Nonfatal Violence Involving Days Away From Work Following California's 2017 Workplace Violence Prevention in Health Care Safety Standard

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Objectives. To examine the impact of the California Occupational Safety and Health Administration's (Cal/OSHA's) 2017 workplace violence (WPV) prevention in health care safety standard on nonfatal violent injuries among health care workers (HCWs).

Methods. We accessed estimated counts of WPV from the survey of occupational injuries and illness from 2011 to 2019 specific to HCWs. We used the Current Population Survey estimates of HCWs to create rates per 10 000. We conducted a longitudinal panel analysis and a comparative interrupted time-series analysis to examine the change in incidence and in rates associated with California's new standard.

Results. Adoption of the 2017 safety standard led to an additional 3.48 reported WPV injuries per 10 000 HCWs in California, or an additional 473 injuries. Sensitivity analyses suggest other injuries did not change in the same period.

Conclusions. It appears that the Cal/OSHA standard increased reporting of WPV injuries among HCWs in the first year of its adoption compared with the United States. Mandating reporting of all WPV incidents in the health care setting may be a means to ensure a more complete understanding of this public health problem. (*Am J Public Health*. 2022;112(11):1668–1675. https://doi.org/10.2105/AJPH.2022.307029)

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Workplace violence (WPV) among health care workers (HCWs) is a pervasive public health problem. Since 2011, the incidence rate per 100 000 population of nonfatal WPV against HCWs has increased 62.5%.[1] HCWs are 5 times more likely to be a victim of WPV than are workers overall[1,2] and accounted for 73% of all nonfatal injuries and illness owing to violence in 2018.[1] Notably, only around 20% of WPV involves a physical assault.[3]

Unfortunately, these estimates represent a largely underreported problem. Previous research suggests that WPV is formally reported between 7% and 42% of the time.[2–8] How HCWs perceive the violence they suffer (intentional vs unintentional or related to an illness) is a major factor in whether physical WPV is reported.[4,9–11] Organizational factors, including the hierarchical nature of the perpetrator–victim relationship, are a major factor in whether verbal WPV incidents are reported.[4,12,13]

Preventing WPV in health care has been the subject of much study.[14,15] Interventions to prevent WPV exist at the individual, organizational, and regulatory levels. Individual interventions focus primarily on behavioral modification through knowledge attainment, attitudes, and propensity to report a WPV incident, typically using Web-based or classroom-based programs.[14] Although individual interventions have been shown to increase knowledge, there is mixed evidence to support their long-term effectiveness. Organizational interventions focus on the workplace safety culture of management or

the physical design of the workplace.[15–19] Similar to individual-level interventions, organizational-level interventions have limited results, with potential reductions related to improving workplace safety culture.

Currently, 9 states (CA, CT, IL, ME, MD, NJ, NY, OR, and WA) have laws requiring health care organizations to have WPV prevention programs.[20,21] California was the first state to pass legislation to this effect, when in 1993 it passed the California Hospital Safety and Security Act.[22] New Jersey is the latest state to pass legislation: the 2011 New Jersey Violence Prevention in Health Care Facilities Act.[20] These laws largely contain similar components and require health care facilities to create and implement WPV prevention programs, which include training plans, reporting systems, and, in some cases, WPV risk assessment plans. Investigations into the impact of these state policies are limited and largely consider implementation or opinion rather than impact.[20,22,23] One evaluation found that the California law did reduce assaults in for-profit and smaller hospitals, but there were no observed reductions in assaults at nonprofit hospitals.[24]

In 2017, California's Occupational Safety and Health Administration (Cal/OSHA) adopted the first workplace safety standard related to WPV in the United States (Workplace Violence Prevention in Health Care, California Code of Regulations, Title 8, Section 3342). The standard was a result of 2 HCW unions filing petitions with California's Occupational Safety and Health Standard Board to request a new standard to provide HCWs with specific protections against WPV.[25] This was the first such standard enforceable by a state or federal OSHA.

The standard mandated that hospitals develop a comprehensive violence prevention plan with training for workers. Baseline training requirements mandated by the standard included a 1-time initial training on an employer's WPV prevention plan for all employees and an annual refresher training for employees who perform patient contact activities. However, the regulation did not mandate a specific class or training module, nor did it require a specific length of training time. Importantly, the standard required acute care and psychiatric hospitals to report violent events within 72 hours of occurrence to Cal/OSHA through a Web-based platform.

To our knowledge, no evaluation of California's safety standard has been conducted to date. Odes et al. analyzed the WPV reports submitted to Cal/OSHA from July 2017 to September 2018 to understand characteristics of WPV in California's various types of health care organizations.[26] During the study period, behavioral health units had 1.82 times greater odds of a physical injury stemming from a WPV incident than did inpatient medical care units. Investor-owned, or privately owned, facilities had nearly 2.5 times greater odds of having a WPV incident resulting in a physical injury than did public facilities. However, Odes et al. did not evaluate the impact of Cal/OSHA's safety standard. Odes et al. chose to look at WPV incidents during the first year under the new reporting rules presumably because they expected the new regulation to produce more complete records of WPV incidents. That was an assumption on their part that has not yet been tested.

We tested this assumption. Given that Cal/OSHA's new safety standard may present a new method for preventing WPV among HCWs, it is imperative to understand its impact on reported WPV. Therefore, we estimated the impact of Cal/OSHA's safety standard on violent intentional injuries among HCWs. We hypothesized that the number of reported violent and intentional injuries involving days away from work would increase in the post–safety standard adoption period corresponding with the increased emphasis the safety standard places on reporting.

METHODS

We used 2 quasiexperimental designs to estimate the impact of adopting the Cal/OSHA safety standard on violent nonfatal injuries involving days away from work among HCWs from 2011 to 2019. We used a longitudinal panel regression with 2-way fixed effects (TWFE) to estimate the incidence rate ratios (IRRs) comparing California to other states. We used a multiple-group, comparative interruptive time-series analysis (CITS) to estimate the difference in injury rates per 10 000 HCWs associated with regulation adoption.

Variables and Data Sources

We defined WPV as violent, intentional, nonfatal injuries involving days away from work as our primary outcome. We ascertained counts of WPV injuries from the Bureau of Land Statistics (BLS) Survey of Occupational Injuries and Illnesses (SOII). We accessed the publicly available data and specified injuries from intentional violence by other person (event code = 111* in the Occupational Injury and Illness Classification System [OIICS; https://bit.ly/3AMkcxU]). We specified data for the standard occupational classification group health care practitioners and technical occupations (code = 29–0000). We aggregated injuries to the state level and indexed them by year from 2011 to

2019, with 2011 being the first year of data availability. Additionally, we obtained counts of slip, trip, and fall injuries (OIICS code = 4*) involving days away from work and non-WPV injuries (OIICS code = 2*, 3*, 4*, 5*, 6*, 7*, 12*, 13*) involving days away from work among HCWs from BLS. We included these other placebo outcomes for comparison, as the WPV standard should not have influenced reporting of non-WPV incidents. We obtained population counts of HCWs for state and year from the Current Population Survey's Annual Social and Economic Supplement to calculate rates per 10 000 population.[27]

Throughout the study period, 41 states and the District of Columbia provided data to SOII or had data that meet publishability criteria set by BLS. Several states did not provide data and so were excluded from the analysis (CO, FL, ID, MS, NH, ND, RI, SD, WY). Cal/OSHA's safety regulation went into effect July 1, 2017.[28] Thus, we operationalized the presence of the regulation dichotomously, with "0" representing the absence of the law and "1" representing the presence of the law. When the law changed, the law variable changed from "0" to "1" in California in the first full year the law was in effect (i.e., 2018).

Because interventions to address WPV exist at the individual, organizational, and regulatory levels, the social ecological model aided our selection of covariates and modeling decisions.[29] Previous evidence examining factors that lead to increased odds or risk of violence suggest at the individual level that having at least a high school education and having private health insurance is protective against general violence.[30] At the organizational or community level, evidence suggests that living in a metropolitan statistical area and the rate of unemployment have harmful relationships with WPV.[31] Being part of a union has been shown to have a protective relationship with WPV.[32]

We ascertained the unemployment rate from the BLS. We acquired all other covariates from the Current Population Survey. Data were available from 2011 to 2019. To control for the regulatory environment, we dropped states with laws similar to the Cal/OSHA WPV safety standard.

Analysis

We provided yearly rates of WPV injuries among HCWs for reporting states and descriptive statistics looking at the average number of injuries and average rate of injuries before and after the Cal/OSHA safety regulation for California and the United States. We conducted 2 separate quasiexperimental analyses. First, we conducted a pooled, cross-sectional time-series analysis with TWFE examining the impact of Cal/OSHA's safety regulation on incidence using a Poisson distribution. We specified robust SEs to protect against heterogeneity. We used a population offset of the number of HCWs to produce IRRs.

We also conducted a multiple-group CITS analysis examining the impact of Cal/OSHA's safety regulation on injury rates per 10 000 HCWs. We compared the difference in predicted pre–post linear trends for California to an average of all other included states to examine the difference-in-difference (DiD) in level and trend change. We compared predicted preadoption trends for California and the United States as a test of model assumptions. We conducted the CITS using the Stata (StataCorp LP, College Station, TX) command itsa specifying Newey–West SEs with a lag of 0.[33] For both the TWFE and the CITS analyses, we included all covariates previously listed.

We conducted several sensitivity analyses. First, we tested our model specification by using falls, slips, and trips, as well as non-WPV injuries among HCWs as outcomes and conducted both TWFE and CITS analyses. Additionally, we tested whether including states with potentially similar legislation affected our TWFE and CITS analyses. We also conducted TWFE and CITS analyses including outcome data from 2020, as the COVID-19 pandemic likely affected how HCWs and patients and families interact.[7,34]

RESULTS

Rates of WPV injuries among HCWs fluctuated from 2011 to 2019, with the number of reporting states increasing over time (Table A, available as a supplement to the online version of this article at http://www.ajph.org). In 2011, 31 states reported WPV injuries, with a yearly average of 4.65 per 10 000 HCWs; 2020 saw 39 reporting states and a yearly average of 5.91 per 10 000 HCWs, indicating an increase in the reported number of injuries over time. California's WPV trended downward in the post–standard adoption period, with rates of 8.08 in 2018 and 7.86 in 2019 per 10 000 HCWs (Table A).

Table 1 provides a descriptive analysis of injuries among HCWs comparing California to the United States. Before regulation adoption, California had a lower average rate of WPV injury per 10 000 HCWs (3.47) compared with the United States overall (3.98). From 2018 to 2019, the average number of WPV injuries increased 134.4%, and the average rate of injuries increased 129.7%. The United States saw much smaller increases in the same period; the average number of WPV injuries

TABLE 1— Descriptive Analysis of Reported Workplace Violence (WPV) Among Health Care Workers, Comparison of California to United States: 2011–2020

	Average No. of Injuries per Year			Average Rate of Injury per 10 000 workers		
	2011–2017	2018–2019	% Change	2011–2017	2018–2019	% Change
WPV injuries[a]						
California	454.28	1065	+134.44	3.47	7.97	+129.68
US[b]	73.62	80.66	+9.56	3.98	4.16	+4.52
Falls, slips, and trips injuries[c]						
California	1450	1710	+17.93	10.83	12.80	+18.19
US[b]	250.71	248.59	−0.85	12.45	12.41	−0.32
Non-WPV injuries[d]						
California	6972.86	7310	+4.84	52.31	54.72	+4.61
US[b]	826.41	788.18	−4.63	40.96	38.86	–5.13

Note. OIICS = Occupational Injury and Illness Classification System (https://bit.ly/3AMkcxU). We calculated rates by dividing injury counts by the estimated number of health care workers per state and year. The WPV standard was issued in California and implemented on July 1, 2017. The following states did not report data to the Survey of Occupational Injuries and Illnesses during the study period: CO, FL, ID, NH, ND, RI, SD, and WY.

[a]We defined WPV as intentional and violent nonfatal injuries involving days away from work (OIICS code = 11*).
[b]The mean US values were constructed with 33 states and Washington, DC.
[c]Slips, trips, and falls had OIICS code = 4*. We included data for fall-related injuries as a means of comparison.
[d]Non-WPV injuries had OIICS code = 2*, 3*, 4*, 5*, 6*, 7*, 12*, 13*.

increased 9.6%, and the average rate of WPV injuries increased 4.5% (Table 1). Rates of other placebo outcomes did not display a large change in the average number or rate of injury.

Primary Analyses

Results from the TWFE models indicate that California, compared with all other states, had an expected rate that was 1.94 times greater for WPV incidents ($P < .001$; 95% confidence interval [CI] = 1.42, 2.65), controlling for state percentage population who had a high school education, lived in a metropolitan statistical area, were part of union, and had private health insurance as well as the unemployment rate. No other covariates displayed significant associations with our outcome. Non–WPV-related outcomes did not display significant associations (falls, slips and trips injuries: IRR = 1.19 [95% CI = 0.97, 1.47]; all non-WPV injuries: IRR = 1.06 [95% CI = 0.95, 1.19]).

Results from the multiple-group CITS analysis suggests that adoption of the WPV safety standard led to an additional 3.48 reported injuries per 10 000 HCWs (95% CI = 0.95, 6.00; Table 2) in the first year of the regulation (Figure 1) above what would have been expected had the safety standard not been adopted. This number translates to approximately 473 additional reported WPV injuries in the first full year that the safety standard was in place (data not shown). Importantly, tests of preadoption slope differences indicate that California's linear trend was not different from the average of the other comparison states (parameter estimate = 0.17; 95% CI = −0.38, 0.72). Furthermore, non–WPV-related outcomes did not display significant changes in rate or slope related to the Cal/OSHA safety standard adoption. Notably, visual inspection of Figure 1 and Table 2 suggest that California and the comparison states had similar slopes in 2018 and 2019 (parameter estimate = 0.02; 95% CI = −1.04, 1.08). Trend lines presented in Figure 1 present results from a univariate model to ease readability.

Sensitivity Analyses

Sensitivity analyses suggest that the inclusion of states with laws similar to the Cal/OSHA safety standard does not affect the found associations. Tables B and C (available as a supplement to the online version of this article at http://www.ajph.org) provide results from the TWFE and CITS analyses on WPV injuries and the 2 non-WPV outcomes. Notably, WPV injuries maintained a similar level of significance and directionality in the sensitivity models compared to the primary model. Figures A, B, and C (available as a supplement to the online version of this article at http://www.ajph.org) represent the CITS models from these sensitivity analyses.

Data from 2020 may influence the results seen in the first 2 years of implementation. With 2020 data, the

TABLE 2— Impact of California's Safety Standard on Workplace Violence Using Multiple-Group Comparative Time-Series Analysis: 2011–2019

	Workplace Violence Standard, b (95% CI)
WVI rate	
Test of equal preimplementation slopes	0.17 (−0.38, 0.72)
DiD for initial level change, 1st year of implementation	3.48 (0.95, 6.00)
DiD for trend, after implementation	0.02 (−1.04, 1.08)
Falls, slips, and trips injury rate	
Test of equal preimplementation slopes	1.04 (0.25, 1.82)
DiD for initial level change, 1st year of implementation	−1.03 (−5.25, 3.19)
DiD for trend, after implementation	−1.79 (−4.86, 1.27)
All non-WVI rate	
Test of equal preimplementation slopes	2.07 (−0.71, 4.85)
DiD for initial level change, 1st year of implementation	−1.47 (−17.03, 14.08)
DiD for trend, after implementation	−0.97 (−8.53, 6.61)

Note. CI = confidence interval; DiD = difference-in-difference; WVI = workplace violence injury. Comparative time-series with multiple groups. The table includes 3 separate models: counts of injuries related to workplace violence; counts of injuries related to falls, slips, and trips; and all nonworkplace violence injuries per 10 000 health care workers. Each model included unemployment rate and percentage population living in a metropolitan statistical area, with a high school education, working as part of a union, and with private health insurance. In each model, workplace violence standard was coded "1" for 2018–2019 in California and "0" for all other state–year indexes. We used the number of health care workers as population to create injuries per 10 000 workers. Model used Newey–West SEs with a lag of "0."

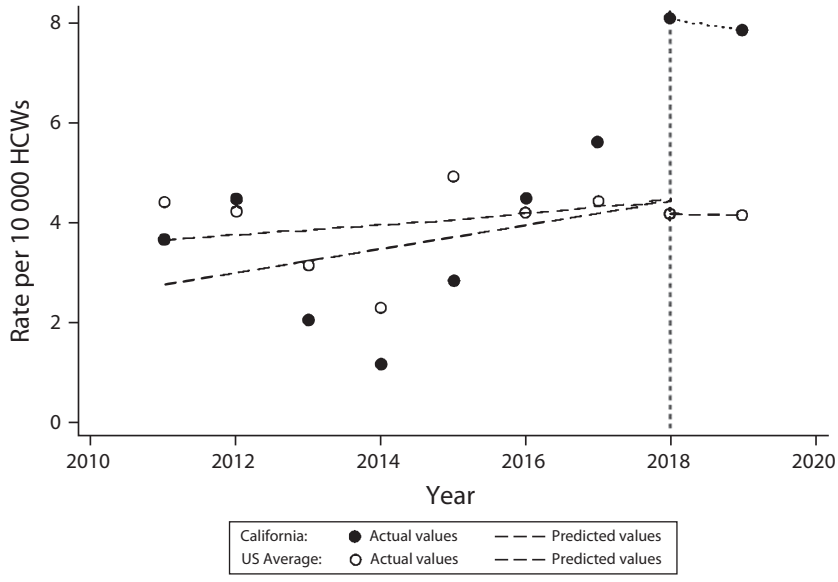

FIGURE 1— Impact of California's Safety Standard on Workplace Violence per 10 000 Health Care Worker (HCWs): California vs Control States: 2011–2019

incidence of expected WPV injuries was 1.66 times greater in California than in all other states ($P < .016$; 95% CI = 1.10, 2.50; Table D available as a supplement to the online version of this article at http://www.ajph.org). Although the DiD comparing initial level change associated with the safety standard's adoption was similar to the primary CITS analysis (3.48 vs 3.96 per 10 000 HCW), the DiD comparing slope change (coefficient = −1.70) was significantly larger than the primary model and displayed a significant decrease (95% CI = −2.59, −0.80; Table E; Figure D, available as a supplement to the online version of this article at http://www.ajph.org). This indicates that the inclusion of 2020 data likely caused California's WPV injury rate to decrease significantly. Trend lines including 2020 data for 2 non-WPV outcomes are available in Figures E and F (available as a supplement to the online version of this article at http://www.ajph.org).

DISCUSSION

California reported an additional 473 WPV injuries above expectation in the first year after the Cal/OSHA WPV prevention standard was adopted, controlling for covariates. Moreover, we found that in the year after adoption, the WPV injury rate remained significantly higher than the US average. To our knowledge, this is the first attempt to quantify the longitudinal impact of the Cal/OSHA safety standard on WPV.

The reported number of WPV injuries increased after Cal/OSHA safety standard adoption. This finding was likely driven by the standard's emphasis on reporting. For this study, we defined WPV as violent and intentional nonfatal injuries involving days away from work as our primary outcome. Thus, our

results likely reflect WPV incidents involving a moderate to severe physical injury. As injuries of that severity are likely to have been recorded even before the standard, it was important to test whether the additional WPV incidents observed after the standard's onset reflected an increase in the total number of reported incidents or incidents that previously would have been coded as other types of injuries that were correctly coded as WPV incidents after the standard. In the latter case, we should see a reduction in the expected number of non-WPV incidents after implementation of the standard. We found that non-WPV injuries did not show a decrease across both statistical techniques. This suggests that the increase in WPV injuries involving days away from work after standard implementation is likely attributable to more WPV incidents being reported.

The safety standard's emphasis on training and reporting possibly changed how organizations and employees view WPV and may have led to improved WPV reporting. In addition to the WPV training required by the standard, health care organizations may have adopted procedures that promote WPV reporting because of the standard. Employees may have internalized the safety standard and its required yearly training as an organization's newfound commitment to reducing WPV. These potential outcomes may have also happened in tandem: organizational-level changes may have caused employees and managers to increase their commitment to workplace safety culture, which includes timely reporting of incidents. However, without hospital-level data, this is not possible to confirm.

California saw a reduction in reported WPV injuries in 2020. The results of our sensitivity analyses including 2020 data suggest that the year may not be representative of previous trends. In our CITS sensitivity analysis (Table E), there was a significant difference in trends in the postadoption period comparing California to the average of the United States, indicating a divergent trend from the analysis using data from 2011 to 2019. There are several reasons for this. First, it may be that the Cal/OSHA's emphasis on safety training for employees, especially its yearly training requirement for employees with patient contact, led to decreased WPV injuries. However, previous evidence of individual-based training leading to reductions in WPV is weak,[14] and there is no set standard for how the WPV training is implemented on a facility-to-facility level.

The COVID-19 pandemic may explain California's decrease in WPV in 2020 that we saw in the sensitivity analyses. Throughout 2020, California was among the hardest hit states in terms of COVID-19–related hospitalizations and deaths.[35] As of this writing, Los Angeles County, California, had the greatest number of COVID-19–related deaths in the United States (27 166).[35] The pandemic affected how patients and families interact with HCWs. Recent research found that nurses who cared for COVID-19 patients experienced more physical violence and verbal abuse than did those who did not care for COVID-19 patients, but they also found that nurses who cared for COVID-19 patients had more difficulty reporting their incident to management.[36] Another possible explanation for the drop in WPV in the content of COVID-19 is that health care facilities reduced or eliminated visitors. As patients and their families accounted for the largest portion of WPV incidence,[34,37] it may be that California's HCWs reported less WPV incidents overall because of their high interaction with patients who had COVID-19.

Although increased reporting of WPV is certainly a desirable outcome, from a public health perspective, increased reporting should be viewed as secondary or tertiary prevention at best. There is some reason to believe that the increased emphasis on reporting WPV injuries among HCWs may cause hospitals and their managers to enact more primary prevention–motivated interventions. However, the Cal/OSHA safety standard for WPV stops short of requiring those types of changes. Practically speaking, as states consider ways to reduce WPV among HCWs, it may be prudent to incorporate primary prevention interventions into these efforts.

Future research is needed to investigate whether the drop in WPV seen in 2020 in California was a result of the safety standard or other external factors. An examination of Cal/OSHA reporting data, combined with qualitative exploration, would likely go far toward this end. OSHA has recognized WPV and violence against HCWs as a workplace hazard, issuing guidance in 2016 aimed at reducing or preventing WPV against HCWs and social service workers.[2] WPV has also been the subject of OSHA citations for employers who fail to protect HCWs from the hazard of occupational violence.[21] However, violence against HCWs continues to occur. In the absence of federal OSHA standard making and congressional legislation, states should endeavor to better ensure HCW safety, especially considering HCW shortages and burnout and the increasing strains on the health care system.

Limitations

The use of SOII as our outcome of interest was necessary but had

limitations. The accuracy of SOII depends on employer compliance regarding injury and illness recordkeeping, and evidence suggests employers have a limited understanding of proper reporting protocols.[38] Previous research also suggests possible systematic differences in SOII reporting at the state level.[39] However, SOII is currently the only nationally available, public longitudinal data source for nonfatal occupational injuries. Our use of a national average as a control group reduces some of the bias introduced by possible systematic differences in state reporting.

Multiple-group CITS are susceptible to the selection bias that can occur when evaluating social policy. Because of data reporting in SOII, we elected to use the US average as our control for CITS, excluding states with laws similar to the safety standard. However, this was potentially problematic, as there was no randomization driving our control selection. To combat this problem, we conducted a sensitivity analysis that included all states. The relationships we found in our primary analysis was nearly the same when we included the control states, indicating that the absence of these state-level laws had minimal impact on our primary analysis. Both CITS and longitudinal TWFE are susceptible to omitted variable bias. However, the use of TWFE with a pooled cross-sectional, time-series design reduces the bias seen from omitted variable bias.

The COVID-19 pandemic posed a challenge to this study.[40] We attempted to assess the impact of the pandemic on our posttrend analysis through sensitivity analyses. We could not discern whether the drop in reported WPV in California was a direct result of the safety standard or an externality related to the COVID-19 pandemic. However, changes to visitation rules and the increase in use of ventilators for COVID-19 patients indicate that there was less day-to-day exposure to potential WPV from type II offenders, the group most responsible for WPV against HCWs.[2]

Conclusions

Cal/OSHA's Workplace Violence Prevention in Health Care standard may have led to an increase in the reported number of WPV incidents in the years after its implementation. This increase in reporting is likely a function of the emphasis placed on reporting through a Web-based program. Thus, the reported number of WPV injuries after safety regulation implementation may better reflect the actual counts compared with the numbers from previous years. We noted a decrease in reported WPV injuries in the third year after the standard was implemented. Although we cannot attribute this decrease to the policy alone, we suspect that the decrease is partially driven by the COVID-19 pandemic. More research is needed to fully understand the future impact of the Cal/OSHA safety standard. AJPH

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CONTRIBUTORS

M. L. Doucette conceptualized the study and wrote the initial draft of the article. M. L. Doucette, M. T. Bulzacchelli, and C. K. Crifasi contributed to the statistical approach. S. J. Surber contributed to the legal research. B. C. Dal Santo acquired the data. All authors revised the article and approved the final version.

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CONFLICTS OF INTEREST

The authors have no conflicts of interest to report.

HUMAN PARTICIPANT PROTECTION

This article is based on publicly available, aggregated, and nonidentifiable secondary data and therefore does not require human participant research approval.

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