

Workplace Suicides Before and During the COVID-19 Pandemic: Results from the  
National Violent Death Reporting System, 2013-2020

Muna Hassan

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Committee:  
Ali Rowhani-Rahbar  
Marissa Baker

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Muna Hassan

University of Washington

**Abstract**

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Muna Hassan

Chair of Supervisory Committee:

Ali Rowhani-Rahbar

Department of Epidemiology

This study examines the occurrence of workplace suicides and their contextual factors before and during the COVID-19 pandemic using data from the Centers for Disease Control's National Violent Death Reporting System (NVDRS). The study analyzes demographic, geographical, occupation, and circumstantial factors in workplace suicides and explores changes in these factors during the pandemic. The data spans from 2013 to 2020, focusing on suicides in which would was categorized as a "Major Factor," "Minor Factor," or "Not Documented Factor." Descriptive analyses and statistical tests were conducted to identify patterns and associations. Of the 200,490 suicides analyzed, 9.08% were identified as work-related to some extent. The proportion of suicides where work was identified as a major contributor remained consistent at

3.02% before and during COVID-19. Across all years of the study—higher proportions of suicides where work was a major contributor were observed among males, individuals aged 45-54, married or separated individuals, those with a college education or higher, as well as Asian/Pacific Islander and Hispanic individuals. Moreover, specific occupations such as management, legal, protective services, healthcare practitioners, and military showed a significant prevalence of major work-related suicides compared to other occupations. The most common death mechanisms among suicides where work was a significant contributing factor were firearms, hanging, strangulation, suffocation, and poisoning. Financial problems, eviction or loss of home, depressed mood, and relationship problems emerged as prevailing circumstances associated with major workplace suicides. These findings highlight the potential impact of COVID-19 on work-related suicides and emphasize the significance of considering demographic factors and circumstances in comprehending and addressing these incidents.

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## **Introduction:**

In 2020, suicide was the 12th leading cause of death overall in the United States (US)<sup>1</sup>. Suicide is a significant public health problem and understanding the circumstances related to it is crucial for developing effective preventive measures.<sup>2</sup> The impact of workplace factors such as job strain, financial stress, job loss, workplace bullying, social isolation at work, and long shift hours on suicide is widely acknowledged and researched globally.<sup>3-8</sup> While the overall impact of workplace factors on suicide is well-documented globally, further studies focusing on occupation-specific influences within the US context are still relatively scarce.<sup>9-12</sup>

The Bureau of Labor Statistics (BLS) and the National Institute of Occupational Safety and Health (NIOSH) define workplace or occupational suicides as suicides that occur at work sites.<sup>13,14</sup> However, in this study, workplace or work-related suicides are defined as suicides wherein work was considered a contributing factor. Workplace suicides are among the leading manners of occupational fatalities in the US.<sup>15-18</sup> Of all occupational deaths in 2020, 5.4% were due to suicide.<sup>15</sup> Evidence suggests that workplace suicides differ by occupation, age group, marital status, and sex.<sup>9,10,14,15,17</sup> Previous research efforts include identifying occupations at risk for suicide and work-related predictors for suicide, such as stressors, burnout, job characteristics, workplace access to lethal means (e.g. firearms, medication), and physical work environment that contribute to suicidal ideation and behaviors.<sup>19,20</sup>

On average, employed individuals in the US spend at least 8 hours of their day in a work environment.<sup>21</sup> The COVID-19 pandemic and stay-at-home restrictions have significantly altered the work environment and culture for millions of people in the US. In

2019, only 24% of employees worked remotely, compared to 38% in 2021.<sup>22</sup> The number of remote employees in 2020 is estimated to be triple that of the previous year. Remote work has led to improved working conditions and a better work-life balance for some individuals; however, remote work has also been associated with an increase in workload, and erosion of work/life boundaries which can cause stress.<sup>23</sup> The beginning of the pandemic also resulted in job loss for many Americans, either through voluntarily or involuntarily leaving a job.<sup>24,25</sup>

Researchers hypothesize that the COVID-19 pandemic may have brought changes to the factors and circumstances related to suicide in the workplace. While limited studies have been conducted in the US, it is believed that determinants such as job loss, job insecurity, burnout, exposure to traumatic events in healthcare, financial strain, and heightened stress may contribute to elevated suicide rates.<sup>26</sup> Conversely, remote work options, improved accessibility and increased funding through unemployment benefits, and enhanced access to mental health resources could have been protective factors.<sup>27-29</sup> These circumstances have prompted questions about the changes in the occurrence and situational aspects of suicide incidents, particularly in the workplace for those who were required to continue working during stay-at-home restrictions due to the nature of their profession. It's worth mentioning that 75% of Americans had non-relocatable occupations, such as healthcare, food industry, and retail, during the pandemic.<sup>30</sup>

This study builds upon previous research by Peek-Asa et al., which examined work-related suicides categorized as "injury-at-work" or "job problem/job crisis" in death certificates and reports.<sup>9,31</sup> Peek-Asa et al. studies used data from the NVDRS spanning

2013-2017; the study found that approximately 12.1% of the 84,389 analyzed suicides were associated with work to varying degrees.<sup>9,31</sup>

Here, we aimed to analyze the occurrence of workplace suicides and their contextual factors before and during the COVID-19 pandemic, utilizing the comprehensive database of the Centers for Disease Control's (CDC) NVDRS.

## **Methods:**

### *Obtainment of Data and Ethical Considerations*

Data were secured through the approval of CDC and National Center for Injury Prevention and Control (NCIPC) standard process. Considering the nature of the NVDRS data, additional measures were needed to safeguard personal information. The data were stored on an encrypted, password protected, secure database where only the investigators had access. All data was protected to maximize confidentiality. No identifiable information was reported in the study (e.g., no attempt was made to identify specific individuals, households, or institutions). The data was not disclosed, revealed, or given to any entity or individual without prior approval from the CDC.

### *Study Design and Sources*

This retrospective study employed a cross-sectional approach to explore demographic, geographical, and circumstantial factors in workplace suicides. Quantitative data from the CDC's NVDRS from 2013 through 2020 (most recent available year) were utilized. NVDRS is a comprehensive surveillance system that annually gathers detailed information on violent deaths in the U.S., including residents

and nonresidents, using primary documents such as death certificates, reports from coroners/medical examiners, toxicology reports, and law enforcement reports.<sup>32</sup> From 2013 to 2020, NVDRS collected data from 47 states, Puerto Rico, and the District of Columbia, with 17 states providing data for all study years, and the remaining 30 states, Puerto Rico, and the District of Columbia contributing data for at least one year.<sup>32</sup>

### *Study Population*

The study population consisted of both non-resident and resident deceased individuals who died in a US state, the District of Columbia, and Puerto Rico. The primary outcome of interest was death by suicide. Therefore, individuals who died under other circumstances, such as homicide-suicide, homicide, legal intervention deaths, and unintentional firearm injuries, were excluded from the study population. Additionally, individuals younger than 18 years of age were excluded as they may have different workplace circumstantial factors that could contribute to suicide compared to adults.

### *Study Variables*

Exposure variables in this study included demographic factors (sex, age, marital status, education, race/ethnicity, geographic area), occupational classification (2-digit standard occupational classification (SOC) code), death mechanisms, and circumstances prior to death (financial problems, eviction or loss of home, depressed mood, relationship problems, alcohol problems, suicide note, family relationship problems, mental health problems, death of friend or family, physical health problem, argument, suicide attempt history). These variables were analyzed to identify potential

determinants of workplace suicides. The outcome variable, workplace suicide, was identified using three sources within NVDRS data: if a death certificate indicates that death was an “injury-at-work” or that the death investigation finds that the decedent was having a “job problem” or “job crisis” related to their death. Suicides were categorized based on the degree of work-relatedness: "Major Factor," "Minor Factor," or "Not Documented Factor," following the classification used in the Peek-Asa et al. studies.<sup>9,31</sup>

### *Analysis*

NVDRS data from 2013-2020 were utilized to conduct descriptive analyses to identify patterns within demographic indicators (sex, age, marital status, education, race/ethnicity), geographic location (urban vs. rural), occupation using 2-digit SOC, death mechanisms, and circumstances. Urbanity and rurality were defined using the RUCA secondary codes.<sup>33</sup> Among the 299,963 deaths recorded by the NVDRS, only 200,490 individuals who died by suicide and were 18 years of age or older were included in the analysis as the study population.

All individuals aged 18 years and above in the dataset who died by suicide were categorized as "Major Factor," "Minor Factor," or "Not Documented Factor," depending on whether their suicide was noted as an "injury at work," "job crisis," or "job problem." Individuals injured at work or with a positive indication of a job crisis were classified as "Major Factor." Similarly, individuals who had an indication of a "job problem" but were not injured at work or had no positive history of a job crisis were classified as "Minor

Factor." All other individuals who did not have an "injury at work" or positive indications of a job crisis or job problem were classified as "Not Documented Factor."

The proportions of suicides for these three categories were summarized by demographic variables, geographic location, occupation, death mechanisms, and circumstances. For race/ethnicity, occupation, and circumstances the relative change was calculated between the periods before COVID (2013-2019) and during COVID (2020). A Chi-squared Test for Independence was performed to compare the proportions before and during COVID. Boxplots were used to visualize the distributions of relative change in the proportions for race/ethnicity, occupation, and circumstance subgroups.

A subset of the data from 2016-2020 was chosen for the trend analysis to ensure a more accurate comparison, considering the proximity of the selected years to the occurrence of the pandemic in 2020. This approach aimed to capture any potential changes in demographic factors, geographic location, occupations, death mechanisms, and circumstances that might be associated with the pandemic. By focusing on data from the years closest to the pandemic, the analysis sought to provide insights into the potential impact of the pandemic on these factors. All statistical analyses were conducted using RStudio (version 2022.07.2+576).<sup>34</sup>

## **Results:**

Of the 200,490 suicides included in the analysis, 9.08% were identified as work-related to some extent. The proportion of major work-related suicides remained consistent before COVID-19 and during COVID-19 at 3.02%, while the proportion of

minor work-related suicides decreased from 6.25% to 5.26% during the same period. Suicides not documented as work-related slightly increased from 90.73% before COVID to 91.72% during COVID (**Table 1**). To assess the association between work-relatedness (Major Factor, Minor Factor, Not Documented Factor) and the relative change in the proportion of suicides before and during COVID across race/ethnicity, occupation, and circumstances (**Appendix 1**), a chi-squared test for independence was conducted. The analysis revealed a statistically significant association ( $p < 0.001$ ) between work-relatedness and these exposure variables.

**Table 1** presents the proportions of suicides within each work-related category (Major Factor, Minor Factor, Not Documented Factor) before COVID (2013-2019) and during COVID (2020) across various demographic variables (sex, age, marital status, education, race/ethnicity, geographic location, and occupation). Among males, a higher proportion of suicides were classified as major or minor work-related before COVID, accounting for 3.34% and 6.82% before 2019 and 3.24% and 5.54% in 2020, respectively. Among individuals aged 18-34 and 65+, major and minor work-related suicides were generally less prevalent during both study periods, compared to individuals aged 45-54 who had a higher prevalence of major work-related suicides, accounting for 4.33% pre-pandemic and 4.36% in 2020. Notably, there was a 0.59% decrease in the proportion of major work-related suicides among individuals aged 75+ from before COVID to during COVID. Individuals who were married or in a domestic partnership or separated, as well as those with a college education or higher, had a higher prevalence of major work-related suicides (**Table 1**). Major and minor

work-related suicides were also more common among Asian/Pacific Islander and Hispanic individuals than other racial/ethnic groups ( $p < 0.001$ ) [**Table 1**].

Six occupations were identified having a proportion of major work-related suicides equal to or greater than 5%. The proportions of major work-related suicides before and during COVID were as follows: management (5.15% [before], 4.98% [after]), legal (5.04%, 6.42%), protective services (4.64%, 5.14%), healthcare practitioners and technical (4.18%, 5.23%), and military (5.53%, 5.28%). Notably, healthcare support occupations showed a 0.91% increase in proportions of major work-related suicides from before to during COVID ( $p < 0.001$ ).

Firearms (2.96%, 3.10%), hanging/strangulation/suffocation (3.76%, 3.50%), and poisoning (2.00%, 2.17%) were identified as the most common mechanisms of death, with the respective proportions of major work-related suicides before and during COVID (**Table 2**). Among individuals with recorded positive circumstances financial problems (7.89%, 9.50%), eviction or loss of home (5.28%, 5.68%), depressed mood (4.41%, 4.68%), and relationship problems with others (5.31%, 5.04%) exhibited the highest prevalence for major work-related suicides ( $p < 0.001$ ). Similarly, the proportions of minor work-related suicides for positive circumstances were as follows: financial problems (25.19%, 28.17%), eviction or loss of home (15.85%, 15.06%), depressed mood (11.15%, 10.18%), and relationship problems with others (12.55%, 12.67%).

**Figure 1** displays a box plot illustrating the relative change in the distributions of major work-related suicides for race/ethnicity, occupation, and circumstances between the periods before COVID (2013-2019) and during COVID (2020). The median relative changes were as follows: race/ethnicity (0.02), occupation (0.02), and circumstances

(0.08), indicating an overall increase in major work-related suicides in 2020 compared to before COVID. Notably, there were outliers in the occupation analysis (-0.57, 0.91), particularly within the healthcare support occupation (0.91). While there was a small range of relative change values for circumstances, there was one outlier for family problems (0.35). Regarding race/ethnicity, no outliers were observed; however, the box plot indicates a positively skewed distribution with a long right tail and a wide variability of data points within the interquartile range.

### **Discussion:**

The findings of this study reveal consistent proportions of major work-related suicides before and during COVID-19, with notable variations among demographic groups, occupations, and circumstances. Additionally, the results suggest that race/ethnicity, occupation, and circumstances may play a role in determining the work-relatedness of suicides, highlighting the importance of considering these factors in understanding and addressing work-related suicide incidents. To effectively mitigate the underlying factors contributing to work-related suicides and promote mental well-being in vulnerable populations, targeted interventions, and support are critically needed. While previous studies conducted by Peek-Asa et al. and other researchers have examined the circumstances and prevalence of work-related suicides, this study is the first to identify and assess the potential impact of COVID-19 on the prevalence of work-related suicides amidst evolving work environments.<sup>9,31,35,36</sup>

Results showed that the proportion of major work-related suicides across race/ethnicity subgroups varied significantly before and during the pandemic and was

most prevalent among Asian/Pacific Islander (API) and Hispanic individuals, which differs from the findings of Peek-Asa et al. (2013-2017), who reported higher proportions among White, Non-Hispanic individuals.<sup>9</sup> However, it should be noted that there was only a marginal difference in the proportion of suicides between White, Non-Hispanic (3.09%) and API (3.19%), and Hispanic (3.48%) individuals in 2020. These discrepancies in findings highlight the importance and necessity of utilizing disaggregated data to assess variations among different racial and ethnic groups, considering their diverse exposure to work-related circumstances and demographic factors. Additionally, these disparities are likely attributed to misclassification resulting from the reporting of race/ethnicity on death certificates, medical coroners' examinations, and by law enforcement agencies. Furthermore, in the context of COVID-19, we are now well aware of the detrimental impact of systemic inequities, including elevated rates of unemployment and adverse working environments experienced by marginalized racial and ethnic populations in the US.<sup>37-41</sup> These circumstances have potentially contributed to a heightened vulnerability and increased risk of work-related suicides among marginalized racial and ethnic populations during the COVID-19 pandemic.

Overall, the proportion of work-related suicides increased for most circumstances from the pre-COVID period to the during-COVID period, except for "relationship problems with others" and "death of a family, friend, or other." Both major and minor work-related suicides were associated with financial problems before and during the pandemic, which aligns with previous studies indicating that financial problems are a significant predictor of suicide or suicide attempts.<sup>42,43</sup> A study focusing on adults aged

40-64 also revealed a higher prevalence of suicides related to job and financial stressors within this age group.<sup>44</sup> The combination of financial strain, job stress, and challenging work conditions during the pandemic could create a situation where individuals feel hopeless, depressed, or experience suicidal ideation.<sup>45,46</sup> It is worth noting that other circumstances, such as eviction or loss of home and depressed mood, also showed an elevated proportion of major work-related suicides in 2020. Previous research examining these factors has reported similar findings, and considering the social and economic climate during the initial year of the pandemic, it is understandable that we observed an increase in the proportion of suicides related to these circumstances.

Suicides among management, legal, protective services, healthcare practitioners/technical, and military occupations were found to have a higher likelihood of being work-related compared to other occupations when comparing the periods before and during COVID. This occupational disparity in work-related suicides could be attributed to the demanding nature of the work, including long working hours and other work-related stressors. Furthermore, it is important to note that certain occupations, such as military, protective services, and healthcare, experienced particularly demanding work conditions and frontline exposure during the COVID-19 pandemic, which may have contributed to higher levels of job stress. However, further research is needed to understand occupation-specific stressors better and identify effective strategies to support mental well-being in these fields. Notably, the proportion of major work-related suicides among healthcare support workers doubled in 2020, indicating a potentially significant impact of COVID on individuals in this occupation. Relative

change distributions in major work-related suicides revealed notable outliers, particularly in the healthcare support occupation, suggesting potential areas of concern and warranting further exploration. These findings may signify unique circumstances or factors contributing to a significant decrease or increase in major work-related suicides within this occupation during the COVID period. Moreover, evidence suggests that healthcare practitioners and support staff experienced substantial burnout, trauma, emotional distress, and other work-related factors during the COVID pandemic, which could help explain this substantial increase in major work-related suicides.<sup>47-50</sup>

While previous studies have examined suicide rates by occupation/industry and the work related-ness of suicides, this study uniquely investigated the work-relatedness of suicides by occupation while comparing the pre- and during COVID periods.<sup>9,31,51-53</sup> In March 2020, nationwide lockdowns and stay-at-home orders were implemented due to a rapid increase in COVID cases across the US.<sup>54</sup> Consequently, work environments underwent significant changes to adhere to these new measures. While some occupations adopted remote work, flexible hours, and increased sick leave options, others, such as customer service, healthcare, and protective services, lacked similar protective resources.<sup>55,56</sup> Furthermore, a recent study estimated that 75% of Americans had non-relocatable jobs during the pandemic, further highlighting the impact of limited job mobility on work environments and occupational circumstances.<sup>30</sup> It is important to note that these individuals who could not work from home, particularly racialized and lower-paid workers, were disproportionately affected by this lack of job flexibility.<sup>26,30</sup> These findings emphasize the necessity of addressing unfair policies and workplace cultures contributing to major work-related suicides. The majority of American

employees faced disadvantages during the pandemic, such as a lack of autonomy to work flexible hours or from home, limited sick leave, and inadequate access to proper personal protective equipment.<sup>56,57</sup> Despite the fear of COVID exposure, many workers faced challenges in quitting their jobs due to limited alternatives for financial assistance. In some cases, only legal residents were eligible to access unemployment payments after being laid off. However, it is important to note that unemployment benefits vary by state, and in certain regions, such as Washington, New York, and Colorado, non-US residents could also receive such benefits.<sup>58,59</sup> Additionally, a significant issue arises from the fact that many workers may not know how to access the unemployment benefits they are entitled to, which further compounds the problem. Furthermore, the first stimulus relief distribution was not scheduled until December 2020. While this study focused solely on data from 2020 during the COVID period, it is reasonable to assume that the impacts of COVID on work-related suicides were potentially even more significant in the subsequent years (2021-2023). Nevertheless, this study significantly contributes to our understanding of the demographic and circumstantial factors associated with workplace suicides.

The study was subject to several limitations related to the nature of the NVDRS dataset. Firstly, the coverage of NVDRS was limited to 47 states, Puerto Rico, and the District of Columbia as of 2020, which could have affected the generalizability of the findings to the entire country. While approximately 17 states consistently contributed data to NVDRS, the remaining states, Puerto Rico and the District of Columbia, participated partially or not at all between 2013-2020, making it challenging to conduct comparative analyses between states with limited data. Secondly, the dataset relied on

various sources, such as death certificates and police reports, which could have been incomplete or unavailable in some instances, leading to potential data availability issues. Thirdly, the data quality may have varied across states and sources, affecting the accuracy and consistency of the information obtained. Lastly, using secondary RUCA codes to define urbanity and rurality can lead to misclassifications and oversimplifications, as they were not specifically developed for the classification of rural and urban areas and may not capture the full complexity of this classification. However, the benefit of using RUCA codes to classify rural and urban areas for analysis is providing a standardized and consistent method that allows for comparisons across studies and datasets, enhancing the understanding of geographical variations and their impact on research outcomes. Additionally, suicides occurring during remote work or work-related travel may have been undercounted or miscategorized in NVDRS, as these incidents may not have consistently been recognized as work-related suicides in the reports. Moreover, the study was limited to individuals who died from suicide a work-related suicide, thus restricting its generalizability to other non-work-related suicides.

The findings of this research have significant implications for understanding and addressing the circumstantial and demographic factors associated with workplace suicides, particularly in the context of the COVID-19 pandemic. Critical steps include implementing equitable workplace policies, enhancing mental health resources, improving financial stability, and fostering supportive work cultures. National policies are needed to protect employees from harmful work conditions, including addressing the lack of appropriate paid sick time and ensuring workers with sick time are empowered to

take it without retaliation or retribution. Furthermore, advocacy groups and governmental organizations have developed toolkits with multi-level interventions for employers to promote better employee mental health outcomes.<sup>36,60-62</sup> Targeted interventions and support are also necessary to address the underlying factors contributing to work-related suicide disparities among vulnerable populations.

Regarding future research, it is paramount to examine the long-term impact of COVID-19 on work-related suicides. Additionally, conducting research studies using disaggregated data across subgroups can help identify disparities among different demographic groups, allowing for targeted interventions. Exploring the impact of remote versus non-remote work conditions is another important area to investigate. Finally, complementing the quantitative analysis with qualitative research methods can provide a deeper understanding of the circumstances surrounding workplace suicides and offer valuable insights for developing effective interventions.

**Table 1:** The proportion of suicides for which work was a major, minor, or not documented as factor before and during the COVID-19 pandemic by demographic and geographic characteristics, from 2013 to 2020.

Characteristics	Total Number <sup>c</sup>		Major (%)		Minor (%)		Not Documented (%)	
	<2019	2020	<2019	2020	<2019	2020	<2019	2020
<b>Overall Count/Percentage</b>	163,745	36,745	3.02	3.02	6.25	5.26	90.73	91.72
<b>Sex</b>								
Female	36,464	7,378	1.87	2.14	4.27	4.11	93.86	93.75
Male	127,261	29,363	3.34	3.24	6.82	5.54	89.84	91.21
Unknown*	20	4	0	0	0	0	100	100
<b>Age (Years)</b>								
18-24	17,780	4,201	2.77	2.93	4.79	4.07	92.45	93.00
25-34	28,030	7,072	2.94	3.13	6.96	5.26	90.09	91.61
35-44	26,732	6,075	3.54	3.44	7.66	6.24	88.80	90.32
45-54	31,533	6,082	4.33	4.36	8.68	7.89	87.00	87.75
55-64	29,575	5,915	3.52	3.97	7.48	7.07	89.00	88.96
65-74	16,462	3,859	1.25	1.30	2.30	2.51	96.45	96.19
75+	13,592	3,535	0.49	0.20	0.41	0.40	99.11	99.41
Unknown*	41	6	2.44	0	0	0	97.56	100
<b>Marital Status</b>								
Married/Civil Union/Domestic Partnership	52,502	11,329	3.87	3.89	6.78	5.99	89.35	90.11
Married/Civil Union/Domestic Partnership, but separated	4,900	1,004	3.67	4.28	5.92	6.67	90.41	89.04
Never Married	56,575	13,945	2.78	2.80	6.50	4.97	90.73	92.23
Single, not specified	2,531	392	2.29	3.83	6.60	7.65	91.11	88.52
Widowed/Divorced	45,484	9,656	2.32	2.22	5.43	4.66	92.25	93.12
Unknown*	1,753	419	2.40	1.67	4.11	2.86	93.50	95.47
<b>Education</b>								
Less than High School	19,934	4,544	1.81	1.80	3.91	3.17	94.29	95.03
High School Diploma/ Some college credit, But no degree	90,897	21,860	2.87	2.83	5.74	4.74	91.39	92.43
Associate's/Bachelor's Degree	31,512	7,361	3.62	3.97	8.07	7.20	88.31	88.83
Master's/Doctorate Degree	9,675	2,275	4.86	4.53	9.10	8.13	86.05	87.34
Unknown*	11,727	705	3.04	2.13	6.98	4.96	89.98	92.91
<b>Race</b>								
White, Non-Hispanic	135,202	29,025	3.03	3.09	6.38	5.39	90.59	91.52
Black or African American, Non-Hispanic	9,770	2,585	2.77	1.78	5.63	4.60	91.60	93.62
Asian/Pacific Islander, non-Hispanic	4,125	1,033	3.90	3.19	6.62	5.13	89.48	91.67
American Indian or Alaska Native, non-Hispanic	2,049	454	1.17	2.20	3.32	3.96	95.51	93.83
Two or more races, non-Hispanic	1,439	377	2.22	3.45	6.32	4.24	91.45	92.31
Hispanic	10,508	3,107	3.15	3.48	5.70	4.96	91.15	91.57
Unknown/Unspecified*	652	164	2.91	1.83	3.99	4.88	93.10	93.29
<b>Geographic Location<sup>†</sup></b>								
Rural	32,289	7,718	2.41	2.55	4.83	3.99	92.76	93.46

Urban	125,753	27,657	3.22	3.21	6.76	5.77	90.02	91.02
<i>Unknown</i> *	5,703	1,370	2.03	1.82	3.03	2.04	94.93	96.13
<b>Occupation</b>								
Management	11,680	2,571	5.15	4.98	8.23	6.81	86.63	88.21
Legal	1,131	218	5.04	6.42	11.14	8.26	83.82	85.32
Protective Service	3,965	953	4.64	5.14	7.77	5.77	87.59	89.09
Architecture and Engineering	3,659	792	3.36	2.02	7.60	7.70	89.04	90.28
Life, Physical, and Social Science	1,245	295	3.94	1.69	8.19	5.08	87.87	93.22
Healthcare Practitioners and Technical	5,497	1,071	4.18	5.23	8.55	7.47	87.27	87.30
Business and Financial Operations	3,609	778	4.05	3.86	9.73	7.58	86.23	88.56
Computer and Mathematical	3,061	647	4.05	3.71	10.13	10.20	85.82	86.09
Sales and Related	11,079	2,188	3.93	2.51	7.61	6.44	88.46	91.04
Farming, Fishing, and Forestry	1,186	299	3.12	4.35	4.47	3.68	92.41	91.97
Building and Grounds Cleaning and Maintenance	4,972	1,029	3.30	3.50	5.77	3.79	90.93	92.71
Education, Training, and Library	3,122	724	2.56	2.49	5.57	5.39	91.86	92.13
Installation, Maintenance, and Repair	8,742	2,086	3.49	3.55	6.13	4.79	90.38	91.66
Transportation and Material Moving	13,060	3,050	3.22	3.48	6.36	5.84	90.42	90.69
Arts, Design, Entertainment, Sports, and Media	3,701	767	2.86	2.22	7.05	4.95	90.08	92.83
Production	11,373	2,527	2.86	2.69	6.07	5.22	91.07	92.09
Office and Administrative Support	7,718	1,642	2.75	2.44	6.27	4.75	90.98	92.81
Food Preparation and Serving Related	5,526	1,308	2.53	2.60	5.97	6.04	91.49	91.36
Personal Care and Service	3,080	716	2.53	3.21	4.90	4.75	92.56	92.04
Construction and Extraction	18,526	4,381	2.38	2.47	5.89	4.50	91.73	93.04
Community and Social Service	1,353	317	3.47	4.10	6.87	5.99	89.65	89.91
Healthcare Support	1,996	396	2.51	4.80	5.11	4.80	92.38	90.40
Military	2,839	663	5.53	5.28	7.22	5.73	87.25	88.99
Not in workforce <sup>1</sup>	16,520	3,162	0.73	0.57	2.02	1.87	97.26	97.56
<i>Unknown</i> *	15,105	4,165	2.03	2.67	5.71	4.83	92.26	92.51

<sup>c</sup> Counts.

\* Individuals with unknown or missing demographic or geographical information were categorized as "Unknown".

<sup>†</sup> Injury zip codes were categorized as Urban and Rural using RUCA secondary codes.

<sup>1</sup> Individuals not in the workforce include students, homemakers, volunteers, or those unable to work [e.g., child, patient, inmate].

**Table 2:** The proportion of suicides for which work was a major, minor, or not documented factor before and during the COVID-19 pandemic by mechanism and circumstances, from 2013 to 2020.

Characteristics	Total Number <sup>c</sup>		Major (%)		Minor (%)		Not Documented (%)	
	<2019	2020	<2019	2020	<2019	2020	<2019	2020
<b>Overall Percentage</b>			3.02	3.02	6.25	5.26	90.73	91.72
<b>Mechanism</b>								
Biological weapons	2	0	0	0	0	0	100	0
Blunt instrument	154	54	2.60	0	1.95	1.85	95.45	98.15
Drowning	1,629	364	2.39	2.20	4.67	5.77	92.94	92.03
Explosive	22	6	4.55	0	9.09	0	86.36	100
Fall	4,050	957	3.14	3.13	4.62	4.60	92.25	92.27
Fire or Burns	708	131	1.98	2.29	4.66	2.29	93.36	95.42
Firearms	79,891	18,810	2.96	3.10	6.39	5.40	90.65	91.50
Hanging, strangulation, suffocation	46,538	10,027	3.76	3.50	7.37	5.94	88.87	90.56
Intentional neglect (e.g. starving a baby)	17	4	0	0	0	0	100	100
Motor vehicle	1,199	279	1.75	2.15	4.00	2.87	94.25	94.98
Non-powder gun	31	5	12.90	0	0	20.00	87.10	80.00
Other (e.g. taser, electrocution, nail gun)	239	36	3.35	2.78	3.77	0	92.89	97.22
Other transport vehicle (e.g. trains, planes, boats)	1,400	293	1.50	0.68	4.14	3.41	94.36	95.90
Personal weapons	3	3	0	0	0	0	100	100
Poisoning	23,208	4,200	2.00	2.17	4.63	4.33	93.37	93.50
Sharp instrument	3,263	805	3.59	3.98	6.31	5.84	90.10	90.19
Unknown*	1,391	771	0.43	0.39	0.43	0.26	99.14	99.35
<b>Circumstances<sup>†</sup></b>								
Financial Problem	13,542	2,084	7.89	9.50	25.19	28.17	66.93	62.33
Eviction or Loss of Home	5,641	863	5.28	5.68	15.85	15.06	78.87	79.26
Depressed Mood	53,242	9,989	4.41	4.68	11.15	10.18	84.44	85.14
Relationship Problems with Others	2,901	655	5.31	5.04	12.55	12.67	82.14	82.29
Alcohol Problem	28,139	5,852	3.82	4.29	10.12	9.93	86.07	85.78
Suicide Note	49,581	9,107	3.45	3.73	7.51	6.24	89.03	90.03
Family Relationship Problem	12,289	2,186	3.42	4.62	10.48	8.42	86.10	86.96
Mental Health Problem	73,069	14,868	2.99	3.51	7.24	6.85	89.77	89.63
Death Friend or Family, or Other	9,589	1,834	2.89	2.73	7.55	6.87	89.56	90.40
Physical Health Problem	33,213	6,377	1.96	2.00	5.63	4.83	92.41	93.16
Argument	22,883	5,107	2.80	3.07	6.91	6.54	90.29	90.39
Suicide Attempt History	30,014	5,712	2.59	2.73	6.76	6.32	90.65	90.95

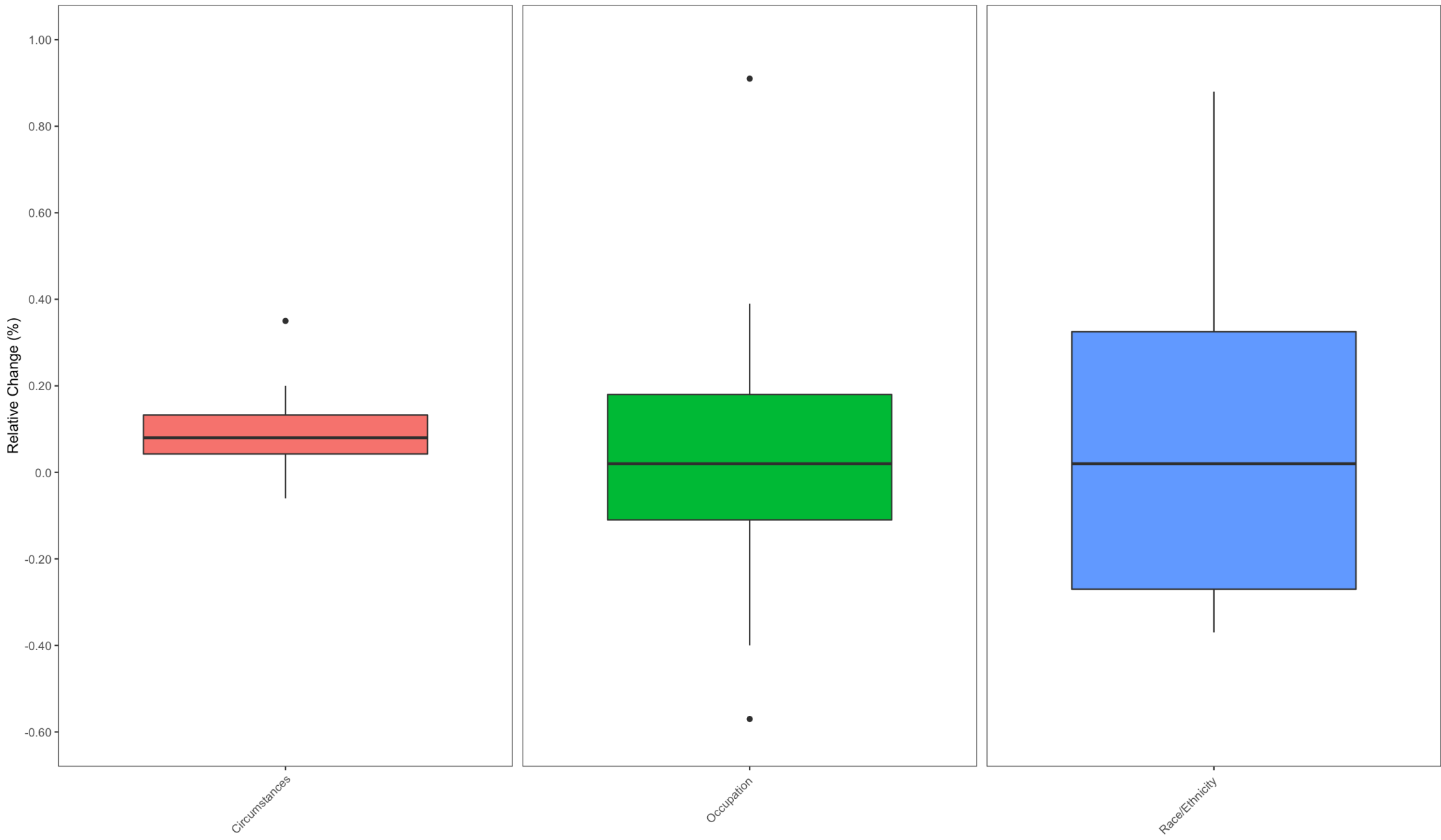
<sup>c</sup> Counts.

\* Individuals with unknown or missing demographic or geographical information were categorized as "Unknown".

<sup>†</sup> "Personal weapons" is defined by NVDRS as including fists, feet, and hands in actions such as punching, kicking or hitting.

<sup>†</sup> For the variable 'circumstance', of all the individuals that died by suicide only individuals with a positive circumstance (i.e., 'yes') were included in the calculation of the proportion of suicides that were categorized as major, minor, or not documented as a contributing factor.

Figure 1: Relative change in the proportion of suicides for which work was a major factor before and during the COVID-19 pandemic by race/ethnicity, occupation, and circumstances from 2013-2020



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Appendix:

**Table 3:** Relative change of the proportion of suicides for which work was a major, minor, or not documented as factor before and during the COVID-19 pandemic by race/ethnicity, occupation, and circumstances, from 2013-2020.

Characteristics	Total Number <sup>c</sup>		Major (%)		Relative Change (%)	Minor (%)		Relative Change (%)	Not Documented (%)		Relative Change (%)	Chi-square <sup>1</sup>
	<2019	2020	<2019	2020		<2019	2020		<2019	2020		
<b>Overall Count/Percentage</b>	163,745	36,745	3.02	3.02	0	6.25	5.26	-0.16	90.73	91.72	0.01	
<b>Race</b>												p < 0.001***
White, Non-Hispanic	135,202	29,025	3.03	3.09	0.02	6.38	5.39	-0.15	90.59	91.52	0.01	
Black or African American, Non-Hispanic	9,770	2,585	2.77	1.78	-0.36	5.63	4.60	-0.18	91.60	93.62	0.02	
Asian/Pacific Islander, non-Hispanic	4,125	1,033	3.90	3.19	-0.18	6.62	5.13	-0.23	89.48	91.67	0.02	
American Indian or Alaska Native, non-Hispanic	2,049	454	1.17	2.20	0.88	3.32	3.96	0.19	95.51	93.83	-0.02	
Two or more races, non-Hispanic	1,439	377	2.22	3.45	0.55	6.32	4.24	-0.33	91.45	92.31	0.01	
Hispanic	10,508	3,107	3.15	3.48	0.10	5.70	4.96	-0.13	91.15	91.57	0.00	
Unknown/Unspecified*	652	164	2.91	1.83	-0.37	3.99	4.88	0.22	93.10	93.29	0.00	
<b>Occupation</b>												p < 0.001***
Management	11,680	2,571	5.15	4.98	-0.03	8.23	6.81	-0.17	86.63	88.21	0.02	
Legal	1,131	218	5.04	6.42	0.27	11.14	8.26	-0.26	83.82	85.32	0.02	
Protective Service	3,965	953	4.64	5.14	0.11	7.77	5.77	-0.26	87.59	89.09	0.02	
Architecture and Engineering	3,659	792	3.36	2.02	-0.40	7.60	7.70	0.01	89.04	90.28	0.01	
Life, Physical, and Social Science	1,245	295	3.94	1.69	-0.57	8.19	5.08	-0.38	87.87	93.22	0.06	
Healthcare Practitioners and Technical	5,497	1,071	4.18	5.23	0.25	8.55	7.47	-0.13	87.27	87.30	0.00	
Business and Financial Operations	3,609	778	4.05	3.86	-0.05	9.73	7.58	-0.22	86.23	88.56	0.03	
Computer and Mathematical	3,061	647	4.05	3.71	-0.22	10.13	10.20	0.01	85.82	86.09	0.00	
Sales and Related	11,079	2,188	3.93	2.51	-0.36	7.61	6.44	-0.15	88.46	91.04	0.03	
Farming, Fishing, and Forestry	1,186	299	3.12	4.35	0.39	4.47	3.68	-0.18	92.41	91.97	0.00	
Building and Grounds Cleaning and Maintenance	4,972	1,029	3.30	3.50	0.06	5.77	3.79	-0.34	90.93	92.71	0.02	
Education, Training, and Library	3,122	724	2.56	2.49	-0.03	5.57	5.39	-0.03	91.86	92.13	0.00	
Installation, Maintenance, and Repair	8,742	2,086	3.49	3.55	0.02	6.13	4.79	-0.22	90.38	91.66	0.01	
Transportation and Material Moving	13,060	3,050	3.22	3.48	0.08	6.36	5.84	-0.08	90.42	90.69	0.00	
Arts, Design, Entertainment, Sports, and Media	3,701	767	2.86	2.22	-0.22	7.05	4.95	-0.30	90.08	92.83	0.03	
Production	11,373	2,527	2.86	2.69	-0.06	6.07	5.22	-0.14	91.07	92.09	0.01	
Office and Administrative Support	7,718	1,642	2.75	2.44	-0.11	6.27	4.75	-0.24	90.98	92.81	0.02	
Food Preparation and Serving Related	5,526	1,308	2.53	2.60	0.03	5.97	6.04	0.01	91.49	91.36	0.00	
Personal Care and Service	3,080	716	2.53	3.21	0.27	4.90	4.75	-0.03	92.56	92.04	-0.01	
Construction and Extraction	18,526	4,381	2.38	2.47	0.04	5.89	4.50	-0.24	91.73	93.04	0.01	
Community and Social Service	1,353	317	3.47	4.10	0.18	6.87	5.99	-0.13	89.65	89.91	0.00	
Healthcare Support	1,996	396	2.51	4.80	0.91	5.11	4.80	-0.06	92.38	90.40	-0.02	
Military	2,839	663	5.53	5.28	-0.05	7.22	5.73	-0.21	87.25	88.99	0.02	
Not in workforce <sup>2</sup>	16,520	3,162	0.73	0.57	-0.22	2.02	1.87	-0.07	97.26	97.56	0.00	
Unknown*	15,105	4,165	2.03	2.67	0.32	5.71	4.83	-0.15	92.26	92.51	0.00	

Circumstances <sup>†</sup>												
Financial Problem	13,542	2,084	7.89	9.50	0.20	25.19	28.17	0.12	66.93	62.33	-0.07	p < 0.001***
Eviction or Loss of Home	5,641	863	5.28	5.68	0.08	15.85	15.06	-0.05	78.87	79.26	0.00	p < 0.001***
Depressed Mood	53,242	9,989	4.41	4.68	0.06	11.15	10.18	-0.09	84.44	85.14	0.01	p < 0.001***
Relationship Problems with Others	2,901	655	5.31	5.04	-0.05	12.55	12.67	0.01	82.14	82.29	0.00	p < 0.001***
Alcohol Problem	28,139	5,852	3.82	4.29	0.12	10.12	9.93	-0.02	86.07	85.78	-0.00	p < 0.001***
Suicide Note	49,581	9,107	3.45	3.73	0.08	7.51	6.24	-0.17	89.03	90.03	0.01	p < 0.001***
Family Relationship Problem	12,289	2,186	3.42	4.62	0.35	10.48	8.42	-0.20	86.10	86.96	0.01	p < 0.001***
Mental Health Problem	73,069	14,868	2.99	3.51	0.17	7.24	6.85	-0.05	89.77	89.63	-0.00	p < 0.001***
Death Friend or Family, or Other	9,589	1,834	2.89	2.73	-0.06	7.55	6.87	-0.09	89.56	90.40	0.01	p < 0.001***
Physical Health Problem	33,213	6,377	1.96	2.00	0.02	5.63	4.83	-0.14	92.41	93.16	0.01	p < 0.001***
Argument	22,883	5,107	2.80	3.07	0.10	6.91	6.54	-0.05	90.29	90.39	0.00	p < 0.001***
Suicide Attempt History	30,014	5,712	2.59	2.73	0.05	6.76	6.32	-0.06	90.65	90.95	0.00	p < 0.001***

<sup>c</sup> Counts.

\* Individuals with unknown or missing demographic or geographical information were categorized as "Unknown".

<sup>†</sup> For the variable 'circumstance', of all the individuals that died by suicide only individuals with a positive circumstance (i.e., 'yes') were included in the calculation of the proportion of suicides that were categorized as major, minor, or not documented as a contributing factor.

<sup>1</sup> The proportions of suicides identified in each of the three 'work-related' categories before and during the COVID period were compared by race/ethnicity, occupation, and circumstances using the chi-square test for independence. The chi-square test aimed to examine the relationship between race/ethnicity, occupation, circumstances, and the distribution of suicides across the work-related categories. The test was conducted due to the categorical nature of the variables involved. A significance level of p < 0.001 was used to determine statistical significance.

<sup>2</sup> Individuals not in the workforce include students, homemakers, volunteers, or those unable to work [e.g., child, patient, inmate].