Circumstances Contributing to Installation, Maintenance, and Repair Worker Death by Suicide

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Objective: To examine risk factors related to death by suicide among installation, maintenance, and repair (IMR) workers compared with workers in other occupational groups. **Methods:** The National Violent Death Reporting System (NVDRS) data for the years 2013 to 2018 was used to identify suicide deaths. Circumstance variables were used to examine differences between IMR workers and other workers. **Results:** Having a physical health problem (1.13; 95% confidence interval [CI], 1.03 to 1.23) or a diagnosis of posttraumatic stress disorder (1.24; 95% CI, 1.03 to 1.50) was more likely to contribute to IMR worker suicide compared with other occupations. Installation, maintenance, and repair workers were less likely to receive treatment for a mental health diagnosis or substance use disorder (0.88; 95% CI, 0.81 to 0.94). **Conclusions:** Additional support for physical health problems, posttraumatic stress disorder diagnoses, and mental health care access among IMR workers may reduce suicide deaths.

Keywords: firearms, mental health, occupational health, physical health, suicide

Installation, maintenance, and repair (IMR) is a Bureau of Labor Statistics' Standard Occupational Classification group that includes workers in occupations such as automotive repair, computer repair, and industrial installation.[1,2] Installation, maintenance, and repair workers are mostly White (non-Hispanic) male subjects with a median age of 41.8 years.[3] Suicide rates among IMR workers are significantly higher compared with other occupational groups. Male IMR workers have a suicide mortality rate of 36.9 per 100,000 compared with 27.4 per 100,000 for all male workers in all other occupations.[2] Previous studies have examined death by suicide among automotive repair workers—a subgroup in the IMR group—and found that exposure to solvents may lead to increased risk.[4,5] Chronic exposure to solvents may lead to mental health issues such as depressive symptoms and emotional stability, which are associated with greater risk of suicide.[4,5] However, risk factors for suicide have not been examined in IMR workers as a whole, including well-established risk factors for suicide in the general population such as physical health problems, injuries at work, receiving treatment for a mental health or substance use problem, or a mental health diagnosis.[6–16]

LEARNING OUTCOMES

1. Understand the differences in demographics and health conditions of installation, maintenance, and repair workers who died by suicide compared with workers in other occupations.
2. Summarize which circumstances more frequently contribute to suicides among installation, maintenance, and repair workers relative to other workers.

In addition to having a higher overall suicide rate, IMR workers have a higher proportion of suicides related to firearms (56.5%) relative to the general population (51.2%).[17] Little is known about firearm-related suicides in the IMR occupational group, but previous studies examining firearm-related suicides in the US population have indicated that firearm ownership, storage, and type of firearm are risk factors for suicide.[18–21] A potential explanation for the higher rate of suicide observed for IMR workers may be differences in firearm ownership and storage.

Installation, maintenance, and repair occupations are also physically challenging. These positions can require standing for long periods, lifting heavy objects, working in extreme hot or cold work environments, and working in cramped positions, all of which increase the risk for occupational injuries and chronic pain.[1,22,23] Chronic pain has been associated with a higher rate of suicide.[22,23] According to the Bureau of Labor Statistics, IMR occupations have the fourth highest injury rate among all occupational groups,[10] with common types of injuries including sprains and strains and complaints of general soreness and pain.[24]

The primary purpose of this study is to examine demographic, psychosocial, and firearm-specific circumstances related to death by suicide among IMR workers in the United States compared with workers from all other occupations.

METHODS

Data Source and Study Sample

The National Violent Death Reporting System (NVDRS) is a case-only national database that tracks violence-related mortality (eg, suicide, homicide). Data for NVDRS come from police reports, death certificates, medical examiner reports, and toxicology reports.[25] Data abstracted from these sources include demographics, mental health conditions and treatment, physical conditions, toxicology results, life stressors, and event-specific characteristics including weapons used. In addition, NVDRS data provide detailed information about work-related injuries and weapons used in the violent death including firearm storage behaviors and firearm ownership.

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All suicide deaths in the NVDRS were requested for the years 2013 to 2018 (Fig. 1). Decedents of all other occupational groups were included in this study as a comparison (n = 88,815 [72.7%]) to IMR workers (n = 6469 [5.3%]) except those who were classified as "not in workforce," "military," or "missing, unknown, inadequate response to code" (n = 26,908 [22%]). As suggested by the NVDRS guidelines, only individuals with at least one known circumstance related to suicides were included in this study (ie, any information is available in the coroner/medical examiner report or law enforcement report about the circumstances related to the suicide death), as cases with no circumstance may reflect missing information or low-quality information.[26] Finally, individuals were included only if they were between the ages of 16 and 64 years, which is considered "working age" in occupational research (Fig. 1).[2]

Study Design and Measures

We used a cross-sectional study design to examine risk factors for suicide and firearm-related suicides, comparing IMR workers and all other occupational groups. Installation, maintenance, and repair occupations were identified using the two-digit Standard Occupational Classification System code 49-0000.[27] The Standard Occupational Classification codes are provided with each data release of NVDRS and are coded based on a decedent's usual occupation recorded on the death certificate. Usual occupation is the longest held occupation and does not necessarily indicate that the suicide decedent had the occupation or was currently employed at the time of the decedent's death. Demographic variables included age, biological sex, race/ethnicity, educational level, marital status, and veteran status. Age was categorized as 16 to 24, 25 to 34, 35 to 44, 45 to 54, and 55 to 64 years. Several psychosocial variables are available in the NVDRS data, including mental health or substance abuse treatment or conditions and physical health problems (ie, chronic pain, cancer) that were observed before the suicide. The presence of these circumstances is identified by trained abstractors who review medical examiner reports, law enforcement reports, and other data sources related to the death. Rules for recording the presence of these circumstances are described in the NVDRS coding manual.[28] Briefly, treatments related to mental health or substance abuse include having a prescription for a psychiatric medication at the time of death, seeing a mental health professional in the prior 2 months, or receiving outpatient treatment or attending alcohol anonymous at the time of death. Mental health diagnoses (ie, depression, bipolar disorder, anxiety, posttraumatic stress disorder [PTSD], schizophrenia, other) were identified as present or not present based on reports from law enforcement or the medical examiner and recorded by NVDRS abstractors. Decedents with mental health diagnoses were combined into the "other" category (eg, attention deficit/hyperactivity disorder, eating disorders) for mental health diagnoses where 20 or fewer IMR workers were identified. If no diagnosis was identified, a decedent was categorized as "no, not available, or unknown" because the absence of each diagnosis is not specifically recorded. In addition, ever having a mental health diagnosis was examined for IMR workers and compared with workers in other occupations.

Physical health problems that seem to have contributed to suicides are recorded in the NVDRS record when a terminal or debilitating disease was present at the time of death or there is evidence of chronic pain for the decedent. If a physical health problem was not indicated in the data sources, suicide decedents were recorded in NVDRS as "no, not available, or unknown." Firearm-related variables including the type of firearm used in the suicide, whether the firearm used was known to be locked in storage, whether the firearm used was always stored loaded, and the owner of the firearm used were examined to compare firearm-related suicides among IMR workers to firearm-related suicides among all other workers. Type of firearm used was divided into three categories (handgun, long gun, unknown), and firearm ownership was grouped to compare whether the suicide decedent owned the firearm

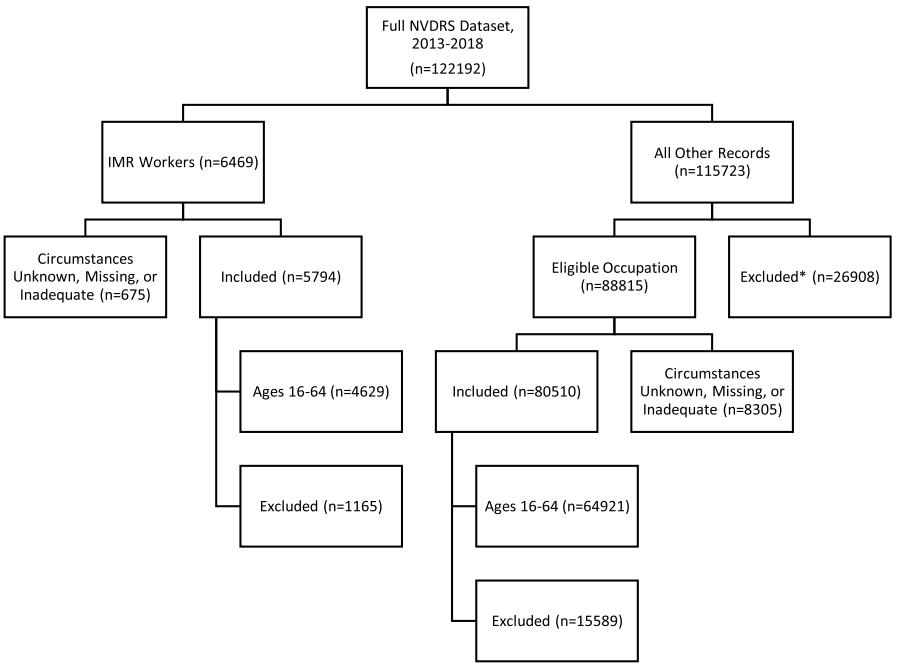

FIGURE 1. Flowchart of study participants. NVDRS (2013–2018) and IMR workers (n = 6469) were identified based on two-digit SOC system codes. Eligible occupations among all other records include all SOC system code groups except for those who were classified as "not in workforce," "military," or "missing, unknown, inadequate response to code" (n = 88,815). Decedents were included if they had at least one known circumstance related to their death and were aged 16 to 64 years (IMR, n = 4629; all other workers, n = 64,921). IMR, installation, maintenance, and repair; NVDRS, National Violent Death Reporting System; SOC, Standard Occupational Classification.

(ie, shooter, any other owner). Unknown data from all firearm variables were included as a descriptive category given the volume of missing or unknown data in NVDRS.

Statistical Analysis

All demographic, psychosocial, and firearm-related variables were compared across occupation designation using χ^2 tests. Multivariable logistic regression was used to examine risk factors for suicide among IMR workers, compared with all other occupational groups. Male and female decedents were separated into two distinct models given the proportional difference between the two groups (male: 98.3%; female: 1.7%). Because of the small sample size among female decedents (n = 77), the primary analysis included male subjects only. Models for female IMR decedents are reported in the supplemental materials (Appendix A, Appendix B, http://links.lww.com/JOM/B260). Age, race/ethnicity, educational level, and marital status were controlled for in each model. Models were built examining the likelihood of psychosocial variables contributing to suicide among IMR occupations relative to other occupations. The model for firearm-related suicides examined the type of firearm used in the suicide, whether the firearm used was typically locked in storage, whether the firearm used was always stored loaded, and the owner of the firearm used. Odds ratios with 95% confidence intervals (CIs) were reported for each variable. The data analysis was conducted using SAS (SAS Institute Inc, Cary, NC).

RESULTS

Among IMR workers, 4629 (71.6%) met the inclusion criteria, whereas among all other occupations, 64,921 (73.1%) met the inclusion criteria (Fig. 1). Comparisons of demographic variables (ie, age, race/ethnicity, biological sex, educational level, marital status) between included and excluded suicide deaths did not differ by more than 5%.

TABLE 1. Distributions and χ^2 Tests of Demographic and Psychosocial Factors Among Suicides in IMR Workers (n = 4,629) and All Other Occupational Groups (n = 64,921), N = 69,550

		IMR Workers		Workers From All Other Occupations		χ^2
Variable	**Level**	**n**	**%**	**n**	**%**	***P***
Age, years	16–24	394	8.5	6,396	9.9	0.005*
	25–34	975	21.1	13,281	20.5	
	35–44	998	21.6	13,566	20.9	
	45–54	1,227	26.5	16,392	25.2	
	55–64	1,035	22.4	15,286	23.5	
Race/ethnicity	Black, non-Hispanic	139	3.0	3,688	5.7	<0.001*
	Hispanic	268	5.8	4,303	6.6	
	Other, non-Hispanic	141	3.0	3,005	4.6	
	White, non-Hispanic	4,081	88.2	53,925	83.1	
Biological sex	Male	4,552	98.3	50,621	78.0	<0.001*
	Female	77	1.7	14,300	22.0	
Educational level as measured by the highest degree attained or level completed	Less than high school	640	13.8	7,470	11.5	<0.001*
	High school diploma/Some college credit, but no degree	2,396	51.8	27,374	42.2	
	College degree and above	1,593	34.4	30,077	46.3	
Marital status	Married/civil union/domestic partnership	1,524	32.9	20,067	30.9	<0.001*
	Never married	1,549	33.5	24,214	37.3	
	Widowed	104	2.2	1,432	2.2	
	Divorced	1,140	24.6	15,292	23.6	
	Married/civil union/domestic partnership, but separated	218	4.7	2,597	4.0	
	Single, not otherwise specified	94	2.0	1,319	2.0	
Treatment for a mental health problem or substance abuse problem (current)	Yes	1,018	22.0	18,137	27.9	<0.001*
	No, not available, unknown	3,611	78.0	46,784	72.1	
Physical health problem(s) appear to have contributed to the death	Yes	761	16.4	10,073	15.5	0.094
	No, not available, unknown	3,868	83.6	54,848	84.5	
Diagnosis of depression (ever)	Yes	1,511	32.6	24,867	38.3	<0.001*
	No, not available, unknown	3,118	67.4	40,054	61.7	
Diagnosis of bipolar disorder (ever)	Yes	285	6.2	5,133	7.9	<0.001*
	No, not available, unknown	4,344	93.8	59,788	92.1	
Diagnosis of anxiety (ever)	Yes	337	7.3	6,004	9.2	<0.001*
	No, not available, unknown	4,292	92.7	58,917	90.8	
Diagnosis of posttraumatic stress disorder (ever)	Yes	129	2.8	1,460	2.2	0.018*
	No, not available, unknown	4,500	97.2	63,461	97.8	
Diagnosis of schizophrenia (ever)	Yes	108	2.3	1,638	2.5	0.425
	No, not available, unknown	4,521	97.7	63,283	97.5	
Other mental health diagnosis (ever)*	Yes	238	5.1	3,904	6.0	0.015*
	No, not available, unknown	4,391	94.9	61,017	94.0	
Has the person ever served in the US Armed Forces?	No	3,800	82.1	57,088	88.0	<0.001*
	Yes	749	16.2	6,599	10.2	
	Missing	<5	—	84	0.1	
	Unknown	78	1.7	1,150	1.8	

*$P < 0.05$.

*Other mental health diagnoses include attention-deficit disorder or hyperactivity disorder, eating disorder, obsessive-compulsive disorder, autism spectrum disorder (includes Asperger syndrome), fetal alcohol syndrome, Down syndrome, dementia (eg, Alzheimer disease, Lewy body dementia), personality disorders, and others not included.

IMR, installation, maintenance, and repair.

Installation, maintenance, and repair workers represented 6.0% of the total workers used in this analysis. More than one-third of the IMR suicides occurred among automotive technicians and repairers (n = 1784 [34.6%]), followed by general maintenance and repair workers (n = 502 [9.7%]) and industrial machinery installation, repair, and maintenance workers (n = 466, 9.0%) (Appendix, http://links.lww.com/JOM/B260**C**).

Most IMR suicide decedents among all suicides were White (non-Hispanic) male subjects (Table 1). More than one-quarter of deaths were between 46 and 55 years of age. A higher percentage of IMR suicide decedents had their high school diplomas or some college credits compared with all other occupations and were more likely to be married, divorced, or separated compared with all other occupations. A higher percentage of IMR workers had a physical health problem that likely contributed to suicides compared with workers from all other occupations. A smaller percentage of IMR workers were not being treated for a mental health or substance abuse problem compared with all other workers. A smaller percentage of IMR workers also had a mental health diagnosis except for PTSD. Among suicide decedents, a larger percentage of IMR workers were veterans (16.2%) than all other occupations (10.2%) (Table 1).

Among firearm-related suicides for IMR decedents and all other occupational groups, circumstances were known for 2677 (89.8%) and 30,755 (90.9%) workers, respectively. Installation, maintenance, and repair workers represented 8% of the total workers used in this analysis. Firearm-related suicides among IMR workers accounted for 55.4% of all suicides compared with 45.5% of the suicides in all other occupational groups. Firearm-related suicides among IMR workers most frequently occurred among those who were White (non-Hispanic) male subjects, between 46 and 55 years old, had a high school diploma or college credits, and were married or in a domestic partnership (Table 2). The prevalence of firearm type, storage, and ownership were similar between IMR and all other worker groups. Handguns were used in most firearm-related suicides for both worker groups. How the firearms were usually stored and who owned them were unknown in the majority of records for both IMR and other occupation workers (Table 2).

After adjusting for age, race/ethnicity, educational level, and marital status, male IMR decedents were more likely (1.12; 95% CI, 1.03 to 1.23) to have a physical health problem that contributed to the suicide compared with other occupations (Table 3). Installation, maintenance, and repair worker decedents were less likely to have been treated for a mental health or substance abuse problem (0.88; 95% CI, 0.82 to 0.95). Installation, maintenance, and repair workers were also less likely to be diagnosed with depression (0.91; 95% CI, 0.85 to 0.97) but were 24% more likely to have been diagnosed with PTSD (1.24; 95% CI, 1.03 to 1.50), compared with all other occupations (Table 3). When the model is adjusted for veteran status, PTSD diagnosis is no longer significant (adjusted odds ratio, 1.06; 95% CI,

TABLE 2. Distributions and χ^2 Tests of Demographic and Firearm-Related Risk Factors Among Firearm-Related Suicides in IMR Workers (n = 2,580) and All Other Occupational Groups (n = 29,658), N = 32,238

		IMR Workers		Workers From All Other Occupations		χ^2
Variable	**Level**	**n**	**%**	**n**	**%**	***P***
Age, years	16–24	233	9.0	3,134	10.6	0.075
	25–34	514	19.9	5,733	19.3	
	35–44	517	20.0	5,663	19.1	
	45–54	657	25.5	7,277	24.5	
	55–64	659	25.5	7,851	26.5	
Race/ethnicity	Black, Non-Hispanic	81	3.1	1,774	6.0	<0.001*
	Hispanic	100	3.9	1,445	4.9	
	Other, Non-Hispanic	76	2.9	1,000	3.4	
	White, Non-Hispanic	2,323	90.0	25,439	85.8	
Biological sex	Male	2,549	98.8	25,430	85.7	<0.001*
	Female	31	1.2	4,228	14.3	
Educational level as measured by the highest degree attained or level completed	Less than high school	335	13.0	2,988	10.1	<0.001*
	High school diploma/some college credit, but no degree	1,337	51.8	13,036	44.0	
	College degree and above	908	35.2	13,634	46.0	
Marital status	Married/civil union/domestic partnership	927	35.9	10,314	34.8	0.018*
	Never married	803	31.1	10,200	34.4	
	Widowed	62	2.4	633	2.1	
	Divorced	621	24.1	6,734	22.7	
	Married/civil union/domestic partnership, but separated	117	4.5	1,161	3.9	
	Single, not otherwise specified	50	1.9	616	2.1	
Type of firearm used in the suicide	Handgun	1,790	69.4	21,448	72.3	0.006*
	Long gun	638	24.7	6,624	22.3	
	Unknown	152	5.9	1,586	5.3	
Storage of firearm used in suicide	Locked	100	3.9	1,273	4.3	0.370
	NA	151	5.9	1,644	5.5	
	Not locked	130	5.0	1,678	5.7	
	Unknown	2,199	85.2	25,063	84.5	
Firearm used in suicide always stored loaded	Loaded	108	4.2	1,249	4.2	0.809
	NA	151	5.9	1,629	5.5	
	Unloaded	64	2.5	682	2.3	
	Unknown	2,257	87.5	26,098	88.0	
Ownership of firearm used in suicide	Any other owner	168	6.5	2,786	9.4	<0.001*
	Shooter	804	31.2	9,017	30.4	
	Unknown	1,608	62.3	17,855	60.2	

*$P < 0.05$.

IMR, installation, maintenance, and repair; NA, Not Applicable.

TABLE 3. Unadjusted and Adjusted Odds Ratios With 95% CIs Examining the Association Between Psychosocial Factors and Suicide Among IMR Workers (n = 4,552) and Workers From All Other Occupational Groups (n = 50,621) (Male Subjects Only) (N = 55,173)

			Unadjusted	Adjusted*
Covariate	**Level**	**n**	**Odds Ratio (95% CI)**	**Odds Ratio (95% CI)**
Treatment for a mental health problem or substance abuse problem (current)	Yes	13,210	0.87 (0.81–0.94)†	0.88 (0.82–0.95)†
	No, not available, unknown	41,963	—	—
Physical health problem(s) appear to have contributed to the death	Yes	8,215	1.13 (1.04–1.23)†	1.12 (1.03–1.23)†
	No, not available, unknown	46,958	—	—
Diagnosis of depression (ever)	Yes	19,007	0.91 (0.85–0.97)†	0.91 (0.85–0.97)†
	No, Not Available Unknown	36,166	—	—
Diagnosis of bipolar disorder (ever)	Yes	3,561	0.92 (0.81–1.05)	0.93 (0.82–1.06)
	No, not available, unknown	51,612	—	—
Diagnosis of anxiety (ever)	Yes	4,257	0.93 (0.82–1.04)	0.93 (0.82–1.04)
	No, not available, unknown	50,916	—	—
Diagnosis of posttraumatic stress disorder (ever)	Yes	1,234	1.26 (1.05–1.52)†	1.24 (1.03–1.50)†
	No, not available, unknown	53,939	—	—
Diagnosis of schizophrenia (ever)	Yes	1,387	0.91 (0.74–1.11)	0.98 (0.80–1.20)
	No, not available, unknown	53,786	—	—
Other mental health diagnosis (ever)‡	Yes	3,193	0.85 (0.74–0.98)†	0.90 (0.79–1.04)
	No, not available, unknown	51,980	—	—

*Adjusted for age, race/ethnicity, educational level, and marital status.

†$P < 0.05$.

‡Other mental health diagnoses include schizophrenia, attention-deficit disorder or hyperactivity disorder, eating disorder, obsessive-compulsive disorder, autism spectrum (includes Asperger syndrome), fetal alcohol syndrome, Down syndrome, dementia (eg, Alzheimer disease, Lewy body dementia), personality disorders, and others not included.

CI, confidence interval; IMR, installation, maintenance, and repair.

0.87 to 1.28). There were no significant associations between any of the firearm-related variables and death by suicide among IMR decedents compared with other occupations for male subjects (Table 4) or female subjects (Appendix B, http://links.lww.com/JOM/B260).

DISCUSSION

In this study, we hypothesized that physical health problems appearing to contribute to suicides would disproportionately be higher among IMR workers compared with workers in other occupations. Consistent with this hypothesis, we found a higher proportion of male IMR suicide decedents to have physical health problems appearing to contribute to suicides compared with male suicide decedents in all other occupational groups. We also found that IMR workers were less likely have been treated for a mental health or substance abuse problem around the time of suicide death but more likely to have been diagnosed with PTSD, compared with workers from all other occupations.

Physical health problems have been found to be associated with death by suicide in previous studies among populations with chronic health complications.[6–9] In these studies, physical health problems included cancer, chronic pain, dementia, chronic obstructive pulmonary disorder, and many others.[26] Automotive technicians and repairers, which represent 34.6% of the IMR occupational group (Appendix C, http://links.lww.com/JOM/B260), are at higher risk of injury compared with others outside of the IMR occupations, with overexertion being the second most common type of injury.[29,30] Overexertion injuries are associated with chronic pain, which could partially explain the higher proportion of physical health problems observed for IMR workers.[31] Previous studies have observed an increase in the rate of

TABLE 4. Unadjusted and Adjusted Odds Ratios With 95% CIs Examining the Association Between Firearm-Related Factors and Suicide Among IMR Workers (n = 2,549) and Workers From All Other Occupational Groups (n = 25,430) (Male Subjects Only) (N = 27,979)

			Unadjusted	Adjusted*
Covariate	**Level**	**n**	**Odds Ratio (95% CI)**	**Odds Ratio (95% CI)**
Type of firearm used in the suicide	Handgun	19,598	0.97 (0.88–1.07)	1.02 (0.93–1.12)
	Long gun	1,498	—	—
	Unknown	6,883	1.09 (0.91–1.32)	1.13 (0.94–1.37)
Storage of firearm used in suicide	Locked	1,136	0.96 (0.73–1.27)	0.98 (0.74–1.29)
	NA	1,521	1.10 (0.86–1.42)	1.12 (0.87–1.44)
	Not locked	1,375	—	—
	Unknown	23,947	1.01 (0.83–1.22)	1.02 (0.84–1.23)
Firearm used in suicide always stored loaded	Loaded	1,080	0.91 (0.65–1.26)	0.90 (0.64–1.25)
	NA	1,506	0.94 (0.69–1.28)	0.93 (0.68–1.27)
	Unloaded	599	—	—
	Unknown	24,794	0.84 (0.65–1.10)	0.83 (0.64–1.09)
Ownership of firearm used in suicide	Any other owner	2,045	0.87 (0.73–1.04)	0.86 (0.72–1.03)
	Shooter	8,763	—	—
	Unknown	17,171	1.03 (0.94–1.12)	1.02 (0.93–1.12)

*Adjusted for age, race/ethnicity, educational level, marital status.

CI, confidence interval; IMR, installation, maintenance, and repair; NA, Not Applicable.

suicide for people with chronic pain.[22,23] Therefore, developing injury prevention strategies that prevent injury or relieve chronic pain in IMR workers could reduce suicide rates for this occupational group.

In addition, IMR workers were less likely to receive treatment for a mental health or substance abuse problem compared with other occupations. This finding may suggest that IMR workers have less access to this type of treatment or less frequently choose to seek treatment for mental health or substance use–related diseases compared with workers in other occupations. Installation, maintenance, and repair workers have similar but slightly higher health care access compared with workers in other occupations.[32] Despite the comparable level of access, we observed less frequent use of mental health or substance use treatment compared with workers in other occupations. Lower utilization of insurance benefits by IMR workers is a potential explanation for the less frequent treatment observed relative to other workers. Mental health treatments—pharmacologic and nonpharmacologic—have been suggested to decrease the risk of suicide and suicidal ideation among at-risk adults.[14,15] Improving utilization of mental health treatment by IMR workers may be another mechanism to reduce the suicide rate for these workers.

The odds of having a mental health diagnosis of PTSD were 24% higher among IMR workers compared with all other occupations. This effect was partially due to the higher proportion of veterans in the IMR occupation. Posttraumatic stress disorder is one of the most frequently diagnosed disorders among veterans.[33,34] Previous studies have suggested that individuals who are diagnosed with PTSD are at higher risk for suicidal ideation and dying by suicide.[35,36] Suicide prevention programs that support veterans should consider the occupation-specific stressors that may further contribute to suicide risk and seek out occupations with a higher proportion of veterans such as the IMR occupation.

There was no difference between firearm type, storage, and ownership and suicides, comparing IMR workers with workers from other occupations. Although we did not find an occupation-specific difference in firearm storage or ownership, this finding does not dispute the importance of safely storing firearms as a strategy to deter suicide attempts because firearms are the primary weapon used to commit a suicide among men.[18–21]

This study has several strengths. First, this is one of the first studies to examine risk factors related to death by suicide among IMR workers, an occupation group at elevated risk for suicide. Moreover, this study utilized a database that includes decedents from 39 states, the District of Columbia, and Puerto Rico, suggesting that findings are likely generalizable to US workers.

This study also had limitations. Among firearm-related variables, most suicide cases had missing or unknown information. The firearm storage variable alone was missing or unknown for approximately 90% of the suicide cases. Although this may affect the power, there was not a meaningful difference between IMR workers and other workers regarding the proportion of response categorized as unknown, so we believe the analysis results were not biased by the missing data. Missing responses were less prevalent for the nonfirearm circumstance variables and not impacted by occupational group. Second, this study compares IMR workers to all other occupational groups represented among NVDRS suicides. Therefore, there is variation within the control group, and therefore, heterogeneity of suicide risk may exist. Despite the comprehensiveness and coverage of NVDRS, we were unable to report on each individual occupation within the group. Finally, there is lack of data in NVDRS that investigates occupational exposures (eg, chemical exposure) that may contribute to IMR workers having higher suicide rates.

CONCLUSIONS

This study examines risk factors that contribute to death by suicide among IMR workers and how they may differ from other occupations. Reducing injuries and increasing mental health access may decrease the odds of suicides and should be considered when developing suicide interventions among IMR workers. Mental health services for PTSD should also be considered when developing suicide prevention strategies, especially for IMR workers who are veterans. Finally, researchers should further examine differences across specific occupations within the IMR group to identify specific worker groups who may be at higher risk. There is further need to investigate the experience of female IMR workers and how their circumstances may differ from male IMR workers as additional years of surveillance are included in the NVDRS data.

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