



HHS Public Access

Author manuscript

J Occup Environ Med. Author manuscript; available in PMC 2024 May 01.

Published in final edited form as:

J Occup Environ Med. 2023 May 01; 65(5): 413–418. doi:10.1097/JOM.0000000000002798.

Suicides in Massachusetts by Industry and Occupation, 2016–2019

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Abstract

Objective: To examine suicide deaths among working-aged residents in Massachusetts, and to determine industries and occupations with high numbers and rates of suicides.

Methods: The Massachusetts Violent Death Reporting System (MAVDRS) and Massachusetts death certificates were used to analyze suicide deaths from 2016–2019. Counts and rates were generated by demographics, and industry and occupation groupings.

Results: There were 2,199 working-age Massachusetts residents that died by suicide. Higher suicide rates were associated with being male, aged ≥ 65 years, White, non-Hispanic, or having military background. Suicide rates were higher among the Construction industry sector and the Construction and Extraction occupational group compared to the average rate for all Massachusetts workers.

Conclusions: Suicide rates differed between industries and occupations, suggesting that work-related factors may play a role and should be considered when planning outreach initiatives and interventions.

Keywords

suicide prevention; industry; occupation; work; death certificates

Introduction

Suicides are a highly significant, yet largely preventable public health issue that can have lasting harmful effects on individuals, families, and communities. Suicide is a leading cause of death in the United States.¹ In 2020, suicide was responsible for nearly 46,000 deaths.¹

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Conflict of Interest for All Authors: *None Declared*

Ethical Considerations & Disclosure(s): *None*

Furthermore, an estimated 12.2 million adults seriously thought about suicide, 3.2 million made a plan, and 1.2 million attempted suicide.¹ In 2019, the Massachusetts' (MA) rate of suicide is low (9.3 deaths/100,000 MA residents) compared to national rates (14.5 deaths/100,000 U.S. residents), however, it has been steadily growing.² In 2019, suicide took 642 lives in Massachusetts, with rates increasing 41% since 2003.² Substantially more people each year are hospitalized as a result of nonfatal suicidal behavior, and even more are injured and treated in emergency departments or other ambulatory settings or not treated at all.³

There are numerous risk factors for suicide, in which many relate to work, as work is an important social determinant of health. Nationally, there is a wide variation in suicide rates by industry and occupation.^{4–7} Research indicates suicide risk is associated with low-skilled work, lower absolute and relative socioeconomic status, work-related access to lethal means, and job stress, including poor supervisory and colleague support, low job control, and job insecurity.^{8–11} In recent years, 2018–2019, suicide at work has been a leading cause of workplace fatalities in Massachusetts.¹² A death by suicide can have long-lasting lingering psychological effects on close relatives, friends, and co-workers which may also increase their own suicide risk.¹³ Thus, suicide of a worker is not only a workplace issue but a community issue.

This analysis aims to provide practitioners, suicide prevention specialists and employers information on the trends, magnitude, and risk factors for suicides among working-age decedents in Massachusetts, as well as information to identify industries and occupations with high numbers and rates of suicides. As previous research at the national level and within Massachusetts¹⁴ show, all occupations and industries do not have the same rate of suicide, suggesting that work should be considered when planning outreach interventions and initiatives. Also, the workplace represents an important venue for suicide prevention activities. In addition, as the patterns in the workforce in Massachusetts differ some to the patterns at the national level¹⁵, it is important to understand specific trends in Massachusetts to inform prevention efforts at the local level.

Methods

We analyzed data from death certificates provided by the Massachusetts Violent Death Reporting System (MAVDRS) for working-age Massachusetts residents (16 years or older) who died of suicide from 2016 through 2019, by industry and occupation, and other demographic and work-related factors. MAVDRS is part of the National Violent Death Reporting System (NVDRS), which is a CDC-funded system in all 50 states, the District of Columbia, and Puerto Rico that links data from death certificates, medical examiner files, and police reports to provide a more complete picture of the circumstances surrounding violent deaths. MAVDRS captures all violent deaths (homicides, suicides, deaths of undetermined intent, legal intervention deaths, and all firearm deaths) occurring in Massachusetts, regardless of residency, and has been collecting data since 2003. All data were ascertained using guidelines recommended by the Centers for Disease Control and Prevention (CDC) and are based upon the International Classification for Disease codes (ICD-10) for mortality.¹⁶

Suicide refers to those who die by ending their own life. NVDRS relies on medical examiner reports to determine if a death is a suicide. The following ICD-10 codes were used to classify suicides, X60-X84, Y87.0, and U03. Occupation describes the kind of work an individual does to earn a living (i.e., job title), while industry describes the activities the individual's employer is engaged in. NVDRS mainly records industry and occupation from death certificates, however, NVDRS also relies on medical examiner reports and law enforcement records for additional information. Using the National Institute for Occupational Safety and Health Industry and Occupational Computerized Coding System (NIOCCS)¹⁷, industry and occupation were assigned Census Industry Classification (CIC) codes and Census Occupation Classification (COC) codes¹⁸, respectively, and were further classified by manual review. The data were used to describe the distribution and rate of suicides among working-age Massachusetts residents by industry and occupation, overall, and within sex (Male; Female), age (16–24 years old; 25–34 years old; 35–44 years old; 45–54 years old; 55–64 years old; 65 years old), racial/ethnic groups (White, non-Hispanic; Hispanic; Black, non-Hispanic; Asian or Pacific Islander, non-Hispanic; American Indian/Alaska Native, non-Hispanic; Other/Unspecified), military status (Yes; No; Unknown), marital status (Married; Widowed; Divorced; Never married; Unknown), education level (8th grade or less; 9–12th grade, high school diploma, or GED; Some college, Associates or Bachelors degree; Master's, Doctorate, or Professional degree; Unknown) and means of suicide (Hanging/suffocation; Firearm; Poisoning; Sharp; Fall; Other method). To note, sex is recorded on the Massachusetts death certificate as male, female, or unknown. Sexual orientation and non-binary gender identity are not recorded. Analyses focused on deaths occurring in 2016 through 2019, thus, the four-year average annual suicide rates among decedents were calculated as the number of deaths per 100,000 workers. For brevity, all average annual rates are referred to as just rates. Rates were not calculated on counts of less than or equal to five. 95% confidence intervals were calculated for all rates. Rate differences are considered statistically significant if the confidence intervals for the compared rates did not overlap. Data on the average annual number of workers employed in Massachusetts between 2016 and 2019 were obtained from the American Community Survey (ACS) 2016–2019 and served as the denominator for rates. The ACS, conducted by the U.S. Census Bureau, is an annual, representative survey of over 3.5 million households in the United States that is administered on a continuous basis throughout the year. It is assumed that decedents who had an industry and/or occupation reported on their death certificates were employed in that industry and/or occupation in the years prior to death. Workers in ACS were defined as an individual greater than 15 years old, reported to have worked at least 1 week during past 12 months and had an employment status as either 'civilian employed, at work' or 'civilian employed, with a job but not at work'. Coding of industry and occupation were provided as CIC and/or COC codes.

Death certificates contain information about the usual, not current, industry and/or occupation. If the decedents' usual industry and occupation were different from the industry and occupation they were working in during the period prior to death, this assumption may not be true. Additionally, if the decedent had been retired the assumption may be invalid. However, previous research has shown high rates of concordance between usual and current industry and occupation, including those reported on death certificates.^{19–20} A sensitivity

analysis was conducted that excluded decedents over the age of 55 years old, who accounted for 40% of the deaths among those assumed to be working in this study. The overall distributions of suicides by industry and occupation were found to be similar with or without the age restriction. Therefore, findings presented in this study are based on deaths among workers of all ages.

To gain insight into how work-related factors may be contributing to high suicide rates, several national surveys were used to categorize occupation groups by work-related factors. Data from the Bureau of Labor Statistics (BLS) 2019 Massachusetts Survey of Occupational Injuries and Illnesses (SOII) were used to categorize occupation groups according to injury rates.²¹ The SOII is a Federal/State cooperative program that publishes estimates on nonfatal occupational injuries and illnesses. Each year, 200,000 employers report for establishments in private industry and the public sector. Groups were categorized based on the number of injuries and illnesses per 10,000 full-time equivalents in Massachusetts in 2019. The four categories were: 0–49, 50–99, 100–199, and 200+ injuries. The following occupations were classified into each category: 0–49 category included Architecture and Engineering, Office and Administrative Support, Business and Financial Operations, Life, Physical and Social Science, and Computer and Mathematical; 55–99 category included Personal Care and Service, Sales and Related, Management, and Education, Training and Library; 100–199 category included Food Preparation and Serving Relates, Arts, Design, Entertainment, Sports and Media, Community and Social Services, Protective Service, and Healthcare Practitioner and Technical; 200+ category included Construction and Extraction, Farming, Fishing, and Forestry, Installation, Maintenance, and Repair, Transportation and Material Moving, Production, Building/Grounds Cleaning and Maintenance, and Healthcare Support. Legal occupations were not included in any category due to unavailable injury rates. In addition, we also looked at suicide rates in relation to other factors that vary by occupation: availability of paid sick leave and income. Using national data from the BLS Employee Benefits Survey from 2019, a comprehensive survey that measures compensation cost trends and the coverage, costs, and provisions of employer-sponsored benefits in the United States, occupation groups were categorized according to the availability level (high or low) of paid sick leave. An occupation was considered to have high availability of paid sick leave if 70% or more survey respondents within that occupation reported having access to paid sick leave. An occupation was considered to have low availability of paid sick leave if less than 70% of survey respondents within that occupation reported having access to paid sick leave. Using data from ACS, 2016 through 2019, occupations were classified according to their median income in Massachusetts. Occupation groups were categorized into the following five annual income categories: < \$20,000, \$20,000 - \$29,999, \$30,000 - \$39,999, \$40,000 - \$49,999 and \$50,000+.

This study was performed at the Massachusetts Department of Public Health (MDPH) and was conducted within the scope of existing reviewed and approved surveillance activities, including the use of death certificate data from the electronic death registration system. For this study, the MDPH was not engaged in human subjects research, and no additional Institutional Review Board (IRB) review was required.

Results

There was a total of 2,693 suicides in Massachusetts from 2016 through 2019. One hundred and thirty-nine suicides occurred among out-of-state residents or had missing residence information and were thus excluded from the analysis. Three hundred and one suicides were excluded because the death certificates for these individuals indicated that they were not in the workforce either because they were homemakers (n=69), were unemployed or had never been employed (n=38), were unable to work due to a disability or other reason (n=31), or were students (n=163). An additional 54 individuals were excluded because their death certificates contained no information or not enough information to code either industry or occupation. If only industry or only occupation was coded, they were included in the analysis. A total of 2,199 deaths with usable industry and/or occupation information were included in this analysis, which represents 82% of all suicides that occurred during this time period.

The average suicide rate for all Massachusetts workers was 15.2 deaths per 100,000 workers (Table 1). Compared to the rate for all Massachusetts workers, men had a suicide rate statistically higher (23.6 deaths per 100,000 workers). As the age of decedents increased, the rate of suicides also increased. The age group 65 years old had a suicide rate statistically higher than the average rate for all Massachusetts workers (38.3 deaths per 100,000 workers). Asian or Pacific Islander, non-Hispanic workers had the lowest suicide rate compared to all other racial/ethnic groups (5.1 deaths per 100,000 workers), followed by Hispanic (8.0 deaths per 100,000 workers) and Black, non-Hispanic (9.8 deaths per 100,000 workers) workers. The suicide rate for workers who were reported as being military personnel (active or inactive) was statistically higher than the rate for all Massachusetts workers (35.9 deaths per 100,000 workers). Workers who were widowed or divorced had suicide rates statistically higher than the rate for all Massachusetts workers (44.4 and 33.4 deaths per 100,000 workers, respectively). The suicide rate among workers with an education level of 9–12th grade, a high school diploma, or GED was statistically higher than the rate for all Massachusetts workers (31.1 deaths per 100,000 workers) (Table 1).

Compared to the rate for all Massachusetts workers, the suicide rate was statistically higher among occupations with 200+ injuries and illnesses (30.9 deaths per 100,000 workers) (Table 2).

The average suicide rate for all Massachusetts workers across all industry sectors was 14.9 deaths per 100,000 workers (Figure 1). The industry sector with the highest rate of suicides was Agriculture, Forestry, Fishing, and Hunting (46.5 deaths per 100,000 workers), although this industry sector had the lowest number of suicides (n=25). The Construction industry sector had the highest number of suicides (n=358) and the second highest rate of suicides (42.3 deaths per 100,000 workers), which was also statistically higher than the average rate for all Massachusetts workers.

The average rate for all Massachusetts workers across all occupation groups was 15.0 deaths per 100,000 workers (Figure 2). The occupation group with the highest rate of suicides was Construction and Extraction (49.2 deaths per 100,000 workers) and this occupation

group also had the highest number of suicides (n=316). Compared to the average rate for all Massachusetts workers, the following occupation groups had suicide rates statistically higher, Construction and Extraction; Installation, Maintenance, Repair; and Production (49.2, 37.6 and 27.9 deaths per 100,000 workers, respectively).

Overall, the most prevalent means of suicide among Massachusetts working-age decedents across all occupation groups were hanging/suffocation (n= 1,064, 48.9%) and firearm (n= 495, 22.8%) (Figure 3). For the three occupation groups that had a higher suicide rate than average of all Massachusetts workers (Construction and Extraction; Installation, Maintenance, and Repair; Production), hanging/suffocation was most prevalent (n= 188, 59.5%; n= 57, 50.0%; n= 67, 42.7%, respectively). For suicides by poisoning/overdose among working-age Massachusetts decedents, antidepressants and opiates were the most common classes of substances used.

Discussion

This analysis used death certificates provided by the Massachusetts Violent Death Reporting System (MAVDRS) to examine suicide rates and counts among working-age decedents in Massachusetts. We examined individual demographics, work-related characteristics, and major industry and occupational groups. Higher rates of suicide were found among workers who were male, were aged 65 years or older, were White, non-Hispanic, had any military background, were widowed or divorced, or had a 9–12th grade, high school or GED education. These findings are generally consistent with previous literature.^{1,22} These groups may disproportionately experience factors associated with suicide, such as differences in mental health problems, substance misuse, relationship problems, physical health problems, job or financial problems, gender roles and societal expectations, and/or easy access to lethal means.^{23–29}

The Construction industry sector and Construction and Extraction, Installation, Maintenance, and Repair, and Production occupational groups had suicide rates higher than the average rate for all Massachusetts workers. Occupations categorized as having a high number of occupational injuries and illness or low availability of paid sick leave had high suicide rates higher than the average for all workers. These findings are consistent with previous research.^{30–31} The literature indicates that suicide risk is associated with lower relative and absolute socioeconomic status, work-related access to lethal means, low-skilled work, and job stress, including low job control, low job insecurity, and poor supervisory and colleague support.^{8–11}

Firearms are used in more than half of suicides nationally³¹, however, among Massachusetts working-age decedents the most prevalent means of suicide were hanging/suffocation. Firearms had a higher proportion of means of suicide among the Production occupation group compared to all occupations, although not statistically significant. In Massachusetts, elevated proportions of suicides by firearms are found in some Western counties, which are more rural areas, and among older adults. When thinking about suicide prevention strategies, it is critical to understand the means of suicide. Means safety (ensuring there are safety measures in place with lethal means) is an important part of a comprehensive approach to

suicide prevention. Through our analysis here, in examining means by occupation, we can begin to examine some of these trends in order to inform tailored prevention strategies to various occupational groups. However, more analyses are needed to fully explore patterns of the means. For example, the potential correlation of means of suicide between Production occupations and either age or rurality would be worth exploring in the future.

This analysis highlights many important findings about the magnitude and extent of suicides among working-age Massachusetts residents. However, there are some limitations that must be noted. There was an assumption that the industry and/or occupation reported on the decedents death certificate was the industry or occupation at the time of death or just preceding death. Suicide rates may be over- or under-estimated if the decedents were not employed, retired, or working in another type of business or job at the time of death. Individual data on work-related factors, such as the incidence of work injury and availability of paid sick leave, both found to be associated with rates of suicide, were unknown, thus, conclusions about causal links between these factors and suicide rates cannot be determined. Finally, decedents in this study may have had a baseline/background rate or prevalence of mental health issues that independently contributed to their risk of suicide. It is worth noting that mental health issues are often caused by a multitude of factors. In particular, as it relates to suicide, often several different issues are at play simultaneously, and no one factor is the ultimate cause of a suicide. Factors can range from genetics to physical/emotional abuse to stigmas to economic hardships, among many others. The factors included in this analysis were restricted to select work-related and demographic factors.

As this data as well as previous research demonstrates, all industries and occupations do not have the same rate of suicide, suggesting when planning outreach initiatives and interventions suicide prevention efforts should be placed in workplaces, especially those that are at higher risk. An important venue for health and safety is at the workplace, which includes concerns related to mental health and suicide prevention. Worker groups, employers, unions, practitioners, and suicide prevention specialists can all play a vital role in suicide prevention. Some workplace strategies include but are not limited to: creating a work environment that fosters communication, cultivates connectedness, and promotes asking for help; increasing access and referring employees to mental health and behavioral health services; offering introductory level training in suicide prevention at workplaces for employers and employees to recognize the signs of suicide and instill confidence in talking about suicide; and developing campaigns and educational materials on suicide prevention that raise awareness of the signs of suicide for high-risk industries and occupations, encourage creating a protective environment at the workplace, and promote help-seeking behaviors. Although relative comparisons of suicide rates in this manner are useful for prevention purposes, these results should not overshadow the fact that the suicide rate in Massachusetts has increased by 41% in less than 2 decades. Therefore, workers in all industry sectors and occupational groups may be impacted by suicide and should be considered in prevention efforts.

Funding Sources For All Authors:

The results reported herein correspond to specific aims of the Comprehensive Suicide Prevention grant CDC-RFA-CE20-2001 to principal investigator Kelley Cunningham from the Centers for Disease Control.

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Learning Objectives:

1. Understand how work and work-related factors are related to risk of suicide
2. Understand how suicides differ by industry and occupation
3. Become familiar with workplace strategies that can be used in suicide prevention

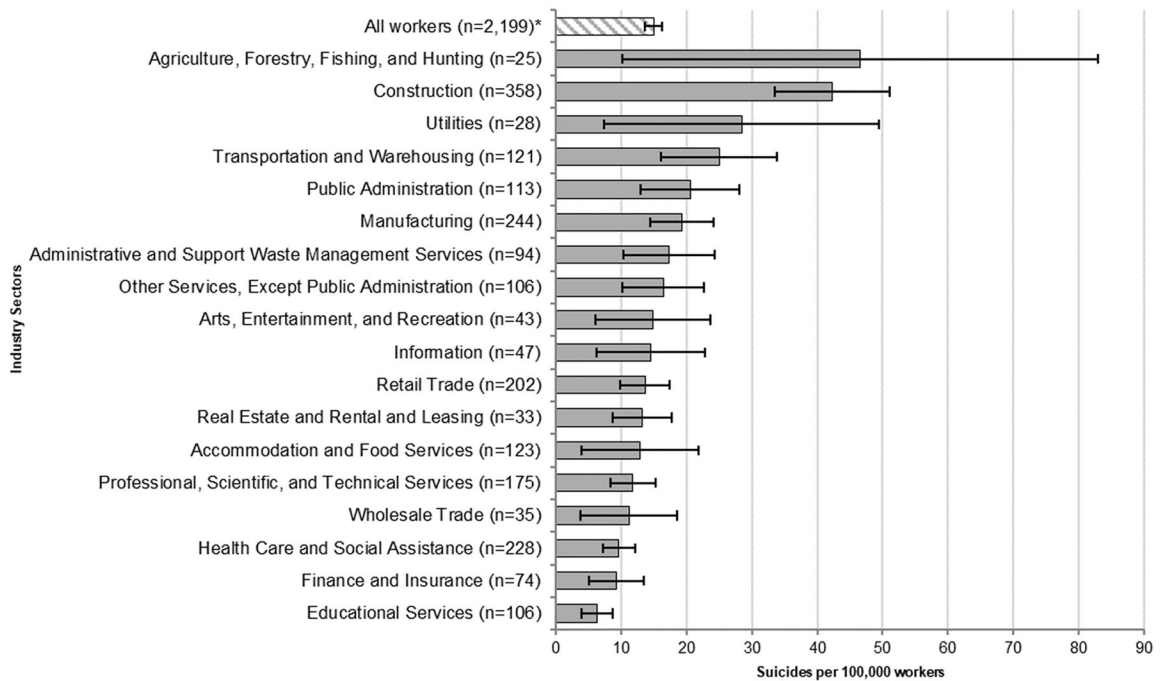


Figure 1.

Suicide Rates by Industry Sectors, Massachusetts Workers, 2016–2019, n=2,199*

*This category excluded 11 suicides among those working in the military or military specific industries due to lack of denominator information and 33 suicides because the death certificates did not contain enough information to code industries.

Numerator source: MA Violent Death Reporting System, MA Department of Public Health, 2016–2019

Denominator source: American Community Survey, 2016–2019

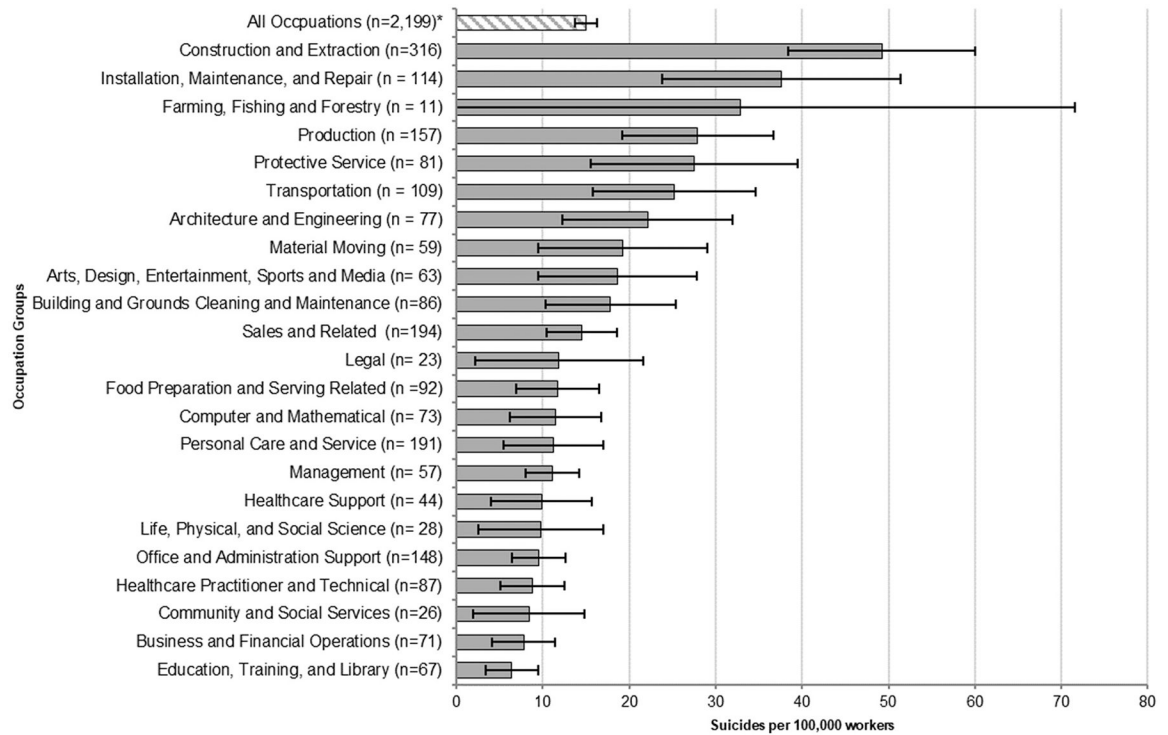


Figure 2.
 Suicide Rates by Occupation Groups, Massachusetts Workers, 2016–2019, n=2,199*
 *This category excluded 12 suicides among those working in the military or military specific occupations due to lack of denominator information and 13 suicides because the death certificates did not contain enough information to code occupation.
 Numerator source: MA Violent Death Reporting System, MA Department of Public Health, 2016–2019
 Denominator source: American Community Survey, 2016–2019

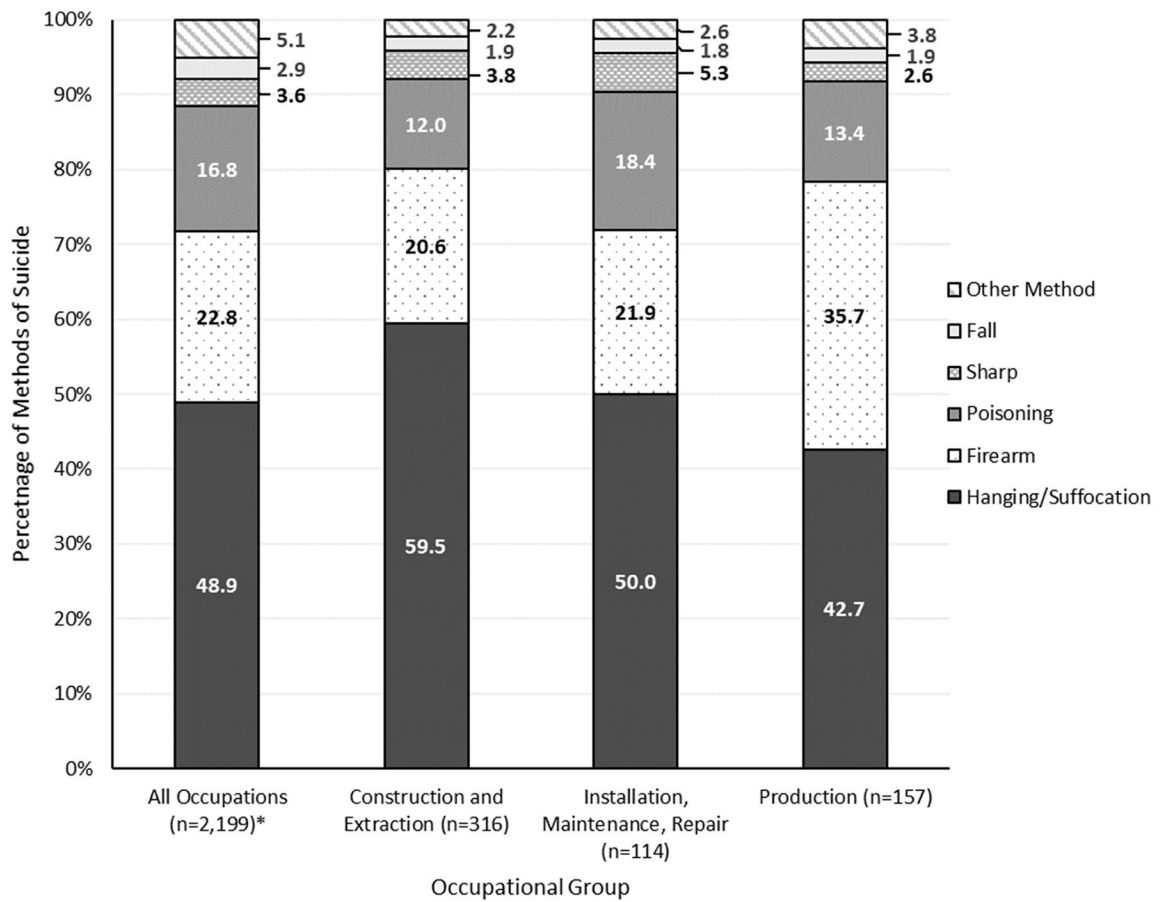


Figure 3. Means of Suicide among the Occupational Groups with a Suicide Rate Statistically Significantly Higher than the Average Rate for All Massachusetts Workers
 *This category excluded 12 suicides among those working in the military or military specific occupations due to lack of denominator information and 13 suicides because the death certificates did not contain enough information to code occupation.
 Source: MA Violent Death Reporting System, MA Department of Public Health, 2016–2019

Table 1.

Distribution of Suicides by Demographic Characteristics, Massachusetts Working-Age Decedents, 2016–2019

Characteristic	Suicides N (%)	Suicides per 100,000 workers (95% CI)
Sex		
Male	1,734 (78.9%)	23.6 (21.4, 25.8) ^I
Female	465 (21.2%)	6.5 (5.3, 7.7)
Age group		
16–24	138 (6.3%)	7.3 (4.9, 9.7)
25–34	364 (16.6%)	11.3 (9.0, 13.6)
35–44	351 (16.0%)	14.0 (11.1, 17.0)
45–54	473 (21.5%)	15.6 (12.8, 18.5)
55–64	500 (22.7%)	19.2 (15.9, 22.6)
65	373 (17.0%)	38.3 (30.5, 46.0) ^I
Race/Ethnicity		
White, non-Hispanic	1,923 (87.5%)	18.1 (16.4, 19.7)
Hispanic	121 (5.5%)	8.0 (5.2, 10.9)
Black, non-Hispanic	96 (4.4%)	9.8 (5.9, 13.7)
Asian or Pacific Islander, non-Hispanic	50 (2.3%)	5.1 (2.3, 8.0)
American Indian / Alaska Native, non-Hispanic	2 (0.1%)	---
Other/Unspecified	7 (0.3%)	---
Military Status		
Yes	232 (10.6%)	35.9 (26.6, 45.1) ^I
No	1,962 (89.2%)	14.2 (12.9, 15.4)
Unknown	5 (0.2%)	---
Marital Status		
Married	729 (33.2%)	9.9 (8.5, 11.4)
Widowed	102 (4.6%)	44.4 (27.2, 61.7) ^I
Divorced	445 (20.2%)	33.4 (27.2, 39.6) ^I
Never married	919 (41.8%)	17.2 (15.0, 19.5)
Unknown	4 (0.2%)	--
Education level		
8 th grade or less	50 (2.3%)	22.9 (10.2, 35.5)
9–12 th grade, high school diploma, or GED	1,159 (52.7%)	31.1 (27.6, 34.7) ^I
Some college, Associate, or Bachelor's degree	772 (35.1%)	10.3 (8.8, 11.7)
Master's, Doctorate, or Professional degree	216 (9.8%)	7.4 (5.4, 9.4)
Unknown	2 (0.1%)	---
All Workers	2,199 (100.0%)	15.2 (13.9, 16.4)

^IRate significantly higher than rate for all workers

Table 2.

Distribution of Suicides by Work-Related Factors, Massachusetts Working-Age Decedents, 2016–2019

Work-related factors	Suicides N (%) ¹	Suicides per 100,000 workers (95% CI)
Rate of occupational injury and illness per 10,000 full-time workers ²		
0–49	397 (18.5%)	10.6 (8.5, 12.7)
50–99	509 (23.7%)	11.0 (9.1, 12.9)
100–199	349 (16.2%)	12.8 (10.1, 15.5)
200+	896 (41.7%)	30.9 (26.8, 34.9) ⁶
Percent with paid sick leave ³		
High	971 (56.9%)	48.4 (46.9, 50.0) ⁶
Low	735 (43.1%)	95.2 (91.8, 98.7) ⁶
Income range ⁴		
<\$20,000	57 (2.6%)	11.2 (5.4, 17.0)
\$20,000 - \$29,999	281 (12.9%)	13.9 (10.7, 17.2)
\$30,000 - \$39,999	120 (5.5%)	25.7 (16.5, 34.9)
\$40,000 - \$49,999	710 (32.7%)	20.8 (17.8, 23.9) ⁶
\$50,000	1,006 (46.3%)	12.4 (10.9, 14.0)
All Occupations⁵	2,187 (100.0%)	15.0 (13.7, 16.3)

¹Some totals do not add up to 2,199 because suicides were excluded if the occupation of the decedent could not be linked to the work-related factor being examined

²Work-related injury and illness rates by occupation: BLS Massachusetts Survey of Occupational Injuries and Illnesses, 2019

³Percent of workers reporting access to paid sick leave by occupation: BLS Employee Benefits Survey, 2019

⁴Median income by occupation: ACS, 2016–2019

⁵This category excluded 12 suicides among those working in the military or military specific occupations due to lack of denominator information and 13 suicides because the death certificates did not contain enough information to code occupation.

⁶Rate significantly higher than rate for all workers