Transportation	262	665	13.1
4441	Building Material and Supplies Dealers	34,565	97,247	11.9
4921	Couriers	20,842	62,706	11.1
3116	Animal Slaughtering and Processing	4,343	16,127	9.0
5622	Waste Treatment and Disposal	2,767	10,640	8.7
4811	Scheduled Air Transportation	11,357	45,848	8.3
3365	Railroad Rolling Stock Manufacturing	92	384	8.0
1121	Cattle Ranching and Farming	6,252	26,632	7.8
4529	Other General Merchandise Stores	9,436	62,235	7.6
3211	Sawmills and Wood Preservation	446	1,977	7.5

Data Visualization: A publically accessible, web-based data dashboard in Tableau has been created for the CDPH Occupational Health Branch (OHB) website, and the underlying data tables will be available on the DIR website. The dashboard allows users to browse through a table of NAICS 4-digit industries which include the total claim count, total FTE, and injury rate for each industry. When users select the table row for an industry, the dashboard displays charts detailing the distribution of claims for that industry by occupational class code, employee age, employee gender, employee tenure, cause of injury, nature of injury, and part of body injured.

Translation of Findings

The methods and results developed here provide a greater level of detail on the types of injuries, industries, and other demographic and employment risk factors for occupational injury than were previously available. Findings from this project can be used to prevent workplace diseases and injuries by providing rates of work-related injuries to stakeholders including the California Department of Public Health, the California Department of Industrial Relations, workers' compensation insurance companies, and community and worker advocacy groups, who can then direct scarce resources at the most at-risk workers. Agencies and other groups working in occupational health that focus their intervention programs in a few key industries can target industries identified by the prevention index as high rate and high number of claims. Several of these industries were not identified in the Bureau of Labor Statistics Survey of Occupational Injuries and Illnesses (SOII), or they had a higher rate of injuries in workers' compensation claims than their rate in SOII. These industries could have additional enforcement and prevention efforts directed toward them. The results can be used for rulemaking for OSHA standards, directing large employer and insurance provider's prevention resources, advocacy for worker groups, and targeted enforcement. In addition, the methods developed during this project have been shared with other states using workers' compensation data for public health prevention allowing them to build their own capacity to detect at-risk industries in their states.

Research Outcomes/Impact

1) **Potential outcomes**: The major output for this project was developing a methodology for calculating rates by 4-digit NAICS code for workers' compensation claims with a date of injury from January 1, 2015-December

31, 2017. Emerging issues identified by this project include the risks to couriers and other workers in transportation and warehousing, and an increasing number of injuries to temporary agency workers.

2) **Intermediate outcomes**: As a result of the two technical advisory group meetings, presentations at national conferences, and participation in workgroups of state agencies, there has been lively discussion and debate about the implications and applications of this research. Several follow-up communications with outside researchers took place to further refine our methodology. California has shared results at both breakout and roundtable sessions of the Council of State and Territorial Epidemiologists (CSTE) annual meeting where representatives from over 20 states participated, along with NIOSH. Quarterly community of practice conference calls and a listserv for states using workers' compensation data for public health prevention were also established. Through these and other efforts, the results of this project have been shared with policy makers, stakeholders, and others, who can mobilize resources for prevention and create policies to prevent injuries.

3) **End outcomes**: Since 2000, DIR has been collecting WCIS data, but researchers (both internal and external to the NIOSH project) have heretofore been unable to calculate rates. The quantity of claims coupled with poor industry coding has meant that DIR (and CDPH) have not been able to calculate overall injury rates or industry specific rates. This project is expanding on the utility of our work with WCIS, specifically through access to QCEW denominator data. As our methods for dealing with various data issues have codified, we are better able to understand injury and illness rates in California, and to develop further methods for calculating cost, identifying risk factors, and increasing awareness about the utility of this data set. We have built skills in Tableau software that will help us in our other work in occupational health surveillance. Our work with the BWF, QCEW, and ACS data are also helping us with our ongoing work, and building our capacity to calculate industry and occupation rates. In addition, through this project we have been able to investigate occupational heat illness, disparities in injury rates by wage groups, and contributed to the NIOSH oil and gas working group. We have also assisted other researchers in other states who are working with their own workers' compensation data. The MOUs developed between DIR and EDD and between DIR and CDPH are being renewed for another three-year period so the framework is in place to continue this work.

Scientific Report

Background

Work-related injuries exert an emotional, physical, and mental toll on the workers who experience them, as well as by their coworkers, families, and communities. In addition to the medical costs associated with injuries, lost work time often means a loss of economic support and mental and psychological effects of injuries can also occur. Understanding and tracking the trends, magnitude, and risk factors of occupational illnesses and injuries is essential for preventing them. Public health surveillance of these injuries can identify especially risky industries and occupations, detect new hazards or worsening conditions, and highlight interventions that are effective at preventing injuries.

While the Bureau of Labor Statistics' (BLS) Census of Fatal Occupational Injuries (CFOI) is a near-comprehensive source for information on fatal work-related injuries in the U.S., no comparable data source

exists for comprehensive information on non-fatal work-related injuries or for work-related illnesses.[1] The standard source for identifying work-related injuries is the BLS Survey of Occupational Injuries and Illnesses (SOII), which has significant limitations. Rather than a complete count of all injuries, and unlike CFOI's multiple information sources, the SOII relies exclusively on an employer survey that samples around 230,000 work establishments each year and is subject to the known limitations of survey data.[2] Employers are asked about injuries that were previously recorded on OSHA- required injury and illness logs, known as OSHA 300 Logs. Injuries are recordable on these forms if they resulted in loss of consciousness, days away from work, restricted work activity or transfer, or medical treatment beyond first aid. The SOII has been demonstrated to to undercount all injuries, and to have specific difficulty counting some specific types of injuries, including occupational illnesses with long latency periods and injuries not recordable on OSHA forms or not eligible for workers' compensation.[3,4] In addition, research into reasons for underreporting show that many employers do not record all injuries. [5] This may be from confusion about types of cases and reliance on workers' compensation definitions for what constitutes a work-related injury, or willful underreporting to avoid inspection targeting, insurance ramifications, or reprimand.

With these limitations, SOII data is particularly insufficient for surveillance activities. It can be difficult or impossible to access data beyond what is publicly available to generate detailed information on the types of injuries within a specific industry or occupation group or over time. Small sample sizes often require a specific request to BLS, and some data may be masked to prevent employer identification.

Information about specific occupational injuries or illnesses is available from several national surveys, including the National Health Interview Survey (NHIS), some years of the Behavioral Risk Factor Surveillance System (BRFSS), and the Medical Expenditure Panel Survey (MEPS). However, this data is limited in nature because occupational injury is only one topic among many in these surveys and is only addressed in a few questions, or analysis of specific sub-populations including state or industry groups is not possible. In response to the need to track work-related injuries and the dearth of available data, many researchers have turned to workers' compensation claims as a resource for state-based public health prevention activities.

Workers' compensation is a no-fault system that provides medical and income replacement benefits for victims of occupational injuries and illnesses; these benefits include paying for costs of medical treatment, temporary and permanent disability benefits (indemnity payments), return-to-work assistance, and death benefits for surviving dependents. In California, any injury of an employee that necessitates time off beyond the day of injury or treatment beyond first aid is eligible for workers' compensation. All workers' compensation claims are required to be reported to the Department of Industrial Relations, which maintains an administrative database of information about the claims. This reporting is mandatory, so the database housing these claims represents a near-complete collection of workers' compensation eligible injuries. Information is reported about the worker who experienced the injury including age, gender, occupation and length of time with the employer; the employer including their industry and address, the insurer or claims administrator; and information on the injury itself including the cause of injury, nature of injury, part of body injured, and a narrative description of what happened. Much of this information is categorized in standard codes that are used by multiple states, although these codes are unique to the workers' compensation insurance agency and do not directly correspond to the coding system used by SOII.[6]

Workers' compensation claim data in California was first electronically submitted in 1999 and information on medical treatment reporting began in 2006.[7] California's workers' compensation system is the largest system

in the country: 673,421 claims were reported in 2017.[8] In 2016, 66% of injuries occurred among workers of insured employers, 31% among workers of employers that self-insured, and 3% among State of California workers.[9] In 2015, 220 insurers were licensed to write workers' compensation policies.[10]

Aggregate and specific information from these claims has long been used by actuaries in the workers' compensation insurance industry to assess job risk and set rates of premiums they charge companies for insurance policies. In addition, workers' compensation claims data are often requested by legislators, labor and business leaders, and advocacy and community groups to help describe the scope and burden of workplace injuries and illnesses. Some of the occupational health issues utilizing workers' compensation claims in California include tracking work-related asthma, pesticide illness, Valley Fever, carpal tunnel syndrome (CTS), sharps injuries in non-healthcare workers, workload in janitorial workers, first responder health, risks faced by young workers, the scope of workplace violence, and many more topics. These projects range in complexity and build on our understanding of the utility, completeness, and challenges of using workers' compensation data for public health surveillance and prevention efforts.

Workers' compensation claims have become a predominant data source for occupational health and safety research in the past decade. In September 2009 and June 2012, Federal, state, and academic researchers gathered in workshops on the use of workers' compensation for occupational safety and health and NIOSH produced a primer on the use of workers' compensation for public health to help public health researchers and practitioners broaden their understanding of workers' compensation insurance and identify potential uses of the information for public health purposes.[11] At the time, much of the use of workers' compensation records was for economic rather than health purposes, including calculating the direct costs of work related injuries at $65 million and the indirect costs at $106 million.[12] Those numbers have since been updated, and costs are now estimated at $250 million in direct and indirect costs for work-related injuries and illnesses.[13] An annual report from the National Academy of Social Insurance also provides information on the costs of workers' compensation to both employers and insurance agencies.[14]

Individual state workers' compensation bureaus also publish information about claims, but with few exceptions it is poorly integrated with public health prevention activities. Many specific injuries have been examined using workers' compensation claims, including investigating machine-related injuries among metal fabrication workers,[15] occupational eye injuries,[16] burn injuries,[17] asthma,[18] and carpal tunnel syndrome.[19] Some states have also examined workers' compensation claims to describe details of at-risk worker groups including young workers and seafood preparation and packing workers in Oregon, [20,21] athletic trainers in California and Washington,[22] oil and gas workers in Montana,[23] temporary agency workers and law enforcement officers in Illinois,[24,25] and ambulance service industry workers in Ohio.[26] Washington state, which is one of a handful of states that states that act as the exclusive workers' compensation insurer for employers in the jurisdiction has done considerable research using their claims and well-integrated their claims with injury prevention activities. They have published on a range of topics including aquaculture workers, construction workers, commercial janitors, and animal care workers.[27,28,29,30] Workers' compensation records have also been used for health outcomes research, most notably comparing the results of surgeries paid for within and outside of the workers' compensation system and finding that persons with workers' compensation claims suffer worse functional outcomes than those without claims.[31,32]

Data from workers' compensation continue to be used for these projects and other because they are useful for producing timely, flexible, and stable research that has been widely accepted and produces interpretable

analysis. With very few exceptions, almost every topic of interest to occupational health and safety professionals has relevant information within workers' compensation systems. With concerted effort, data can be extracted for any demographic group, any industry, or any specific type of injury. Many institutions rely on this data to make decisions and take actions to prevent occupational injuries. Workers' compensation claims data can be analyzed to better understand what job factors caused a past injury or illness to help find ways to improve workplace safety and health in the future.

Unlike SOII, workers' compensation is a state-based system, and each state has unique eligibility requirements, reporting requirements, and data management systems. In California, as in many states, different government agencies with competing missions, interests, and priorities are responsible for administering the collection of workers' compensation claims, the collection of employment data, the practice of occupational health surveillance (when it exists), and occupational health enforcement.

To identify trends in illnesses and injuries by cause of injury, industry, or occupation, incidence rates are based on full-time equivalent workers (FTE) that account for varying employment by industry and over time and the differing use of part-time work by industry. Rates can be used to help determine what job factors caused a past injury or illness, and identify ways to inform and improve workplace health and safety in the future. They can help identify effective safety and health programs that reduce the severity of past injuries and develop leading indicators and catch early signs of emerging risk factors or new problems. However, there is no information on FTE within California's workers' compensation system, so calculating rates requires combining several different databases housed by different government agencies. In addition, industry and occupation, two of the main risk factors of interest in occupational safety and health, are not consistently or accurately coded in workers' compensation claims.

While many projects utilize workers' compensation claims, these challenges in calculating rates is one reason why they are still an underutilized resource and are not used in in the regular, systematic use of the data collected for public health prevention efforts. The National Academies of Sciences identified exploring and promoting the expanded use of workers' compensation data for occupational injury and illness surveillance as a key priority.[33] To further utilize workers' compensation for prevention, there is a need to build relationships that utilize this resource and find shared goals. This report provides a description of analysis done in California to increase the utility of workers' compensation claims by calculating industry-specific rates of injury, and provides a comparison of the results from these calculations with the data that is available from SOII. Workers' compensation data provide a unique ability to analyze information not available in other data systems, and this project is an example of the potential value for surveillance of occupational injuries within workers' compensation.

Specific Aims

This project enhanced the capacity of California to use existing state-level workers' compensation (WC) data to conduct public health surveillance. To that end, the specific aims were:

Aim 1 Develop and increase collaborations among three California Departments [Department of Industrial Relations (DIR), Department of Public Health (CDPH), Employment Development Department (EDD)], and other stakeholders to acquire, combine, analyze, and disseminate existing WC data and employment denominator sources for occupational safety and health prevention purposes.

Aim 2 Combine California WC claims data with Quarterly Census of Employment and Wages (QCEW) data and the American Community Survey (ACS) to develop rates of private sector WC claims per full-time equivalent (FTE) by NAICS industries and employer sizes, including sensitivity analyses among rate estimates derived from various denominator data sources.

Aim 3 Summarize technical information addressing the utility and limitations of California WC and denominator databases.

Aim 4 Distribute a data analysis report for the public that includes numbers and rates of WC claims by: 1) medical-only and lost-time claims; 2) NIOSH NORA industry sectors, NAICS industries, high-risk occupations, and employer size categories; and 3) injury/illness part of body, nature, and cause. Prioritize industries and injury/illness cause using prevention indices, perform time trend analysis, identify emerging issues, and make recommendations for workplace interventions.

Aim 5 Create a publically accessible electronic WC case dataset including First Report of Injury (FROI) fields.

Aim 6 Disseminate significant findings to achieve the best distribution to targeted audiences and the greatest impact of our findings.

Methodology

To accurately calculate rates of injury by industry code it was necessary to match four distinct datasets together: workers' compensation claims from California's Workers' Compensation Information System (WCIS), employment records from the base wage file (BWF), counts of workers by industry code in the Quarterly Census of Employment and Wages (QCEW), and an adjustment of hours worked per week from the American Community Survey (ACS). Each dataset is described below. Rates were calculated using NAICS codes, a hierarchical six-digit classification system used by federal and statistical agencies to collect, analyze, and publish data about businesses in the US economy. The first two digits of the six-digit code designate the highest level groupings among major industry sectors (for instance, retail trade or non-durable goods manufacturing), and each additional digit of the code adds greater detail to the description. The hierarchical nature of NAICS means that every 6-digit code can be aggregated into less specific codes at the five-, four-, three-, and two- digit level. In this report, 2-digit, 3-digit, and 4-digit codes are used to categorize industry.

Data Sources

Workers' Compensation Information System

All private sector workers' compensation claims with a date of injury between 1/1/2015 and 12/31/2017 were eligible for inclusion in industry and demographic rate calculation (local, state, and federal workers were excluded).

Every employer in California must secure its liability for workers' compensation, either by obtaining insurance from a licensed insurer or obtaining a certificate of consent to self-insure. About 1 in 4 California workers is at a self-insured employer in California.[34] The only lawful exception to this requirement is the State of California, which is legally uninsured. Insured employers, self-insured employers, and the State of California all report information from workers' compensation claims to the WCIS, the electronic repository of all workers' compensation claims in the state. When a worker is injured on the job, their employer is required to report the injury to a claims administrator within 5 days of the injury date using Form 5020, the Employers' First Report of Occupational Injury to their workers' compensation claims administrator. In addition, any physician attending an occupational injury or illness is required to complete Form 5021, the Doctor's First Report of Occupational Injury or Illness and send this to the employer's insurance carrier or the insured employer. Both of these forms can generate a First Report of Occupational Injury (FROI) that is submitted to the Division of Workers' Compensation within 10 business days. A FROI is also required when a claims administrator receives an Application for Adjudication of an injury filed with the Workers' Compensation Appeals Board, or information indicating an injury required medical treatment by a physician.[35] A Subsequent Report of Occupational Injury (SROI) is required whenever a claim administrator begins paying benefits, ends paying benefits, or updates the benefits.

Data are transmitted to WCIS based on California-specific FROI/SROI and medical bill payment using Electronic Data Exchange (EDI). EDI reporting regulations are compatible with the International Association of Industrial Accident Boards and Commissions (IAIABC) national standards (California Labor Code §138.6). IAIABC is a not-for-profit trade association that sets the national standard for the transmission of WC claims data via EDI (IAIABC 2014). Currently, the California-specific guides use Release 2 version of IAIABC Medical Bill Payment Release and Version 1.0 of IAIABC FROI/SROI Release 2.

California's WCIS system is the largest system in the country; 670,301 claims were reported in 2017.[36] In 2016, 66% of injuries occurred among workers of insured employers, 31% among workers of employees that self-insured, and 3% among State of California workers (Commission on Health and Safety and Workers' Compensation (CHSWC) 2017). In 2015, over 213 insurers were licensed to write WC policies, (California Department of Insurance 2018).

Each workers' compensation claim includes information about the injury itself, the employer where the injury took place and the worker who was injured. This information is useful for determining risk factors leading to an occupational injury. SROIs include information on payments for medical and indemnity (partial wage replacement) and the time spent away from work. Medical billing information includes a bill date, treatment date, diagnosis and treatment codes (currently International Classification of Disease-10), the provider type, amount paid, amount billed, and any adjustment between paid and billed amounts. Medical bills are linked to FROI/SROI fields by the jurisdictional claim number (JCN) and claim administrator claim number.

Quarterly Census of Employment and Wages

The Quarterly Census of Employment and Wages (QCEW) is a cooperative program between BLS and California Employment Development Department (EDD) Labor Market Information Division. The QCEW program produces a comprehensive tabulation of employment and wage information for workers covered by California Unemployment Insurance (UI) laws and Federal workers covered by the Unemployment Compensation for Federal Employees (UCFE) program. The QCEW program serves as a near census of monthly employment and quarterly wage information. The database has an employer key that links to the Base Wage File (BWF), which was used to link workers in workers' compensation with employment information. QCEW has information on the number of employees, whether a firm is private, state, federal, or local government, the NAICS code of each establishment, and a multi-establishment employment indicator (MEEI) code which classifies whether employers are single establishment or operate multiple establishments.

Base Wage File

The BWF is compiled from quarterly employer reporting of employees, and includes the employee name, social security number (SSN), and wages paid. Each employee in the BWF has an employer account number that identifies the employer in the QCEW. This file acted as an employer match between the employer information in WCIS and the employer records in the QCEW. It allows us to ensure that the correct employer is identified for every workers' compensation claim, and that the same industry code is assigned to the claim and employees. There are important attributes missing from this database: there is no information on age, sex, race, or other demographic data, no occupation data and no industry code. For multi-establishment employers there is no information identifying the establishment where an employee works.

American Community Survey

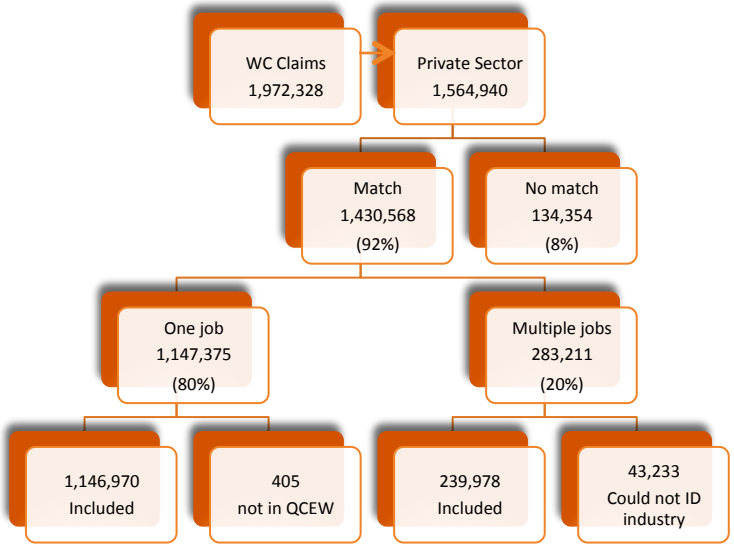
The American Community Survey (ACS) replaced the long form census in 2007, and is a household based survey that asks about jobs and occupations, educational attainment, and other social and economic aspects. The primary job of all employed individuals is industry coded to a census industry code (CIC code), which were cross-walked to a 3-digit NAICS code. These 3-digit codes were used to calculate the FTE for each 4-digit

NAICS code it contained. Free, publicly available Public Use Microdata files (PUMS) were used to calculate the ratio of full-time equivalent to total workers by industry in California for 2015, 2016, and 2017.

Data Matching

Figure 1 describes the process for matching workers' compensation claims to an employer in the QCEW. Private sector claims were selected from workers' compensation and SSN was used to match claims to worker records in the BWF in the quarter of injury. Ninety-two percent of private sector claims matched to at least one base wage file record. Of those, 80% had one job and 20% had multiple jobs. For workers who had multiple jobs, we identified the correct employer using an employer identifier in both workers' compensation and BWF, or we identified industry without determining an employer, either because all wage records for that worker were in a single industry code or by using the industry code in workers' compensation to choose the correct industry code. Among workers with multiple jobs, an employer was selected 85% of the time.

Figure 1: Methods of Matching Workers' Compensation Claims to Employer Records, California 2015-2017.



Multi-Establishment Firms

As the name implies, a multi-establishment firm is an employer where work occurs at several different locations, or within different industries at the same location. Table 1 provides information on the number of single and multiple establishment firms in California from QCEW for private sector employers during the study period; these numbers do not differ meaningfully over the three-year study period. Multi-establishment firms make up less than 1% of California private sector employers but employ 37% of workers. Each multi-establishment firm where at least 80% of employees were in a single NAICS code was assigned that code. For multi-establishment firms where the primary NAICS was 5613 ("Employment services"), we assigned all employees to this code regardless of how many of their employees worked at an establishment with this NAICS code. Among claims that linked to a multi-establishment employer, we were able to identify a NAICS code for 85% of claims. For the other 15% of claims, we assigned a unique multi-establishment non-NAICS classification for rate calculation and inclusion in analysis. A detailed explanation of matching methods is in Appendix B.

Table 1: Single and Multi-establishment firms in California, 2015-2017

Firm Type	Employers (annual average)	Workers (annual average)	Included Claims
Single Establishment	1,110,142 (99%)	8,981,138 (63%)	673,089 (49%)
Multiple Establishment with identified NAICS	8,681 (1%)	4,338,781 (30%)	602,439 (43%)
Multiple Establishment no NAICS identified	1,412 (0%)	992,162 (7%)	111,420 (8%)
Total	1,120,235	14,312,080	1,386,948

INDUSTRY FTE CALCULATION

To express the number of FTE workers by industry, the number of hours worked per week was used to adjust the counts of workers by industry obtained through the QCEW. Using FTEs allows for a comparison of risk across industry that includes an adjustment for part-time work and overtime hours. We used the ACS hours worked per week to adjust counts of employees from QCEW from the California sample of the 2015, 2016, and 2017 PUMS files. More detail on these methods and on alternate calculations is in Appendix A.

RATE CALCULATION

Rates were calculated by age, sex, and tenure groups. Rates for age and sex categories were calculated using ACS data alone, because QCEW does not have any information on age or sex. For tenure, the distribution of tenure with current employer was taken from the BLS Current Population Survey (CPS) January 2018 supplement national data,[37] and time at job was multiplied by total FTE to get counts of workers in each tenure category.

Industry and quarter combinations were suppressed in the results for any 4-digit industry with less than 11 claims or any industry where a single employer makes up 80% or more of the employment or there are fewer than 5 employers. National Occupational Research Agenda (NORA) Sectors are classified according to Figure 2. NAICS 2012 code 4521 “Department Stores” was cross-walked to NAICS 2017 code 4522 “'General Merchandise Stores, including Warehouse Clubs and Supercenters.” The twenty NAICS industries with the highest injury rates by 4-digit NAICS codes are presented. The sum of claims by industry was divided by the FTE by industry and multiplied by 100 to calculate the rate per 100 FTEs. Rates were calculated first by 4-digit NAICS and then these were aggregated into 3-digit rates for comparison to SOII.

Figure 1: NORA Sector Groups

NORA Sector Group	NAICS Code
Agriculture, Forestry & Fishing (except Wildland Firefighting and including seafood processing)	11, 3117
Construction	23
Healthcare & Social Assistance (including Veterinary Medicine/Animal Care)	62, 5419, 8129

Manufacturing (except seafood processing)	31-33
Mining (except Oil and Gas Extraction)	21
Oil and Gas Extraction	211, 2131
Public Safety (including Wildland Firefighting)	9221
Services (except Public Safety and Veterinary Medicine/Animal Care)	51, 52, 53, 54, 55, 56, 61, 71, 72, 81 & 92
Transportation, Warehousing & Utilities	48-49 & 22
Wholesale and Retail Trade	42 & 44-45

In an effort to create the most valid comparison between SOII and workers' compensation, we compare private sector three-digit NAICS rates per 100 FTE obtained from SOII (Total cases rate) and this project's calculations. SOII data presented here are publicly available.[38] In addition to the differences in data sources listed above, the methods of calculating FTE by industry for the two projects differ. Rate ratios were calculated by dividing the rate calculated using workers' compensation claims to by the rate calculated in SOII.

Counts by quarter are examined to identify seasonal variation. Industries with greater than 100 injuries per year, a rate greater than 6 injuries per 100 FTE, and where the coefficient of variation is in the top 10% are included.

Rates by size class are calculated by aggregating all employers by size. No data exists on hours worked in the state by size class, so these calculations are for number of employees directly from QCEW data, and not adjusted by FTE. Because of aggregating higher and lower risk employers, these rates are presented by 1000 employees.

Prevention Index

A prevention index takes multiple attributes of importance that are calculated separately and combines them into a single variable. For this project, a prevention index was calculated that included the rate of claims, a measure of risk, and the number of claims, a measure of magnitude. Each industry was ranked in ascending order on both rate and number of claims and then assigned two ranks in ascending order: one based on their rate per 100 workers and one based on the number of claims. Those two numbers were averaged and the result is the prevention index.[39]

Industries were categorized in four ways. Industries with high rates and high ranks had a prevention index over 40, meaning the average rank of the rate and claim count was 40 or higher. Industries with a rate rank in the top 20% and a count rank in the bottom 40% were categorized as high rate low count. Industries with a count in the top 20% and a rate in the bottom 40% were categorized as high count low rank. Finally, industries with at least 30 claims over the three-year period with both the rank and rate were in the bottom 20% were categorized as low rate low count. Industries that did not have claims for all three years, industries with a changing NAICS code between 2012 and 2017, and industries where data suppression was necessary to avoid identifying either an employer or individual are excluded from prevention index calculations.

Comparing Workers' Compensation Rates with BLS SOII

Published BLS SOII industry rates for total cases, California private sector workers were compared to the rates obtained through this project. Three-digit rates were compared because BLS includes more industries at 3-digit than at the 4- digit level. All rates are per 100 FTE, although the methods of calculating FTE differ between the two projects. A ratio of the rate of claims calculated through this project divided by the rate of claims in SOII is presented to describe the magnitude and direction of the difference between the two rates.

Results

The overall rate of injury among private sector workers was 3.3 per 100 FTE (Table 2). The rate among men was 1.07 times higher than the rate in women. While the largest number of injuries occurred to workers aged 25-34 years, the highest rate of injury was among 15-18 year olds (6.2 per 100 FTE).

Table 2: Incidence rates of occupational injury and illness by selected demographic and job characteristics, private industry, California 2015-2017

	Claims	Percent	Annual FTE	Annual Rate per 100 FTE
Overall	**1,386,948**	**100%**	**13,825,229**	**3.3**
Sex*				
Female	584,328	42%	6,769,956	2.9
Male	789,763	57%	8,543,437	3.1
Unknown	12,857	1%	--	--
Age Category*				
15 - 18	16,704	1%	90,451	6.2
19 - 24	188,733	14%	1,392,625	4.5
25 - 34	345,481	25%	4,037,010	2.9
35 - 44	287,081	21%	3,567,361	2.7
45 - 54	300,015	22%	3,336,962	3.0
55 - 64	205,194	15%	2,325,629	2.9
65+	40,575	3%	558,438	2.4
Unknown	3,165	<1%	--	--
Job Tenure[+]				
Under one year	451,353	33%	3,414,887	4.4
1 to <2 years	184,565	13%	1,056,624	5.8
2 to <5 years	235,695	17%	3,552,707	2.2
5 to <10 years	175,411	13%	2,878,918	2.0
10 years or more	249,027	18%	4,410,257	1.9
Unknown	9,0897	7%	--	--

*FTE data on age and sex from the American Community Survey (ACS), 1-year PUMS estimates, and does not match overall number because it is not based on any QCEW data. Overall QCEW estimates a lower number of annual FTE than the ACS, so the summed FTE for all categories of age and sex are higher than the Overall FTE. Likewise, rates are lower for age and sex categories because the FTE count is higher.
[+]Tenure distribution from https://www.bls.gov/news.release/tenure.t03.htm multiplied by total FTE.

The most common cause of injury was lifting strains (10.3%), followed by not otherwise classified strains (7.7%), miscellaneous causes (6.3%), and repetitive motion (5.6%) (Table 3). Of the ten most common causes of injury, four were strains, two were falls or slips, and two were miscellaneous causes. There were no

significant changes in the rank of the top thirty-five causes of injury over the three-year time period, and the same causes of injury composed the top ten causes each year of the study period. However, there were 11% fewer cumulative injuries and 7% fewer repetitive motion strains in the third year of analysis, likely due to delayed identification and reporting of these injuries (data not shown). From 2015-2017 there was a 44% increase in injuries caused by a person in act of a crime, from 1,588 injuries in 2015 to 2,288 injuries in 2017. Other cause of injury categories with a 25% increase or greater over the three year period and more than 500 injuries per year were temperature extremes; dust, gases, fumes or vapors; not otherwise classified contact with burn or scald-heat or cold exposure; injury by a fellow Worker, patient or other person; and steam or hot fluids.

Table 3: Incidence rates of occupational injury and illness by cause of injury, private sector, California 2015-2017

Cause of Injury	Claims	Annual rate per 1,000 FTE
Strain, Lifting	142,547 (10.3%)	3.44
Strain, Strain or Injury by, Not Otherwise Classified (NOC)	107,188 (7.7%)	2.58
Miscellaneous Causes, Other Miscellaneous, NOC	87,799 (6.3%)	2.12
Strain, Repetitive Motion	77,269 (5.6%)	1.86
Fall or Slip, Fall, Slip, Trip, NOC	63,805 (4.6%)	1.54
Fall or Slip, On Same Level	59,558 (4.3%)	1.44
Miscellaneous Causes, Cumulative, NOC	58,994 (4.3%)	1.42
Cut, Puncture, Scrape, Cut, Puncture, Scrape	54,882 (4%)	1.32
Strain, Pushing or Pulling	52,981 (3.8%)	1.28
Struck, Falling or Flying Object	50,294 (3.6%)	1.21
Cut, Puncture, Scrape, Hand Tool, Utensil; Not Powered	35,790 (2.6%)	0.86
Struck, Object Being Lifted or Handled	32,896 (2.4%)	0.79
Cut, Puncture, Scrape, Object Being Lifted or Handled	32,454 (2.3%)	0.78
Struck, Struck or Injured, NOC	31,522 (2.3%)	0.76
Striking Against or Stepping on, Stationary Object	29,154 (2.1%)	0.70
Strain, Twisting	28,680 (2.1%)	0.69
Miscellaneous Causes, Foreign Matter (Body) in Eye(s)	25,198 (1.8%)	0.61
Struck, Animal or Insect	24,019 (1.7%)	0.58
Fall or Slip, From Different Level (Elevation)	21,967 (1.6%)	0.53
Strain, Holding or Carrying	21,425 (1.5%)	0.52
Miscellaneous Causes, Other Than Physical Cause of Injury	20,611 (1.5%)	0.50
Struck, Fellow Worker, Patient	20,076 (1.4%)	0.48
Motor Vehicle, Collision or Sideswipe with Another Vehicle	19,324 (1.4%)	0.47
Caught in or Between, Caught in, Under or Between, NOC	18,127 (1.3%)	0.44
Fall or Slip, From Liquid or Grease Spills	17,418 (1.3%)	0.42
Strain, Reaching	16,280 (1.2%)	0.39

Caught in or Between, Object Handled	14,976 (1.1%)	0.36
Fall or Slip, From Ladder or Scaffolding	14,521 (1%)	0.35
Miscellaneous Causes, Absorption, Ingestion or Inhalation, NOC	14,169 (1%)	0.34
Fall or Slip, On Stairs	13,390 (1%)	0.32
Striking Against or Stepping on, Striking Against or Stepping on, NOC	12,860 (0.9%)	0.31
Fall or Slip, Slipped, Did Not Fall	12,155 (0.9%)	0.29
Motor Vehicle, Motor Vehicle, NOC	11,184 (0.8%)	0.27
Cut, Puncture, Scrape, Powered Hand Tool, Appliance	10,552 (0.8%)	0.25
Burn or Scald-Heat or Cold Exposure, Hot Objects or Substances	8,999 (0.6%)	0.22
All Other Causes	123,884 (8.9%)	2.99
Total	1,386,948 (100%)	33.44

Strain or tear was by far the most common nature of injury, accounting for 30.6% of all injuries and 10.23 injuries per 1,000 FTE each year (Table 4). Contusions (11.7%), lacerations (10.9%), all other injuries (8.9%), and sprain or tear (8.5%) were the next most common natures of injury. The ranking of the top three categories of nature of injury was the same each year. From 2015-2017 there was a 45% increase in heat prostration from 575 injuries to 832 injuries and a 44% increase in no physical injury from 3,696 injuries to 5,339 injuries. Asbestosis, respiratory disorders, and mental disorders also all increased over the three-year period.

Table 4: Incidence rates of occupational injury and illness by nature of injury, private sector, California 2015-2017

Nature of Injury	Claims	Annual rate per 1,000 FTE
Strain or Tear	424,119 (30.6%)	10.23
Contusion	162,601 (11.7%)	3.92
Laceration	150,864 (10.9%)	3.64
All Other Specific Injuries, Not Otherwise Classified (NOC)	122,969 (8.9%)	2.96
Sprain or Tear	117,765 (8.5%)	2.84
All Other Cumulative Injuries	54,848 (4%)	1.32
Puncture	53,831 (3.9%)	1.30
Multiple Physical Injuries Only	43,200 (3.1%)	1.04
Fracture	36,558 (2.6%)	0.88
Inflammation	36,169 (2.6%)	0.87
Foreign Body	28,611 (2.1%)	0.69
Burn	23,907 (1.7%)	0.58
Mental Stress	15,203 (1.1%)	0.37
Crushing	13,886 (1%)	0.33
No Physical Injury	13,277 (1%)	0.32
Dermatitis	8,190 (0.6%)	0.20

Hernia	7,632 (0.6%)	0.18
Carpal Tunnel Syndrome	7,381 (0.5%)	0.18
Dislocation	7,155 (0.5%)	0.17
Myocardial Infarction (Heart Attack)	6,762 (0.5%)	0.16
Multiple Injuries Including Both Physical and Psychological	6,661 (0.5%)	0.16
Concussion	5,757 (0.4%)	0.14
Infection	4,526 (0.3%)	0.11
All Other Occupational Disease Injury, NOC	4,501 (0.3%)	0.11
Syncope	3,966 (0.3%)	0.10
Respiratory Disorders (Gases, Fumes, Chemicals, etc.)	3,656 (0.3%)	0.09
Contagious Diseases	3,483 (0.3%)	0.08
Mental Disorder	3,054 (0.2%)	0.07
Bad or missing code	2,389 (0.2%)	0.06
Heat Prostration	1,958 (0.1%)	0.05
Rupture	1,785 (0.1%)	0.04
Amputation	1,584 (0.1%)	0.04
Electric Shock	1,463 (0.1%)	0.04
Hearing Loss or Impairment	1,149 (0.1%)	0.03
Poisoning-General (Not Overdose or Cumulative Injury)	1,048 (0.1%)	0.03
All Other	5,040 (0.4%)	0.12
Total	1,386,948 (100%)	33.44

Injuries to the low back area accounted for 12.1% of injuries, followed by injuries to multiple body parts (9.5%), and fingers (8.8%) (Table 5). These were the top three causes each year, and no category in the top 12 changed more than one rank over the three-year period. Low back injuries decreased from 55,917 in 2015 to 54,715 but were the most common cause of injury each year. Hand, knee, ankle, and food injuries all increased over the study period.

Table 5: Incidence rates of occupational injury and illness by part of body injured, private sector, California 2015-2017

Part of Body	Claims	Annual rate per 1,000 FTE
Low Back Area (Lumbar and Lumbo-Sacral)	167,724 (12.1%)	4.04
Multiple Body Parts (incl. Body Systems and Body Parts)	131,474 (9.5%)	3.17
Finger(s)	122,492 (8.8%)	2.95
Knee	87,560 (6.3%)	2.11
Hand (excl. Wrist and Fingers)	86,526 (6.2%)	2.09
Shoulder(s)	82,738 (6%)	1.99
Wrist	58,858 (4.2%)	1.42
Ankle	48,900 (3.5%)	1.18

Eye(s)	46,940 (3.4%)	1.13
Foot	44,657 (3.2%)	1.08
Lower Arm	42,324 (3.1%)	1.02
Thumb	39,434 (2.8%)	0.95
Lower Leg	27.404 (2%)	0.66
Multiple Head Injury	26,329 (1.9%)	0.63
Upper Back Area (Thoracic Area)	26,013 (1.9%)	0.63
Elbow	25,910 (1.9%)	0.62
Soft Tissue	23,923 (1.7%)	0.58
Multiple Upper Extremities	23,487 (1.7%)	0.57
Abdomen incl. Groin (excl. Internal Organs)	21,301 (1.5%)	0.51
Upper Arm (excl. Clavicle and Scapula)	19,365 (1.4%)	0.47
Body Systems and Multiple Body Systems	18,805 (1.4%)	0.45
No Physical Injury	17,833 (1.3%)	0.43
Insufficient Info to Properly Identify-Unclassified	17,718 (1.3%)	0.43
Chest (incl. Ribs, Sternum and Soft Tissue)	17,340 (1.3%)	0.42
Soft Tissue	13.917 (1%)	0.34
Wrist(s) & Hand(s)	11.637 (0.8%)	0.28
Skull	10/347 (0.7%)	0.25
Multiple Lower Extremities	10.330 (0.7%)	0.25
Lumbar and/or Sacral Vertebrae (Vertebrae NOC Trunk)	9,742 (0.7%)	0.23
Hip	9,327 (0.7%)	0.22
Toe(s)	9,083 (0.7%)	0.22
Upper Leg	8,900 (0.6%)	0.21
Multiple Neck Injury	8,523 (0.6%)	0.21
Brain	5,917 (0.4%)	0.14
Multiple Trunk	5,326 (0.4%)	0.13
All Other	58,844 (4.2%)	1.42
Total	1,386,948 (100%)	33.44

The industry sector with the highest rate of injury was transportation, warehousing, & utilities with 5.8 injuries per 100 FTE, followed by agriculture, forestry, and fishing (4.9 per 100 FTE) and wholesale and retail trade (4.2 per 100 FTE). All three of these industries experienced an increase in the number of claims and the rate of claims over the study period; the largest increase was in transportation, warehousing & utilities where injuries increased 18% over the study period and the rate increased 3.4% (Table 6). The greatest number of claims was in services (except public safety) with over 140,000 claims each year.

Table 6: Incidence rates of occupational injury and illness per 100 full time equivalent (FTE) by National Occupational Research Agenda (NORA) industry sector, private sector, California 2015-2017

NORA Sector	2015 Claims	2015 Rate	2016 Claims	2016 Rate	2017 Claims	2017 Rate	2015-2017 Rate
Transportation, Warehousing & Utilities	26,635	5.8	28,023	5.7	31,489	6.0	5.8
Agriculture, Forestry, and Fishing	21,821	4.9	21,779	4.8	23,275	5.1	4.9
Wholesale and Retail Trade	82,417	4.1	82,304	4.1	88,995	4.3	4.2
Construction	28,043	3.9	29,038	3.8	30,362	3.8	3.8
Manufacturing	43,616	3.6	44,945	3.7	45,173	3.7	3.6
Healthcare & Social Assistance	59,873	3.2	60,981	3.1	63,117	3.1	3.1
Mining	756	3.1	609	2.6	674	2.9	2.9
Services (except Public Safety)	147,211	2.7	150,984	2.6	160,864	2.7	2.7
Oil and Gas Extraction	374	2.1	269	2.0	293	2.1	2.1
Overall	**449,110**	**3.7**	**457,383**	**3.7**	**480,455**	**3.8**	**3.3**

The 20 4-digit NAICS industries with the highest rates of injury over the three-year period are shown in Table 7. In three industries, more than 10 in every 100 FTE workers are injured each year: interurban and rural bus transportation (13.1 per 100 FTE), building material and supplies dealers (11.9 per 100 FTE), and couriers (11.1 per 100 FTE). Both interurban and rural bus transportation and couriers are in the transportation, warehousing & utilities sector, along with scheduled air transportation (8.3 per 100 FTE) and warehousing and storage (7.3 per 100 FTE) also both in the top 20.

Table 7: North American Industrial Classification System (NAICS) industries with the highest incidence rates of occupational injury and illness per 100 full-time equivalent (FTE), private sector, California 2015-2017

4-digit NAICS	Industry Description	Claims 2015-2016	FTE 2015-2017	Rate per 100 FTE
4852	Interurban and Rural Bus Transportation	262	665	13.1
4441	Building Material and Supplies Dealers	34,565	97,247	11.9
4921	Couriers	20,842	62,706	11.1
3116	Animal Slaughtering and Processing	4,343	16,127	9.0
5622	Waste Treatment and Disposal	2,767	10,640	8.7
4811	Scheduled Air Transportation	11,357	45,848	8.3
1121	Cattle Ranching and Farming	6,252	26,632	7.8
4529	Other General Merchandise Stores	9,436	62,235	7.6
3211	Sawmills and Wood Preservation	446	1,977	7.5
1123	Poultry and Egg Production	586	2,622	7.5

5621	Waste Collection	4,605	20,793	7.4
7131	Amusement Parks and Arcades	8,457	38,559	7.3
3159	Apparel Accessories and Other Apparel Manufacturing	442	2,022	7.3
4931	Warehousing and Storage	11,773	54,007	7.3
7211	Traveler Accommodation	42,603	198,192	7.2
4523	General Merchandise Stores	15,897	76,159	7.0
6222	Psychiatric and Substance Abuse Hospitals	1,367	6,424	7.1
6219	Other Ambulatory Health Care Services	4,838	23,914	6.7
4533	Used Merchandise Stores	2,640	13,259	6.6
3315	Foundries	1,238	6,238	6.6

The industry with the most seasonal variation in the number of injuries was fruit and vegetable preserving and specialty food manufacturing which had the most injuries in the second and third quarter of the year (Table 8). While this industry has some increase in employment in the third quarter, rates by person (not FTE) were also variable by season. Sugar and confectionary product manufacturing showed a similar pattern of injuries increasing in the second and third quarters of the year. Spectator sports and warehousing and storage both increased throughout the year from the first to the fourth quarter. Industries with the highest seasonal variation by rate include cut and sew apparel manufacturing (NAICS 3152), support activities for forestry (NAICS 1153), other animal production (NAICS 1129). However, these calculations are based on counts of workers (not FTE) because ACS data is not available for adjusting counts of workers to FTEs on a sub-annual basis.

Table 8: Ten industries with the highest seasonal variation in number of claims, private sector, California average of 2015-2017

4-digit NAICS	Industry Description	All Claims	Rate per 100 workers	Q1	Q2	Q3	Q4	SE*
3114	Fruit and Vegetable Preserving and Specialty Food Manufacturing	4,781	6.04	834	1,031	2,071	845	0.43
7112	Spectator Sports	2,940	6.48	481	674	866	919	0.23
3159	Apparel Accessories and Other Apparel Manufacturing	442	7.29	89	133	108	112	0.14
4931	Warehousing and Storage	11,773	7.27	2,345	2,786	3,256	3,386	0.14
4882	Support Activities for Rail Transportation	540	6.27	106	143	141	150	0.13
3113	Sugar and Confectionery Product Manufacturing	1,073	6.28	229	302	300	242	0.12
7131	Amusement Parks and Arcades	8,457	7.31	1,714	2,166	2,437	2,140	0.12
4248	Beer, Wine, and Distilled Alcoholic Beverage Merchant Wholesalers	3,931	6.29	827	1,120	1,066	918	0.12
3379	Other Furniture Related Product Manufacturing	803	6.29	173	184	233	213	0.12
3313	Alumina and Aluminum Production and	589	5.95	120	158	165	146	0.12

Processing

*Standard Error (SE) is a measure of variation used to determine the industries with the most seasonal variation.

The rate of injury increased with company size in a monotonic relationship. The majority of companies (73%) had less than five employees. These companies had the lowest injury rate, 1.28 per 1,000 workers. The highest rate was in companies with over 1,000 employees, 10.9 per 1,000 employees per year. These large firms with high injury rates make up less than one percent of all companies but employ 31% of workers in the state.

Table 9: Incidence rates of occupational injury and illness per 100 full time equivalent workers (FTE) by size category, private sector, California 2015-2017

Size Category	Companies	Claims 2015-2017	Employees 2015-2017	Rate per 1,000 employees
0 to 4	9,803,350	19,182	15,041,934	1.28
5 to 9	1,577,113	32,179	10,375,721	3.10
10 to 19	985,962	59,129	13,303,222	4.44
20 to 49	657,027	123,997	19,908,051	6.23
50 to 99	219,000	122,460	15,113,442	8.10
100 to 249	128,507	182,097	19,453,251	9.36
250 to 499	38,627	129,849	13,245,515	9.80
500 to 999	18,298	120,021	12,591,539	9.53
1000+	14,938	570,933	52,712,286	10.83
Total*	**13,442,822**	**1,359,847**	**171,744,961**	**7.92**

Note: The totals are different from other tables because the claim counts only include claims that matched to a QCEW employer and the denominator is an employee count rather than FTE. There were 27,101 claims we assigned to an industry without assigning an employer.

Industries are classified into four prevention categories based on their rate and their count (Figure 2). Industries with a high rate of claims and a high number of claims included building material and supplies dealers (NAICS 4852), couriers (NAICS 4921), traveler accommodation (NAICS 7211), grocery stores (NAICS 4451), and scheduled air transportation (4811). These industries have the highest prevention index rank and would be good industries to direct resources into prevention. Industries with a high rate and low number of claims are small industries with high rates, including interurban and rural bus transportation (NAICS 4851), animal slaughtering and processing (NAICS 3116), and waste treatment and disposal (NAICS 5622). A table with the annual rates and prevention index calculation for each industry is in Appendix B.

Figure 2: Prevention Index Highlighting Some Industries, California 2015-2017

Rates of injury from workers' compensation were compared with SOII rates each year. In 2015, there were 68 3-digit industries with rates calculated for both this workers' compensation project and in the publicly available California BLS SOII. Of those, 46 (68%) had a higher rate in workers' compensation than in SOII (Appendix D). There were eight industries where the rate in workers' compensation was more than twice as high as the rate in SOII: textile product mills, petroleum and coal products manufacturing, oil and gas extraction, building material and supply dealers, textile mills, publishing industries (except internet) and electronics and appliance stores. The rates for the industries with the 20 highest rates of injury in workers' compensation in 2015 are in Table 10. The rate of injury in workers' compensation claims was more than

twice as high in building material and garden equipment supply dealers than the SOII rate. Couriers and messengers and waste management and remediation services also had rates in workers' compensation that were much higher than in SOII.

Table 10: Incidence rates of occupational injury and illness per 100 full time equivalent workers (FTE), Workers' Compensation (WC) calculation and Bureau of Labor Statistics Survey of Occupational Injury and Illnesses, California 2015

Industry Description (NAICS code)	WC Project Rate	SOII Total Recordable Rate	SOII Total DART Rate	SOII Other Recordable Rate	WC to SOII Ratio
Building material and garden equipment and supplies dealers (444)	10.5	5.1	3.5	1.5	2.1
Couriers and messengers (492)	10.2	8.4	6.8	1.6	1.2
Air transportation (481)	7.9	7.7	6.0	1.8	1.0
Animal production and aquaculture (112)	7.4	7.8	5.3	2.4	0.9
Warehousing and storage (493)	7.2	7.1	5.5	1.6	1.0
Accommodation (721)	7.1	6.9	4.6	2.3	1.0
Waste management and remediation services (562)	6.8	4.6	3.2	1.4	1.5
General merchandise stores (452)	6.2	5.4	3.3	2.1	1.1
Wood product manufacturing (321)	6.1	6.6	4.5	2.1	0.9
Beverage and tobacco product manufacturing (312)	5.7	5.5	4.4	1.1	1.0
Food and beverage stores (445)	5.7	5.3	4.0	1.4	1.1
Nursing and residential care facilities (623)	5.6	7.6	5.4	2.2	0.7
Food manufacturing (311)	5.6	5.2	3.7	1.6	1.1
Furniture and related product manufacturing (337)	5.4	5.5	3.9	1.6	1.0
Primary metal manufacturing (331)	5.4	5.2	4.0	1.2	1.0
Nonmetallic mineral product manufacturing (327)	5.4	4.7	3.4	1.3	1.1
Rental and leasing services(532)	5.2	3.8	2.8	1.0	1.4
Hospitals (622)	5.1	6.8	3.6	3.3	0.7
Crop production (111)	5.1	5.5	3.6	1.9	0.9
Truck transportation (484)	5.0	5.4	3.9	1.5	0.9

In 2016, there were 64 three-digit industries with a rate for both SOII and WC and 39 (61%) were higher in WC (Appendix D). The twenty industries with the highest rates in workers' compensation are shown with comparison to SOII rates for 2016 in Table 11. As in 2015, building material and garden equipment and supplies dealers had a rate in SOII that was less than half of the rate in workers' compensation claims (10.7 vs. 4.0). In addition, the rate in apparel manufacturing was 6.3 per 100 FTE in workers' compensation but only 1.6 per 100 FTE in SOII. Some industries with the highest rates in workers' compensation had even higher rates in SOII, including wood product manufacturing and leather and allied product manufacturing.

Table 11: Incidence rates of occupational injury and illness per 100 full time equivalent workers (FTE), Workers' Compensation (WC) calculation and Bureau of Labor Statistics Survey of Occupational Injury and Illnesses, California 2016

Industry Description (NAICS code)	WC Project Rate	SOII Total Recordable Rate	SOII Total DART Rate	SOII Other Recordable Rate	WC to SOII Ratio
Building material and garden equipment and supplies dealers (444)	10.7	4	3.1	0.8	2.7
Couriers and messengers (492)	10.1	8.8	7	1.7	1.1
Air transportation (481)	7.8	7.8	5.6	2.2	1.0
Animal production and aquaculture (112)	7.3	5.9	4.3	1.6	1.2
Accommodation (721)	7.1	6	3.7	2.3	1.2
Warehousing and storage (493)	6.7	6	4.7	1.3	1.1
Wood product manufacturing (321)	6.6	9.4	6.6	2.8	0.7
Apparel manufacturing (315)	6.3	1.6	1	0.6	3.9
General merchandise stores (452)	5.9	5.4	3.7	1.7	1.1
Leather and allied product manufacturing (316)	5.8	10	9.6	0	0.6
Food manufacturing (311)	5.8	4.8	3.4	1.4	1.2
Food and beverage stores (445)	5.7	4.9	3.3	1.6	1.2
Nursing and residential care facilities (623)	5.7	6.5	4.1	2.5	0.9
Nonmetallic mineral product manufacturing (327)	5.4	3.9	3.2	0.8	1.4
Beverage and tobacco product manufacturing (312)	5.2	5.5	4.2	1.3	1.0
Furniture and related product manufacturing (337)	5.1	5.4	3.2	2.3	0.9
Crop production (111)	5.1	6.3	3.7	2.6	0.8
Furniture and home furnishings stores (442)	5.0	4.5	2.7	1.8	1.1
Hospitals (622)	5.0	6.6	3.5	3.1	0.8
Primary metal manufacturing (331)	4.9	5	3.6	1.3	1.0

In 2017, there were 64 three-digit industries with a rate for both workers' compensation and SOII. Of those, the rate was higher in workers' compensation for 45 (70%) of the industries (Appendix C). Table 12 shows the comparison of rates between workers' compensation and SOII for 2017. The largest difference was in building material and garden equipment and supplies dealers, utilities, and administrative and support services. Social assistance, hospitals, and amusement gambling and recreation industries all had higher rates in SOII than in WC (Table 12).

Table 12: Incidence rates of occupational injury and illness per 100 full time equivalent workers (FTE), Workers' Compensation (WC) calculation and Bureau of Labor Statistics Survey of Occupational Injury and Illnesses, California 2017

Industry Description (NAICS code)	WC Project Rate	SOII Total Recordable Rate	SOII Total DART Rate	SOII Other Recordable Rate	WC to SOII Ratio
Building material and garden equipment and supplies dealers (444)	12.4	4.3	3.2	1	2.9
Couriers and messengers (492)	10.2	9.4	7.9	1.5	1.1
Air transportation (481)	7.8	7	5.7	1.2	1.1
Warehousing and storage (493)	7.8	6.1	4.5	1.7	1.3
Animal production and aquaculture (112)	7.4	7.9	4.4	3.4	0.9
Accommodation (721)	7.1	6.1	4	2.1	1.2
Waste management and remediation services (562)	6.9	5.2	3.3	1.9	1.3
Wood product manufacturing (321)	6.7	5	3.5	1.5	1.3
Food manufacturing (311)	6.0	5.6	4	1.5	1.1
Food and beverage stores (445)	6.0	5.3	3.2	2.1	1.1
Primary metal manufacturing (331)	5.8	4.1	2.6	1.5	1.4
Nursing and residential care facilities (623)	5.8	6.4	4.1	2.3	0.9
General merchandise stores (452)	5.6	4.8	3.1	1.7	1.2
Nonmetallic mineral product manufacturing (327)	5.5	5.7	4.1	1.6	1.0
Crop production (111)	5.5	5	3.1	1.9	1.1
Utilities (221)	5.2	1.4	0.7	0.8	3.7
Beverage and tobacco product manufacturing (312)	5.2	5.2	3.7	1.5	1.0
Hospitals (622)	5.1	6.4	3.4	2.9	0.8
Leather and allied product manufacturing (316)	5.0	5.7	4.3	0	0.9
Furniture and related product manufacturing (337)	5.0	4.6	3.4	1.2	1.1

Employment and risk for injury changes over the course of a working life. Table 13 shows the ten industries that had the highest number of injuries in each of four age groups: 15-18 year olds, 19-24 year olds, 25-64 year olds, and workers 65 and older. Restaurants and eating places had more injuries than any other industry for all workers less than 65 years of age. Some industries only experienced high numbers of injuries among either young workers or older workers. For example, motion picture and video industries, amusement parks and arcades, other amusement and recreation, and clothing stores were all in the top industries for 15-18 year olds, but were not industries with high numbers of injury among workers in any other age group. Among workers aged 65 years and older, individual family services is the seventh most common industry, but it is not an industry with a large number of claims in any other age group.

Table 13: Ten industries with the highest number of injuries by age group, California 2015-2017

Rank	15-18 year olds	19-24 year olds	25-64 year olds	65 year olds and older
1	Restaurants and Other Eating Places	Restaurants and Other Eating Places	Restaurants and Other Eating Places	General Medical and Surgical Hospitals
2	Grocery Stores	Employment Services	Employment Services	Traveler Accommodation
3	Employment Services	Grocery Stores	General Medical and Surgical Hospitals	Building Material and Supplies Dealers
4	Building Material and Supplies Dealers	Building Material and Supplies Dealers	Grocery Stores	Employment Services
5	Motion Picture and Video Industries	Traveler Accommodation	Traveler Accommodation	Grocery Stores
6	Amusement Parks and Arcades	Couriers	Services to Buildings and Dwellings	Restaurants and Other Eating Places
7	Support Activities for Crop Production	Support Activities for Crop Production	Support Activities for Crop Production	Individual and Family Services
8	Other Amusement and Recreation Industries	Services to Buildings and Dwellings	Building Material and Supplies Dealers	Services to Buildings and Dwellings
9	Couriers	General Merchandise Stores, including Warehouse Clubs and Supercenters	Building Equipment Contractors	Nursing Care Facilities
10	Clothing Stores	Community Care Facilities for the Elderly	Nursing Care Facilities	Support Activities for Crop Production

Results presented here, along with a web-based interactive data dashboard on the Tableau platform will be posted on the OHB website, and the underlying data tables will be available on the DIR website. The dashboard allows users to browse through a table of NAICS 4-digit industries, which includes the total claim count, total employee count, and injury rate for each industry. Users can view data for a single year or

combined data for three years. When users select the table row for a NAICS industry, the dashboard displays charts detailing the distribution of claims for that industry by:

- Occupational class code
- Employee age
- Employee gender
- Employee tenure
- Cause of Injury
- Nature of Injury
- Part of Body Injured

The dashboard has been approved by CDPH and DIR legal divisions and the IT departments of the respective agencies are working on positing this data publicly. A topic page on the OHB website will include technical information about the data tool and a summary of methods used, in language that is appropriate for a large audience of users.

Discussion

This project combined four datasets collected and maintained by three separate government agencies to calculate the most accurate rates of worker injuries possible. Workers' compensation injury claims data was matched to a database of all workers maintained by the EDD to identify the worker's employer in the QCEW (also maintained by EDD). QCEW data by establishment was used to identify the employer industry and number of workers per industry. To account for different hours worked by industry, these numbers were adjusted by ACS hours worked, a product of the U.S. Census Bureau. Previously, this information was not available, and while annual reports of workers' compensation claims by part of body, cause of injury, nature of injury, age, gender, county, and month of injury are available online for public use, no information about industry has been available.[40]

Between 2015-2017 in California, there were 3.2 reported workers' compensation claims per 100 FTE. Rates were higher among men, workers younger than 25 years old, and among workers who had been in their jobs for less than two years. Industries in the transportation, warehousing, and utilities sectors had high rates of injury, and those rates were often higher than rates in BLS SOII. In particular, building material and garden equipment and supplies dealers had twice as high a rate in workers' compensation than in SOII for each year in this study. Apparel manufacturing and utilities also had higher rates in workers' compensation than in SOII. The industries employing and injuring workers were different for different age groups of workers. In California, without sacrificing employer or worker privacy, 4-digit NAICS rates can be calculated using workers' compensation claims for almost all industries each year, showing a greater level of detail than is available in SOII. One possible end product of this data are injury profiles by industry that include the causes of injury, natures of injury, and demographic breakdowns for each individual industry, allowing for targeted interventions that address industry-specific risks, which is available online as a result of this project. (See Appendix E for a screenshot of the data sharing tool).

Workers' compensation claims are useful in occupational safety and health research because they include all industries and all occupations and have coded fields for cause of injury, nature of injury, and part of body injured. This makes the database of these claims flexible to use in many different applications. The same data can identify commercial bakers and bus drivers, and describe the similarities and differences in injuries that both groups experience. Rates identify the risks faced by different industries for comparison, and can track trends over time. The data is comparably timely and so can provide information on changing risk factors as injuries begin to occur, although this is easier for traumatic injuries than cumulative trauma injuries. From 2015-2017, heat illness injuries and injuries from a person in the act of a crime increased 45% and 44%, respectively. Identifying these increases is essential to taking timely steps to prevent further injury.

Since workers' compensation is a census rather than survey, it is not subject to sampling error. While not used in this data, workers' compensation includes both medical-only and time-loss claims, so it is possible to measure severity of injuries. In addition, in California all medical bills are collected in a medical billing database that gives researchers ability to track medical services for claims, medical costs of claims, and prescription drugs prescribed to workers. An evaluation of how time-loss claims and medical billing data could be used to calculate costs of injuries is included in Appendix F.

There are some characteristics about injuries and the resulting claims that we cannot glean from our work. We cannot accurately determine medical-only claims, because determining medical-only claims relies on

SROI reporting. Claims with a SROI for indemnity payments are certainly time loss claims, however, some injuries may have required time away from work but not had a SROI reported. While some claims have some information on wages, this data was not complete enough to be able to classify low-wage workers to determine if they are at-risk workers. Work-arrangement is not well characterized, so it is difficult to identify workers in multi-employer relationships such as temporary workers or contract workers. While claims have a free text occupation description, they are often too vague to be able to categorize effectively, and so occupation rates were not calculated. There is no data on race or ethnicity recorded in workers' compensation claims, so we have no way to calculate rates or magnitude to be able to track this important demographic variable. It is also difficult to compare results from one state to another because of substantial differences in eligibility and reporting requirements among states.

Perhaps the greatest limitation to workers' compensation rates is the limitation of under reporting.[41] Barriers to filing claims might change which injuries get reported, and is likely influenced by demographic characteristics of the workers. Lack of familiarity with workers' compensation, uncertainty about work-relatedness, and reliance on patients to identify their own work-related injuries all lead to under reporting of occupational injuries.[42] Employers may also deter workers from reporting injuries to avoid inspection targeting. Studies examining the costs of group health medical claims comparing individuals with and without workers' comp claims show that employer liability costs are shifted to the group health system instead of being paid for by workers' compensation.[43] This cost shifting may be a contributing factor in the declining claims rates for MSDs and other injuries.[44] However, this under reporting in workers' compensation may still be less than in SOII, where research found that 20% of lost time claims were likely ineligible for SOII case reporting during the survey year.[45]

This project used the BWF as a link between worker claims and counts of workers by employer and industry in the QCEW. Using the BWF to match workers to their employers and thus ensure that workers their and employers were assigned the same industry code was a huge methodological advancement from this project. When workers have multiple jobs we can determine the job where the worker was injured using employer key, and only 58% of private sector workers with multiple jobs were injured at the job that provided them the most wages in a given quarter. However, because the BWF stores information on workers at the firm level rather than the establishment level, it was difficult to identify the correct industry code for some workers at complex multi-establishment firms. Multi-establishment firms make up only 1% of establishments in California, but 37% of workers, and 51% of workers' compensation claims. Other research using unemployment insurance data have often limited analysis to private sector single establishment firms.[46] We assigned a NAICS code to 84% of multi-establishment employers, 81% of multi-establishment workers, and 84% of included multi-establishment claims and so these workers are included in our analysis.

The establishment data from QCEW is the gold standard for the number of workers per industry in the U.S., and using this data source allowed us to calculate accurate rates of injury by industry. Monthly counts of workers from QCEW allowed us to identify seasonal trends. Because QCEW does not have hours worked by industry, we supplemented the QCEW with the ACS to calculate injury rates by FTEs per industry, rather than per worker. However, the industry of public sector (state, city, county employees) is not well counted or identified in QCEW or workers' compensation. Many public sector employers listed the majority of their employees in "Other Justice and Public Safety" with QCEW when they perform complex tasks in other industries. While workers' compensation includes claims for workers in the public sector (state and local government), they often list all employees as county or city employees, even though these employees work

at different establishment in different industries. It is thus challenging to calculate a rate for public sector workers, and even more challenging to determine rates by public sector industry. More detail on public sector claims is Appendix G. These claims make up the majority of claims that were excluded from our analysis, and data on excluded claims is in Appendix H.

Conclusion

Research that uses workers' compensation data for compliance and research increases our understanding of the risk factors for work-related injuries and illness. States with state-administered workers' compensation systems, like Washington and Ohio, are able to do similar work as this project without matching data because of the availability of hours worked within the workers' compensation system and the availability of employer identifiers in multiple data systems.[47,48] With some additional financial support the reporting of industry-specific rates of workers' compensation claims reported in this paper could be provided each year. Additional work disseminating this information to organizations and individuals involved in work-related injury prevention and occupational safety and health regulation could better prevent costly work-related injuries.

Since 2000, DIR has been collecting WCIS data, but researchers (both internal and external to this project) have had difficulty calculating rates. The quantity of claims coupled with poor industry coding has meant that DIR and CDPH have not been able to calculate overall injury rates or industry specific rates. This project is expanding on the utility of our work with WCIS, specifically through access to QCEW denominator data.

As our methods for dealing with various data issues have codified, we are better able to understand injury and illness rates in California, and to develop further methods for calculating cost, adjusting numbers, and increasing awareness about the utility of this data set. We have built skills in Tableau software that will help us in our other work in occupational health surveillance. Our work with the BWF, QCEW, and ACS data are also helping us with our ongoing work, and building our capacity to calculate industry and occupation rates. In addition, using the information gained from this project we have been able to utilize occupational heat illness, examine disparities in injury rates by wage groups, and contribute data to the NIOSH oil and gas work group.

Appendices

Appendix A: Using the American Community Survey to Calculate FTE's

Much of our work on adjusting employee counts in QCEW using the ACS was influenced by very thorough and thoughtful work by Martha Jones, Tim Bushnell, and Steve Wurzelbacher that was summarized in the whitepaper, "Estimating Full-Time-Equivalent Employee Denominators for Calculation Workers' Compensation Rates."[49]

We examined several different denominator adjustments through the course of this project. They are listed below and given alphabetic distinctions that correspond to calculations and notations below:

1. American Community Survey – California Data – 2015-2017
    a. Weeks worked and hours worked (method A)
    b. Hours worked only (Method B)
    c. Three years of annual data files (Method C)
    d. Five year data (Method D)
2. American Community Survey – National Data – 2015-2017 (Method E)
3. CES Data – 4 digit NAICS (Method F)
4. Employed Labor Force (ELF) query system – FTE calculation – 4 digit data (Method G)

While there is some variation in the FTE adjustments from these different calculation methods, we found that once we used these FTE adjustments to calculate rates, Because these differences are so small, the ranking of the industries by rate did not change much. As would be expected, the numerator and the count of workers in the denominator both were more substantial contributors to the rate than the FTE adjustment. The level of detail involved in calculating FTEs was not proportionate to the resulting impact of the prevention message; rather the prevention messages and the at-risk industries remain the same regardless of what FTE adjustment you use. For public health purposes, a simpler method would be preferable.

Below is a table of ten industries with the highest rates of injury in the three-year period and their rates using various methods identified above. The rates in this table do not correspond to the rates presented in this report and are for illustrative purposes only. These were calculated before the final methodology for the project was determined and were calculated using 6 months of data as part of the pilot for the methodology.

For comparison purposes only: Example rates per 100 FTE using various FTE adjustment factors.

NAICS code	Industry Description	Rate (Method A)	Rate (Method E)	Rate (Method F)	Rate (Method G)
4852	Interurban and Rural Bus Transportation	15.397	15.812	12.102	14.089
4441	Building Material and Supplies Dealers	11.564	10.290	11.793	10.215
4921	Couriers and Express Delivery Services	11.505	10.626	11.958	9.861
5622	Waste Treatment and Disposal	9.721	8.801	8.311	10.141
3116	Animal Slaughtering and Processing	9.039	8.661	8.408	8.453
4811	Scheduled Air Transportation	9.015	8.495	10.843	8.324

1121	Cattle Ranching and Farming	8.964	8.330	7.857	8.691
4529	Other General Merchandise Stores	8.058	7.636	7.792	6.591
3211	Sawmills and Wood Preservation	6.483	6.701	6.607	6.557

In addition to this work using different versions of California ACS data. The differences in rates using either hours or hours and weeks, or annual files or 5-year files were all miniscule and the majority of the time amounted to differences in the tenths digit in rates per 100 workers. That is to say, the level of specificity that these different adjustments made is a difference in 1 injury per 1,000 workers. A decided upon standard method would be preferable so all states can use the same method.

Appendix B: Matching Methods in Detail

We submitted three years of workers' compensation claims data (JCN, injury date, employee SSN, employer FEIN) to EDD Labor Market Information Division (LMID) programmers. LMID used the employee SSN to match WCIS claims data to their employment records in the BWF.

LMID returned a file listing all recorded employers on record for each claimant employee during the calendar quarter of injury. Workers with multiple jobs during a quarter had multiple records returned. Several flags were used to identify different characteristics of the worker-employer match. If the employer FEIN in WCIS matched the employer FEIN in the base wage file, the claim was flagged as a "FEIN Match." When a worker had multiple jobs, the job where the worker earned the highest wages in the quarter was flagged as a "main job."

LMID also provided a second file with detailed employer records from the QCEW. Not all employers in the BWF are in the QCEW, but the majority were included. This file includes the six-digit NAICS code and number of employees for every employer establishment. It also includes zip code of each establishment; the sector (local government, state government, federal government, or private sector); and a multi-establishment employment indicator that identified multi-establishment firms. When a multi-establishment firm had different NAICS codes at different establishments, this file included all multi-establishment NAICS codes.

We assigned a single 4-digit NAICS code to each QCEW employer, whenever possible. Single establishment employers are easy to NAICS code because they have one NAICS. However, it is not always easy or possible for multi-establishment employers with different NAICS codes at their establishments.

For multi-establishment employers we selected the 4-digit NAICS code that covered 80% or more of employees. Employment at establishments coded 551114 ("Corporate, Subsidiary, and Regional Managing Offices") are excluded from this calculation, because we concluded that these establishments do not accurately convey the industry for the employer or reflect the claimant employees. However, roughly 79 multi-establishment employers are given NAICS 5511 because at least 80% of their employees are recorded under this code.

Multi-establishment employers that do not have a single 4-digit NAICS code for 80% of their employees are considered "un-NAICS-able". The employees from these employers are coded in calculations as "XXXX." Employees at these employers and claims determined to link to these employers are not included in any industry rates.

After assigning each employer a NAICS code we identified the QCEW employer record that corresponds to each WCIS claim. Because some injured workers have more than one job each quarter, and the WCIS claim record does not always have sufficient information to clearly identify the employer, we developed ways of identifying a NAICS codes for workers with multiple jobs. Some claims were assigned a 4 digit NAICS code without determining the employer at injury. Inclusion Subset 4 ("multiple matches all have the same NAICS code") selects a NAICS code, not an employer. This step accounts for 1.6% of included claims.

A NAICS code was assigned to 84% of all claims with an employer match, and to 73% of all claims. The other 27% of all claims are given the NAICS Code "XXXX". "XXXX" includes both claims for which we could not select an employer (13% of all claims) and claims linked to an employer for whom we could not determine a NAICS (14% of all claims).

For each 4-digit NAICS code we calculated the total numbers of employees to be adjusted by FTE in the denominator. At an establishment whose NAICS code differs from the NAICS we selected to represent the employer, the employees at that establishment are included in the “XXXX” denominator, *not* in the denominator for the employer’s primary NAICS. This is a way of guaranteeing that workers in other industries at a complex company are not included in the wrong NAICS, and in practice was a way to not count workers in clerical and management occupations along with the higher risk industry that was the predominant business (according to number of employees) for a given company.

Appendix C: Prevention Index (PI) of All Industries, California 2015-2017

NAICS	Industry Description	Rate 2015	Rate 2016	Rate 2017	Annual rate 2015-2017	Claim Rank	Rate Rank	PI	PI Rank
1111	Oilseed and Grain Farming	5.11	6.04	5.83	5.65	203	42	122.5	111
1112	Vegetable and Melon Farming	5.48	5.50	6.27	5.74	48	40	44	21
1113	Fruit and Tree Nut Farming	4.89	4.65	4.99	4.85	17	77	47	24
1114	Greenhouse, Nursery, and Floriculture Production	5.26	6.04	6.18	5.82	61	39	50	29
1119	Other Crop Farming	5.20	5.03	5.84	5.34	141	56	98.5	68
1121	Cattle Ranching and Farming	7.71	7.89	7.87	7.83	47	7	27	12
1122	Hog and Pig Farming	2.28	5.14	1.38	3.12	291	171	231	260
1123	Poultry and Egg Production	7.94	6.38	8.05	7.45	209	9	109	81
1124	Sheep and Goat Farming	5.42	2.20	3.91	3.99	277	125	201	226
1125	Aquaculture	2.50	3.25	2.32	2.68	281	197	239	265
1129	Other Animal Production	4.78	3.74	3.72	4.08	243	118	180.5	195
1132	Forest Nurseries and Gathering of Forest Products	3.00	1.81	2.53	2.51	278	203	240.5	267
1133	Logging	5.38	5.82	5.40	5.52	237	48	142.5	140
1141	Fishing	0.60	1.04	-	0.55	293	286	289.5	295
1142	Hunting and Trapping	-	-	3.50	1.13	296	264	280	290
1151	Support Activities for Crop Production	4.29	4.24	4.63	4.39	8	102	55	32
1152	Support Activities for Animal Production	4.24	3.78	3.42	3.81	239	134	186.5	206
1153	Support Activities for Forestry	5.12	3.28	4.21	4.22	265	109	187	207
2111	Oil and Gas Extraction	1.59	1.61	1.32	1.53	256	247	251.5	273
2121	Coal Mining	1.80	11.12	3.87	3.20	288	167	227.5	258
2122	Metal Ore Mining	3.73	4.25	3.14	3.70	274	140	207	233
2123	Nonmetallic Mineral Mining and Quarrying	3.08	3.79	3.55	3.46	241	151	196	219
2131	Support Activities for Mining	2.51	2.33	2.49	2.45	193	204	198.5	223

2211	Electric Power Generation, Transmission and Distribution	3.59	2.70	3.19	3.16	143	168	155.5	159
2212	Natural Gas Distribution	4.79	5.01	6.16	5.31	49	58	53.5	31
2213	Water, Sewage and Other Systems	5.22	4.92	5.23	5.13	190	66	128	124
2361	Residential Building Construction	3.49	3.46	3.31	3.42	31	155	93	65
2362	Nonresidential Building Construction	3.08	2.90	2.96	2.98	46	180	113	93
2371	Utility System Construction	3.77	3.64	3.42	3.60	68	144	106	76
2372	Land Subdivision	2.27	1.82	2.11	2.07	227	222	224.5	254
2373	Highway, Street, and Bridge Construction	4.02	3.78	3.68	3.82	115	132	123.5	115
2379	Other Heavy and Civil Engineering Construction	3.44	3.44	3.67	3.52	185	146	165.5	167
2381	Foundation, Structure, and Building Exterior Contractors	5.47	5.40	5.58	5.49	12	49	30.5	14
2382	Building Equipment Contractors	3.57	3.48	3.52	3.52	9	146	77.5	52
2383	Building Finishing Contractors	4.09	4.02	3.92	4.01	18	122	70	45
2389	Other Specialty Trade Contractors	3.92	3.87	3.85	3.88	41	129	85	59
3111	Animal Food Manufacturing	5.58	5.64	5.59	5.60	210	44	127	123
3112	Grain and Oilseed Milling	6.38	5.75	6.93	6.36	200	24	112	89
3113	Sugar and Confectionery Product Manufacturing	6.24	6.28	6.32	6.28	172	28	100	71
3114	Fruit and Vegetable Preserving and Specialty Food Manufacturing	6.02	6.10	6.00	6.04	64	34	49	28
3115	Dairy Product Manufacturing	5.28	6.08	6.41	5.94	112	37	74.5	50
3116	Animal Slaughtering and Processing	8.34	8.35	10.45	8.98	70	4	37	17
3117	Seafood Product Preparation and Packaging	4.76	6.59	6.47	5.97	259	35	147	146
3118	Bakeries and Tortilla Manufacturing	4.50	4.53	4.69	4.58	53	90	71.5	47
3119	Other Food Manufacturing	5.26	5.23	5.41	5.30	71	59	65	40
3121	Beverage Manufacturing	5.73	5.25	5.17	5.37	37	54	45.5	23
3122	Tobacco Manufacturing	5.17	-	2.05	2.11	295	217	256	275
3131	Fiber, Yarn, and Thread	3.84	2.39	8.37	4.90	282	74	178	189

	Mills								
3132	Fabric Mills	3.91	3.52	4.06	3.82	255	132	193.5	217
3133	Textile and Fabric Finishing and Fabric Coating Mills	3.63	4.01	3.31	3.65	218	143	180.5	195
3141	Textile Furnishings Mills	4.81	5.12	5.69	5.20	221	63	142	139
3149	Other Textile Product Mills	2.84	2.87	2.70	2.81	226	190	208	235
3151	Apparel Knitting Mills	4.62	4.41	5.54	4.82	261	78	169.5	179
3152	Cut and Sew Apparel Manufacturing	2.98	6.19	4.24	4.44	55	101	78	53
3159	Apparel Accessories and Other Apparel Manufacturing	4.75	8.76	8.27	7.29	225	12	118.5	101
3161	Leather and Hide Tanning and Finishing	1.01	2.68	2.01	1.94	294	225	259.5	277
3162	Footwear Manufacturing	4.21	6.97	2.59	4.58	273	90	181.5	197
3169	Other Leather and Allied Product Manufacturing	4.58	5.67	5.77	5.36	241	55	148	149
3211	Sawmills and Wood Preservation	7.89	7.88	6.83	7.52	224	8	116	96
3212	Veneer, Plywood, and Engineered Wood Product Manufacturing	5.68	6.30	6.58	6.19	215	31	123	114
3219	Other Wood Product Manufacturing	6.00	6.44	6.65	6.37	101	23	62	39
3221	Pulp, Paper, and Paperboard Mills	4.04	3.25	4.04	3.79	268	135	201.5	228
3222	Converted Paper Product Manufacturing	4.60	4.17	4.15	4.30	111	107	109	81
3231	Printing and Related Support Activities	2.79	2.89	3.04	2.91	88	182	135	131
3241	Petroleum and Coal Products Manufacturing	2.73	2.44	1.68	2.20	222	213	217.5	247
3251	Basic Chemical Manufacturing	3.14	2.77	2.64	2.84	233	187	210	238
3252	Resin, Synthetic Rubber, and Artificial and Synthetic Fibers and Filaments Manufacturing	3.75	4.25	4.15	4.05	236	121	178.5	190
3253	Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing	4.66	3.63	4.24	4.17	253	114	183.5	202
3254	Pharmaceutical and Medicine Manufacturing	2.27	2.35	2.58	2.41	89	207	148	149

3255	Paint, Coating, and Adhesive Manufacturing	3.35	2.92	3.09	3.11	230	172	201	226
3256	Soap, Cleaning Compound, and Toilet Preparation Manufacturing	4.00	3.54	3.82	3.78	156	137	146.5	145
3259	Other Chemical Product and Preparation Manufacturing	3.93	2.80	3.62	3.45	205	152	178.5	190
3261	Plastics Product Manufacturing	4.63	4.77	4.72	4.71	52	84	68	43
3262	Rubber Product Manufacturing	5.45	5.22	5.07	5.25	201	60	130.5	128
3271	Clay Product and Refractory Manufacturing	3.92	4.11	4.58	4.19	252	112	182	200
3272	Glass and Glass Product Manufacturing	4.30	5.26	4.68	4.74	177	83	130	127
3273	Cement and Concrete Product Manufacturing	6.37	5.83	6.38	6.19	108	31	69.5	44
3274	Lime and Gypsum Product Manufacturing	3.68	6.17	4.75	4.86	262	76	169	175
3279	Other Nonmetallic Mineral Product Manufacturing	4.86	4.84	4.75	4.82	195	78	136.5	133
3311	Iron and Steel Mills and Ferroalloy Manufacturing	2.31	2.52	2.98	2.59	251	201	226	256
3312	Steel Product Manufacturing from Purchased Steel	5.48	4.94	5.30	5.24	229	61	145	143
3313	Alumina and Aluminum Production and Processing	5.93	5.58	6.32	5.95	207	36	121.5	107
3314	Nonferrous Metal (except Aluminum) Production and Processing	5.21	4.71	5.42	5.12	231	67	149	151
3315	Foundries	6.71	5.96	7.18	6.61	163	19	91	62
3321	Forging and Stamping	6.90	6.10	6.58	6.53	138	20	79	54
3322	Cutlery and Handtool Manufacturing	2.86	2.47	2.99	2.77	260	192	226	256
3323	Architectural and Structural Metals Manufacturing	5.67	5.24	5.45	5.45	60	51	55.5	34
3324	Boiler, Tank, and Shipping Container Manufacturing	5.05	5.31	6.09	5.48	188	50	119	102
3325	Hardware Manufacturing	4.51	5.51	5.62	5.19	244	64	154	156
3326	Spring and Wire Product Manufacturing	3.86	4.47	3.99	4.10	240	117	178.5	190
3327	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	3.13	3.14	3.04	3.10	76	173	124.5	117
3328	Coating, Engraving, Heat	4.18	4.77	4.48	4.48	122	97	109.	83

	Treating, and Allied Activities							5	
3329	Other Fabricated Metal Product Manufacturing	3.92	3.70	3.91	3.84	131	131	131	129
3331	Agriculture, Construction, and Mining Machinery Manufacturing	5.83	5.72	5.26	5.60	180	44	112	89
3332	Industrial Machinery Manufacturing	2.55	2.08	2.09	2.23	173	212	192.5	216
3333	Commercial and Service Industry Machinery Manufacturing	2.74	2.67	2.64	2.68	183	197	190	215
3334	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	4.49	4.01	4.04	4.19	199	112	155.5	159
3335	Metalworking Machinery Manufacturing	3.41	3.57	3.64	3.54	155	145	150	153
3336	Engine, Turbine, and Power Transmission Equipment Manufacturing	2.06	2.03	2.14	2.08	245	221	233	261
3339	Other General Purpose Machinery Manufacturing	3.52	3.71	3.74	3.66	145	142	143.5	142
3341	Computer and Peripheral Equipment Manufacturing	1.18	1.17	1.19	1.18	129	263	196	219
3342	Communications Equipment Manufacturing	1.18	1.35	1.36	1.30	192	258	225	255
3343	Audio and Video Equipment Manufacturing	2.02	1.69	1.26	1.65	247	240	243.5	268
3344	Semiconductor and Other Electronic Component Manufacturing	1.45	1.43	1.40	1.42	87	251	169	175
3345	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	1.95	1.81	1.87	1.88	81	231	156	161
3346	Manufacturing and Reproducing Magnetic and Optical Media	0.85	1.03	1.16	1.01	263	272	267.5	282
3351	Electric Lighting Equipment Manufacturing	3.42	3.17	3.48	3.35	194	158	176	186
3352	Household Appliance Manufacturing	4.00	3.81	4.19	4.00	254	123	188.5	210
3353	Electrical Equipment Manufacturing	2.99	2.96	3.22	3.06	197	174	185.5	204
3359	Other Electrical Equipment and Component	2.51	2.42	2.42	2.45	174	204	189	214

	Manufacturing								
336	Transportation Equipment Manufacturing	4.18	4.39	4.12	4.22	22	109	65.5	41
3371	Household and Institutional Furniture and Kitchen Cabinet Manufacturing	5.43	4.94	4.77	5.05	90	69	79.5	55
3372	Office Furniture (including Fixtures) Manufacturing	4.86	5.22	4.77	4.95	166	72	119	102
3379	Other Furniture Related Product Manufacturing	6.63	5.61	6.60	6.29	187	26	106.5	79
3391	Medical Equipment and Supplies Manufacturing	2.38	2.47	2.29	2.38	92	208	150	153
3399	Other Miscellaneous Manufacturing	3.02	3.05	3.10	3.05	103	175	139	135
4231	Motor Vehicle and Motor Vehicle Parts and Supplies Merchant Wholesalers	4.06	3.53	3.62	3.74	84	139	111.5	86
4232	Furniture and Home Furnishing Merchant Wholesalers	3.93	4.84	2.95	3.91	116	127	121.5	107
4233	Lumber and Other Construction Materials Merchant Wholesalers	4.63	4.95	4.54	4.70	110	85	97.5	67
4234	Professional and Commercial Equipment and Supplies Merchant Wholesalers	1.90	1.82	1.92	1.88	83	231	157	162
4235	Metal and Mineral (except Petroleum) Merchant Wholesalers	4.87	4.64	4.90	4.80	144	80	112	89
4236	Household Appliances and Electrical and Electronic Goods Merchant Wholesalers	1.60	1.54	1.69	1.61	125	244	184.5	203
4237	Hardware, and Plumbing and Heating Equipment and Supplies Merchant Wholesalers	3.87	3.46	3.78	3.70	105	140	122.5	111
4238	Machinery, Equipment, and Supplies Merchant Wholesalers	3.02	3.10	3.31	3.15	69	169	119	102
4239	Miscellaneous Durable Goods Merchant Wholesalers	2.81	2.73	2.77	2.77	91	192	141.5	138
4241	Paper and Paper Product Merchant Wholesalers	2.80	2.78	2.94	2.84	168	187	177.5	188

4242	Drugs and Druggists' Sundries Merchant Wholesalers	1.98	1.96	1.87	1.94	146	225	185.5	204
4243	Apparel, Piece Goods, and Notions Merchant Wholesalers	1.81	1.67	1.94	1.81	124	236	180	194
4244	Grocery and Related Product Merchant Wholesalers	5.36	5.52	5.46	5.45	13	51	32	15
4245	Farm Product Raw Material Merchant Wholesalers	4.01	4.06	5.03	4.38	247	103	175	185
4246	Chemical and Allied Products Merchant Wholesalers	2.77	2.84	3.35	3.00	170	178	174	183
4247	Petroleum and Petroleum Products Merchant Wholesalers	3.19	2.86	3.62	3.23	212	165	188.5	210
4248	Beer, Wine, and Distilled Alcoholic Beverage Merchant Wholesalers	6.05	5.74	7.01	6.29	79	26	52.5	30
4249	Miscellaneous Nondurable Goods Merchant Wholesalers	2.65	2.79	3.20	2.88	74	185	129.5	125
4251	Wholesale Electronic Markets and Agents and Brokers	1.96	1.89	1.84	1.90	56	229	142.5	140
4411	Automobile Dealers	3.32	3.21	3.78	3.44	21	153	87	61
4412	Other Motor Vehicle Dealers	2.89	2.62	3.04	2.85	178	186	182	200
4413	Automotive Parts, Accessories, and Tire Stores	4.17	3.98	4.54	4.23	44	108	76	51
4421	Furniture Stores	4.33	4.93	4.97	4.76	118	81	99.5	70
4422	Home Furnishings Stores	4.43	5.10	5.36	4.96	77	70	73.5	49
4431	Electronics and Appliance Stores	1.84	1.21	1.84	1.62	120	243	181.5	197
4441	Building Material and Supplies Dealers	11.13	11.26	13.12	11.85	6	2	4	1
4442	Lawn and Garden Equipment and Supplies Stores	4.12	4.84	4.57	4.51	165	94	129.5	125
4451	Grocery Stores	6.20	6.21	6.48	6.30	3	25	14	4
4452	Specialty Food Stores	2.59	2.43	2.54	2.52	140	202	171	180
4453	Beer, Wine, and Liquor Stores	1.76	1.61	1.58	1.65	196	240	218	248
4461	Health and Personal Care Stores	3.60	3.51	3.37	3.49	32	150	91	62

4471	Gasoline Stations	1.87	1.92	2.01	1.93	97	227	162	165
4481	Clothing Stores	2.87	2.83	3.24	2.99	33	179	106	76
4482	Shoe Stores	2.23	2.19	2.46	2.29	150	209	179.5	193
4483	Jewelry, Luggage, and Leather Goods Stores	2.17	2.27	2.28	2.24	186	211	198.5	223
4511	Sporting Goods, Hobby, and Musical Instrument Stores	3.25	3.52	3.51	3.42	73	155	114	95
4512	Book Stores and News Dealers	2.87	2.43	2.54	2.62	213	199	206	232
4522	Department Stores	5.17	4.86	4.70	4.93	23	73	48	27
4523	General Merchandise Stores, including Warehouse Clubs and Supercenters	7.75	7.42	6.21	6.96	15	16	15.5	5
4531	Florists	2.22	2.18	2.40	2.27	249	210	229.5	259
4532	Office Supplies, Stationery, and Gift Stores	3.49	3.25	3.83	3.52	104	146	125	118
4533	Used Merchandise Stores	6.90	6.50	6.50	6.64	113	18	65.5	41
4539	Other Miscellaneous Store Retailers	4.41	4.42	4.71	4.51	78	94	86	60
4541	Electronic Shopping and Mail-Order Houses	2.12	2.19	1.99	2.10	114	219	166.5	170
4542	Vending Machine Operators	3.71	4.15	3.93	3.93	266	126	196	219
4543	Direct Selling Establishments	4.32	4.70	5.55	4.87	176	75	125.5	120
4811	Scheduled Air Transportation	8.27	8.22	8.28	8.26	27	6	16.5	6
4812	Nonscheduled Air Transportation	3.51	3.17	3.03	3.22	232	166	199	225
4821	Rail Transportation	1.93	1.80	0.71	1.49	290	249	269.5	283
4831	Deep Sea, Coastal, and Great Lakes Water Transportation	1.16	1.24	1.22	1.21	257	261	259	276
4832	Inland Water Transportation	0.53	1.30	0.55	0.80	292	281	286.5	294
4841	General Freight Trucking	5.24	4.87	4.78	4.96	24	70	47	24
4842	Specialized Freight Trucking	4.60	4.40	4.55	4.51	51	94	72.5	48
4851	Urban Transit Systems	4.08	3.06	6.13	4.54	246	92	169	175
4852	Interurban and Rural Bus Transportation	15.05	13.14	11.04	13.13	250	1	125.5	120
4853	Taxi and Limousine Service	2.60	2.00	1.53	1.97	217	224	220.5	250

4854	School and Employee Bus Transportation	5.57	5.92	5.31	5.60	162	44	103	73
4855	Charter Bus Industry	3.36	5.02	3.94	4.17	228	114	171	180
4859	Other Transit and Ground Passenger Transportation	5.98	6.63	5.99	6.21	130	30	80	56
4861	Pipeline Transportation of Crude Oil	3.52	5.09	4.09	4.12	280	116	198	222
4862	Pipeline Transportation of Natural Gas	2.90	-	2.78	1.53	296	247	271.5	286
4869	Other Pipeline Transportation	1.79	1.22	1.59	1.54	279	245	262	279
4871	Scenic and Sightseeing Transportation, Land	3.12	3.14	3.93	3.41	258	157	207.5	234
4872	Scenic and Sightseeing Transportation, Water	0.53	0.50	0.51	0.51	282	289	285.5	293
4879	Scenic and Sightseeing Transportation, Other	5.02	2.20	2.84	3.34	286	160	223	253
4881	Support Activities for Air Transportation	5.79	5.86	6.62	6.13	62	33	47.5	26
4882	Support Activities for Rail Transportation	6.28	6.20	6.33	6.27	216	29	122.5	111
4883	Support Activities for Water Transportation	0.72	0.64	0.56	0.64	238	284	261	278
4884	Support Activities for Road Transportation	3.63	3.78	3.84	3.75	142	138	140	136
4885	Freight Transportation Arrangement	2.31	2.72	2.77	2.61	117	200	158.5	163
4889	Other Support Activities for Transportation	3.30	3.62	4.64	3.90	208	128	168	171
4911	Postal Service	1.34	1.15	1.46	1.32	285	256	270.5	284
4921	Couriers and Express Delivery Services	11.17	10.94	11.13	11.08	10	3	6.5	2
4922	Local Messengers and Local Delivery	4.08	4.44	4.81	4.47	154	99	126.5	122
4931	Warehousing and Storage	7.15	6.69	7.81	7.27	26	13	19.5	8
5111	Newspaper, Periodical, Book, and Directory Publishers	1.50	1.38	1.35	1.41	159	252	205.5	231
5112	Software Publishers	0.42	0.39	0.34	0.38	198	294	246	269
5121	Motion Picture and Video Industries	1.95	2.19	2.34	2.16	29	214	121.5	107
5122	Sound Recording Industries	0.52	0.69	0.45	0.55	276	286	281	291
5151	Radio and Television Broadcasting	1.28	1.26	1.39	1.31	160	257	208.5	236

5152	Cable and Other Subscription Programming	4.90	4.21	3.99	4.34	137	105	121	106
5171	Wired Telecommunications Carriers	2.96	4.74	NULL	4.00	100	123	111.5	86
5172	Wireless Telecommunications Carriers (except Satellite)	1.26	1.23	NULL	1.24	234	260	247	271
5173	Wired and Wireless Telecommunications Carriers	NULL	NULL	4.38	4.38	38	103	70.5	46
5174	Satellite Telecommunications	1.42	1.17	0.70	1.09	289	267	278	289
5179	Other Telecommunications	1.07	0.95	0.64	0.87	264	278	271	285
5182	Data Processing, Hosting, and Related Services	0.69	0.48	0.44	0.52	204	288	246	269
5191	Other Information Services	0.48	0.51	0.47	0.48	151	290	220.5	250
5211	Monetary Authorities-Central Bank	1.66	2.24	2.05	1.99	271	223	247	271
5221	Depository Credit Intermediation	1.76	1.62	1.58	1.65	50	240	145	143
5222	Nondepository Credit Intermediation	0.78	0.72	0.74	0.75	157	282	219.5	249
5223	Activities Related to Credit Intermediation	1.09	0.94	0.80	0.94	171	274	222.5	252
5231	Securities and Commodity Contracts Intermediation and Brokerage	0.39	0.37	0.42	0.39	235	293	264	281
5232	Securities and Commodity Exchanges	-	0.95	-	0.29	298	297	297.5	298
5239	Other Financial Investment Activities	0.67	0.47	0.28	0.45	182	291	236.5	263
5241	Insurance Carriers	1.90	1.83	1.75	1.84	86	234	160	164
5242	Agencies, Brokerages, and Other Insurance Related Activities	1.10	1.05	0.98	1.04	93	270	181.5	197
5251	Insurance and Employee Benefit Funds	0.77	1.02	0.02	0.03	287	298	292.5	297
5259	Other Investment Pools and Funds	1.28	1.19	0.17	0.36	284	296	290	296
5311	Lessors of Real Estate	2.76	2.90	3.02	2.89	59	184	121.5	107
5312	Offices of Real Estate Agents and Brokers	1.13	0.98	1.04	1.05	153	269	211	240
5313	Activities Related to Real Estate	3.29	3.42	3.13	3.27	35	162	98.5	68

5321	Automotive Equipment Rental and Leasing	6.01	5.79	5.95	5.91	82	38	60	36
5322	Consumer Goods Rental	5.13	4.14	4.27	4.53	133	93	113	93
5323	General Rental Centers	4.44	5.38	4.42	4.75	223	82	152.5	155
5324	Commercial and Industrial Machinery and Equipment Rental and Leasing	4.44	4.20	4.01	4.21	128	111	119.5	105
5331	Lessors of Nonfinancial Intangible Assets (except Copyrighted Works)	0.84	0.89	0.72	0.82	275	280	277.5	288
5411	Legal Services	0.77	0.74	0.74	0.75	95	282	188.5	210
5412	Accounting, Tax Preparation, Bookkeeping, and Payroll Services	1.33	0.90	0.75	0.99	80	273	176.5	187
5413	Architectural, Engineering, and Related Services	1.09	1.06	1.02	1.06	57	268	162.5	166
5414	Specialized Design Services	0.91	0.87	0.89	0.89	202	277	239.5	266
5415	Computer Systems Design and Related Services	0.44	0.47	0.37	0.43	85	292	188.5	210
5416	Management, Scientific, and Technical Consulting Services	1.13	1.09	1.10	1.11	43	265	154	156
5417	Scientific Research and Development Services	1.29	1.29	1.30	1.29	72	259	165.5	167
5418	Advertising, Public Relations, and Related Services	1.05	1.00	1.04	1.03	132	271	201.5	228
5419	Other Professional, Scientific, and Technical Services	5.14	4.95	5.60	5.23	28	62	45	22
5511	Management of Companies and Enterprises	1.95	1.74	1.57	1.74	136	239	187.5	208
5611	Office Administrative Services	1.78	1.64	1.86	1.76	98	238	168	171
5612	Facilities Support Services	4.57	5.31	5.56	5.16	158	65	111.5	86
5613	Employment Services	5.11	5.35	6.15	5.54	2	47	24.5	10
5614	Business Support Services	2.00	1.93	1.78	1.90	109	229	169	175
5615	Travel Arrangement and Reservation Services	1.30	1.93	2.07	1.79	167	237	202	230
5616	Investigation and Security Services	3.01	2.99	3.13	3.05	25	175	100	71
5617	Services to Buildings and	5.45	5.23	5.46	5.38	7	53	30	13

	Dwellings								
5619	Other Support Services	2.76	3.04	2.89	2.90	126	183	154.5	158
5621	Waste Collection	7.29	7.11	7.75	7.38	67	10	38.5	18
5622	Waste Treatment and Disposal	8.91	7.84	9.22	8.67	105	5	55	32
5629	Remediation and Other Waste Management Services	4.54	3.98	4.52	4.34	127	105	116	96
6111	Elementary and Secondary Schools	2.87	2.75	2.86	2.83	58	189	123.5	115
6112	Junior Colleges	1.58	1.45	0.85	1.34	270	255	262.5	280
6113	Colleges, Universities, and Professional Schools	2.80	2.74	2.64	2.72	39	195	117	98
6114	Business Schools and Computer and Management Training	0.56	1.04	0.93	0.85	267	279	273	287
6115	Technical and Trade Schools	1.86	1.93	1.98	1.92	189	228	208.5	236
6116	Other Schools and Instruction	1.03	0.81	0.91	0.92	148	276	212	241
6117	Educational Support Services	1.86	1.60	1.99	1.82	191	235	213	243
6211	Offices of Physicians	2.46	1.96	2.01	2.16	20	214	117	98
6212	Offices of Dentists	1.87	1.77	1.93	1.86	42	233	137.5	134
6213	Offices of Other Health Practitioners	1.27	1.30	1.53	1.37	96	253	174.5	184
6214	Outpatient Care Centers	4.42	4.72	4.23	4.46	16	100	58	35
6215	Medical and Diagnostic Laboratories	3.42	3.36	3.02	3.26	107	164	135.5	132
6216	Home Health Care Services	3.15	3.21	3.10	3.15	45	169	107	80
6219	Other Ambulatory Health Care Services	7.37	6.40	6.50	6.74	62	17	39.5	19
6221	General Medical and Surgical Hospitals	5.09	4.99	5.11	5.06	4	68	36	16
6222	Psychiatric and Substance Abuse Hospitals	6.42	6.82	7.90	7.09	152	15	83.5	58
6223	Specialty (except Psychiatric and Substance Abuse) Hospitals	3.84	3.48	3.08	3.44	184	153	168.5	174
6231	Nursing Care Facilities (Skilled Nursing Facilities)	5.50	5.70	5.90	5.70	11	41	26	11
6232	Residential Intellectual and	4.55	4.00	3.71	4.08	66	118	92	64

	Developmental Disability, Mental Health, and Substance Abuse Facilities								
6233	Continuing Care Retirement Communities and Assisted Living Facilities for the Elderly	6.41	6.53	6.57	6.50	14	21	17.5	7
6239	Other Residential Care Facilities	4.71	4.38	4.78	4.62	149	87	118	100
6241	Individual and Family Services	0.92	0.96	0.92	0.93	19	275	147	146
6242	Community Food and Housing, and Emergency and Other Relief Services	4.64	4.85	4.53	4.67	135	86	110.5	84
6243	Vocational Rehabilitation Services	4.70	4.33	4.42	4.48	94	97	95.5	66
6244	Child Day Care Services	3.40	3.38	3.28	3.35	54	158	106	76
7111	Performing Arts Companies	3.01	2.93	2.88	2.94	164	181	172.5	182
7112	Spectator Sports	5.75	6.65	7.04	6.48	99	22	60.5	37
7113	Promoters of Performing Arts, Sports, and Similar Events	2.45	2.37	2.48	2.44	169	206	187.5	208
7114	Agents and Managers for Artists, Athletes, Entertainers, and Other Public Figures	0.38	0.35	0.38	0.37	269	295	282	292
7115	Independent Artists, Writers, and Performers	1.19	1.25	1.12	1.19	214	262	238	264
7121	Museums, Historical Sites, and Similar Institutions	3.79	3.72	4.08	3.87	139	130	134.5	130
7131	Amusement Parks and Arcades	6.90	7.10	7.93	7.31	36	11	23.5	9
7132	Gambling Industries	3.97	3.98	3.45	3.79	147	135	141	137
7139	Other Amusement and Recreation Industries	3.00	2.99	3.07	3.02	30	177	103.5	74
7211	Traveler Accommodation	7.17	7.17	7.16	7.17	5	14	9.5	3
7212	RV (Recreational Vehicle) Parks and Recreational Camps	3.68	4.51	3.96	4.06	211	120	165.5	167
7213	Rooming and Boarding Houses, Dormitories, and Workers' Camps	2.95	3.11	2.09	2.76	272	194	233	261
7223	Special Food Services	5.23	5.80	5.77	5.61	40	43	41.5	20
7224	Drinking Places (Alcoholic Beverages)	1.44	1.34	1.27	1.35	179	254	216.5	245

7225	Restaurants and Other Eating Places	3.24	3.21	3.35	3.27	1	162	81.5	57
8111	Automotive Repair and Maintenance	2.84	2.70	2.82	2.79	34	191	112.5	92
8112	Electronic and Precision Equipment Repair and Maintenance	1.95	2.15	2.20	2.10	206	219	212.5	242
8113	Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance	4.67	4.67	4.48	4.61	121	88	104.5	75
8114	Personal and Household Goods Repair and Maintenance	2.13	1.98	2.35	2.16	219	214	216.5	245
8121	Personal Care Services	1.14	1.17	1.02	1.11	122	265	193.5	217
8122	Death Care Services	4.53	4.49	4.75	4.59	161	89	125	118
8123	Drycleaning and Laundry Services	5.36	5.29	5.32	5.33	65	57	61	38
8129	Other Personal Services	3.52	3.49	3.54	3.52	75	146	110.5	84
8131	Religious Organizations	1.65	1.56	1.21	1.45	181	250	215.5	244
8132	Grantmaking and Giving Services	1.53	1.52	1.57	1.54	175	245	210	238
8133	Social Advocacy Organizations	3.16	3.42	3.43	3.34	134	160	147	146
8134	Civic and Social Organizations	2.55	2.66	2.86	2.69	102	196	149	151
8139	Business, Professional, Labor, Political, and Similar Organizations	2.15	1.97	2.20	2.11	119	217	168	171
8141	Private Households	0.70	0.59	0.51	0.60	220	285	252.5	274

Appendix D: Comparison Between Workers' Compensation and BLS SOII Rates, 2015-2017

Table D1: Incidence Rates of occupational injury and illness per 100 full time equivalent workers (FTE), Workers' Compensation (WC) calculation and Bureau of Labor Statistics Survey of Occupational Injury and Illnesses (SOII), California 2015

NAICS	Industry Description	SOII Total Recordable Cases	SOII Total DART Cases	SOII Other Recordable Cases	WC Project Rate	Rate Ratio
111	Crop production	5.5	3.6	1.9	5.1	0.92
112	Animal production and aquaculture	7.8	5.3	2.4	7.4	0.94
113	Forestry and logging	3.7	3.5	--	4.7	1.28
115	Support activities for agriculture and forestry	5.3	3.6	1.8	4.3	0.81
211	Oil and gas extraction	0.4	0.3	--	1.6	3.98
212	Mining (except oil and gas)	2	1.4	0.6	3.0	1.52
221	Utilities	1.8	1.4	0.4	4.5	2.48
236	Construction of buildings	2.9	1.9	--	3.3	1.15
237	Heavy and civil engineering construction	3.1	1.9	1.1	3.7	1.18
238	Specialty trade contractors	3.5	2.4	1.1	4.1	1.18
311	Food manufacturing	5.2	3.7	1.6	5.6	1.08
312	Beverage and tobacco product manufacturing	5.5	4.4	1.1	5.7	1.04
313	Textile mills	1.8	1.5	0.4	3.7	2.06
314	Textile product mills	0.7	0.7	--	3.6	5.16
315	Apparel manufacturing	1.9	0.8	1.1	3.1	1.63
316	Leather and allied product manufacturing	5.3	5.1	--	4.4	0.82
321	Wood product manufacturing	6.6	4.5	2.1	6.1	0.93
322	Paper manufacturing	3.1	2.1	1	4.6	1.48
323	Printing and related support activities	1.5	0.9	0.6	2.8	1.86
324	Petroleum and coal products manufacturing	0.6	0.3	--	2.7	4.55
325	Chemical manufacturing	2.7	1.8	0.9	2.9	1.07
326	Plastics and rubber products manufacturing	4.1	2.6	1.5	4.7	1.15
327	Nonmetallic mineral product manufacturing	4.7	3.4	1.3	5.4	1.14

331	Primary metal manufacturing	5.2	4	1.2	5.4	1.03
332	Fabricated metal product manufacturing	3.8	2.3	1.5	4.3	1.14
333	Machinery manufacturing	3	2.2	0.8	3.3	1.11
334	Computer and electronic product manufacturing	1.2	0.8	0.4	1.5	1.24
335	Electrical equipment appliance and component manufacturing	2.8	1.9	0.9	2.9	1.05
336	Transportation equipment manufacturing	3.8	2.7	1.1	4.2	1.10
337	Furniture and related product manufacturing	5.5	3.9	1.6	5.4	0.99
339	Miscellaneous manufacturing	2.1	1.3	0.8	2.6	1.25
423	Merchant wholesalers durable goods	3	1.9	--	2.9	0.98
424	Merchant wholesalers nondurable goods	3.9	3	0.9	3.7	0.96
441	Motor vehicle and parts dealers	3.4	2.1	1.3	3.5	1.03
442	Furniture and home furnishings stores	2.4	1.8	0.6	4.4	1.83
443	Electronics and appliance stores	0.9	0.7	0.2	1.8	2.04
444	Building material and garden equipment and supplies dealers	5.1	3.5	1.5	10.5	2.07
445	Food and beverage stores	5.3	4	1.4	5.7	1.08
446	Health and personal care stores	2.2	0.8	1.4	3.6	1.63
451	Sporting goods hobby book and music stores	3.6	1.6	2	3.2	0.89
452	General merchandise stores	5.4	3.3	2.1	6.2	1.14
453	Miscellaneous store retailers	4.4	3	1.3	4.4	1.00
481	Air transportation	7.7	6	1.8	7.9	1.03
482	Rail transportation8	2.1	1.4	0.7	1.9	0.92
484	Truck transportation	5.4	3.9	1.5	5.0	0.93
485	Transit and ground passenger transportation	4.7	3.4	1.3	5.0	1.06
488	Support activities for transportation	3.4	2.8	0.6	3.3	0.96
492	Couriers and messengers	8.4	6.8	1.6	10.2	1.22
493	Warehousing and storage	7.1	5.5	1.6	7.2	1.01
511	Publishing industries (except internet)	0.4	0.2	0.2	0.8	2.06
515	Broadcasting (except internet)	1.7	1.1	0.6	2.3	1.36
517	Telecommunications	2.9	1.9	1.1	2.2	0.75
531	Real estate	3.5	2.1	--	2.7	0.76
532	Rental and leasing services	3.8	2.8	1	5.2	1.37
551	Management of companies and	1.7	1	0.7	2.0	1.15

	enterprises					
561	Administrative and support services	3	1.7	1.2	4.4	1.46
562	Waste management and remediation services	4.6	3.2	1.4	6.8	1.47
611	Educational services	2.5	1.1	--	2.3	0.91
621	Ambulatory health care services	3	1	1.9	2.8	0.93
622	Hospitals	6.8	3.6	3.3	5.1	0.75
623	Nursing and residential care facilities	7.6	5.4	2.2	5.6	0.74
624	Social assistance	3.4	2	1.4	1.4	0.41
712	Museums historical sites and similar institutions	4.9	3.5	1.4	3.8	0.77
713	Amusement gambling and recreation industries	4.8	3.1	1.7	4.0	0.83
721	Accommodation	6.9	4.6	2.3	7.1	1.02
722	Food services and drinking places	3.7	2	1.8	3.3	0.89
811	Repair and maintenance	2.7	1.5	--	3.0	1.10
812	Personal and laundry services	2.2	1.5	0.7	2.9	1.31

Table D2: Incidence rates of occupational injury and illness per 100 full time equivalent workers (FTE), Workers' Compensation (WC) calculation and Bureau of Labor Statistics Survey of Occupational Injury and Illnesses (SOII), California 2016

NAICS	Industry Description	SOII Total Recordable Cases	SOII Total DART Cases	SOII Other Recordable Cases	WC Project Rate	Rate Ratio
111	Crop production	6.3	3.7	2.6	5.1	0.81
112	Animal production and aquaculture	5.9	4.3	1.6	7.3	1.24
113	Forestry and logging	6.4	5.2	--	4.9	0.77
115	Support activities for agriculture and forestry	5.4	3.4	2	4.2	0.78
211	Oil and gas extraction	1.1	0.4	0.7	1.6	1.47
212	Mining (except oil and gas)7	2.4	1.7	0.7	4.0	1.67
213	Support activities for mining	1.4	0.6	--	2.3	1.67
221	Utilities	2.4	1.5	0.9	4.4	1.81
236	Construction of buildings	3.1	1.9	1.2	3.2	1.04
237	Heavy and civil engineering construction	3	1.9	1.1	3.5	1.17
238	Specialty trade contractors	4.1	3	1.1	4.1	0.99
311	Food manufacturing	4.8	3.4	1.4	5.8	1.20
312	Beverage and tobacco product manufacturing	5.5	4.2	1.3	5.2	0.95
313	Textile mills	5.7	3.8	1.8	3.8	0.67

315	Apparel manufacturing	1.6	1	0.6	6.3	3.91
316	Leather and allied product manufacturing	10	9.6	--	5.8	0.58
321	Wood product manufacturing	9.4	6.6	2.8	6.6	0.70
322	Paper manufacturing	3.2	1.9	1.2	4.1	1.29
323	Printing and related support activities	2.6	1.7	0.9	2.9	1.11
324	Petroleum and coal products manufacturing	0.6	0.4	0.2	2.4	4.06
325	Chemical manufacturing	3.3	2.1	1.2	2.7	0.83
326	Plastics and rubber products manufacturing	4.4	3.4	1.1	4.8	1.09
327	Nonmetallic mineral product manufacturing	3.9	3.2	0.8	5.4	1.40
331	Primary metal manufacturing	5	3.6	1.3	4.9	0.99
332	Fabricated metal product manufacturing	4	2.5	1.5	4.3	1.07
333	Machinery manufacturing	2.7	1.7	1	3.2	1.20
334	Computer and electronic product manufacturing	1.2	0.7	0.5	1.5	1.21
335	Electrical equipment appliance and component manufacturing	3.1	2.5	0.6	2.8	0.91
336	Transportation equipment manufacturing	3.2	2.1	1.2	4.4	1.37
337	Furniture and related product manufacturing	5.4	3.2	2.3	5.1	0.94
339	Miscellaneous manufacturing	1.8	1.1	0.6	2.7	1.50
423	Merchant wholesalers durable goods	2.3	1.6	0.7	2.9	1.26
424	Merchant wholesalers nondurable goods	3.4	2.4	1	3.8	1.11
441	Motor vehicle and parts dealers	3.2	2	1.2	3.4	1.05
442	Furniture and home furnishings stores	4.5	2.7	1.8	5.0	1.12
444	Building material and garden equipment and supplies dealers	4	3.1	0.8	10.7	2.68
445	Food and beverage stores	4.9	3.3	1.6	5.7	1.17
446	Health and personal care stores	2.7	1.5	1.2	3.5	1.30
448	Clothing and clothing accessories stores	2.4	1.2	1.3	2.7	1.12
451	Sporting goods hobby book and music stores	4.2	2.6	1.5	3.4	0.80
452	General merchandise stores	5.4	3.7	1.7	5.9	1.09
453	Miscellaneous store retailers	4.2	2.7	1.5	4.3	1.01
481	Air transportation	7.8	5.6	2.2	7.8	1.00
484	Truck transportation	4.7	3.3	1.4	4.7	1.00
485	Transit and ground passenger transportation	5.2	4.1	1.1	4.9	0.95
488	Support activities for transportation	4.4	3.1	1.3	3.5	0.79
492	Couriers and messengers	8.8	7	1.7	10.1	1.14

493	Warehousing and storage	6	4.7	1.3	6.7	1.12
511	Publishing industries (except internet)	0.4	0.3	0.1	0.7	1.82
517	Telecommunications	3.6	2.7	0.9	3.4	0.96
531	Real estate	2.3	1.7	0.6	2.7	1.18
532	Rental and leasing services	5.9	4.5	1.4	4.9	0.82
551	Management of companies and enterprises	2.2	1.2	--	1.7	0.79
561	Administrative and support services	2.9	2.2	0.8	4.4	1.53
611	Educational services	2	1	1	2.2	1.08
621	Ambulatory health care services	3	1.1	1.8	2.8	0.92
622	Hospitals	6.6	3.5	3.1	5.0	0.76
623	Nursing and residential care facilities	6.5	4.1	2.5	5.7	0.87
624	Social assistance	4.3	2.5	1.8	1.4	0.33
712	Museums historical sites and similar institutions	2.9	1.4	1.5	3.7	1.28
713	Amusement gambling and recreation industries	4.9	3	1.9	4.0	0.82
721	Accommodation	6	3.7	2.3	7.1	1.18
722	Food services and drinking places	3.5	1.7	1.8	3.3	0.94
812	Personal and laundry services	3.6	2.4	--	2.9	0.79

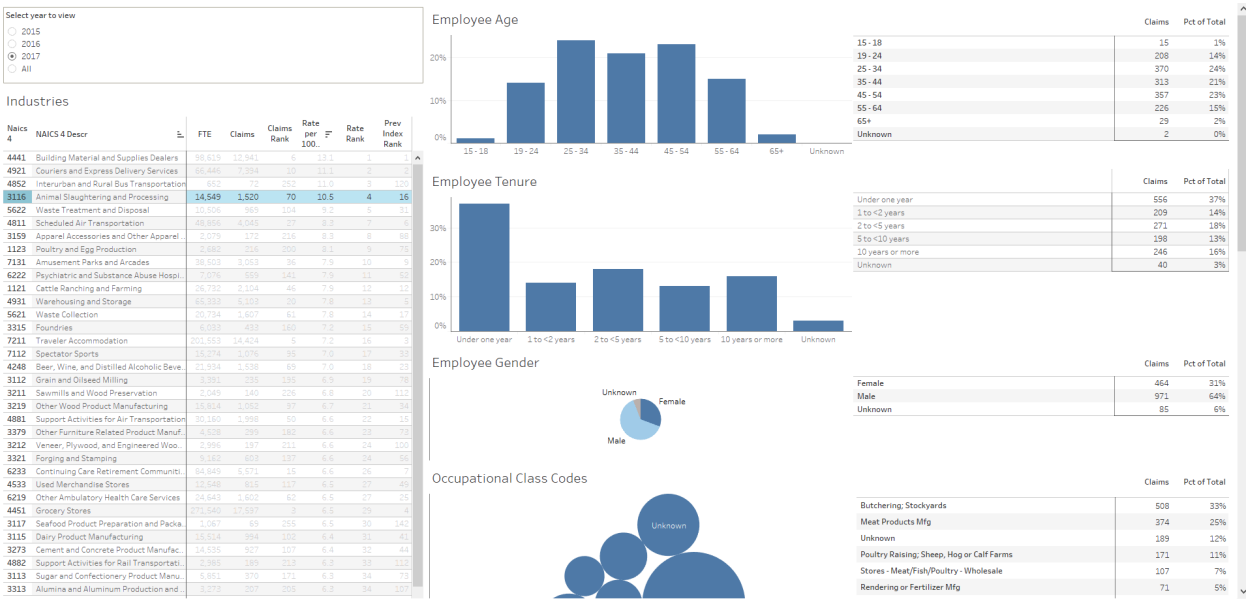
Table E3: Incidence rates of occupational injury and illness per 100 full time equivalent workers (FTE), Workers' Compensation (WC) calculation and Bureau of Labor Statistics Survey of Occupational Injury and Illnesses (SOII), California 2017

NAICS	Industry Description	SOII Total Recordable Cases	SOII Total DART Cases	SOII Other Recordable Cases	WC Project Rate	Rate Ratio
111	Crop production	5	3.1	1.9	5.5	1.09
112	Animal production and aquaculture	7.9	4.4	3.4	7.4	0.94
115	Support activities for agriculture and forestry	5.2	3	2.1	4.6	0.89
211	Oil and gas extraction	0.4	--	0.4	1.3	3.29
212	Mining (except oil and gas)	1.7	1.2	0.6	3.5	2.04
221	Utilities	1.4	0.7	0.8	5.2	3.71
236	Construction of buildings	4.1	2.7	--	3.2	0.77
237	Heavy and civil engineering construction	2.6	1.9	0.7	3.4	1.31
238	Specialty trade contractors	4.6	3.1	1.6	4.1	0.89
311	Food manufacturing	5.6	4	1.5	6.0	1.08
312	Beverage and tobacco product	5.2	3.7	1.5	5.2	0.99

	manufacturing					
315	Apparel manufacturing	2.8	1.7	1.1	4.5	1.61
316	Leather and allied product manufacturing	5.7	4.3	--	5.0	0.88
321	Wood product manufacturing	5	3.5	1.5	6.7	1.33
322	Paper manufacturing	2.2	1.1	1.1	4.1	1.88
323	Printing and related support activities	1.7	1.1	0.6	3.0	1.79
324	Petroleum and coal products manufacturing	0.7	0.4	0.3	1.7	2.40
325	Chemical manufacturing	2.2	1.4	0.8	3.0	1.35
326	Plastics and rubber products manufacturing	4.2	2.8	1.4	4.8	1.13
327	Nonmetallic mineral product manufacturing	5.7	4.1	1.6	5.5	0.97
331	Primary metal manufacturing	4.1	2.6	1.5	5.8	1.40
332	Fabricated metal product manufacturing	4	2.6	1.3	4.3	1.08
333	Machinery manufacturing	2.1	1.1	1	3.2	1.52
334	Computer and electronic product manufacturing	1.1	0.7	0.4	1.5	1.35
335	Electrical equipment appliance and component manufacturing	2.5	1.3	1.2	3.0	1.18
336	Transportation equipment manufacturing	3	2	1	4.1	1.37
337	Furniture and related product manufacturing	4.6	3.4	1.2	5.0	1.09
339	Miscellaneous manufacturing	2.2	1.4	0.9	2.6	1.19
423	Merchant wholesalers durable goods	2.7	1.9	0.8	2.9	1.07
424	Merchant wholesalers nondurable goods	3.5	2.6	0.9	4.0	1.15
441	Motor vehicle and parts dealers	3.8	2.1	1.6	3.9	1.03
443	Electronics and appliance stores	1.7	0.9	0.8	1.8	1.08
444	Building material and garden equipment and supplies dealers	4.3	3.2	1	12.4	2.88
445	Food and beverage stores	5.3	3.2	2.1	6.0	1.13
446	Health and personal care stores	3.2	1.5	--	3.4	1.05
451	Sporting goods hobby book and music stores	4.2	2.1	2.1	3.4	0.80
452	General merchandise stores	4.8	3.1	1.7	5.6	1.17
453	Miscellaneous store retailers	4.7	2.8	1.9	4.6	0.98
481	Air transportation	7	5.7	1.2	7.8	1.12
484	Truck transportation	4.3	3.1	1.2	4.7	1.09
485	Transit and ground passenger transportation	4.4	3.2	1.2	4.4	1.00
488	Support activities for transportation	3.4	2.2	1.2	3.9	1.14
492	Couriers and messengers	9.4	7.9	1.5	10.2	1.09

493	Warehousing and storage	6.1	4.5	1.7	7.8	1.28
511	Publishing industries (except internet)	0.3	0.2	0.1	0.6	2.15
515	Broadcasting (except internet)	2.4	1.5	0.8	2.2	0.92
517	Telecommunications	3.3	2.4	0.9	4.0	1.20
531	Real estate	2	1.4	0.6	2.6	1.32
551	Management of companies and enterprises	1.7	1	0.7	1.6	0.92
561	Administrative and support services	2.7	1.7	0.9	4.9	1.81
562	Waste management and remediation services	5.2	3.3	1.9	6.9	1.33
611	Educational services	2.2	1.1	1.2	2.2	0.99
621	Ambulatory health care services	3.6	1.6	2	2.7	0.75
622	Hospitals	6.4	3.4	2.9	5.1	0.80
623	Nursing and residential care facilities	6.4	4.1	2.3	5.8	0.90
624	Social assistance	3.1	1.6	1.5	1.4	0.44
711	Performing arts spectator sports and related industries	2.6	0.9	1.7	2.9	1.11
712	Museums historical sites and similar institutions	3.1	2.3	0.8	4.1	1.32
713	Amusement gambling and recreation industries	5.2	3.4	1.8	4.2	0.80
721	Accommodation	6.1	4	2.1	7.1	1.16
722	Food services and drinking places	3.9	1.7	2.2	3.4	0.87
811	Repair and maintenance	2.2	--	--	2.9	1.33
812	Personal and laundry services	2.6	2	0.6	2.8	1.08

Appendix E: Screenshots of Data Sharing Tool



Appendix F: Cost Calculation

Information on costs of workers' compensation claims can be gathered from the following in workers' compensation:

1. Indemnity costs
    a. Temporary disability
    b. Permanent disability
2. Medical costs
    a. Medical billing data
    b. Claims (SROI) data
3. Lost wages
    a. SROI data
4. Contested claims
    a. Database of settlements

Appendix G: Public Sector Claims

As we worked on this project, it became clear that the public sector (local, state, and federal government) would not be able to be included in rate calculation. There are several reasons for this. First, federal government is not included in the state workers' compensation database and so should not be included. State and local claims are included in the workers' compensation database, but industry coding of them was especially challenging. Many local government claims are coded under a single employer with a single NAICS code despite having varied government functions (like construction, maintaining parks, providing social services, running hospitals). Many of these claims have the NAICS code 9211 "Other General Government Support" in WCIS and NAICS 9221 "Justice, Public Order, and Safety Activities" in QCEW. However, both of these codes have very small denominators and do not accurately represent the complexity of government activities. Compounding this problem, in QCEW, many local government agencies were multi-establishment firms where no single NAICS code was used for 80% of employees, so these were non-NAICSable employers.

We decided to identify all public sector claims and exclude them from analysis. To do this we followed a multi-step process.

1. We attempted to assign claims a Private Sector or Public Sector status based on their links to the BWF/QCEW data.
    a. When we were able to link to a specific employer in the QCEW (85% of all claims), we used that employer's public/private status in the QCEW to flag the claim as public/private.
    b. When we could not link definitively to a specific employer (15% of all claims), we assigned the claim a public/private status based on the status of the majority of the employers the employee linked to. For example, if the employee on a given claim linked to three employers, and we could not determine which of these was the employer at injury, but two of the three employers were private sector in the QCEW, we flagged that claim as private sector.
    c. For any claims for which none of the above methods assigned a public/private status, we used the public/private status of the employer at the primary job by wages.
2. These results were used to build a database of the likelihood that each employer name, employer FEIN, class code, or industry code indicated public sector or private sector employment.
    a. For every distinct employer name in the data set, we calculated the percentage of claims with that name that are public sector.
    b. For every distinct employer FEIN in the data set, we calculated the percentage of claims with that name that are public sector.
    c. For every distinct class in the data set, we calculated the percentage of claims with that name that are public sector.

Class codes with the highest percentage of public sector claims, California 2015-2017

Code	CLASS_CODE_DESCRIPTION	Total Claims	Total Public Claims	Percent Public
7722	POLICE - VOLUNTEER	1,609	1,589	99%

9422	ROAD DISTRICTS OR DEPARTMENTS	541	531	98%
7706	Firemen-not volunteers	13,377	13,021	97%
8875	Public Colleges or Schools	98,300	95,371	97%
9410	MUNICIPAL/STATE/PUBLIC AGENCY EMPLOYEES	103,470	99,359	96%
7133	Railroads-operation & maintenance	1,838	1,755	95%
5000	Discontinued or Not Available	16	15	94%
9420	MUNICIPAL/STATE/PUBLIC AGENCY OTHERS	14,460	13,474	93%
9033	Housing Authorities	628	561	89%
7580	Sanitary or Sanitation Districts Operation	1,178	1,045	89%

d. For every distinct industry in the WCIS data (here using the original code supplied by the claims administrator, not the code we selected through EDD matching), we calculated the percentage of claims that are public sector.

Industry codes with the highest percentage of public sector claims, California 2015-2017

Code	INDUSTRY_CODE_DESCRIPTION	Total Claims	Total Public Claims	Percent Public
9441SC	Administration of Social, Human Resource and Income Maintenance Programs	947	942	99%
9199SC	General Government, Not Elsewhere Classified	33998	33516	99%
921110	Executive Offices	17037	16810	99%
9229SC	Public Order and Safety, Not Elsewhere Classified	2686	2652	99%
920000	Public Administration	728	718	99%
921140	Executive and Legislative Offices, Combined	448	445	99%
9121SC	Legislative Bodies	1004	995	99%
485210	Interurban and Rural Bus Transportation	1145	1134	99%
921190	Other General Government Support	68204	66962	98%
922120	Police Protection	7008	6862	98%

3. We used these tables to calculate a Public Sector sum for every claim where employer name and employer FEIN are weighted with a stronger predictive value than class code and industry code.

After calculating these public sector percentages for each distinct Employer Name, Employer FEIN, class code, and industry code, they are summed for each claim. If the percent public sum is greater than 280% (numerically 2.8) then the claim is identified as public sector.

This worked correctly with a few exceptions.

First, there are a relatively small number of claims where the employer name appears to clearly indicate a public sector employer, but the total score is below 2.8. For most of these this is because the claim has no FEIN, class code, or industry Code. To correct for this we created a manual override for these employers. The result was that 595 claims were flagged as public sector that did not meet to 2.8 score threshold. These represent only 0.14% of the 411,605 claims flagged as public.

Many charter schools and private schools scored above the 2.8 public sector threshold because their class codes and industry codes matched those used by public schools. In order to correct for this we required a higher threshold of 4.57 for schools (claims with class code 8875, "Public Colleges or Schools" or industry code like NAICS 61111 or SIC 8211) and considered all schools with "CHART" or "ACADEMY" in their name to be private, regardless of score. This did result in incorrectly flagging a handful of claims from public school employees as private sector, but it corrected far more than it got wrong.

Any claims not already flagged as Public by the above steps, and with a PctPublic SUM score < 4 are flagged as private. The end result is 37 claims not flagged as either public or private. These are all schools. Most are charter schools. Some are community colleges. These were marked as "Unknown" in order to clearly mark the gray area between public and private scoring

Year	Ownership Sector	Average Employment
2015	Federal government	244,652
2015	State government	450,782
2015	Local government	1,684,479
2015	Private	13,919,324
2016	Unknown	22
2016	Federal government	247,800
2016	State government	456,667
2016	Local government	1,725,937

2016	Private	14,293,180
2017	Unknown	8
2017	Federal government	248,366
2017	State government	461,693
2017	Local government	1,740,235
2017	Private	14,721,516

Using these methods, we calculated rates of injury for all public sector claims. Because of the limitations noted above, these are not further divided into industry.

Year	Public Claims	Public Employees	Public FTE (estimate)	Public Rate per 100 Employees	Public Rate per 100 FTE
2015	134,687	2,135,261	2,062,662	6.31	6.53
2016	137,944	2,182,604	2,108,395	6.32	6.54
2017	134,757	2,211,928	2,136,722	6.09	6.31

Publications and Presentations

California's Workers' Compensation Technical Advisory Group Meeting October 6, 2016

Council of State and Territorial Epidemiologists Winter Meeting December xx, 2016 Atlanta, GE

California's Workers' Compensation Technical Advisory Group Meeting May 31, 2017

CSTE 2017 – Rates of Injury by Industry Using California's Workers' Compensation Claims, June 5, 2017 Boise

CSTE 2017 Expanding the Use of Workers' Compensation Data for Occupational Health Surveillance and Outreach – a Working Roundtable June 6, 2017 Boise

WestON 2017 Work-related injuries among California's inmate laborers September 13, 2017 Denver

Winter Meeting 2017 Minneapolis

CSTE 2018 – Workers' Compensation Data: Adding to our Knowledge about Vulnerable Workers June 12, 2018 West Palm Beach

Winter Meeting 2018 Denver

References

[1] National Academies of Sciences, Engineering, and Medicine. 2018. A Smarter National Surveillance System for Occupational Safety and Health in the 21st Century. Washington, DC: The National Academies Press. https://doi.org/10.17226/24835.

[2] Bureau of Labor Statistics. Survey of Occupational Injuries and Illnesses Handbook of Methods. https://www.bls.gov/opub/hom/soii/home.htm. Accessed May 10, 2019.

[3] John W. Ruser, "Examining evidence on whether BLS undercounts workplace injuries and illnesses," Monthly Labor Review, August 2008, https://www.bls.gov/opub/mlr/2008/08/art2full.pdf. Accessed May 10, 2019

[4] William J. Wiatrowski, "Examining the completeness of occupational injury and illness data: an update on current research," Monthly Labor Review, June 2014, https://www.bls.gov/opub/mlr/2014/article/examining-the-completeness-of-occupational-injury-and-illness-data-an-update-on-current-research-1.htm. Accessed May 10, 2019.

[5] Gunter MM. "An update on SOII undercount research activities. Monthly Labor Review, U.S. Bureau of Labor Statistics, September 2016. DOI: https://doi.org/10.21916/mlr.2016.41. Accessed May 10, 2019.

[6] Workers' Compensation Insurance Organizations. Injury Description Table – Part/Nature/Cause. https://www.wcio.org/Document%20Library/InjuryDescriptionTablePage.aspx. Accessed June 17, 2019.

[7] California Department of Industrial Relations. Workers' Compensation Information System. https://www.dir.ca.gov/dworkers' compensation/workers' compensation.htm. Last updated April 2019. Accessed May 10, 2019.

[8] California Department of Industrial Relations Division of Workers' Compensation. Table 9: FROI and SROI Data Summary, by Year of Injury, 2000-2017. https://www.dir.ca.gov/dworkers' compensation/workers' compensationis/workers' compensation_tables/AggregateFROISROIData/AggregateFROISROIData.html. Accessed on: May 10, 2019

[9] Commission on Health and Safety and Workers' Compensation (CHSWC) 2018 Annual Report. December 2018. https://www.dir.ca.gov/CHSWC/Reports/2018/CHSWC_AnnualReport2018.pdf. Accessed on May 10, 2019.

[10] California Department of Insurance. Worker's Compensation Companies by Market Share. https://interactive.web.insurance.ca.gov/webuser/ncdw_ranked_co_line$cprm_mc.querylist. Last Revised: November 7, 2015. Accessed May 10, 2019.

[11] Utterback DF, Meyers AR, Wurzelbacher SJ (2014). *Workers' Compensation Insurance: A Primer for Public Health.* DHHS (NIOSH) Publication No. 2014–110.

[12] Leigh JP, Markowitz SB, Fahs M, Shin C, Landrigan PJ. Occupational Injury and Illness in the United States: Estimates of Costs, Morbidity, and Mortality. *Arch Intern Med.* 1997;157(14):1557–1568. Doi:10.1001/archinte.1997.00440350063006. Accessed May 7, 2019.

[13] Leigh JP. Economic burden of occupational injury and illness in the United States. Milbank Q. 2011 Dec;89(4):728-72. doi: 10.1111/j.1468-0009.2011.00648.x. PubMed PMID: 22188353; PubMed Central PMCID: PMC3250639.

[14] McLaren CF, Baldwin ML, Boden, LI. Workers' Compensation Benefits, Costs, and Coverage – 2016 Data. Published October 2018. https://www.nasi.org/research/2018/report-workers%E2%80%99-compensation-benefits-costs-coverage-%E2%80%93-2016. Accessed May 7, 2019.

[15] Yamin SC, Bejan A, Parker DL, Xi M, Brosseau LM. Analysis of workers' compensation claims data for machine-related injuries in metal fabrication businesses. Am J Ind Med. 2016 Aug;59(8):656-64. doi: 10.1002/ajim.22603. Epub 2016 May 16. PubMed PMID: 27195962.

[16] McCall BP, Horwitz IB, Taylor OA. Occupational eye injury and risk reduction: Kentucky workers' compensation claim analysis 1994-2003. Inj Prev. 2009 Jun;15(3):176-82. doi: 10.1136/ip.2008.020024. PubMed PMID: 19494097.
[17] Horwitz IB, McCall BP. An epidemiological and risk analysis of Virginia workers' compensation burn claims 1999 to 2002: identifying and prioritizing preventive workplace interventions. J Occup Environ Med. 2007 Dec;49(12):1376-85. doi: 10.1097/JOM.0b013e318157d9bc. PubMed PMID: 18231084.
[18] LaSee CR, Reeb-Whitaker CK. Work-related asthma surveillance in Washington State: time trends, industry rates, and workers' compensation costs, 2002-2016. J Asthma. 2019 Jan 31:1-10. doi: 10.1080/02770903.2019.1571084. [Epub ahead of print] PubMed PMID: 30701998.
[19] Jackson R, Beckman J, Frederick M, Musolin K, Harrison R. Rates of Carpal Tunnel Syndrome in a State Workers' Compensation Information System, by Industry and Occupation - California, 2007-2014. MMWR Morb Mortal Wkly Rep. 2018 Oct 5;67(39):1094-1097. doi: 10.15585/mmwr.mm6739a4. PubMed PMID: 30286058; PubMed
Central PMCID: PMC6171895.
[20] Walters JK, Christensen KA, Green MK, Karam LE, Kincl, LD. Occupational injuries to Oregon workers 24 years and younger: An analysis of workers' compensation claims, 2000-2997. American Journal of Industrial Medicine 16 September 2010. Volume 52, issue 10. DOI: https://doi.org/10.1002/ajim.20819. Accessed May 7, 2019.
[21] Syron LN, Kincl L, Yang L, Cain DT, Smit E. Analysis of workers' compensation disabling claims in Oregon's seafood preparation and packaging industry, 2007-2013. Am J Ind Med. 2017 May;60(5):484-493. doi: 10.1002/ajim.22706. Epub 2017 Mar 6. PubMed PMID: 28262964.
[22] Kucera KL, Roos KG, Hootman JM, Lipscomb HJ, Dement JM, Silverstein BA. Work-related illness and injury claims among nationally certified athletic trainers reported to Washington and California from 2001 to 2011. Am J Ind Med. 2016 Dec;59(12):1156-1168. doi: 10.1002/ajim.22648. Epub 2016 Oct 24. PubMed PMID: 27779316; PubMed Central PMCID: PMC5749227.
[23] Bradley C, Brennan J, Wagner B. Workplace injury rates and firm-level turnover in Montana's oil and gas industry. Am J Ind Med. 2019 May 2. doi: 10.1002/ajim.22983. [Epub ahead of print] PubMed PMID: 31046143.
[24] Madigan D, Forst L, Friedman LS. Workers' compensation filings of temporary workers compared to direct hire workers in Illinois, 2007-2012. Am J Ind Med. 2017 Jan;60(1):11-19. doi: 10.1002/ajim.22678. Epub 2016 Nov 15. PubMed PMID: 27862136.
[25] Holloway-Beth A, Forst L, Freels S, Brandt-Rauf S, Friedman L. Occupational Injury Surveillance Among Law Enforcement Officers Using Workers' Compensation Data, Illinois 1980 to 2008. J Occup Environ Med. 2016 Jun;58(6):594-600. doi: 10.1097/JOM.0000000000000708. PubMed PMID: 27035107.
[26] Reichard AA, Al-Tarawneh IS, Konda S, Wei C, Wurzelbacher SJ, Meyers AR, Bertke SJ, Bushnell PT, Tseng CY, Lampl MP, Robins DC. Workers' compensation injury claims among workers in the private ambulance services industry-Ohio, 2001-2011. Am J Ind Med. 2018 Dec;61(12):986-996. doi: 10.1002/ajim.22917. Epub 2018 Nov 12. PubMed PMID: 30417397.
[27] Turner K, Rabinowitz P, Anderson N, Cohen M, Pappaioanou M. Occupational Injuries of Aquaculture Workers: Washington State. J Agromedicine. 2018;23(4):336-346. doi: 10.1080/1059924X.2018.1501452. PubMed PMID: 30230431.
[28] Marcum JL, Foley M, Adams D, Bonauto D. Characteristics of construction firms at risk for future workers' compensation claims using administrative data systems, Washington State. J Safety Res. 2018 Jun;65:53-58. doi:
10.1016/j.jsr.2018.02.005. Epub 2018 Mar 12. PubMed PMID: 29776529.

[29] Smith CK, Anderson NJ. Work-related injuries among commercial janitors in Washington State, comparisons by gender. J Safety Res. 2017 Sep;62:199-207. doi: 10.1016/j.jsr.2017.06.016. Epub 2017 Jul 4. PubMed PMID: 28882267.
[30] Fowler H, Adams D, Bonauto D, Rabinowitz P. Work-related injuries to animal care workers, Washington 2007-2011. Am J Ind Med. 2016 Mar;59(3):236-44. doi: 10.1002/ajim.22547. Epub 2015 Dec 17. PubMed PMID: 26681112; PubMed Central PMCID: PMC4872621.
[31] Daniels AH, Kuris EO, Kleinhenz DT, Palumbo MA. Spine Surgery Outcomes in Workers' Compensation Patients. J Am Acad Orthop Surg. 2017 Oct;25(10):e225-e234. doi: 10.5435/JAAOS-D-16-00895. Review. PubMed PMID: 28953088.
[32] Dunn JC, Kusnezov NA, Koehler LR, Vanden Berge D, Genco B, Mitchell J, Orr JD, Pallis M. Outcomes Following Carpal Tunnel Release in Patients Receiving Workers' Compensation: A Systematic Review. Hand (N Y). 2018 Mar;13(2):137-142. doi: 10.1177/1558944717701240. Epub 2017 Apr 7. PubMed PMID: 28387162; PubMed Central PMCID: PMC5950969.
[33] National Academies of Sciences, Engineering, and Medicine 2018. A Smarter National Surveillance System for Occupational Safety and Health in the 21st Century. Washington, DC: The National Academies Press. https://doi.org/10.17226/24835.
[34] OSIP 2018 https://www.dir.ca.gov/osip/
[35] California Code of Regulations (CCR) Section 9701(e)(3-4)
[36] State of California, Department of Industrial Relations. "Table 9: FROI and SROI Data Summary, by year of Injury, 2000-2017" Data as of Jun 11,2018 https://www.dir.ca.gov/dwc/wcis/WCIS_tables/AggregateFROISROIData/AggregateFROISROIData.html Accessed on 8/1/2019.
[37] Table 3, "Distribution of employed wage and salary workers by tenure with current employer, age, sex, race, and Hispanic or Latino ethnicity" (BLS 2018)
[38] https://www.dir.ca.gov/OPRL/nonfatal.htm
[39] Silverstein B, Viikari-Juntura E, Kalat J. Use of a prevention index to identify industries at high risk for work-related musculoskeletal disorders of the neck, back, and upper extremity in Washington state, 1990-1998. Am J Ind Med. 2002 Mar;41(3):149-69. PubMed PMID: 11920960.
[40] WCIS Reports 2014
[41] Azaroff LS, Levenstein C, Wegman DH. Occupational injury and illness surveillance: conceptual filters explain underreporting. Am J Public Health. 2002 Sep;92(9):1421-9. PubMed PMID: 12197968; PubMed Central PMCID: PMC1447253.
[42] Azaroff LS, Davis LK, Naparstek R, Hashimot D, Laing JR, Wegman DH. Barriers to Use of Workers' Compensation for Patient Care at Massachusetts Community Health Centers. Health Services Research February 28. 2013. Volume 48, Issue 4. DOI: https://doi.org/10.1111/1475-6773.12045. Accessed May 7, 2019.
[43] Bhattacharya A, Park RM. Excess healthcare costs associated with prior workers' compensation activity. Am J Ind Med. 2012 Nov;55(11):1018-27. doi: 10.1002/ajim.22112. Epub 2012 Sep 11. PubMed PMID: 22968954.
[44] Lipscomb HJ, Schoenfisch AL, Cameron W, Kucera KL, Adams D, Silverstein BA. Contrasting patterns of care for musculoskeletal disorders and injuries of the upper extremity and knee through workers' compensation and private health care insurance among union carpenters in Washington State, 1989 to 2008. Am J Ind Med. 2015 Sep;58(9):955-63. doi: 10.1002/ajim.22455. Epub 2015 May 4. PubMed PMID: 25939759.
[45] Wuellner SE, Adams DA, Bonauto DK. Workers' compensation claims not reported in the Survey of Occupational Injuries and Illnesses: Injury and claim characteristics. Am J Ind Med. 2017 Mar;60(3):264-275. doi: 10.1002/ajim.22685. Epub 2017 Feb 1. PubMed PMID: 28144976.

[46] Centers for Disease Control and Prevention (CDC). Workers' compensation claims for musculoskeletal disorders among wholesale and retail trade industry workers--Ohio, 2005-2009. MMWR Morb Mortal Wkly Rep. 2013 Jun 7;62(22):437-42. PubMed PMID: 23739337; PubMed Central PMCID: PMC4604982.
[47] Wurzelbacher SJ, Al-Tarawneh IS, Meyers AR, Bushnell PT, Lampl MP, Robins DC, Tseng CY, Wei C, Bertke SJ, Raudabaugh JA, Haviland TM, Schnorr TM. Development of methods for using workers' compensation data for surveillance and prevention of occupational injuries among State-insured private employers in Ohio. Am J Ind
Med. 2016 Dec;59(12):1087-1104. doi: 10.1002/ajim.22653. Epub 2016 Sep 26. PubMed PMID: 27667651.
[48] Marcum J, Adams D. Work-related musculoskeletal disorder surveillance using the Washington state workers' compensation system: Recent declines and patterns by industry, 1999-2013. Am J Ind Med. 2017 May;60(5):457-471. doi: 10.1002/ajim.22708. Epub 2017 Mar 15. PubMed PMID: 28295479.
[49] Jones MWM, Bushnell T, Wurzelbacher S Estimating Full-Time-Equivalent Employee Denominators for Calculating Workers' Compensation Claim Rates: Notes on estimating FTEs per employee using American Community Survey data from the U.S. Census Bureau and Labor Productivity and Costs data from the Bureau of Labor Statistics. Discussion Draft distributed November 29, 2017.