Impact of Employment Laws on Construction Worker Suicide

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CPWR THE CENTER FOR CONSTRUCTION RESEARCH AND TRAINING

Addressing Suicide and Opioid Risks in Construction: CPWR's Approach

Construction workers in the United States face a mental health crisis: their suicide rates are twice the national average and they account for over one in six opioid overdose deaths.

CPWR is leading a *Research and Action Agenda on Suicide, Mental Health and Opioids* focusing on three objectives:

1. **Tackling Root Causes:** Addressing upstream, work-related factors that contribute to mental health struggles and substance use.
2. **Breaking Down Barriers:** Ensuring workers have access to essential treatment and recovery resources
3. **Enhancing Support Systems:** Strengthening services, programs, and policies to support workers facing mental health and substance use challenges.

CPWR partners with North America's Building Trades Unions (NABTU), fourteen international union representatives, employers, building trades council representatives, insurers, and government partners to share successful strategies for preventing suicide and opioid deaths, address common challenges, and put knowledge into action through training, health programs, member services, and communications. Subscribe to our free quarterly newsletter REASON (Resources and Effective programs Addressing Suicide and Opioids Now) for updates and materials.

CPWR funded five small studies to advance knowledge and action on suicide prevention and opioid overdose. This report highlights one such study.

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Impact of employment laws on construction worker suicide

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Abstract

Approach: Suicide decedents aged 16 to 64 were identified during 2013 to 2020. Data was linked to population count data by occupation, age, sex, race, and year. Labor related laws were abstracted by state and time and further linked to suicide rate data. Quasi-Poisson regression was used to model the impact of labor related laws on male and female construction worker suicide rates.

Results: During 2013 to 2020 there were 127,872 suicide deaths identified for working people aged 16 to 64, of which, 19,511 (15.26%) worked in construction. Overall, when family and paid leave laws were present, rates of suicide for construction workers were lower. This was statistically significant for female construction workers. Additionally, laws that restricted opioid prescribing resulted in statistically significant lower rates of suicide for male construction workers.

Conclusion: State level polices are an opportunity to reduce suicide risk for construction workers.

Key Findings

- Female construction workers had a lower rate of suicide when family and paid leave laws were in place. This was also true for male construction workers, but the reduction was not statistically significant.

- Male construction workers had lower rates of suicide when laws restricting opioid prescribing practice were present. Construction workers were more likely to have substance use contribute to their suicide compared to workers in other occupations.

- Community level factors may influence construction worker suicide. Construction workers who died by suicide disproportionately lived in areas with lower income and lacked access to recreation.

- Construction workers who died by suicide were more likely to live in areas with high violent crime.

- The National Violent Death Reporting system can be linked to external datasets to evaluate policy and inform best practice.

1. Introduction

Construction workers die by suicide at a rate higher than any other occupation. Despite this well documented increased risk, there has been little research into the upstream protective factors that can help prevent construction worker suicide. The National Violent Death Reporting System (NVDRS), a surveillance system for violent death, provides essential information about suicide by identifying common circumstances that occurred prior to the death through abstraction of medical examiner and law enforcement reports. Further, the NVDRS routinely codes occupation of decedents through autocoding allowing for the linking of the dataset to population estimates to calculate rates of suicide and study state and community level risk factors. We have previously evaluated this autocoding process for NVDRS data and found it to be accurate for construction workers. With the addition of occupation, NVDRS became the first source for data that both thoroughly and accurately identifies occupation for decedents of suicide and identifies critical information necessary to study risk and protective factors. In this study we use these advancements in the surveillance of violent death to evaluate the impact of laws and community level factors on construction worker suicide.

2. Objective

The objective of this study is to identify upstream policy and community factors that are effective in reducing construction worker suicide risk. No prior work has linked the NVDRS data to policy data or community level factors and evaluated suicide risk for workers. This linkage is critical to studying upstream factors, as while suicide is a frequent cause of death, death is a rare outcome that cannot be efficiently studied in the short term with small scale cohort studies. This work is the next step in shaping best practice and informing policies by providing empirical evidence about the effectiveness of polices through the analysis of linked data.

3. Methods

NVDRS data for construction workers aged 16 to 64 was used to identify deaths from suicide occurring during 2013 to 2020. During this period, 49 states and the District of Columbia reported data to the NVDRS for use in restricted access dataset. Major grouping from the Standardized Occupation Classification (SOC) system are available from NVDRS and assigned by autocoding along with manual review. SOC codes were used to group occupations into major (2-digit SOC code). Decedents with no occupation were excluded. Workers in construction and extraction were identified as those in the SOC group “47 Construction and Extraction Occupations.” All analysis was also run excluding workers in extraction occupations (Appendix Table 2 to Table 4).

Variables: Legal Analysis. Employment laws were identified for year and geographic location through abstraction of state laws by a trained law student research assistant. Laws were classified as the following: paid sick leave, family medical leave, union restrictive, restriction on shift scheduling, and opioid related laws. To be considered present a law had to be more comprehensive than federal requirements. Family medical leave was further classified as paid or unpaid leave. All laws were identified by quarter year and identified as present in the quarter following the date of enactment of the law.

Community Level Factors. Community level factors were identified using the County Health Rankings and Roadmaps (CHRR) data. The CHRR is a program administered by the University

of Wisconsin Population Health Institute. The program aggregates publicly available county level data about factors that could impact the health of residents of that county. We used the following community level factors in our analysis: ratio of residents to mental health providers, rurality, food insecurity, violent crime, housing problems, access to exercise opportunities, and community income level. Sources and categorization of each of these variables are listed in Box 1.

Box 1. Community Level Variable Sources

Construct	Categorize	Source
Ratio of Mental Health Providers	Median	HRSA Area Resource File
Food Insecurity	Median	USDA Environmental Food Atlas
Housing Problems	Median	Comprehensive Housing Affordability Straegy
Access To Exercise Opportunities	Median	Derived based on proximity to parks and recreation facilities derived by CHR
Viole crime Uniform	Median	Uniform Crime Reporting
Percent Rural	>50% Rural	Census Population Estimates
Ave. Income >50K	>$50,000 median household income	Small Area Income and Poverty Estimates
Food environment index raw value	Median	USDA Food Environment Atlas

Analytic Plan. Poisson regression models were built to model presence of a law and suicide rate. Geographic and temporal periods without the law were the control group. Offset population counts for the model were calculated using American Community Survey (ACS) data. Suicide rate is overdispersed and, therefore, a quasi-Poisson model was used to model suicide rates. Models were constructed for male and females separately. Generalize Estimating Equations were used to account for within state clusters. As part of sensitivity analysis models were also run controlling for age and race/ethnicity. Additionally, analysis was repeated for deaths with an opioid present as identified by the NVDRS toxicology report.

For community level exposure logistic regression models were built controlling for age, race/ethnicity, military status, and education level to model likelihood of the exposures occurring around the death of individuals in construction with workers not in that occupation. Additionally, suicide circumstance variables collected in the NVDRS were compared using the same methodology. Analysis was completed for male and female workers separately and by race/ethnicity and if a decedent was foreign born. Because of the smaller number of female suicides our models were only able to control for age. Full models with all covariates did not converge.

4. Accomplishments and Results

Accomplishments: Tools and Resources. A significant portion of this work involved creation of a labor law database that can be linked with temporal state data to evaluate the impact of these laws. This database will be published with the main results of this study. Another major aspect of this work was harmonization of the NVDRS and ACS Data. The code used to crosswalk occupations and standardize demographic variables will also be made available as part of the publication of the main results.

The methods used in this study can be applied to other populations, outcomes, and risk factors to further improve worker health. This works has resulted in new partnerships with the University of Iowa Injury Prevention Research Center to use the linked data to evaluate firearm related suicide and with the Iowa Public Policy Center to evaluate protective service occupation suicide risk.

Results: Descriptive. During 2013 to 2020, 49 states and the District of Columbia reported data to the National Violent Death Reporting System (NVDRS). Florida had established a state VDRS program and began reporting data in 2020 but is currently excluded from the NVDRS national data due to incomplete reporting. During 2013 to 2020 there were 168,555 deaths from suicide collected in the NVDRS for people aged 16 to 64. 127,872 (75.9%) had an occupation listed on their death certificate and coded by the NVDRS. We observed that 15.26% (n=19,511) of decedents with an occupation identified worked in Construction and Extraction Occupations (major SOC Code 47). The most common types of occupations defined by SOC Broad Occupation classification within construction were Construction Laborers (47-2060, 31.0%) and Carpenters (47-2030, 16.9%). The frequency of each Broad Occupation Group is presented in Table 1.

Table 1: Decedent Broad Occupation Classification within Construction, 2013-2020

Code	SOC2018_BroadOccupation	N[a]	%
47-1010	First-Line Supervisors of Construction Trades and Extraction Workers	1544	7.9
47-2010	Boilermakers	51	0.3
47-2020	Brickmasons, Blockmasons, and Stonemasons	451	2.3
47-2030	Carpenters	3303	16.9
47-2040	Carpet, Floor, and Tile Installers and Finishers	405	2.1
47-2050	Cement Masons, Concrete Finishers, and Terrazzo Workers	162	0.8
47-2060	Construction Laborers	6039	31.0
47-2070	Construction Equipment Operators	956	4.9
47-2080	Drywall Installers, Ceiling Tile Installers, and Tapers	230	1.2
47-2110	Electricians	1777	9.1
47-2120	Glaziers	93	0.5
47-2130	Insulation Workers	58	0.3
47-2140	Painters and Paperhangers	1029	5.3
47-2150	Pipelayers, Plumbers, Pipefitters, and Steamfitters	1101	5.6
47-2160	Plasterers and Stucco Masons	23	0.1
47-2170	Reinforcing Iron and Rebar Workers	<10	NC
47-2180	Roofers	668	3.4
47-2210	Sheet Metal Workers	269	1.4
47-2220	Structural Iron and Steel Workers	236	1.2
47-2230	Solar Photovoltaic Installers	13	0.1
47-3010	Helpers, Construction Trades	43	0.2
47-4010	Construction and Building Inspectors	81	0.4
47-4020	Elevator and Escalator Installers and Repairers	51	0.3
47-4030	Fence Erectors	41	0.2
47-4040	Hazardous Materials Removal Workers	22	0.1
47-4050	Highway Maintenance Workers	114	0.6
47-4060	Rail-Track Laying and Maintenance Equipment Operators	11	0.1
47-4070	Septic Tank Servicers and Sewer Pipe Cleaners	<10	NC
47-4090	Miscellaneous Construction and Related Workers	16	0.1
47-5010	Derrick, Rotary Drill, and Service Unit Operators, Oil and Gas	94	0.5
47-5020	Surface Mining Machine Operators and Earth Drillers	70	0.4
47-5030	Explosives Workers, Ordnance Handling Experts, and Blasters	17	0.1
47-5040	Underground Mining Machine Operators	48	0.3
47-5050	Rock Splitters, Quarry	<10	NC
47-5070	Roustabouts, Oil and Gas	38	0.2
47-5080	Helpers--Extraction Workers	37	0.2
47-5090	Miscellaneous Extraction Workers	411	2.1

Abbreviations: NC, not calculated.

[a]Results less than 10 censored per NVDRS data release policy.

Most construction workers who died by suicide were male (n=19,260, 98.7%). Demographic characteristics across sex and occupation are presented in Table 2. The primary demographic difference between construction workers and other workers was a lower level of obtained education. This was true for male and female workers.

Table 2: Worker Demographic Characteristics by Sex, 2013-2020

Variable	Level	Male Other Occ N=83816	%	Male Construction N=19351	%	Female Other Occ N=25027	%	Female Construction N=251[a]	%
Age	<25	9054	10.8	1807	9.3	2014	8.0	21	8.4
	25-44	35279	42.1	9092	47.0	10006	40.0	105	41.8
	45-64	39483	47.1	8452	43.7	13007	52.0	125	49.8
Race and ethnicity of victim (combined)	White	67638	80.8	16011	82.8	20610	82.4	202	80.5
	Black	6027	7.2	697	3.6	1516	6.1	<10	3.2
	AI/AN	1046	1.2	424	2.2	313	1.3	14	5.6
	Asian/PI	1964	2.3	137	0.7	726	2.9	<10	0.4
	Two or More	1078	1.3	224	1.2	341	1.4	<10	2.8
	Hispanic	5990	7.2	1847	9.6	1505	6.0	19	7.6
	Missing	73	-	11	-	16	-	0	-
Education	Less than Grade 12	8753	11.0	4110	22.4	1581	6.7	43	18.1
	High School Diploma	34513	43.4	10379	56.6	7914	33.4	123	51.9
	College	36250	45.6	3852	21.0	14187	59.9	71	30
	Missing	4300	-	1010	-	1345	-	14	-
Marital status	Married[b]	26318	31.5	5199	27.1	7633	30.7	66	26.5
	Never Married/Single	35315	42.3	8179	42.6	8160	32.8	92	36.9
	Widowed/divorced/separated	21797	26.1	5837	30.4	9095	36.5	91	36.5
	Missing	386	-	136	-	139	-	<10	-
Served in the U.S. Armed Forces	No	71193	87.0	16954	89.9	23686	97.2	234	94.4
	Yes	10644	13.0	1905	10.1	679	2.8	14	5.6
	Missing	1979	-	492	-	662	-	<10	-
Means	Firearm	44055	52.6	9332	48.2	7754	31	92	36.7
	Cutting/Stabbing	1793	2.1	380	2.0	377	1.5	<10	NC
	Poisoning	7443	8.9	1470	7.6	7772	31.1	36	14.3
	Asphyxiation	25302	30.2	7283	37.6	7228	28.9	105	41.8
	Fall	1782	2.1	249	1.3	607	2.4	<10	NC
	Motor vehicle/	1294	1.5	273	1.4	429	1.7	<10	NC
	Other	2147	2.6	364	1.9	860	3.4	<10	NC

Abbreviations: NC, not calculated; Occ, Occupation; AI/AN, American Indian/Alaskan Native; Asian/PI, Asian American/Pacific Islander

[a]Results less than 10 censored per NVDRS data release policy.

[b]Married includes domestic partnerships.

Legal Requirements Analysis. State-level legal requirements related to worker wellbeing were abstracted and linked to the NVDRS data. Paid Leave laws were established in 11 states over the study period, family medical leave laws in 11 states, and union restrictive (i.e. right to work laws) in 27 states. 6 states had family medical leave and Paid Leave law (California, New Jersey, Oregon, Rhode Island, Vermont and Washington). Additionally, Colorado, Maine, New

Mexico, and New York implemented a paid leave law after January 1st, 2021, and Massachusetts and New York implemented a family medical leave law after January 1st, 2021. These states were not consider as having the law in this analysis. The District of Columbia had a medical leave law but no requirement for paid sick leave. There were 38 states were a law restricting opioid prescribing (amount or type) during the study period. A detailed description of the timing of the inaction of each law has been abstracted into a database.

We modeled the impact of each law on suicide rates for men and women separately and for all other occupations and construction separately. The impact of each law is presented in Table 3.

Table 3: Presence of Law and Suicide Rate

			Other Occupation	Construction
Sex	Law	Level	RR (95% CI)[a]	RR (95% CI)[a]
All	Family Leave	Unpaid	0.86 (0.63-1.18)	0.93 (0.69-1.25)
		Paid	0.78 (0.50-1.23)	0.78 (0.49-1.22)
	Any Family Leave[b]	Present	0.82 (0.61-1.11)	0.84 (0.61-1.14)
	Opioid	Present	0.81 (0.69-0.96)	0.84 (0.70-1.01)
	Paid Leave	Present	0.87 (0.68-1.11)	0.91 (0.71-1.15)
	Union Restrictive[c]	Present	1.12 (0.87-1.43)	1.15 (0.90-1.46)
Male	Family Leave	Unpaid	0.86 (0.63-1.17)	0.92 (0.68-1.25)
		Paid	0.77 (0.49-1.20)	0.78 (0.49-1.25)
	Any Family Leave[b]	Present	0.81 (0.60-1.09)	0.84 (0.61-1.15)
	Opioid	Present	0.80 (0.68-0.95)	0.82 (0.69-0.98)
	Paid Leave	Present	0.85 (0.66-1.08)	0.92 (0.71-1.17)
	Union Restrictive[c]	Present	1.15 (0.90-1.45)	1.15 (0.90-1.47)
Female	Family Leave	Unpaid	0.91 (0.70-1.17)	0.44 (0.20-0.97)
		Paid	0.86 (0.57-1.32)	0.39 (0.26-0.58)
	Any Family Leave[b]	Present	0.88 (0.66-1.18)	0.40 (0.27-0.60)
	Opioid	Present	0.83 (0.70-0.98)	1.10 (0.74-1.63)
	Paid Leave	Present	0.92 (0.72-1.18)	0.66 (0.41-1.04)
	Union Restrictive[c]	Present	1.12 (0.87-1.44)	1.32 (0.97-1.82)

Abbreviations: RR, Rate Ratio.

[a]Poisson regression model comparing presence and absence of law. Absence of law was the reference category. Quasi-Poisson regression used to account for model over dispersion. Models controlled for year. Sensitivity analysis included analysis with additional covariates of age and race/ethnicity.

[b]Any family leave combined paid and unpaid leave.

[c]Union Restrictive included right-to-work laws or laws.

Overall, when laws that provided more substantial leave then federal requirements were enacted a lower rate of suicide was observed. While, not statistically significant we observed a lower rate for male workers with family leave and paid leave and a statistically significant decrease in suicides for workers in states with laws with restrictions on opioid prescribing. For female construction workers, the presence of family medical leave laws occurred with lower rates of suicide. The observed lower rate was statistically significant. Notably, the reduce rate ratio of suicides was more pronounced for female construction than female workers overall. Finally, when states had union restrictive laws in place, we observed a higher rate of suicide for both male and female works, but this increase was not statistically significant.

Having only few states with family leave and paid leave laws prevented meaningful sensitivity analysis to determine the impact these policies on suicide rates independent of each other.

However, we were able to analyze the impact of these laws in the presence of union restrictive legislation and found their impact on suicide rates to not be confounded by the presence or absence of union restrictive laws. We did not find any state level shift scheduling laws. These laws were only present at the city level and, therefore, not analyzed.

Sensitivity analysis was run with models including the covariates age and race/ethnicity. We did not find any meaningfully different results when controlling for these variables. Additionally, we evaluated the heterogeneity of the results by subsetting the analysis on race for the following groups race/ethnicity groups: White, Black, American Indian/Alaskan Native, Hispanic. The general magnitude and direction of the effects of the laws was consistent across racial groups. Due to the fewer number of female construction worker suicides, we were not able to run similar sensitivity analysis. The lack of confounding and homogeneity found for male workers does bolster the likelihood that the result for female construction workers would not change if we were able to complete this analysis.

Additional sensitivity analysis was run for deaths with an opioid present as indicated by the toxicology report in NVDRS. Opioids were identified in 10.0% of suicides (n=12,774). Analysis of the impact of laws on deaths with opioid present did not differ from overall analysis in terms of leave related laws. Surprisingly, opioid related laws were no longer significantly protective for male workers. However, this could be due to reduced power from the smaller number of deaths included in the analysis.

Community Level Factors. We used county of resident of suicide decedent to identify how community factors may disproportionally impact construction worker suicide compared to other occupations. Unadjusted and adjusted odds ratios for community level factors are presented in Table 4. Factors were linked to decedents based on their county of residents at the time of death. For male construction workers, living in higher income areas (average income greater than $50,000) and having access to exercise opportunities were the most protective factors of those evaluated but only modestly (OR=0.86 and OR=0.90 respectively). The same two factors were also the most protective for female workers, but the effects were more pronounced (OR=0.59, exercise opportunities; OR=0.52, higher income area). Both male and female construction workers were more likely to live in areas with high violent crime compared to other occupations. Compared to other workers, female construction workers were more likely to live in areas of high rurality and have higher population to mental health provider ratio (i.e. fewer providers per person). The small number of female construction workers limited our ability to disentangle the direct case of each of these factors, but these results provide initial evidence to inform studies evaluating specific county level factors.

Table 4: County level differences.

County Level[a]	Other Occ N (%)	Construction N (%)	Odds Ratio (95% CI)	Adj. Odds Ratio (95% CI)[b]
	Male			
MH Providers	42409 (51.3)	10414 (54.7)	1.15 (1.11-1.18)	1.02 (0.99-1.06)
Food Insecurity	44083 (53.1)	10779 (56.3)	1.14 (1.10-1.17)	1.08 (1.05-1.12)
Food environment	41834 (50.4)	9068 (47.4)	0.88 (0.86-0.91)	0.97 (0.94-1.00)
Housing Problems	43684 (52.6)	8573 (44.8)	0.73 (0.71-0.75)	0.86 (0.83-0.89)
Exercise Opp.	41101 (50.2)	9060 (48.2)	0.92 (0.89-0.95)	0.96 (0.93-0.99)
Violent crime	14676 (17.7)	4510 (23.6)	1.43 (1.38-1.49)	1.19 (1.14-1.24)
Rural	37422 (45.2)	7997 (41.9)	0.87 (0.85-0.90)	0.93 (0.90-0.96)
Ave. Income >50K	62645 (75.5)	13457 (70.3)	0.77 (0.74-0.79)	0.90 (0.86-0.93)
	Female			
MH Providers	12124 (49.0)	144 (58.5)	1.47 (1.14-1.90)	1.47 (1.14-1.90)
Food Insecurity	13092 (52.7)	150 (60.7)	1.39 (1.07-1.79)	1.39 (1.07-1.79)
Food environment	12970 (52.2)	119 (48.2)	0.85 (0.66-1.09)	0.85 (0.66-1.09)
Housing Problems	13691 (55.1)	104 (42.1)	0.59 (0.46-0.76)	0.59 (0.46-0.76)
Exercise Opp.	12500 (51.0)	124 (51.2)	1.01 (0.78-1.30)	1.01 (0.78-1.30)
Violent crime	3888 (15.7)	61 (24.7)	1.77 (1.32-2.36)	1.77 (1.32-2.37)
Rural	11422 (46.1)	86 (34.8)	0.62 (0.48-0.81)	0.62 (0.48-0.81)
Ave. Income >50K	19224 (77.4)	158 (64.0)	0.52 (0.40-0.67)	0.52 (0.40-0.67)

Abbreviations: MH, Mental MH; Occ., Occupation; Exercise Opp., Exercise Opportunity; Ave. Income, Median House Hold Income of County.

[a]See box 1 for categories of variables listed.

[b]Logistic regression models controlled for age, race/ethnicity, military status, and education level for male decedents and age for female decedents.

Circumstances. The NVDRS collects information about the circumstances the preceded a death from suicide. To further understand how construction worker suicides differ from other workers the frequency and odds of each circumstance was compared across occupation and sex. The greatest difference between construction workers and other workers was the contribution of a substance use problem to the suicide. This was true for both male and female workers. The comparison of common suicide circumstances is presented in Table 5.

Table 5: NVDRS Suicide Circumstance by Sex and Occupation

	Male Workers			Female Workers		
	Other Occ. N (%)	Con. N (%)	Adj. Odds Ratio[a] (95% CI)	Other Occ. N (%)	Con. N (%)	Adj. Odds Ratio[a] (95% CI)
Mental Health Problem	34483 (46.3)	6887 (40.2)	0.85 (0.82-0.88)	15008 (65.3)	123 (53.0)	0.60 (0.46-0.78)
Physical Health	10620 (14.3)	2269 (13.2)	0.95 (0.90-1.00)	4031 (17.5)	27 (11.6)	0.63 (0.42-0.94)
Alcohol Use	16841 (22.6)	4683 (27.3)	1.21 (1.16-1.26)	4349 (18.9)	52 (22.4)	1.24 (0.91-1.69)
Substance Use	13565 (18.2)	5128 (29.9)	1.64 (1.57-1.70)	4741 (20.6)	71 (30.6)	1.68 (1.26-2.23)
Suicide Attempt History	13060 (17.5)	2980 (17.4)	0.96 (0.91-1.00)	7699 (33.5)	73 (31.5)	0.91 (0.69-1.20)
Job Problem	10921 (14.7)	1824 (10.6)	0.79 (0.75-0.84)	2272 (9.9)	12 (5.2)	0.50 (0.28-0.89)
Financial Problem	8195 (11.0)	1572 (9.2)	0.86 (0.81-0.91)	1981 (8.6)	16 (6.9)	0.79 (0.48-1.32)
Eviction	2982 (4.0)	721 (4.2)	1.02 (0.94-1.12)	899 (3.9)	<10	NC
Legal Problem	8028 (10.8)	2362 (13.8)	1.25 (1.19-1.32)	984 (4.3)	15 (6.5)	1.52 (0.90-2.58)
Family Relationship	6196 (8.3)	1556 (9.1)	1.05 (0.98-1.11)	2509 (10.9)	31 (13.4)	1.26 (0.86-1.84)
Intimate Partner	25413 (34.1)	6353 (37.1)	1.08 (1.04-1.13)	6609 (28.7)	85 (36.6)	1.42 (1.08-1.87)

Abbreviations: NC, Not calculated; Occ. Occupations; Con. Construction.
[a]Logistic regression models controlled for age, race/ethnicity, military status, and education level for male decedents and age for female decedents.

Relevance and practical application. This work is the first study to evaluate the impact of labor related laws and suicide rates for construction workers. We have identified several policy related measures that may be effective in reducing suicide rates for construction workers. First, when states had family leave related policies in place that were more comprehensive than federal requirements, women construction workers had lower rates of suicided. This suggests that implementing state level policies providing for family medical leave will be protective against suicide for women construction workers. Further, we believe this finding informs best practices that businesses and unions can adopt to reduce suicide amongst construction worker employees.

When in states with laws restricting opioid prescribing, men working in construction had lower rates of suicide then when laws were not enacted. This is consistent with a higher level of substance use observed among male construction workers compared to other workers. In addition to policy implications, this finding should be considered by providers who treat construction workers. Providers should monitor and consider a patient's individual risk for substance use or suicide when prescribing opioids. The increased role of substance use in construction worker suicide supports the need for substance use recovery and support measures being implemented in the construction industry.

5. Changes to methods and lessons learned

Overall, we followed our study protocol outlined in the application. Our greatest deviation came in the analysis of community level variables. We originally planned on treating community variables with the same analytic methods as our legal analysis. A limitation of the ACS data is county of residence is not listed for every sampled person for anonymity reasons. Restricting analysis to only those with a county of residence in the ACS data would limit the generalizability of results as rural, sparsely populated areas were more likely to have their county masked in the ACS data. We instead adopted a strategy of comparing community level variables in the same way that the circumstance data of NVDRS is used. The convention is using logistic regression to compare the frequency that an element is present between two or more groups of suicide decedents. Essentially, we are comparing the community environment present at the time of death and comparing how this differs from other workers. Through this method we were able to identify several community level factors that are different between the two groups. We view these results as hypothesizes generating and will inform future analysis. An alternative approach would be working with a Research Data Center to access restricted data elements. Use of the ACS data in this setting allows for release of county of residence for all records. However, use of the restricted data requires additional cost and permission for access and necessitates traveling to the data center for analysis.

We made a change in the data presentation. We constructed frequentist (95% confidence intervals) and Bayesian (95% credible intervals) in our analysis. For easier comparison with the existing literature, we chose to use frequentist confidence intervals for our data presentation and for identifying statistical significance.

6. Future Funding Plans

We are further developing this research to investigate the role of construction work in mental health disparities. Our preliminary data suggest Hispanic and American Indian/Alaska Native populations make up a disproportionate amount of the cases in the NVDRS occupation data. We are also seeking to link job exposure information beyond occupation title with the NVDRS to better understand how work is impacting worker suicide risk. To fund this work, we are pursuing opportunities available from the National Institute of Mental Health, National Institute on Minority Health and Health Disparities priorities, and the National Center for Injury Prevention and Control.

For immediate expansion of this work, I have secured departmental funds to work with the ACS restricted data. This will further strengthen my ability to evaluate community level protective and risk factors for suicide and provide additional preliminary data for an expanded research project. Finally, the methods used in this research can be applied to additional health outcomes. The most relevant health outcome for future study is death form unintentional overdose. The State Unintentional Drug Overdose Reporting System (SUDORS) is a companion system to the

NVDRS. SUDORS began collecting data in all states the late 2010s. Still being in a relatively early stage of the program, the data has not been made publicly available for research. If similar data release policies to the NVDRS are adopted, we will pursue applying the methodology developed in this study to the SUDORS data. We are also exploring potential for working with individual states to access state level SUDORS data in the event national data does not become available.

7. Presentations and Publications

Dale AM, Davis J, Rohlman D, Evanoff B. Implementing Multifaceted and Evidence-Based Approaches to Address Suicide Prevention in the Construction Industry. Construction Working Minds Summit. February 2024. Kansas City, MO.

Davis J, et al. The Impact of Employment Laws on Construction Woker Suicide. *In preparation.*

8. Dissemination plan

We have developed a manuscript detailing the results of the legal analysis targeting BMJ Occupational and Environmental Health or American Journal of Industrial Hygiene for publication. The legal database created for the analysis will be published with the manuscript as well as the standardized code used to harmonize variables between NVDRS and ACS. We are working with the Healthier Workforce Center of the Midwest (HWC) to generate a one-page policy brief and info sheet for employers to be shared through the HWC network of businesses and health professionals. This material will be made available to CPWR for cobranding or adaption for use by CPWR partners. Additionally, we will present the results to business leaders through HWC collaborative learning communities. As new partners emerge during the dissemination of this work, we will create group specific materials to covey best practices and applications of the work.

Appendix Tables. Analysis excluding 718 (3.7%) extraction workers (47-5010 to 47-5090).

Table 2: Worker Demographic Characteristics by Sex, 2013-2020 (Excluding Extraction Workers)

Variable	Level	Male Other Occ N=83816	%	Male Construction N=18638	%	Female Other Occ N=25027	%	Female Construction N=246[a]	%
Age	<25	9054	10.8	1733	9.3	2014	8	21	8.5
	25-44	35279	42.1	8736	46.9	10006	40	104	42.3
	45-64	39483	47.1	8169	43.8	13007	52	121	49.2
Race and ethnicity of victim (combined)	White	67638	80.8	15400	82.7	20610	82.4	198	80.5
	Black	6027	7.2	689	3.7	1516	6.1	<10	NC
	AI/AN	1046	1.2	402	2.2	313	1.3	13	5.3
	Asian/PI	1964	2.3	133	0.7	726	2.9	<10	NC
	Two or More	1078	1.3	216	1.2	341	1.4	<10	NC
	Hispanic	5990	7.2	1787	9.6	1505	6	19	7.7
	Missing	73	-	11	-	16	-	0	-
Education	Less than Grade 12	8753	11	3972	22.5	1581	6.7	43	18.5
	High School Diploma	34513	43.4	9964	56.4	7914	33.4	120	51.5
	College	36250	45.6	3737	21.1	14187	59.9	70	30
	Missing	4300	-	965	-	1345	-	13	-
Marital status	Married[b]	26318	31.5	4954	26.8	7633	30.7	62	25.4
	Never Married/Single	35315	42.3	7968	43.1	8160	32.8	92	37.7
	Widowed/divorced/separated	21797	26.1	5584	30.2	9095	36.5	90	36.9
	Missing	386	-	132	-	139	-	<10	NC
Served in the U.S. Armed Forces	No	71193	87	16354	90	23686	97.2	229	94.2
	Yes	10644	13	1812	10	679	2.8	14	5.8
	Missing	1979	-	472	-	662	-	<10	NC
Means	Firearm	44055	52.6	8899	47.7	7754	31	90	36.6
	Cutting/Stabbing	1793	2.1	352	1.9	377	1.5	6	2.4
	Poisoning	7443	8.9	373	2	7772	31.1	<10	NC
	Asphyxiation	25302	30.2	1429	7.7	7228	28.9	35	14.2
	Fall	1782	2.1	7073	37.9	607	2.4	104	42.3
	Motor vehicle/	1294	1.5	246	1.3	429	1.7	<10	NC
	Other	2147	2.6	266	1.4	860	3.4	<10	NC

Abbreviations: NC, not calculated; Occ, Occupation; AI/AN, American Indian/Alaskan Native; Asian/PI, Asian American/Pacific Islander

[a]Results less than 10 censored per NVDRS data release policy.

[b]Married includes domestic partnerships.

Table 3: Presence of Law and Suicide Rate (Excluding Extraction Workers)

			Other Occupation	Construction
Sex	Law	Level	RR (95% CI)[a]	RR (95% CI)[a]
All	Family Leave	Unpaid	0.86 (0.63-1.17)	0.94 (0.70-1.26)
		Paid	0.79 (0.50-1.23)	0.79 (0.50-1.24)
	Any Family Leave[b]	Present	0.82 (0.61-1.11)	0.85 (0.62-1.15)
	Opioid	Present	0.81 (0.69-0.96)	0.85 (0.70-1.02)
	Paid Leave	Present	0.88 (0.69-1.11)	0.92 (0.72-1.16)
	Union Restrictive[c]	Present	1.11 (0.87-1.43)	1.15 (0.90-1.46)
Male	Family Leave	Unpaid	0.86 (0.63-1.17)	0.93 (0.69-1.26)
		Paid	0.77 (0.49-1.20)	0.79 (0.50-1.27)
	Any Family Leave[b]	Present	0.81 (0.60-1.09)	0.85 (0.62-1.17)
	Opioid	Present	0.80 (0.68-0.95)	0.83 (0.70-0.99)
	Paid Leave	Present	0.85 (0.67-1.09)	0.93 (0.72-1.19)
	Union Restrictive[c]	Present	1.14 (0.90-1.45)	1.15 (0.90-1.46)
Female	Family Leave	Unpaid	0.91 (0.70-1.17)	0.46 (0.21-1.00)
		Paid	0.87 (0.57-1.32)	0.40 (0.27-0.60)
	Any Family Leave[b]	Present	0.88 (0.66-1.18)	0.42 (0.28-0.62)
	Opioid	Present	0.83 (0.70-0.98)	1.09 (0.73-1.65)
	Paid Leave	Present	0.93 (0.73-1.19)	0.68 (0.42-1.10)
	Union Restrictive[c]	Present	1.12 (0.87-1.43)	1.30 (0.95-1.78)

Abbreviations: RR, Rate Ratio.

[a]Poisson regression model comparing presence and absence of law. Absence of law was the reference category. Quasi-Poisson regression used to account for model over dispersion. Models controlled for year. Sensitivity analysis included analysis with additional covariates of age and race/ethnicity.

[b]Any family leave combined paid and unpaid leave.

[c]Union Restrictive included right-to-work laws or laws.

Table 4: County level differences (Excluding Extraction Workers)

	Male			
County Level[a]	Other Occ N (%)	Construction N (%)	Odds Ratio (95% CI)	Adj. Odds Ratio (95% CI) [b]
MH Providers	42409 (51.3)	9950 (54.2)	1.12 (1.09-1.16)	1.01 (0.97-1.04)
Food Insecurity	44083 (53.1)	10245 (55.5)	1.10 (1.07-1.14)	1.05 (1.02-1.09)
Food environment	41834 (50.4)	8885 (48.2)	0.91 (0.89-0.94)	1.00 (0.97-1.04)
Housing Problems	43684 (52.6)	8464 (45.9)	0.76 (0.74-0.79)	0.90 (0.87-0.93)
Exercise Opp.	41101 (50.2)	8810 (48.6)	0.94 (0.91-0.97)	0.97 (0.94-1.01)
Violent crime	14676 (17.7)	4209 (22.8)	1.38 (1.32-1.43)	1.14 (1.09-1.19)
Rural	37422 (45.2)	7842 (42.6)	0.90 (0.87-0.93)	0.96 (0.92-0.99)
Ave. Income >50K	62645 (75.5)	13123 (71.1)	0.80 (0.77-0.83)	0.93 (0.90-0.97)
	Female			
MH Providers	12124 (49.0)	140 (58.1)	1.44 (1.12-1.87)	1.45 (1.12-1.87)
Food Insecurity	13092 (52.7)	146 (60.3)	1.36 (1.05-1.77)	1.36 (1.05-1.76)
Food environment	12970 (52.2)	116 (47.9)	0.84 (0.65-1.09)	0.84 (0.65-1.08)
Housing Problems	13691 (55.1)	102 (42.1)	0.59 (0.46-0.77)	0.59 (0.46-0.77)
Exercise Opp.	12500 (51.0)	122 (51.3)	1.01 (0.78-1.31)	1.01 (0.78-1.30)
Violent crime	3888 (15.7)	57 (23.6)	1.66 (1.23-2.24)	1.67 (1.24-2.25)
Rural	11422 (46.1)	85 (35.1)	0.63 (0.49-0.82)	0.63 (0.49-0.83)
Ave. Income >50K	19224 (77.4)	157 (64.9)	0.54 (0.41-0.70)	0.54 (0.41-0.70)

Abbreviations: MH, Mental MH; Occ., Occupation; Exercise Opp., Exercise Opportunity; Ave. Income, Median House Hold Income of County.

[a]See box 1 for categories of variables listed.

[b]Logistic regression models controlled for age, race/ethnicity, military status, and education level for male decedents and age for female decedents.

Table 5: NVDRS Suicide Circumstance by Sex and Occupation (Excluding Extraction Workers)

	Male Workers			Female Workers		
	Other Occ. N (%)	Con. N (%)	Adj. Odds Ratio[a] (95% CI)	Other Occ. N (%)	Con. N (%)	Adj. Odds Ratio[a] (95% CI)
Mental Health Problem	34483 (46.3)	6696 (40.6)	0.86 (0.83-0.89)	15008 (65.3)	120 (52.6)	0.59 (0.46-0.77)
Physical Health	10620 (14.3)	2188 (13.3)	0.94 (0.89-1.00)	4031 (17.5)	25 (11.0)	0.59 (0.38-0.89)
Alcohol Use	16841 (22.6)	4509 (27.3)	1.21 (1.16-1.26)	4349 (18.9)	51 (22.4)	1.23 (0.90-1.69)
Substance Use	13565 (18.2)	4946 (30.0)	1.64 (1.57-1.71)	4741 (20.6)	69 (30.3)	1.64 (1.23-2.19)
Suicide Attempt History	13060 (17.5)	2883 (17.5)	0.96 (0.92-1.01)	7699 (33.5)	71 (31.1)	0.90 (0.68-1.19)
Job Problem	10921 (14.7)	1750 (10.6)	0.78 (0.74-0.83)	2272 (9.9)	11 (4.8)	0.46 (0.25-0.85)
Financial Problem	8195 (11.0)	1520 (9.2)	0.86 (0.81-0.91)	1981 (8.6)	16 (7.0)	0.81 (0.48-1.34)
Eviction	2982 (4.0)	695 (4.2)	1.02 (0.93-1.12)	899 (3.9)	<10	NC
Legal Problem	8028 (10.8)	2264 (13.7)	1.25 (1.18-1.31)	984 (4.3)	14 (6.1)	1.43 (0.83-2.47)
Family Relationship	6196 (8.3)	1491 (9.0)	1.04 (0.98-1.11)	2509 (10.9)	31 (13.6)	1.28 (0.88-1.88)
Intimate Partner	25413 (34.1)	6353 (37.1)	1.08 (1.04-1.12)	6609 (28.7)	84 (36.8)	1.42 (1.08-1.88)

Abbreviations: NC, Not calculated; Occ. Occupations; Con. Construction.

[a]Logistic regression models controlled for age, race/ethnicity, military status, and education level for male decedents and age for female decedents.