Received: 10 April 2024 | Revised: 24 May 2024 | Accepted: 14 June 2024

DOI: 10.1002/ajim.23632

RESEARCH ARTICLE

AMERICAN JOURNAL OF INDUSTRIAL MEDICINE WILEY

Suicides among construction workers in the United States, 2021

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Funding information
National Institute for Occupational Safety and Health, Grant/Award Number: U60OH009762

Abstract

Background: Construction workers have the second highest suicide death rate; despite this, there is limited literature examining suicides in the industry, which is necessary to identify those at higher risk of death by suicide. The objective of this study was to examine the characteristics of those who died by suicide in construction to address this knowledge gap.

Methods: Data from the National Center for Health Statistics National Vital Statistics System 2021 public use Mortality Multiple Cause-of-Death file were used to identify deaths by suicide, while denominator data for rates come from the 2021 Current Population Survey.

Results: In 2021, construction workers were disproportionately affected by suicide deaths. Almost a fifth (17.9%) of deaths by suicide with a reported industry code were in construction, despite construction workers accounting for only 7.4% of the workforce. Male construction workers accounted for a majority (97.8%) of suicide deaths. The highest percent of deaths by suicide were among individuals who were white, non-Hispanic, completed high school or equivalent, and single, across construction and all industries for males and females.

Discussion and Conclusions: Male and female construction workers had the highest rates of suicide across all characteristics when compared to all industries. Our findings support the need for ongoing prevention efforts within the industry. Future research is needed to understand suicide risk among certain characteristics and occupations. In addition, the work environment or other work-related factors should be studied to understand how the unique nature of the construction industry may be associated with higher suicide rates.

KEYWORDS

construction industry, injury prevention, mental health, occupational health, suicide, workplace suicides

Institution at which the work was performed: CPWR—The Center for Construction Research and Training.

1 | INTRODUCTION

Suicide is one of the leading causes of death in the United States (US),[1] yet there is a paucity of research that examines both the current prevalence of suicide deaths among adults who work and the factors that may contribute to higher rates in some industries and occupations. Given that working adults dedicate a significant portion of their waking hours to their jobs, the working environment can significantly influence mental health outcomes. The World Health Organization designates work as a social determinant of mental health because it can be protective of mental health by contributing to a person's sense of accomplishment, confidence, and earnings.[2] However, harmful or poor working conditions, hazardous work environments and work organization, poor working relationships, or unemployment can all significantly contribute to worsening mental health outcomes.[2]

Studies from Australia identified the construction industry as having among the highest suicide death rates and suggest work-related factors may contribute.[3–6] For example, one study identified five themes that may influence suicide death rates (positively or negatively): machoism characteristics of the industry culture; high-risk and fast-paced work environment; financial stability and financial literacy; uneven workload and unconventionally long working hours; and involvement of the employer's management in reassuring the mental well-being.[7]

In the United States, male workers in the construction industry have the second highest suicide death rate compared to other industries.[8,9] Sussell et al.[9] reported that the suicide death rate was 56.0 per 100,000 male construction workers, which was 75% higher than the rate of the overall working population for males (32.0 per 100,000).[9] A key limitation of this work is that it is only a high-level overview of suicides by industry and occupation. There is a need to understand the demographics and other pertinent characteristics of individuals in the construction industry who die by suicide. Such information is essential for informing intervention strategies and monitoring changes over time.

To address these gaps, this study analyzed mortality data from the National Center for Health Statistics' (NCHS) National Vital Statistics System (NVSS). We examined deaths by suicide among US construction workers and identified characteristics of those with higher suicide rates to find insights that might help in the design of future interventions.

2 | MATERIALS AND METHODS

2.1 | Data sources and definitions

Suicide deaths by industry were extracted from the NCHS NVSS 2021 public use Mortality Multiple Cause-of-Death data file.[10] In 2021, 49 states and New York City participated in providing occupation industry data to NCHS.[11] New York and New York City provide data through two registration jurisdictions.[12] Data on usual industry were available in 2021 for decedents 15 years and older from 49 states and New York City. The data excluded Rhode Island and District of Columbia.[11] The NCHS in collaboration with the National Institute for Occupational Safety and Health (NIOSH) coded industry beginning in 2020 using 2012 4-digit Census codes based on the kind of business/industry of the decedent's usual occupation (defined as occupation done for most of working life).[11,13] Cause of death was coded according to the International Classification of Diseases, Tenth revision (ICD-10) codes.[1] We defined suicide deaths as ICD-10 codes X60-X84 and Y870 based on the National Violent Death Reporting System (NVDRS) suicide definition commonly used in literature. However, we excluded U03, which is normally included in suicide definitions, due to these deaths by suicide resulting from terrorism.[11,14] To check the impact of this exclusion, we ran the analyzes with both definitions and found there were no cases coded as U03 in the 2021 data among suicides examined. Our analysis was restricted to US resident decedents aged 16–64 years old to reflect the traditional working age.

Denominator data come from the Bureau of Labor Statistics' (BLS) 2021 Current Population Survey (CPS) which is conducted by the US Census Bureau. Weighted population estimates for all industries and construction were restricted to those aged 16–64 years old in the paid, civilian workforce. CPS data were downloaded from IPUMS.[15] CPS data was used as it is the data source for generating the official employment and unemployment estimates for the United States.[16]

Decedent characteristics were based on reported information in the mortality and CPS data. We examined race, ethnicity, education, marital status, and usual occupation. Race categories included were White, Black, American Indian or Alaskan Native, Asian or Pacific Islander, and Other (any combinations of the prior categories and races not elsewhere specified). The two ethnicity categories were Hispanic and non-Hispanic. Education categories were less than high school, high school (including equivalent attainment such as a GED), some college (including an associate degree), and bachelor's or higher. Marital status categories were single (including widows and divorcees) and married. Usual occupation was defined according to 2010 US Census Standard Occupational Classification (SOC) codes and reflected the decedent's longest held occupation.[17]

2.2 | Data analysis

Descriptive statistics were calculated for all deaths by suicide and characteristics by industry (construction vs. all industries) and sex, with the exclusion of occupation for females due to sample size limitations. Significance tests were not run for descriptive statistics. We suppressed any counts less than 20 to protect the confidentiality of those in the data, as well as to remove unstable rate estimates. To prevent the calculation of suppressed values, other characteristic categories' shown percentages were rounded to the nearest whole number as indicated in the table footnotes when applicable.

Crude suicide death rates by sex and 95% confidence intervals (CIs) were calculated using the number of deaths by suicide from the NVSS mortality data as the numerator and weighted employment estimates from CPS as the denominator. Suicide death rates for construction workers were compared to all workers using rate ratios (RRs). Confidence intervals were calculated using the Exact Poisson Method.[18] Chi-square tests were performed to obtain p-values. All statistical analyzes were conducted in SAS 9.4 (SAS Institute, Cary, NC) or Microsoft Excel. To account for the multi-stage stratified sample design of the CPS, sample weights were used to generate weighted frequencies for worker population estimates using the PROC SURVEYFREQ procedure in SAS. Both data sources are publicly accessible, and the study was deemed exempt by the authors' organizational Institutional Review Board.

3 | RESULTS

In 2021, there were 29,153 deaths by suicide with reported industry codes. Of these, 17.9% were decedents whose usual industry was construction, which indicates a disproportionate burden as construction workers only accounted for 7.4% of the workforce in 2021.[19] The suicide death rate for construction was 2.4 times higher than that for all industries (46.06 per 100,000 workers; 95% CI: 44.81–47.32 vs. 19.47 per 100,000 workers; 95% CI: 19.25–19.70; Figure 1).

A majority (97.8%; $n = 5099$) of deaths by suicide in the construction industry were males, compared to 81.5% ($n = 23{,}761$) for those in all industries (Table 1 and Figure 1). The death by suicide rate for males was 50.49 per 100,000 (95% CI: 49.10–51.87) in construction compared to 30.02 per 100,000 (95% CI: 29.63–30.39) for those in all industries (Tables 2 and 3). The risk of death by suicide was greater for male construction workers compared to males in all industries (RR = 1.68, 95% CI: 1.63–1.73, $p < 0.0001$). In comparison, the suicide death rate was 9.37 per 100,000 (95% CI: 7.65–11.09) for females in construction compared to 7.64 per 100,000 (95% CI: 7.43–7.85) for females in all industries; this difference was also significant (RR = 1.23; 95% CI: 1.02–1.48, $p = 0.031$).

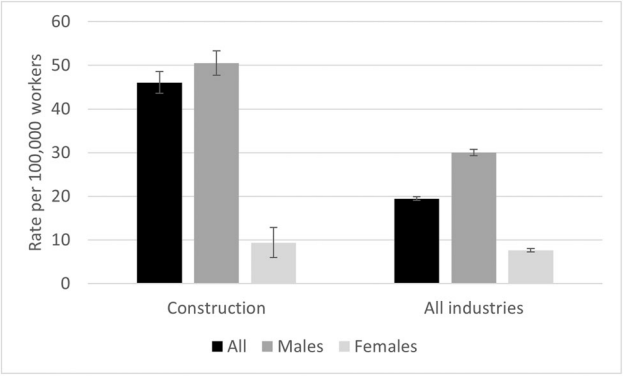

FIGURE 1 Suicides by industry, 2021. *Bars indicate 95% confidence interval.

The highest percent of deaths by suicide were among workers who were white, non-Hispanic, completed high school or equivalent, and single for both males and females across construction and all industries. There were differences among age groups by sex and industry; those aged 35–44 years old accounted for the largest percent of deaths by suicide for both males (25.9%) and females (26.3%) in construction (not tested for significance). In comparison, for all industries, those aged 25–34 years old (24.7%) accounted for the largest percent of deaths by suicide for males, while those aged 45–54 years old (23.8%) accounted for the largest share of deaths by suicide for females (not tested for significance). Rates were then calculated to account for the working population in each group with significance tests to assess differences.

Males in construction and all industries had the highest rates if they were 55–64 years old, American Indian or Alaskan Native, non-Hispanic, completed high school or equivalent, or single (Table 2). The highest RR was found for male American Indian or Alaskan Native male workers in construction (RR = 2.01; 95% CI: 1.51–2.68, $p < 0.0001$). Non-Hispanic male construction workers were at an increased risk of death by suicide compared to non-Hispanic males in all industries (RR = 1.98, 95% CI: 1.92–2.05, $p < 0.0001$). Overall, single males in construction had the highest suicide death rate, which was 1.8 times greater than those in all industries (77.94 per 100,000; 95% CI: 75.38–80.51 vs. 43.45 per 100,000; 95% CI: 42.78–44.12, respectively).

Females in both construction and all industries had the highest rates if they were 55–64 years old, completed high school or equivalent, or single (Table 3). The highest RR for females was those aged 35–44 years old (RR = 1.36; 95% CI: 0.95–1.95, $p = 0.095$). Overall, the highest death by suicide rate for females in construction was among those who completed high school or equivalent (14.26 per 100,000; 95% CI: 10.26–18.25), 1.3 times higher than females in all industries who completed high school or equivalent (11.27 per 100,000, 95% CI: 10.74–11.79).

As shown in Table 4, the top five construction occupations by male suicide rate were also examined. The highest rate was found among male iron and steel workers (117.89 per 100,000; 95% CI: 84.19–151.60). This occupation also had the highest RR compared to all male workers in construction (RR = 2.33; 95% CI: 1.75–3.11). Male laborers, the largest occupation by number of workers,[20] had a RR of 1.41 (95% CI: 1.33–1.49) compared to males in all construction.

4 | DISCUSSION AND CONCLUSIONS

These findings indicate that rates of death by suicide among construction industry workers. Rates for males and females are higher across the various characteristics examined when compared to all industries, emphasizing the need for ongoing intervention and prevention efforts within the construction industry.

Higher suicide rates observed in workers with lower educational attainment (high school or equivalent) and those who are single, are

TABLE 1 Suicides by industry, sex, and selected characteristics, 2021.

	Males				Females			
	Construction		All industries		Construction		All industries	
	#of suicides (%[a])	Workers[b]	#of suicides (%[a])	Workers[b]	#of suicides (%[a])	Workers[b]	#of suicides (%[a])	Workers[b]
Total	5099 (100)	10,099,831	23,761 (100%)	79,159,628	114 (100)	1,216,869	5392 (100)	70,557,782
Age (years)								
16–24	479 (9.4)	1,062,239	2791 (11.7%)	10,509,500	[c]	[c]	552 (10.2)	10,067,732
25–34	1235 (24.2)	2,410,385	5869 (24.7%)	19,475,797	21.0%[d]	285,214	1174 (21.8)	16,927,886
35–44	1323 (25.9)	2,742,110	5320 (22.4)	18,383,019	26.0%[d]	306,596	1131 (21.0)	15,718,113
45–54	1033 (20.3)	2,194,457	4920 (20.7)	16,629,524	23.0%[d]	291,401	1282 (23.8)	15,077,110
55–64	1029 (20.2)	1,690,640	4861 (20.5)	14,161,788	22.0%[d]	235,023	1253 (23.2)	12,766,942
Race								
White	4639 (91.0)	8,839,204	20,400 (85.9)	61,687,523	97 (85.1)	1,040,211	4553 (84.4)	52,985,055
Black	235 (4.6)	686,651	1960 (8.2)	9,210,549	[c]	[c]	458 (8.5)	10,073,603
American Indian or Alaskan Native	114 (2.2)	165,899	399 (1.7)	926,270	[c]	[c]	79 (1.5)	807,339
Asian or Pacific Islander	50 (1.0)	228,700	611 (2.6)	5,617,894	[c]	[c]	197 (3.7)	5,039,803
Other	61 (1.2)	179,378	391 (1.6)	1,717,393	[c]	[c]	105 (1.9)	1,651,981
Ethnicity								
Hispanic	745 (14.6)	3,511,500	2765 (11.6)	16,213,540	[c]	[c]	510 (9.5)	12,154,839
Non-Hispanic	4348 (85.3)	6,588,331	20,975 (88.3)	62,946,088	[c]	[c]	4878 (90.5)	58,402,942
Education status								
Less than high school	1001 (19.6)	1,940,711	3018 (12.7)	7,359,192	[c]	[c]	349 (6.5)	4,570,914
High school	2870 (56.3)	4,343,187	11,009 (46.3)	23,478,364	49 (43.0)	343,734	1774 (32.9)	15,741,731
Some college	960 (18.8)	2,444,676	5705 (24.0)	19,954,394	35 (30.7)	386,288	1692 (31.4)	19,741,948
Bachelor's or higher	233 (4.6)	1,371,257	3906 (16.4)	28,367,678	[c]	[c]	1549 (28.7)	30,503,189
Marital status								
Single	3538 (69.4)	4,539,105	16,168 (68.0)	37,209,006	74 (64.9)	557,698	3632 (67.4)	35,892,252
Married	1545 (30.3)	5,560,726	7519 (31.6)	41,950,622	40 (35.1)	659,171	1741 (32.3)	34,665,530

[a]Percentages may not sum up to 100% due to suppressed and missing values.

[b]A weighted estimate of civilian, noninstitutionalized working persons aged 16–64 years.

[c]Data suppressed due to low frequency (<20).

[d]Due to the potential of being able to calculate suppressed values percentages shown rounded to the nearest whole number, frequencies excluded.

consistent with existing literature.[21–24] Within these two groups, male construction workers overall had higher rates for those who completed high school (or equivalent; 66.08 per 100,000 workers) and were single (77.94 per 100,000 workers) compared to all male workers (46.88 and 43.45, respectively). This finding is not specific to construction, as recently Martin[24] and colleagues found slightly higher workplace suicide deaths among all workers in North Carolina who had completed high school or less compared to those with more than high school. Rates by education and marital status need to be further studied to understand the association and why males experience higher rates by these characteristics.

By occupation and sex, male iron and steel workers have the highest risk of death by suicide, with a RR of 2.33 (95% CI: 1.75–3.11). While male construction laborers had the fifth highest RR at 1.41, they experienced the greatest number of deaths by suicide. This demonstrates that the burden of suicide is not equally shared within the construction industry, even among males, who are at higher risk than females. These findings support the need for additional research to understand those groups at higher risk of suicide, as well as the potential to target prevention efforts to the specific segments of the construction industry with higher suicide death rates.

TABLE 2 Rates of suicides per 100,000 male workers[a] by industry, and selected characteristics, 2021.

	Construction		All industries				
Characteristic	**Crude rate**	**95% CI**	**Crude rate**	**95% CI**	**Rate ratio**	**95% CI**	***p*-value**
Total	50.49	[49.10–51.87]	30.02	[29.63–30.39]	1.68	[1.63–1.73]	<0.0001
Age (years)							
16–24	45.09	[41.06–49.13]	26.56	[25.57–27.54]	1.70	[1.54–1.87]	<0.0001
25–34	51.24	[48.38–54.09]	30.13	[29.36–30.91]	1.70	[1.60–1.81]	<0.0001
35–44	48.25	[45.65–50.85]	28.94	[28.16–29.72]	1.67	[1.57–1.77]	<0.0001
45–54	47.07	[44.20–49.94]	29.59	[28.76–30.41]	1.59	[1.49–1.70]	<0.0001
55–64	60.86	[57.15–64.58]	34.32	[33.36–35.29]	1.77	[1.60–1.90]	<0.0001
Race							
White	52.48	[50.97–53.99]	33.07	[32.62–33.52]	1.59	[1.54–1.64]	<0.0001
Black	34.22	[29.85–38.60]	21.28	[20.34–22.22]	1.61	[1.40–1.84]	<0.0001
American Indian or Alaskan Native	68.72	[56.10–81.33]	43.08	[42.78–44.12]	1.60	[1.30–1.96]	<0.0001
Asian or Pacific Islander	21.86	[15.80–27.92]	10.88	[10.01–11.74]	2.01	[1.51–2.68]	<0.0001
Other	34.01	[25.47–42.54]	22.77	[20.51–25.02]	1.49	[1.14–1.96]	0.0033
Ethnicity							
Hispanic	21.22	[19.69–22.74]	17.05	[16.42–17.69]	1.24	[1.15–1.35]	<0.0001
Non-Hispanic	66.00	[64.03–67.96]	33.32	[32.87–33.77]	1.98	[1.92–2.05]	<0.0001
Education status							
Less than high school	51.58	[48.38–54.77]	41.01	[39.55–42.47]	1.26	[1.17–1.35]	<0.0001
High school	66.08	[63.66–68.50]	46.89	[46.01–47.77]	1.41	[1.35–1.47]	<0.0001
Some college	39.27	[36.78–41.75]	28.59	[27.85–29.33]	1.37	[1.28–1.47]	<0.0001
Bachelor's or higher	16.99	[14.81–19.17]	13.77	[13.34–14.20]	1.23	[1.08–1.41]	0.0018
Marital status							
Single	77.94	[75.38–80.51]	43.45	[42.78–44.12]	1.79	[1.73–1.86]	<0.0001
Married	27.78	[26.40–29.17]	17.92	[17.52–18.33]	1.55	[1.47–1.64]	<0.0001

Abbreviation: CI, confidence interval.

[a]Civilian, noninstitutionalized working persons aged 16–64 years.

The analysis also demonstrates the value of the NVSS mortality data in tracking death by suicide trends by industry and decedent characteristics. The National Violent Death Reporting System (NVDRS) has historically been used to examine suicides, but this data requires access to restricted data through an approved proposal and is only available to those with a master's degree or higher while no requirements exist for the public use NVSS mortality data.[25]

We found a slightly lower rate of deaths by suicide for males in construction than Sussell[9] and colleagues, 50.5 versus 56.0 per 100,000 workers. These studies are not directly comparable due to the use of restricted versus public access data, definition differences, and different denominator data (Current Population Survey vs. American Community Survey).

Limitations of the study include that the method for determining a decedent's occupation or industry are based on "usual" occupation or industry, which may not reflect employment at time of death. As a result, the population for denominator and numerator data are not identical. Another limitation is that not all subcategories available in the data could be examined, particularly for females, due to small sample sizes. The current study did not stratify decedents by detailed single status (i.e., divorcee, widow) and did not account for employment status or other overarching economic conditions which should be further researched.

Unfortunately, the NVSS data do not include work environment characteristics or work-related factors that may have contributed to the higher suicide death rates in construction compared to other industries. The World Health Organization designates work as a social determinant of mental health that can have positive or negative effects on mental health. It is known that work-related factors common with construction such as seasonal or inconsistent work, demanding schedules away from families, work-related injuries and chronic pain, and lack of sick leave or vacation time can lead to

TABLE 3 Rates of suicides per 100,000 female workers[a] by industry, and selected characteristics, 2021.

Characteristic	Construction		All industries				
	Crude rate	95% CI	Crude rate	95% CI	Rate ratio	95% CI	*p*-value
Total	9.37	[7.65–11.09]	7.64	[7.43–7.85]	1.23	[1.02–1.48]	0.031
Age (years)							
16–24	[b]	[b]	5.48	[5.03–5.94]	[b]	[b]	[b]
25–34	8.41	[5.05–11.78]	6.94	[6.54–7.33]	1.21	[0.81–1.82]	0.347
35–44	9.78	[6.28–13.29]	7.20	[6.78–7.61]	1.36	[0.95–1.95]	0.095
45–54	8.92	[5.49–12.35]	8.50	[8.04–8.97]	1.05	[0.71–1.55]	0.81
55–64	10.64	[6.47–14.81]	9.81	[9.27–10.36]	1.08	[0.73–1.61]	0.69
Race							
White	9.33	[7.47–11.18]	8.59	[8.34–8.84]	1.09	[0.89–1.33]	0.19
Black	[b]	[b]	4.55	[4.13–4.96]	[b]	[b]	[b]
American Indian or Alaskan Native	[b]	[b]	9.79	[7.63–11.94]	[b]	[b]	[b]
Asian or Pacific Islander	[b]	[b]	3.91	[3.36–4.45]	[b]	[b]	[b]
Other	[b]	[b]	6.36	[5.14–7.57]	[b]	[b]	[b]
Ethnicity							
Hispanic	[b]	[b]	4.20	[3.83–4.56]	[b]	[b]	[b]
Non-Hispanic	[b]	[b]	8.35	[8.12–8.59]	[b]	[b]	[b]
Education status							
Less than high school	[b]	[b]	7.64	[6.83–8.44]	[b]	[b]	[b]
High school	14.26	[10.26–18.25]	11.27	[10.74–11.79]	1.27	[0.95–1.68]	0.10
Some college	9.06	[6.06–12.06]	8.57	[8.16–8.99]	1.06	[0.76–1.48]	0.74
Bachelor's or higher	[b]	[b]	5.08	[4.83–5.33]	[b]	[b]	[b]
Marital status							
Single	13.27	[10.25–16.29]	10.12	[9.79–10.45]	1.31	[0.79–1.26]	0.02
Married	6.07	[4.19–7.95]	5.02	[4.79–5.26]	1.21	[0.73–1.37]	0.24

Abbreviation: CI, confidence interval.

[a]Civilian, noninstitutionalized working persons aged 16–64 years.

[b]Data suppressed due to low frequency (<20).

TABLE 4 Top 5 occupations with the greatest rates of suicides per 100,000 male construction workers,[a] 2021.

Occupation	Number of suicides (%[b])	Workers	Crude rate	95% CI	Rate ratio[c]	95% CI	*p*-value
Iron and Steel Workers	47 (0.92)	39,867	117.89	[84.19–151.60]	2.33	[1.75–3.11]	<0.0001
Welder	85 (1.67)	97,665	87.03	[68.53–105.54]	1.72	[1.39–2.14]	<0.0001
Brickmasons	77 (1.51)	93,196	82.62	[64.17–106.68]	1.64	[1.31–2.05]	0.000015
Crane Tower Operators	20 (0.39)	26,963	74.17	[41.67–106.68]	1.47	[0.95–2.28]	0.084
Laborers	1498 (29.38)	2,105,200	71.15	[67.55–74.76]	1.41	[1.33–1.49]	<0.0001

Abbreviation: CI, confidence interval.

[a]Civilian, noninstitutionalized working persons aged 16–64 years.

[b]Percentages do not sum to 100% due to only the top five occupations being shown.

[c]Rate ratio calculated between male occupations and all male suicides from Table 2 (CR = 50.49, 95% CI: 49.10–51.87).

substance use, suicidal thoughts, and death.[26–28] While work environment could not be examined, this study provides information on groups disproportionately impacted by suicide deaths in the construction industry. Future research should examine why these groups face higher rates of death by suicide and which characteristics of the work environment should be considered. Suicide is a national problem, and rates are rising among the working-age population.[8,9]

Despite these limitations, by elucidating the characteristics of those who die by suicide within construction, we can understand those who are at higher risk, and use this information for targeted intervention efforts. It is important to repeat and build on these analyzes over time to track national and industry-specific trends. Findings from this analysis can be used to help guide intervention and prevention efforts to reduce suicide deaths in the construction industry.

AUTHOR CONTRIBUTIONS

All authors assisted with the conception and development of the analysis plan. William Harris served as the primary author. He led the coordination among all authors, the mortality data analysis including acquisition and analysis, as well as drafted all sections. Amber B. Trueblood supported William Harris with the overall coordination of the manuscript, development of the analysis plan, acquiring and analyzing Current Population Survey data, calculating rate ratios, and drafting the manuscript. Thomas Yohannes calculated rates and drafted all figures and tables. He also reviewed all sections of the manuscript. Christopher P. Rodman and Rick Rinehart assisted with the literature review and drafting the introduction and discussion sections. They also reviewed the analysis plan. All authors agree to the final approval of the manuscript to be published and to be held accountable for all aspects of the work.

ACKNOWLEDGMENTS

This study was funded by the US National Institute for Occupational Safety and Health (NIOSH) grant U60OH009762.

CONFLICT OF INTEREST STATEMENT

The authors declare that there are no conflicts of interest.

DISCLOSURE BY AJIM EDITOR OF RECORD

John Meyer declares that he has no conflict of interest in the review and publication decision regarding this article.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ETHICS STATEMENT

The study was deemed exempt by the CPWR-The Center for Construction Research and Training Institutional Review Board.

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How to cite this article: Harris W, Trueblood AB, Yohannes T, Rodman CP, Rinehart R. Suicides among construction workers in the United States, 2021. *Am J Ind Med*. 2025;68:S144-S151. doi:10.1002/ajim.23632