

Suicide Rates by Lethal Means and Occupational Group Among US Workers, 2013–2019

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Objective: The aim of the study was to calculate rates of suicide by lethal means and occupational group during 2013–2019 for US workers. **Methods:** This descriptive study included suicide rates for workers 24–65 years of age which were calculated using decedents from the National Violent Death Reporting System and population estimates from the American Community Survey Public Use Microdata Sample. Rates were stratified by lethal means, occupation, and biological sex. **Results:** Firearm-related suicides rates were highest among construction and extraction; installation, maintenance, and repair; and protective service occupations. Poisoning-related suicide rates were highest among arts, design, entertainment, sports, and media; construction and extraction; and healthcare practitioners and technical occupations. **Conclusions:** Occupational groups with access to firearms at work and low-wage jobs have higher rates of firearm-related suicide. Future investigations should examine how occupational access to firearms contributes to suicide risk among workers.

Keywords: suicide, lethal means, occupation, firearms, poisoning

Suicide is a growing problem among US workers. As of June 2024, approximately 63% of the US civilian noninstitutionalized population, 16 years and older were in the labor force with approximately 96% of the labor force employed.¹ Suicide is the sixth leading cause of death among most of those who are working age (25–64 years) and the suicide rate for this age group continues to increase.^{2,3} Workers spend a significant amount of time at work,⁴ where workplace exposures like job stress can increase suicide risk.⁵ Moreover, suicide negatively affects co-workers and the employers. Suicide of a co-worker leads to grief, lower productivity, and social isolation.⁶ It is estimated that suicide cost the US over 502 billion dollars during 2019 and 2020 in lost wages, healthcare costs, and future quality of life.⁷

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LEARNING OUTCOMES

After completing this enduring educational activity, the learner will be better able to:

- Describe the major occupational groups with the highest suicide rates by lethal means and biological sex.
- Summarize which minor, broad, and detailed occupational groups have the highest firearm-related suicide rates among the five major occupational groups with the highest firearm-related suicide rates.

Workers in specific occupations are at particularly elevated risk for suicide. A recent study using 1 year (2016) of National Violent Death Reporting System data showed that workers in construction and extraction; installation, maintenance and repair; arts, design, entertainment, sports, and media; and transportation and material moving have high rates of suicide.³ Workers in certain occupations may also have higher rates of firearm-related suicides, which represented approximately 52% of all suicides in the US during 2001–2022.² Previous studies using US data show that workers in certain occupational groups are more likely to use a firearm in a fatal suicide compared to other lethal means (eg, drug overdose, hanging). Individuals employed as farmers,⁸ construction workers,⁸ police officers,^{8,9} maintenance and repair workers,¹⁰ firefighters,¹¹ pharmacists,¹² and physician assistants¹³ are more likely than workers in other occupations or the general public to use a firearm in the suicide compared to other lethal means. The literature also suggests that firearm-related suicides are more likely to occur among male workers compared to female workers, who are more likely

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Author Contributions: VAS is the principal investigator of the study, and was involved with drafting the manuscript, conducting the statistical analysis, and is responsible for the overall study and final decisions on the analysis and manuscript. JD was involved with conducting and revising the statistical analysis and manuscript. JMP, PAR, and JEC were involved in revising the analysis and manuscript. CC was responsible for overseeing the study and was involved in conducting and revising the statistical analysis and manuscript.

Data Availability: Data used in this study are from the National Violent Death Reporting System (NVDRS) Restricted Access Database (RAD), managed by the Centers for Disease Control and Prevention (CDC) and from the American Community Survey Public Use Microdata Sample, which is publicly available. Access to the NVDRS RAD is restricted and requires approval from the CDC.

Ethical Considerations: This study was not considered human subjects research by the University of Iowa Human Subjects Office (IRB # 202401135).

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to die by poisoning-related suicide.^{3,14–16} However, no national study has examined which occupational groups have the highest rates of firearm-related suicide or examined suicide by lethal means in the US.

As suicides continue to increase among worker populations, identification of workers in occupational groups with the highest suicide rates by lethal means can inform workplace suicide prevention programs. Current programming focuses on general awareness and resources for mental health^{17–19} and does not address work-related factors related to a given occupation like having access to firearms at work. The objective of this study was to examine US rates of suicide by occupation and lethal means during 2013–2019.

METHODS

Data Sources and Study Population

All suicides among US workers ages 25–64 years during 2013–2019 were acquired from the National Violent Death Reporting System (NVDRS). The NVDRS is a case-only, national population-based surveillance system of all violence-related fatalities (suicide, homicide) occurring in the US.²⁰ Data are abstracted from law enforcement reports, coroner/medical examiner reports, toxicology reports, and death certificates, and include characteristics about the suicide decedent (eg, demographics, mental health and substance use, relationship and life stressors, job problems) and variables related to the weapon used (if any).²⁰ By 2020, the NVDRS was tracking violent deaths for all 50 states, the District of Columbia, and Puerto Rico.²⁰ The NVDRS data for this study included suicides recorded during 2013–2019. NVDRS data during 2020 and 2021 were available but not used in this study due to the potential differential effect of the COVID-19 pandemic on the incidence of suicides across occupations.

Denominator data for rate calculations was acquired from the American Community Survey Public Use Microdata Sample (ACS-PUMS). The ACS is a nationally representative, census-based survey conducted annually among the US population.²¹ The ACS-PUMS was used in this study because the full ACS dataset only provides aggregated data, whereas the ACS-PUMS provides deidentified, individual-level data.²¹ ACS-PUMS is a subset of ACS representing approximately 66% of the respondents completing the ACS. ACS-PUMS provides survey weights which were applied to the denominator data to generate national population estimates and standard errors and is publicly available at no cost.²² ACS-PUMS data were downloaded using the 5-year average data for each year of 2013–2019 and used as denominator data to calculate rates of suicide overall and by occupational group and biological sex.

Suicide decedents recorded in the NVDRS with an occupation at the time of death during 2013–2019 were examined. Suicide decedents categorized with a major Standard Occupational Classification (SOC) code as “not in workforce” [97-0000]; “military” [98-0000]; and “missing, unknown, inadequate response to code” [SOC = 99-0000] were excluded from the study. Only suicide decedents aged 25–64 years were included to align denominator estimates from ACS-PUMS with the working age population. Additionally, only suicide decedents with a known lethal mean were included given that the analyses focused on differences in suicide by lethal means. This excluded 0.8% of the suicide decedents aged 25–64 years with an identifiable occupation at the time of death. The total study population included 92,642 suicide decedents.

Variables

Suicide is defined in the NVDRS as an intentional violent death against oneself and includes ICD-10 codes X60–X84, Y87.0, and U03.²⁰ Lethal means is defined in the NVDRS as the type of weapon used to inflict the fatal injury.²⁰ It is captured from the death certificate, coroner/medical examiner report, and/or law enforcement report and recorded as one of the following: firearm, nonpowder gun, sharp in-

strument, blunt instrument, poisoning, hanging/strangulation/suffocation, personal weapons (eg, fists, feet, and hands for actions such as punching, kicking, and hitting), fall, explosive, drowning, fire/burns, motor vehicle (eg, buses, motorcycles), other transport vehicle (eg, trains, planes, boats), intentional neglect (eg, starving oneself), biological weapons, shaking, and other (eg, taser, electrocution, nail gun, exposure to environment/weather). Firearm-related suicides were those where the lethal means documented in the NVDRS was “firearm.” Poisoning-related suicides and asphyxiation-related suicides were those where the lethal means documented in the NVDRS were “poisoning” and “hanging, strangulation, suffocation,” respectively. All other lethal means suicides were those where the lethal means documented in the NVDRS were any of the other lethal means. Decedents with unknown or missing lethal means ($n = 759$, 0.8%) were excluded.

The usual occupation of the decedent as recorded on the death certificate, defined as the longest held occupation by the decedent, was the NVDRS variable used in this study.²⁰ It is coded using the 2018 Standard Occupational Classification (SOC) system, which is organized using a six-digit, tiered system with four levels of aggregation based on the type of work the occupations perform. The major occupational group is the largest category followed by minor occupational group, broad occupational group, and detailed occupational group. The 2010 SOC codes in ACS-PUMS were cross-walked to the most recent 2018 SOC coding structure in the NVDRS using the NIOSH Industry and Occupation Computerized Coding System.²³

Analysis

Rate estimates of all suicides, firearm-related suicides, poisoning-related suicides, asphyxiation-related suicides, and all other lethal means suicides were calculated, by major, minor, broad, and detailed occupational group and biological sex during 2013–2019. Weighted estimates, with 95% confidence intervals, were calculated. Previous studies examining suicide by occupation suggest deaths by suicide differ by biological sex and should be calculated separately.^{3,10} Per NVDRS guidelines, rate estimates with numerators less than 20 were not reported.²⁰

The broad and detailed occupational groups with unexpectedly high suicide rates were further evaluated for accuracy. The weighted proportion of workers in a given occupational group from ACS-PUMS was compared to the proportion of workers from Bureau of Labor Statistics data.¹ Where broad and detailed occupational groups with proportions that were dissimilar, rates were calculated at the next highest SOC code level until the proportions were similar. ACS-PUMS did not provide population estimates for all detailed occupational groups due to data suppression (defined as an occupational group with less than 10,000 people in the US in ACS-PUMS).²⁴ Therefore, rates could not be reported for these occupational groups.

Because of the number of SOC codes, only minor, broad, and detailed occupational groups with the five highest firearm-related suicide rates among the major occupational groups with the five highest firearm-related suicide rates were reported in this study. All suicide rates by biological sex for minor (Appendix A, Appendix B, <http://links.lww.com/JOM/B988>), broad (Appendix C, Appendix D, <http://links.lww.com/JOM/B988>), and detailed (Appendix E, Appendix F, <http://links.lww.com/JOM/B988>) occupational groups are provided in the appendices. All analyses were conducted using SAS 9.4 (SAS Institute Inc., Cary, NC) and STATA 18 (StataCorp LLC, College Station, TX). Authors adhered to the STrengthening the Reporting of OBservational studies in Epidemiology guidelines (see Supplemental Digital Content, STROBE Checklist, <http://links.lww.com/JOM/B989>).

RESULTS

Among the 92,642 suicide decedents in the study population, approximately 80% of the suicide decedents were male ($n = 73,493$) compared to 20% female ($n = 19,146$) (three suicide decedents had missing biological sex) (Table 1). Firearm-related suicides represented

TABLE 1. Rates of Suicide by Major Occupational Group and Biological Sex During 2013–2019

Biological Sex	All Suicides		Firearm-Related Suicides		Poisoning-Related Suicides		Asphyxiation-Related Suicides		All Other Lethal Means Suicides	
	<i>n</i>	Rate (per 100,000 Worker-Years)	<i>n</i>	Rate (per 100,000 Worker-Years)	<i>n</i>	Rate (per 100,000 Worker-Years)	<i>n</i>	Rate (per 100,000 Worker-Years)	<i>n</i>	Rate (per 100,000 Worker-Years)
Male	73,493	28.0 (27.9–28.2)	37,272	13.3 (13.3–13.3)	7,146	2.8 (2.8–2.8)	23,869	7.8 (7.7–7.8)	5,206	2.1 (2.1–2.1)
Female	19,146	9.3 (9.3–9.4)	5,819	2.8 (2.7–2.8)	6,403	2.9 (2.9–3.0)	5,404	2.5 (2.5–2.5)	1,514	0.6 (0.6–0.6)

46.5% of the study population ($n = 43,091$) with asphyxiation-related suicides ($n = 29,273$, 31.6%) and poisoning-related suicides ($n = 13,549$, 14.6%) having the second and third highest numbers, respectively. All other lethal means represented the remaining 7.3% ($n = 6720$) of suicide decedents.

The overall suicide rate in the study population was higher among male workers (28.0 per 100,000 male worker-years in the US in 2013–2019) compared to female workers (9.3 per 100,000 female worker-years in the US in 2013–2019) (Table 1). The firearm-related suicide rate for male workers (13.3 per 100,000 worker-years) was higher than the poisoning-related suicide rate (2.8 per 100,000 worker-years), asphyxiation-related suicide rate (7.8 per 100,000 worker-years), and all other lethal means suicide rate (2.1 per 100,000 worker-years); however, the firearm-related suicide rate among female workers (2.8 per 100,000 worker-years) was similar to the poisoning-related suicide rate (2.9 per 100,000 worker-years) and asphyxiation-related suicide rate (2.5 per 100,000 worker-years).

The major occupational groups with the five highest firearm-related suicide rates (per 100,000 US worker-years 25–64 years in 2013–2019) among male workers were in the following: (1) construction and extraction (25.9); (2) installation, maintenance, and repair (23.7); (3) protective service (21.7); (4) personal care and service (19.7); and (5) farming, fishing, and forestry (18.3) (Table 2). The major occupational groups with the five highest firearm-related suicide rates (per 100,000 US worker-years 25–64 years in 2013–2019) among female workers were in the following: (1) protective service (7.9); (2) construction and extraction (7.2); (3) installation, maintenance, and repair (6.2); (4) arts, design, entertainment, sports, and media (4.0); and (5) personal care and service (3.9).

The major occupational groups with the five highest poisoning-related suicide rates (per 100,000 US worker-years 25–64 years in 2013–2019) among male workers were in the following: (1) healthcare practitioners and technical (4.9); (T2) personal care and service (4.7); (T2) construction and extraction (4.7); (4) arts, design, entertainment, sports, and media (4.6); and (5) installation, maintenance, and repair (3.6) (Table 2). The major occupational groups with the five highest poisoning-related suicide rates (per 100,000 US worker-years 25–64 years in 2013–2019) among female workers were in the following: (1) personal care and service (4.8); (2) arts, design, entertainment, sports, and media (4.7); (T3) installation, maintenance, and repair (4.5); (T3) healthcare practitioners and technical (4.5); and (5) construction and extraction (3.7).

The major occupational groups with the five highest asphyxiation-related suicide rates (per 100,000 US worker-years 25–64 years in 2013–2019) among male workers were in the following: (1) construction and extraction (21.3); (2) arts, design, entertainment, sports, and media (17.3); (3) personal care and service (17.0); (4) farming, fishing, and forestry (14.4); and (5) installation, maintenance, and repair (12.6) (Table 2). The major occupational groups with the five highest asphyxiation-related suicide rates (per 100,000 US worker-years 25–64 years in 2013–2019) among female workers were in the following: (1) construction and extraction (8.0); (2) arts, design, entertainment, sports, and media (6.1); (3) installation, maintenance, and repair

(4.2); (4) personal care and service (4.1); and (5) food preparation and serving (3.9).

Within each of the major occupational groups with the five highest rates of firearm-related suicide, a summary of the highest rates (per 100,000 US worker-years 25–64 years in 2013–2019) for the minor, broad, and detailed occupational groups are provided for males (Table 3) and females (Table 4). Among male worker decedents, the minor occupational group with the highest rate of firearm-related suicide in construction and extraction was extraction workers (47.3) (Table 3). The highest rates among the broad and detailed occupational groups were from brickmasons, blockmasons, and stonemasons (154.1) followed by plumbers, pipefitters, and steamfitters (71.0).

Vehicle and mobile equipment mechanics, installers, and repairers and millwrights had the highest firearm-related suicide rate (29.7) among male installation, maintenance, and repair minor occupational groups with millwrights having the highest rate among detailed occupational groups (42.7) (Table 3). Among male protective service occupations, law enforcement workers had the highest firearm-related suicide rate (25.7) among minor occupational groups, while bailiffs, correctional officers, and jailers had the highest rate among broad occupational groups (29.2).

Funeral service workers had the highest firearm-related suicide rate (32.9) among male personal care and service occupational groups, while fitness trainers and aerobics instructors had the highest rate among the detailed occupational groups (62.6), followed by morticians, undertakers, and funeral directors (36.6) (Table 3). Fishing and hunting workers had the highest rate of firearm-related suicides (45.6) among the male farming, fishing, and forestry minor occupational groups.

Among the protective services major occupational group, the broad occupational groups with the highest firearm-related suicide rates (per 100,000 US worker-years 25–64 years in 2013–2019) among female workers were police officers (15.9) and bailiffs, correctional officers, and jailers (12.4) (Table 4). Because of data suppression, rates for broad and detailed occupational groups among construction and extraction and installation, maintenance, and repair occupational groups could not be calculated. Among female arts, design, entertainment, sports, and media major occupational groups, artists, and related workers among broad occupational groups (14.0) had the highest firearm-related suicide rate (Table 4). Animal care and service workers (6.7), and specifically nonfarm animal caretakers (5.5) had the highest firearm-related suicide rates among the female personal care and service major occupational group.

DISCUSSION

Firearm-related suicide rates were highest among workers in specific occupational groups. Among male workers in major occupational groups, construction and extraction and installation, maintenance, and repair workers had the highest firearm-related suicide rates which corresponds with previous findings examining suicide rates by all lethal means combined.³ The third highest firearm-related suicide rate among male workers was observed for those in protective

TABLE 2. Suicide Rates Among Major Occupational Group, by Lethal Means and Biological Sex During 2013–2019

Major Occupational Groups	Biological Sex	All Suicides		Firearm-Related Suicides		Poisoning-Related Suicides		Asphyxiation-Related Suicides		All Other Lethal Means Suicides	
		n	Rate (per 100,000 Worker-Years) (95% CI)	n	Rate (per 100,000 Worker-Years) (95% CI)	n	Rate (per 100,000 Worker-Years) (95% CI)	n	Rate (per 100,000 Worker-Years) (95% CI)	n	Rate (per 100,000 Worker-Years) (95% CI)
Architecture and engineering occupations	Male	2,102	28.0 (27.9–28.2)	1,156	15.4 (15.4–15.5)	212	2.8 (2.8–2.8)	583	7.8 (7.7–7.8)	151	2.0 (2.0–2.0)
	Female	137	9.8 (9.7–9.9)	39	2.8 (2.8–2.8)	49	3.5 (3.5–3.5)	35	2.5 (2.5–2.5)	–	–
Arts, Design, entertainment, sports, and media occupations	Male	1,920	42.5 (42.3–42.7)	718	15.9 (15.8–16.0)	206	4.6 (4.5–4.6)	781	17.3 (17.2–17.4)	215	4.8 (4.7–4.8)
	Female	763	16.6 (16.5–16.7)	185	4.0 (4.0–4.1)	214	4.7 (4.6–4.7)	282	6.1 (6.1–6.2)	82	1.8 (1.8–1.8)
Building and grounds cleaning and maintenance occupations	Male	3,228	29.3 (29.3–29.6)	1,438	13.1 (13.1–13.2)	273	2.5 (2.5–2.5)	1,276	11.6 (11.6–11.7)	241	2.2 (2.2–2.2)
	Female	532	6.6 (6.5–6.6)	144	1.8 (1.8–1.8)	139	1.7 (1.7–1.7)	203	2.5 (2.5–2.5)	46	0.6 (0.6–0.6)
Business and financial operations occupations	Male	1,753	16.2 (16.1–16.2)	908	8.4 (8.3–8.4)	191	1.8 (1.8–1.8)	498	4.6 (4.6–4.6)	156	1.4 (1.4–1.4)
	Female	905	6.4 (6.4–6.4)	289	2.0 (2.0–2.0)	268	1.9 (1.9–1.9)	265	1.9 (1.9–1.9)	83	0.6 (0.6–0.6)
Community and social service occupations	Male	541	19.5 (19.4–19.7)	246	8.9 (8.8–8.9)	81	2.9 (2.9–2.9)	155	5.6 (5.6–5.6)	59	2.1 (2.1–2.1)
	Female	466	8.1 (8.1–8.2)	117	2.0 (2.0–2.0)	169	2.9 (2.9–3.0)	138	2.4 (2.4–2.4)	42	0.7 (0.7–0.7)
Computer and mathematical occupations	Male	2,221	20.8 (20.6–20.8)	1,102	10.3 (10.2–10.3)	241	2.3 (2.2–2.3)	680	6.4 (6.3–6.4)	198	1.9 (1.8–1.9)
	Female	311	7.3 (7.3–7.4)	108	2.5 (2.5–2.6)	85	2.0 (2.0–2.0)	93	2.2 (2.2–2.2)	25	0.6 (0.6–0.6)
Construction and extraction occupations	Male	13,913	55.0 (55.0–55.2)	6,560	25.9 (25.9–26.0)	1,191	4.7 (4.7–4.7)	5,379	21.3 (21.3–21.3)	783	3.1 (3.1–3.1)
	Female	175	20.0 (19.8–20.3)	63	7.2 (7.1–7.3)	32	3.7 (3.6–3.7)	70	8.0 (7.9–8.1)	–	–
Educational instruction and library occupations	Male	1,020	13.5 (13.4–13.5)	459	6.1 (6.0–6.1)	138	1.8 (1.8–1.8)	304	4.0 (4.0–4.0)	119	1.6 (1.6–1.6)
	Female	993	4.3 (4.3–4.3)	296	1.3 (1.3–1.3)	335	1.5 (1.5–1.5)	283	1.2 (1.2–1.2)	79	0.3 (0.3–0.3)
Farming, fishing, and forestry occupations	Male	747	37.3 (36.9–37.6)	366	18.3 (18.1–18.4)	47	2.3 (2.3–2.4)	288	14.4 (14.2–14.5)	46	2.3 (2.3–2.3)
	Female	28	4.4 (4.3–4.4)	–	–	–	–	–	–	–	–
Food preparation and serving related occupations	Male	2,605	29.2 (29.1–29.4)	900	10.1 (10.1–10.1)	307	3.4 (3.4–3.5)	1,113	12.5 (12.4–12.5)	285	3.2 (3.2–3.2)
	Female	1,317	11.1 (11.1–11.2)	322	2.7 (2.7–2.7)	411	3.5 (3.5–3.5)	467	3.9 (3.9–4.0)	117	1.0 (1.0–1.0)
Healthcare practitioners and technical occupations	Male	1,795	27.8 (27.7–27.9)	876	13.6 (13.5–13.6)	315	4.9 (4.9–4.9)	453	7.0 (7.0–7.0)	151	2.3 (2.3–2.3)
	Female	2,405	10.8 (10.8–10.9)	726	3.3 (3.3–3.3)	988	4.5 (4.5–4.5)	526	2.4 (2.4–2.4)	165	0.7 (0.7–0.7)

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TABLE 2. (Continued)

Major Occupational Groups	Biological Sex	All Suicides		Firearm-Related Suicides		Poisoning-Related Suicides		Asphyxiation-Related Suicides		All Other Lethal Means Suicides	
		n	Rate (per 100,000 Worker-Years) (95% CI)	n	Rate (per 100,000 Worker-Years) (95% CI)	n	Rate (per 100,000 Worker-Years) (95% CI)	n	Rate (per 100,000 Worker-Years) (95% CI)	n	Rate (per 100,000 Worker-Years) (95% CI)
Healthcare support occupations	Male	354	18.6 (18.4–18.7)	149	7.8 (7.7–7.9)	61	3.2 (3.2–3.2)	112	5.9 (5.8–5.9)	32	1.7 (1.7–1.7)
	Female	1,284	9.4 (9.4–9.4)	367	2.7 (2.7–2.7)	461	3.4 (3.4–3.4)	332	2.4 (2.4–2.4)	124	0.9 (0.9–0.9)
Installation, Maintenance, And Repair Occupations	Male	6,194	41.9 (41.9–42.1)	3,505	23.7 (23.7–23.8)	527	3.6 (3.6–3.6)	1,862	12.6 (12.6–12.7)	300	2.0 (2.0–2.0)
	Female	99	15.3 (15.0–15.5)	40	6.2 (6.1–6.3)	29	4.5 (4.4–4.5)	27	4.2 (4.1–4.2)	–	–
Legal occupations	Male	548	22.4 (22.2–22.5)	289	11.8 (11.7–11.9)	63	2.6 (2.6–2.6)	141	5.8 (5.7–5.8)	55	2.2 (2.2–2.3)
	Female	295	10.0 (10.0–10.1)	94	3.2 (3.2–3.2)	87	3.0 (2.9–3.0)	89	3.0 (3.0–3.1)	25	0.9 (0.8–0.9)
Life, physical, and social science occupations	Male	601	25.6 (25.5–25.8)	283	12.1 (12.0–12.2)	57	2.4 (2.4–2.4)	212	9.0 (9.0–9.1)	49	2.1 (2.1–2.1)
	Female	178	8.5 (8.4–8.5)	54	2.6 (2.5–2.6)	55	2.6 (2.6–2.6)	58	2.8 (2.7–2.8)	–	–
Management occupations	Male	6,759	24.0 (23.9–24.1)	3794	13.5 (13.4–13.5)	623	2.2 (2.2–2.2)	1893	6.7 (6.7–6.7)	449	1.6 (1.6–1.6)
	Female	1,406	6.9 (6.9–6.9)	448	2.2 (2.2–2.2)	423	2.1 (2.1–2.1)	416	2.0 (2.0–2.0)	119	0.6 (0.6–0.6)
Office and administrative support occupations	Male	2,609	20.4 (20.4–20.4)	1279	10.0 (10.0–10.0)	301	2.4 (2.4–2.4)	790	6.2 (6.2–6.2)	239	1.9 (1.9–1.9)
	Female	2,869	6.6 (6.6–6.6)	908	2.1 (2.1–2.1)	1048	2.4 (2.4–2.4)	697	1.6 (1.6–1.6)	216	0.5 (0.5–0.5)
Personal care and service occupations	Male	1,136	45.5 (45.2–45.9)	491	19.7 (19.5–19.8)	118	4.7 (4.7–4.8)	424	17.0 (16.9–17.1)	103	4.1 (4.1–4.2)
	Female	1,282	13.8 (13.7–13.8)	362	3.9 (3.9–3.9)	445	4.8 (4.8–4.8)	380	4.1 (4.1–4.1)	95	1.0 (1.0–1.0)
Production occupations	Male	6,861	31.6 (31.5–31.6)	3,776	17.4 (17.3–17.4)	584	2.7 (2.7–2.7)	2,127	9.8 (9.8–9.8)	374	1.7 (1.7–1.7)
	Female	732	7.6 (7.6–7.7)	269	2.8 (2.8–2.8)	217	2.3 (2.3–2.3)	195	2.0 (2.0–2.0)	51	0.5 (0.5–0.5)
Protective service occupations	Male	2,394	30.5 (30.4–30.6)	1,702	21.7 (21.6–21.8)	157	2.0 (2.0–2.0)	441	5.6 (5.6–5.6)	94	1.2 (1.2–1.2)
	Female	309	14.2 (14.1–14.3)	172	7.9 (7.8–8.0)	64	2.9 (2.9–3.0)	58	2.7 (2.6–2.7)	–	–
Sales and related occupations	Male	5,666	25.8 (25.6–25.8)	2934	13.3 (13.3–13.3)	612	2.8 (2.8–2.8)	1633	7.4 (7.4–7.4)	487	2.2 (2.2–2.2)
	Female	1,974	8.9 (8.9–8.9)	589	2.7 (2.6–2.7)	664	3.0 (3.0–3.0)	580	2.6 (2.6–2.6)	141	0.6 (0.6–0.6)
Transportation and material moving occupations	Male	8,526	31.8 (31.7–31.8)	4,341	16.2 (16.1–16.2)	841	3.1 (3.1–3.1)	2,724	10.2 (10.1–10.2)	620	2.3 (2.3–2.3)
	Female	686	9.3 (9.3–9.4)	227	3.1 (3.1–3.1)	212	2.9 (2.9–2.9)	200	2.7 (2.7–2.7)	47	0.6 (0.6–0.6)

–, Unknown values due to data suppression (<20 decedents).

TABLE 3. Top Five Suicide Rates of Minor, Broad, and Detailed Occupational Groups by Major Occupational Groups With the Five Highest Rates of Firearm-Related Suicide During 2013–2019 (Males Only)

Major Occupational Group	Minor Occupational Group	n	Firearm-Related Suicide Rate* (95% CI)	Broad Occupational Group	n	Firearm-Related Suicide Rate* (95% CI)	Detailed Occupational Group	n	Firearm-Related Suicide Rate* (95% CI)
Construction and extraction	Extraction workers	293	47.3 (46.6–48.0)	Brickmasons, blockmasons, and stonemasons	149	154.1 (148.2–160.5)	Plumbers, pipefitters, and steamfitters	409	71.0 (69.9–72.2)
	Construction trades workers	5,506	26.5 (26.3–26.5)	Mining machine operators	130	68.9 (67.2–70.8)	Boilermakers	27	46.7 (44.5–49.1)
	Supervisors of construction and extraction workers	614	23.8 (23.6–23.9)	Construction equipment operators	453	35.5 (35.1–35.8)	Structural iron and steel workers	83	39.5 (38.5–40.5)
	Other construction and related workers	140	14.3 (14.1–14.4)	Earth drillers, except oil and gas	32	33.2 (32.0–34.4)	Construction laborers	1,573	29.0 (28.9–29.2)
Installation, maintenance, and repair	—	—	—	Electricians	745	28.9 (28.7–29.1)	Electricians	745	28.9 (28.7–29.1)
	Vehicle and mobile equipment mechanics, installers, and repairers	1,651	29.7 (29.6–29.9)	Miscellaneous installation, maintenance, and repair workers	147	43.2 (42.3–44.0)	Millwrights	78	42.7 (41.6–43.8)
	Electrical and electronic equipment mechanics, installers, and repairers	408	25.5 (25.2–25.7)	Small Engine Mechanics	60	39.6 (38.5–40.8)	Automotive service technicians and mechanics	948	37.0 (36.7–37.2)
	Other installation, maintenance, and repair occupations	1,319	19.7 (19.6–19.7)	Control and valve installers and repairers	23	36.8 (35.1–38.6)	Computer, automated teller, and office machine repairers	198	33.2 (32.7–33.7)
Protective services	Supervisors of installation, maintenance, and repair workers	127	14.2 (14.0–14.4)	Automotive technicians and repairers	1,088	35.3 (35.1–35.5)	Automotive body and related repairers	127	27.8 (27.3–28.3)
	†	†	†	Computer, automated teller, and office machine repairers	198	33.2 (32.7–33.7)	Locksmiths and safe repairers	20	27.1 (26.0–28.2)
	Law enforcement workers	893	25.7 (25.6–25.9)	Bailiffs, correctional officers, and jailers	292	29.2 (28.9–29.6)	Detectives and criminal investigators	77	22.1 (21.7–22.5)
	Other protective service workers	475	19.0 (18.9–19.2)	Police officers	520	24.8 (24.6–25.0)	Private detectives and investigators	35	21.7 (21.1–22.3)
Personal care and service	Supervisors of protective service workers	154	17.9 (17.7–18.1)	Security guards and gaming surveillance officers	416	19.7 (19.5–19.9)	First-line supervisors of police and detectives	70	20.7 (20.4–21.1)
	Firefighting and prevention workers	180	17.7 (17.5–17.9)	Miscellaneous first-line supervisors, protective service workers	39	19.6 (19.1–20.1)	Firefighters	176	18.4 (18.2–18.6)
	†	†	†	First-line supervisors of firefighting and prevention workers	32	18.6 (18.2–19.1)	—	—	—
	Funeral service workers	36	32.9 (31.8–34.0)	Miscellaneous personal care and service workers	51	30.7 (29.8–31.6)	Fitness trainers and aerobics instructors	45	62.6 (60.0–65.4)
Personal care and service	Other personal care and service workers	217	28.9 (28.5–29.3)	Tour and travel guides	22	28.8 (27.6–30.1)	Morticians, undertakers, and funeral directors	30	36.6 (35.3–38.0)
	Tour and travel guides	22	28.8 (27.6–30.1)	Gaming services workers	26	17.5 (17.0–18.0)	Personal care and service workers, all other	51	30.7 (29.8–31.6)
	Animal care and service workers	51	24.1 (23.6–24.8)	Barbers, hairdressers, hairstylists and cosmetologists	74	16.3 (16.0–16.6)	Nonfarm animal caretakers	34	22.0 (21.4–22.7)
	Personal appearance workers	84	14.1 (13.8–14.3)	Recreation and fitness workers	53	14.2 (13.9–14.5)	Barbers	53	20.8 (20.3–21.4)

Continued next page

TABLE 3. (Continued)

Major Occupational Group	Minor Occupational Group	n	Firearm-Related Suicide Rate* (95% CI)	Broad Occupational Group	n	Firearm-Related Suicide Rate* (95% CI)	Detailed Occupational Group	n	Firearm-Related Suicide Rate* (95% CI)
Farming, fishing, and forestry	Fishing and hunting workers	74	45.6 (44.3–46.9)	Logging workers	95	40.3 (39.4–41.3)	—	—	—
	Forest, conservation, and logging workers	103	37.1 (36.3–37.9)	—	—	—	—	—	—
	Agricultural workers	171	11.9 (11.8–12.0)	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—
	†	†	†	—	—	—	—	—	—

*Rate per 100,000 worker-years 25–64 years of age.

†No additional occupational groups.

—, Unknown values due to data suppression (<20 decedents) or limited occupational groups.

services, who are also issued firearms as part of their job. Female workers in construction and extraction and protective services had the highest rates of firearm-related suicide which corresponds with previous studies of suicide across all lethal means.³ Female installation, maintenance, and repair workers had the third highest firearm-related suicide rate. No prior information is available about female workers in this occupation due to a low number of suicides observed in a single-year study.³

Workers within construction and extraction; installation, maintenance, and repair; and protective service occupational groups were previously found to be more likely to use a firearm in their death.^{8–10} Construction and extraction and installation, maintenance, and repair occupational groups may have more personal access to firearms because they are male-dominated industries^{3,14–16} and have more workers classified as low socioeconomic status,²⁵ which both factors increase the risk of firearm-related suicide. Future studies should assess personal access to firearms among these occupational groups. For protective services specifically, access to firearms at work may contribute to the increased firearm-related suicide rate.²⁶ Previous literature has observed that law enforcement and security guards have the third- and fourth-highest workplace suicide rates across all occupational groups, respectively,²⁷ and that over 80% of law enforcement suicides involved a work-issued firearm.^{28,29} However, this association may also be due to workers in these occupations having more familiarity—and less fear—with using firearms, as suggested by the Interpersonal Theory of Suicide.³⁰ While we are unable to distinguish whether the firearm was used from work or home, this finding suggests access to firearms should be considered for interventions within this occupational group.

Several broad and detailed occupational groups had especially high rates of firearm-related suicide among male decedents. These occupational groups included plumbers, pipefitters, and steamfitters and brickmasons, blockmasons, and stonemasons for construction and extraction workers; millwrights and mechanics (small engine and automotive) for installation, maintenance, and repair workers; and bailiffs, correctional officers, and jailers and police officers for protective service occupations. Future investigations should focus on these groups given that they contribute to the highest firearm-related suicide rates of these major occupational groups.

Firearm-related suicide rates were almost five times higher among male decedents compared to female decedents. This corresponds with findings from national surveillance² and previous studies^{3,31} that suggest males are more likely to die from firearm-related suicide compared to females. This may be due in part to men having more personal ownership of firearms—and therefore, more familiarity with firearms—compared to females.^{31,32} This may be why construction and extraction; farming, fishing, and forestry; and installation, maintenance, and repair occupational groups, which are male-dominated,^{10,16} have high rates of firearm-related suicide. Having more familiarity with firearms may also suggest why female workers in protective service occupations had the highest rate of firearm-related suicide compared to other occupational groups.

Different occupations emerged as having the highest rates of other lethal means of suicide. Poisoning-related suicide rates were highest among healthcare practitioners and technical; personal care and service; and arts, design, entertainment, sports, and media occupational groups. For healthcare practitioners and technical workers, having access to drugs at work may be a contributing factor to these suicides.²⁶ Future investigations should consider how access to drugs at work contributes to suicide among health care workers.

This study has limitations. While we were able to identify occupations with high rates of suicide, there were many occupational groups where we could not calculate rates because there were fewer than 20 suicide decedents.²⁰ We used 7 years of NVDRS data to maximize the number of decedents in each occupational group to reduce the possibility of suppression. There are also limitations of using usual

TABLE 4. Top Five Suicide Rates of Minor, Broad, and Detailed Occupational Groups With the Five Highest Rates of Firearm-Related Suicide During 2013–2019 (Females Only)

Major Occupational Group	Minor Occupational Group	n	Firearm-Related Suicide Rate* (95% CI)	Broad Occupational Group	n	Firearm-Related Suicide Rate* (95% CI)	Detailed Occupational Group	n	Firearm-Related Suicide Rate* (95% CI)
Protective services	Law enforcement workers	105	12.5 (12.3–12.7)	Police officers	53	15.9 (15.6–16.2)	—	—	—
	Other protective service workers	51	4.7 (4.6–4.7)	Bailiffs, correctional officers, and jailers	47	12.4 (12.2–12.6)	—	—	—
	—	—	—	Security guards and gaming surveillance officers	40	5.7 (5.6–5.8)	—	—	—
Construction and extraction	—	—	—	—	—	—	—	—	—
	†	†	†	—	—	—	—	—	—
	Construction trades workers	52	7.6 (7.5–7.7)	—	—	—	—	—	—
Installation, maintenance, and repair	—	—	—	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—
Arts, design, entertainment, sports, and media	†	†	†	—	—	—	—	—	—
	Art and design workers	100	5.4 (5.3–5.4)	Artists and related workers	44	14.0 (13.8–14.3)	—	—	—
	Entertainers and performers, sports and related workers	27	3.6 (3.5–3.6)	Designers	56	3.6 (3.6–3.7)	—	—	—
	Media and communication workers	44	2.7 (2.7–2.7)	Writers and editors	24	2.6 (2.6–2.6)	—	—	—
Personal care and service	—	—	—	—	—	—	—	—	—
	†	†	†	—	—	—	—	—	—
	Animal care and service workers	36	6.7 (6.6–6.8)	Barbers, hairdressers, hairstylists and cosmetologists	105	4.2 (4.2–4.3)	Nonfarm animal caretakers	26	5.5 (5.4–5.6)
	Other personal care and service workers	180	3.8 (3.8–3.8)	—	—	—	—	—	—
	Personal appearance workers	120	3.6 (3.6–3.7)	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—

*Rate per 100,000 worker-years 25–64 years of age.

†No additional occupational groups.

—, Unknown values due to data suppression (<20 decedents) or limited number of occupational groups.

occupation from the death certificate to identify a person's occupation, including underreporting of occupational groups for females, non-White populations, less educated individuals and young people (<30 years).³³ We only included decedents if they were between the ages of 25 and 64 years. This is consistent with other studies and suggestions for working with mortality occupational data to limit misclassification that may occur with young and retired individuals.^{3,34} We did not include decedents with a "missing, unknown, or inadequate response to code" SOC code but observed that a higher proportion of suicide decedents with this SOC code were younger, female, non-Hispanic Black, and less educated. This may be due to the nature and types of occupations of decedents from more marginalized communities. The differential ability to identify occupation for these population groups is consistent with previous studies.^{33,35} Generalizability of our study findings should consider the differential identification of occupation for younger, female, and non-Hispanic black US workers.

CONCLUSIONS

This study identified that workers in construction and extraction; installation, maintenance, and repair; protective service; and farming, fishing, and forestry occupational groups had high rates of firearm-related suicide. Workers in occupations with financial insecurity, access to firearms at work, and male-dominated occupations had higher rates of firearm-related suicide compared to workers in other occupational groups, suggesting that both work-related and psychosocial factors should be considered in developing workplace suicide prevention initiatives for US worker populations. Future investigations should consider how work-related factors like access to lethal means contribute to the risk of suicide.

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