

# Violent Deaths Among Georgia Workers

## An Examination of Suicides and Homicides by Occupation, 2006–2009



Antionette Lavender, MPH,<sup>1</sup> Viani Ramirez-Irizarry, MPH,<sup>1</sup> A. Rana Bayakly, MPH,<sup>1</sup>  
Carol Koplan, MD,<sup>2</sup> J. Michael Bryan, MPH<sup>1</sup>

**Introduction:** Workers in certain occupations may be at an increased risk of a violent-related death such as homicide or suicide. The purpose of this study is to describe rates of violent deaths among Georgia workers by occupation, including cases occurring at work and outside of the workplace, and identify leading circumstances surrounding suicides and homicides for the occupations most at risk.

**Methods:** Data from the 2006–2009 Georgia Violent Death Reporting System were used. Occupational text fields were recoded into 23 major occupation categories based on the 2010 Standard Occupational Classification system. Crude rates and standardized mortality ratios for violent deaths (suicides and homicides) were calculated by occupation among Georgia workers aged  $\geq 16$  years. The leading circumstances precipitating violent deaths among the high-risk occupations were described. Analyses were conducted during 2012–2013 and 2015.

**Results:** A total of 4,616 Georgia resident workers were victims of a violent death during 2006–2009. Of these deaths, 2,888 (62.6%) were suicides and 1,728 (37.4%) were homicides. Farming, fishing, and forestry occupations had the highest rate of violent deaths at 80.5 per 100,000 workers followed by construction and extraction occupations at 65.5 per 100,000. The most common suicide circumstances among workers were having a current depressed mood, a current mental health problem, and an intimate partner problem.

**Conclusions:** Use of the Violent Death Reporting System provides a unique opportunity to explore violent deaths among workers. This analysis shows the need to ensure that workers have access to workplace and community-based suicide and violence prevention services.

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### Introduction

Violence is a serious public health problem that can lead to injury and death.<sup>1,2</sup> WHO defines a death due to violence as a death resulting from the “intentional use of physical force or power against oneself, another person, or against a group or community,” which includes homicides and suicides.<sup>2–4</sup> Nearly

2,000 people in Georgia lose their life each year as a result of violence.<sup>5</sup> Over the past 2 decades, suicide and homicide remained two of the 20 leading causes of preventable death in Georgia.<sup>5</sup>

In order for violent deaths to be prevented, the circumstances of their occurrence should be identified. Circumstances that lead to a violent death can be complex and involve an array of individual, social, community, and environmental factors<sup>3</sup> and may include the victim’s occupation. However, research on which occupations are most at risk of violent death is limited.<sup>6–9</sup> Occupations such as farming, health care, and construction have been identified as high risk for suicide.<sup>6,7,10,11</sup> Taxi drivers and cashiers have been identified as high risk for homicide.<sup>8,12,13</sup> Higher rates of both suicide and homicide have been observed among non-deployed members of the U.S. military and law enforcement officers.<sup>14,15</sup>

From the <sup>1</sup>Georgia Department of Public Health, Division of Health Protection, Epidemiology Program, Atlanta, Georgia; and <sup>2</sup>Department of Behavioral Sciences and Health Education, Rollins School of Public Health, Emory University, Atlanta, Georgia

Address correspondence to: Antionette Lavender, MPH, Georgia Department of Public Health, Division of Health Protection, 2 Peachtree Street NW, 14th Floor, Atlanta GA 30303. E-mail: antionette.lavender@dph.ga.gov.

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Violent deaths among workers affect the well-being of the victims' coworkers, family, and friends.<sup>16,17</sup> This can lead to increased absenteeism, turnover, healthcare costs, and reduced productivity.<sup>1</sup> Homicide, whether it occurs at work or outside of the workplace, damages trust, community, and the sense of security.<sup>1,18</sup> A death by suicide can have lingering psychological effects on close relatives, friends, and coworkers and may increase their own suicide risk.<sup>16</sup> Thus, violent death of a worker is not only a workplace issue but a community issue.<sup>1,8,16</sup>

Violent deaths by occupation have not been thoroughly examined in Georgia. Knowledge of the occupations at high risk for violent deaths will allow for increased targeting of intervention and prevention efforts.<sup>6–8,12,19</sup> The purpose of this article is to describe violent deaths among Georgia workers by occupation, including deaths occurring at work and outside of the workplace, and identify leading circumstances surrounding violent deaths for the occupations most at risk.

## Methods

### Data Sources

Data from the Georgia Violent Death Reporting System (GVDRS) were used to obtain numbers of violent deaths, which are defined as suicides (ICD 10 codes X60–X84, Y87.0) and homicides (ICD 10 codes X85–X99, Y00–Y09, Y87.1),<sup>4,20</sup> occurring during 2006–2009. The GVDRS is a statewide surveillance system that is a part of the National Violent Death Reporting System (NVDRS), which collects data on violent deaths from multiple sources, including death certificates; coroner and medical examiner (CME) reports; and law enforcement reports. The data are abstracted into a standardized electronic database. Information on the circumstances precipitating the death, such as a mental health problem, physical health problem, and recent job problem, are collected from the narratives of CME and law enforcement reports.<sup>2,4</sup> For this study, narrative information from CME and law enforcement reports were reviewed to gauge if the death was work-related or could be attributed to events that occurred in the work environment.

The total number of employed persons in Georgia by occupation were obtained from the 2006–2009 Bureau of Labor Statistics Current Population Survey (CPS) and were used as the denominator for rate calculations. The CPS is a monthly probability selected sample survey of about 60,000 households conducted by the U.S. Census Bureau for the Bureau of Labor Statistics. It provides national and state estimates of demographic, social, and economic characteristics of the civilian non-institutionalized population aged  $\geq 16$  years and is the primary source of labor force statistics in the nation. People on active duty in the U.S. Armed Forces are excluded from coverage.<sup>21</sup>

### Statistical Analysis

Data analysis was conducted during 2012–2013 and 2015. A total of 8,080 violent death cases were included in the 2006–2009 GVDRS database. Violent deaths in which the manner of death

was classified as undetermined, unintentional firearm, legal intervention, or terrorism were not included in analyses. Cases were also excluded if the occupation text stated unknown, not available, homemaker, unemployed, disabled, student, child/infant/toddler, or self-employed. Non-Georgia residents, individuals aged  $< 16$  years, and people in military-specific occupations (SOC code 55) were excluded because of lack of denominator data. This resulted in about 43% of cases being excluded from the analyses.

Occupations of the decedents were obtained from the three text variables in the 2006–2009 GVDRS database where occupation was recorded. When the victim's current occupation was not available, the victim's usual occupation or job in which they spent most of their time was coded. The victim's usual business/industry was used if occupation text was not available. A word search was performed on each occupation text variable using Proc SQL (SAS, version 9.3) to create a new occupation variable based on the 23 major occupation groups from the 2010 Standard Occupation Classification coding system. This coding system is the federal standard used to classify workers into occupational categories.<sup>21,22</sup> Table 1 provides examples of how the text variables were used to create the new occupation variable.

Crude mortality rates per 100,000 workers and 95% CIs were calculated to measure the overall magnitude of violent deaths by occupation compared with all Georgia resident workers aged  $\geq 16$  years. Standardized mortality ratios (SMRs) were used to compare the risk of violent death for each occupation group to that of a standard population. The 2006–2009 mid-year Georgia resident population aged  $\geq 16$  years from the U.S. Census Bureau State Population Estimates was used as the standard population. The age and sex distribution of employed persons by occupation was obtained from the 2006–2009 CPS. Ninety-five percent CIs were calculated to determine statistical significance of the SMR. All frequency analyses were conducted using SAS, version 9.3.

## Results

There were 4,616 Georgia resident workers aged  $\geq 16$  years who experienced a violent death during 2006–2009. Of these deaths, 2,888 (62.6%) were suicides and 1,728 (37.4%) were homicides. The crude rate of violent deaths among all Georgia resident workers aged  $\geq 16$  years was 23.9 per 100,000. Table 2 shows the occupation-specific rates of violent deaths among Georgia resident workers aged  $\geq 16$  years. Rates of violent deaths were highest among individuals employed in farming, fishing, and forestry occupations at 80.5 per 100,000 workers and among those employed in construction and extraction (e.g., oil and gas drilling, quarrying, mining) occupations at 65.5 per 100,000 workers.

### Suicides

The crude rate of suicide among all Georgia workers was 14.9 per 100,000. Suicide rates were highest for individuals in farming, fishing, and forestry occupations (50.7 per 100,000) and construction and extraction occupations (36.6 per 100,000). SMRs were used to determine

**Table 1.** Example Coding of GVDRS Occupational Text Fields

Incident	CME_Occup <sup>a</sup>	DC_UsOcTx <sup>b</sup>	DC_IndTxt <sup>c</sup>	SOC: Occupation coded
1	Machine Operator at Bakery	Machine Operator	Bakery	51: Production Occupations
2	Unknown	Medical Specialist	National Guard	29: Healthcare Practitioners and Technical Occupations
3	Unknown	Merchant Marine	Armed Forces	55: Military Specific Occupations
4	Unknown	Self-Employed	Brick Mason	47: Construction and Extraction
5	Unknown	Self-Employed	Self-Employed	9: Unknown <sup>d</sup>

<sup>a</sup>CME\_Occup: victim's current occupation, obtained from coroner/medical examiner report.

<sup>b</sup>DC\_UsOcTx: victim's usual occupation text, obtained from death certificate.

<sup>c</sup>DC\_IndTxt: victim's usual business/industry text, obtained from death certificate.

<sup>d</sup>Occupations coded '9' for unknown were excluded from analyses.

GVDRS, Georgia Violent Death Reporting System; SOC, Standard Occupation Classification.

potential differences in the risk of suicide by occupation (Table 3). Observed numbers of suicides were significantly higher than expected for six occupation categories: farming, fishing, and forestry (SMR=2.9, 95% CI=2.1, 3.7); construction and extraction (SMR=1.8, 95% CI=1.7, 2.0); arts, design, entertainment, sports, and media (SMR=1.7, 95% CI=1.3, 2.1); production (SMR=1.5, 95% CI=1.3, 1.7); installation, maintenance, and repair (SMR=1.5, 95% CI=1.3, 1.6); and healthcare practitioners and technicians (SMR=1.3, 95% CI=1.1, 1.6). Circumstance data were available for about 67% of the suicide cases (Appendix Table 1). Among cases with known circumstances, the most common suicide circumstances were having a current depressed mood (31.9%); a current mental health problem (29.4%); and/or an intimate partner problem (24.0%). Suicide circumstances varied among the high-risk occupations (Table 4). Use of a firearm (66.9%) was the most common weapon type used for suicides, followed by hanging, strangulation, or suffocation (17.3%), and poisoning (11.5%). This pattern was consistent among all occupations at high risk for suicide, except for healthcare practitioners and technical occupations, who were more likely to die by poisoning (29.0%).

## Homicides

The crude rate of homicide among all Georgia workers was 8.9 per 100,000. Farming, fishing, and forestry occupations (29.8 per 100,000) and construction and extraction occupations (28.9 per 100,000) also had the highest rates of homicide. The observed numbers of homicide were significantly higher than expected for five occupation categories: farming, fishing, and forestry (SMR=2.2, 95% CI=1.4, 3.0); construction and extraction (SMR=1.8, 95% CI=1.6, 2.0); food preparation and serving (SMR=1.7, 95% CI=1.4, 1.9); building and grounds cleaning and maintenance (SMR=1.5, 95% CI=1.2, 1.8); and production (SMR=1.3, 95% CI=1.1,

1.4). Circumstance data were available for about 46% of the homicides cases. Among cases with known circumstances, the most common homicide circumstances were having an argument, abuse, or conflict over something other than money, property, or drugs (33.3%); being precipitated by another crime (26.4%); and experiencing intimate partner violence (20.2%). The majority of homicides were due to use of a firearm (75.4%), followed by use of a sharp object (11.1%) or a blunt instrument (4.9%).

## At-Work Cases

A total of 110 violent death cases occurred while the decedent was at work. Eighty-five of these at-work cases were homicides and 25 were suicides. More than half (56%) of the homicides and 36% of the suicides that occurred at work were considered to be work-related, as they could be attributed to events that occurred in the work environment. The majority of at-work homicides were among male employees in sales and related occupations (17%); transportation and material-moving occupations (16%); management occupations (12%); and food preparation and serving occupations (11%). The majority of at-work suicides were among male employees in sales and related occupations (20%); protective service occupations (15%); and construction and extraction occupations (15%). Table 4 shows the leading suicide and homicide circumstances of at-work cases. It should also be noted that an exploratory review of the first 1,000 records in the 2006–2009 GVDRS database found 36 suicides that were considered work-related but did not occur at work.

## Discussion

This study is unique because it examined the risk of both suicide and homicide among Georgia workers by

**Table 2.** Crude Rates of Violent Deaths Among Workers Aged  $\geq 16$  Years by Occupation, Georgia, 2006–2009

Occupation (SOC code)	Employed Georgia population age $\geq 16$ years, %	Total violent deaths		Suicides		Homicides	
		<i>n</i> (%)	Crude rate per 100,000 (95% CI)	<i>n</i>	Crude rate per 100,000 (95% CI)	<i>n</i>	Crude rate per 100,000 (95% CI)
Management (11)	10.4	349 (7.6)	17.3 (15.5, 19.1)	261	12.9 (11.4, 14.5)	88	4.4 (3.5, 5.3)
Business and financial operations (13)	4.5	141 (3.1)	16.1 (13.5, 18.8)	110	12.6 (10.2, 14.9)	31	3.5 (2.3, 4.8)
Computer and mathematics (15)	2.8	71 (1.5)	13.2 (10.1, 16.2)	66	12.2 (9.3, 15.2)	< 10	~
Architecture and engineering (17)	1.3	71 (1.5)	27.8 (21.3, 34.2)	61	<b>23.9 (17.9, 29.9)</b>	10	3.9 (1.5, 6.3)
Life, physical, and social sciences (19)	0.6	33 (0.7)	26.7 (17.6, 35.8)	25	20.2 (12.3, 28.2)	< 10	~
Community and social services (21)	1.4	35 (0.8)	12.6 (8.4, 16.8)	23	8.3 (4.9, 11.7)	12	4.3 (1.9, 6.8)
Legal occupations (23)	1.0	38 (0.8)	19.5 (13.3, 25.7)	34	17.5 (11.6, 23.3)	< 10	~
Education, training, and library (25)	6.1	101 (2.2)	8.5 (6.9, 10.2)	77	6.5 (5.1, 8.0)	24	2.0 (1.2, 2.8)
Arts, design, entertainment, sports, and media (27)	1.6	111 (2.4)	<b>36.7 (29.9, 43.5)</b>	69	<b>22.8 (17.4, 28.2)</b>	42	<b>13.9 (9.7, 18.1)</b>
Healthcare practitioners and technical occupations (29)	4.6	147 (3.2)	16.4 (13.8, 19.1)	115	12.9 (10.5, 15.2)	32	3.6 (2.3, 4.8)
Healthcare support (31)	1.5	50 (1.1)	17.3 (12.5, 22.1)	29	10.0 (6.4, 13.7)	21	7.3 (4.2, 10.4)
Protective services (33)	2.3	117 (2.5)	26.6 (21.8, 31.5)	86	19.6 (15.4, 23.7)	31	7.1 (4.6, 9.5)
Food preparation and serving (35)	5.1	293 (6.3)	<b>29.8 (26.4, 33.2)</b>	116	11.8 (9.6, 13.9)	177	<b>18.0 (15.3, 20.6)</b>
Building and grounds cleaning and maintenance (37)	3.9	218 (4.7)	<b>29.3 (25.4, 33.1)</b>	97	13.0 (10.4, 15.6)	121	<b>16.2 (13.3, 19.1)</b>
Personal care and service (39)	2.9	58 (1.3)	10.5 (7.8, 13.2)	30	5.4 (3.5, 7.4)	28	5.1 (3.2, 7.0)
Sales and related occupations (41)	12.2	386 (8.4)	16.3 (14.7, 17.9)	251	10.6 (9.3, 11.9)	135	5.7 (4.7, 6.7)
Office and administrative support (43)	13.1	247 (5.4)	9.7 (8.5, 11.0)	142	5.6 (4.7, 6.5)	105	4.1 (3.3, 4.9)
Farming, fishing, and forestry (45)	0.5	81 (1.8)	<b>80.5 (63.0, 98.0)</b>	51	<b>50.7 (36.8, 64.6)</b>	30	<b>29.8 (19.2, 40.5)</b>
Construction and extraction (47)	6.8	865 (18.7)	<b>65.5 (61.1, 69.8)</b>	483	<b>36.6 (33.3, 39.8)</b>	382	<b>28.9 (26.0, 31.8)</b>
Installation, maintenance, and repair (49)	4.1	340 (7.4)	<b>42.5 (38.0, 47.0)</b>	244	<b>30.5 (26.7, 34.3)</b>	96	<b>12.0 (9.6, 14.4)</b>
Production occupations (51)	6.2	457 (9.9)	<b>37.8 (34.3, 41.3)</b>	289	<b>23.9 (21.2, 26.7)</b>	168	<b>13.9 (11.8, 16.0)</b>
Transportation and material moving (53)	6.9	407 (8.8)	<b>30.4 (27.4, 33.3)</b>	229	17.1 (14.9, 19.3)	178	<b>13.3 (11.3, 15.2)</b>
Total	100	4,616 (100)	23.9 (23.2, 24.6)	2,888	14.9 (14.4, 15.5)	1,728	8.9 (8.6, 9.4)

Note: Boldface indicates rates significantly higher (significance level=0.05) than the rate among all Georgia workers aged  $\geq 16$  years. Rates not calculated for fewer than 10 cases. Persons in military-specific occupations (SOC code 55) excluded from analyses.  
 SOC, Standard Occupation Classification.

**Table 3.** Standardized Mortality Ratios (SMR) of Suicides and Homicides by Occupation, Georgia, 2006-2009

Occupation (SOC code)	Suicides, SMR (95% CI)	Homicides, SMR (95% CI)
Management (11)	0.8 (0.7, 0.9)	0.5 (0.4, 0.6)
Business and financial operations (13)	0.9 (0.8, 1.1)	0.4 (0.3, 0.6)
Computer and mathematics (15)	0.7 (0.5, 0.9)	0.1 (0.0, 0.1)
Architecture and engineering (17)	1.2 (0.9, 1.5)	0.3 (0.1, 0.5)
Life, physical, and social sciences (19)	1.4 (0.8, 1.9)	0.6 (0.2, 1.1)
Community and social services (21)	0.6 (0.4, 0.8)	0.6 (0.3, 1.0)
Legal occupations (23)	1.2 (0.8, 1.6)	0.3 (0.0, 0.5)
Education, training, and library (25)	0.7 (0.5, 0.8)	0.3 (0.2, 0.5)
Arts, design, entertainment, sports, and media (27)	<b>1.7 (1.3, 2.1)</b>	1.4 (1.0, 1.8)
Healthcare practitioners and technical occupations (29)	<b>1.3 (1.1, 1.6)</b>	0.6 (0.4, 0.8)
Healthcare support (31)	1.5 (1.0, 2.1)	1.5 (0.9, 2.2)
Protective services (33)	1.1 (0.9, 1.4)	0.6 (0.4, 0.8)
Food preparation and serving (35)	1.2 (1.0, 1.4)	<b>1.7 (1.4, 1.9)</b>
Building and grounds cleaning and maintenance (37)	0.9 (0.7, 1.1)	<b>1.5 (1.2, 1.8)</b>
Personal care and service (39)	0.6 (0.4, 0.9)	0.8 (0.5, 1.1)
Sales and related occupations (41)	0.8 (0.7, 0.9)	0.6 (0.5, 0.7)
Office and administrative support (43)	0.6 (0.5, 0.7)	0.6 (0.5, 0.8)
Farming, fishing, and forestry (45)	<b>2.9 (2.1, 3.7)</b>	<b>2.2 (1.4, 3.0)</b>
Construction and extraction (47)	<b>1.8 (1.7, 2.0)</b>	<b>1.8 (1.6, 2.0)</b>
Installation, maintenance, and repair (49)	<b>1.5 (1.3, 1.6)</b>	0.9 (0.7, 1.0)
Production occupations (51)	<b>1.5 (1.3, 1.7)</b>	<b>1.3 (1.1, 1.4)</b>
Transportation and material moving (53)	0.9 (0.8, 1.0)	1.0 (0.9, 1.2)

Note: Boldface indicates standardized mortality ratios significantly higher (significance level=0.05) than expected.

Persons in military-specific occupations (SOC code 55) excluded from analyses.

SOC, Standard Occupation Classification.

occupation as well as leading circumstances surrounding violent death among high-risk occupations. Most of the violence research literature by occupation focuses only on cases that occur at the workplace,<sup>6,8,12,13</sup> whereas this study examines the risk of violent death by occupation among cases occurring at work and outside of the workplace. By examining the risk of violent deaths by occupation and circumstances, prevention efforts can be better targeted in workplaces and communities. Although the majority of Georgia workers are employed in office and administrative support occupations, sales and related occupations, and management occupations,<sup>23</sup> this study found workers in farming, fishing, and forestry occupations and construction and extraction occupations were most at risk of being victims of suicide and homicide.

This study also observed that Georgia workers in arts, design, entertainment, sports, and media occupations; installation, maintenance, and repair occupations; production occupations; and healthcare practitioner and technical occupations were most at risk of being victims of suicide. High rates of suicide among workers in farming, fishing, and forestry<sup>6,7,11</sup>; construction and extraction<sup>6,24</sup>; and healthcare practitioners and technical occupations<sup>7</sup> have been noted in other studies. Use of firearms was by far the most common lethal means of suicide for each occupation. Increased access to lethal means in certain occupations may play a role in having an increased risk of suicide.<sup>6–8,14,15,25,26</sup> For example, suicide by use of firearm was highest among Georgia workers in farming, fishing, and forestry occupations

**Table 4.** Leading Circumstances and Lethal Means by High Risk in Occupations and At-Work Cases, Georgia, 2006–2009

	Suicide circumstances	Homicide circumstances	Suicide lethal means	Homicide lethal means
All occupations overall	<ul style="list-style-type: none"> <li>● Current depressed mood=31.9%</li> <li>● Current mental health problem=29.4%</li> <li>● Intimate partner problem=24.0%</li> </ul>	<ul style="list-style-type: none"> <li>● Other argument, abuse, conflict=33.3%</li> <li>● Precipitated by another crime=26.4%</li> <li>● Intimate partner violence=20.2%</li> </ul>	<ul style="list-style-type: none"> <li>● Firearm=66.9%</li> <li>● Hanging, strangulation, suffocation=17.3%</li> <li>● Poisoning=11.5%</li> </ul>	<ul style="list-style-type: none"> <li>● Firearm=75.4%</li> <li>● Sharp instrument=11.1%</li> <li>● Blunt instrument=4.9%</li> </ul>
High risk occupations (SOC code)				
Arts, design, entertainment, sports, and media (27) <sup>a</sup>	<ul style="list-style-type: none"> <li>● Disclosed intent to die by suicide=37.0%</li> <li>● Current mental health problem=28.3%</li> <li>● Current depressed mood=26.1%</li> </ul>	<ul style="list-style-type: none"> <li>● Other argument, abuse, conflict=38.5%</li> <li>● Precipitated by another crime=30.8%</li> <li>● Drug involvement=23.1%</li> </ul>	<ul style="list-style-type: none"> <li>● Firearm=62.3%</li> <li>● Hanging, strangulation, suffocation=20.3%</li> <li>● Poisoning=14.5%</li> </ul>	<ul style="list-style-type: none"> <li>● Firearm=85.7%</li> <li>● Sharp instrument=4.8%</li> <li>● Personal weapons=4.8%</li> </ul>
Healthcare practitioners and technical occupations (29) <sup>a</sup>	<ul style="list-style-type: none"> <li>● Current depressed mood=34.0%</li> <li>● Current mental health problem=33.0%</li> <li>● Left a suicide note=31.9%</li> </ul>	<ul style="list-style-type: none"> <li>● Intimate partner violence=42.9%</li> <li>● Precipitated by another crime=28.6%</li> <li>● Intimate partner problem=14.3%</li> </ul>	<ul style="list-style-type: none"> <li>● Firearm=57.0%</li> <li>● Poisoning=29.0%</li> <li>● Hanging, strangulation, suffocation=8.8%</li> </ul>	<ul style="list-style-type: none"> <li>● Firearm=46.9%</li> <li>● Sharp instrument=28.1%</li> <li>● Blunt instrument=9.4%</li> </ul>
Food preparation and serving (35) <sup>b</sup>	<ul style="list-style-type: none"> <li>● Current depressed mood=28.9%</li> <li>● Crisis during previous 2 weeks=27.6%</li> <li>● History of treatment for mental illness; Left a suicide note=21.1%</li> </ul>	<ul style="list-style-type: none"> <li>● Precipitated by another crime=32.5%</li> <li>● Other argument, abuse, conflict=31.3%</li> <li>● Intimate partner violence=16.3%</li> </ul>	<ul style="list-style-type: none"> <li>● Firearm=43.5%</li> <li>● Hanging, strangulation, suffocation=37.4%</li> <li>● Poisoning=14.8%</li> </ul>	<ul style="list-style-type: none"> <li>● Firearm=77.8%</li> <li>● Sharp instrument=9.7%</li> <li>● Hanging, strangulation, suffocation=3.4%</li> </ul>
Building and grounds cleaning and maintenance (37) <sup>b</sup>	<ul style="list-style-type: none"> <li>● Disclosed intent to die by suicide=28.1%</li> <li>● History of mental illness treatment; Current mental health problem=25.0%</li> <li>● Intimate partner problem=23.4%</li> </ul>	<ul style="list-style-type: none"> <li>● Other argument, abuse, conflict=38.5%</li> <li>● Precipitated by another crime=28.8%</li> <li>● Drug involvement=17.3%</li> </ul>	<ul style="list-style-type: none"> <li>● Firearm=59.4%</li> <li>● Hanging, strangulation, suffocation=25.0%</li> <li>● Poisoning=12.5%</li> </ul>	<ul style="list-style-type: none"> <li>● Firearm=68.9%</li> <li>● Sharp instrument=16.8%</li> <li>● Blunt instrument=6.7%</li> </ul>
Farming, fishing, and forestry (45) <sup>a,b</sup>	<ul style="list-style-type: none"> <li>● Disclosed intent to another person=50.0%</li> <li>● Current depressed mood=36.3%</li> <li>● Current mental health problem=31.8%</li> </ul>	<ul style="list-style-type: none"> <li>● Other argument, abuse, conflict=35.7%</li> <li>● Precipitated by another crime=28.6%</li> <li>● Jealousy (“lovers’ triangle”)=14.3%</li> </ul>	<ul style="list-style-type: none"> <li>● Firearm=80.4%</li> <li>● Hanging, strangulation, suffocation=13.7%</li> <li>● Poisoning=3.9%</li> </ul>	<ul style="list-style-type: none"> <li>● Firearm=66.7%</li> <li>● Sharp instrument=20.0%</li> <li>● Blunt instrument; Personal weapons=3.3%</li> </ul>

(continued on next page)



**Table 4.** Leading Circumstances and Lethal Means by High Risk in Occupations and At-Work Cases, Georgia, 2006–2009 (*continued*)

	<b>Suicide circumstances</b>	<b>Homicide circumstances</b>	<b>Suicide lethal means</b>	<b>Homicide lethal means</b>
Construction and extraction (47) <sup>a,b</sup>	<ul style="list-style-type: none"> <li>● Intimate partner problem=29.2%</li> <li>● Current depressed mood=28.2%</li> <li>● Crisis during previous two weeks=26.9%</li> </ul>	<ul style="list-style-type: none"> <li>● Other argument, abuse, conflict=46.6%</li> <li>● Precipitated by another crime=27.2%</li> <li>● Drug involvement=11.0%</li> </ul>	<ul style="list-style-type: none"> <li>● Firearm=60.9%</li> <li>● Hanging, strangulation, suffocation=25.7%</li> <li>● Poisoning=3.9%</li> </ul>	<ul style="list-style-type: none"> <li>● Firearm=76.4%</li> <li>● Sharp instrument=10.5%</li> <li>● Blunt instrument=5.3%</li> </ul>
Installation, maintenance, and repair (49) <sup>a</sup>	<ul style="list-style-type: none"> <li>● Current depressed mood; disclosed intent to die by suicide=30.0%</li> <li>● Intimate partner problem=27.5%</li> <li>● Current mental health problem=26.9%</li> </ul>	<ul style="list-style-type: none"> <li>● Precipitated by another crime=41.7%</li> <li>● Other argument, abuse, conflict=36.1%</li> <li>● Self-defense or defending others; drug involvement=11.1%</li> </ul>	<ul style="list-style-type: none"> <li>● Firearm=74.8%</li> <li>● Hanging, strangulation, suffocation=15.7%</li> <li>● Poisoning=6.2%</li> </ul>	<ul style="list-style-type: none"> <li>● Firearm=79.0%</li> <li>● Sharp instrument=8.4%</li> <li>● Blunt instrument=5.3%</li> </ul>
Production occupations (51) <sup>a,b</sup>	<ul style="list-style-type: none"> <li>● Current mental health problem=32.4%</li> <li>● Intimate partner problem=28.9%</li> <li>● Disclosed to die by suicide=25.4%</li> </ul>	<ul style="list-style-type: none"> <li>● Other argument, abuse, conflict=40.9%</li> <li>● Intimate partner violence=21.2%</li> <li>● Precipitated by another crime=16.7%</li> </ul>	<ul style="list-style-type: none"> <li>● Firearm=74.7%</li> <li>● Hanging, strangulation, suffocation=14.8%</li> <li>● Poisoning=8.3%</li> </ul>	<ul style="list-style-type: none"> <li>● Firearm=76.8%</li> <li>● Sharp instrument=9.5%</li> <li>● Blunt instrument; hanging, strangulation, suffocation=3.6%</li> </ul>
At-work cases	<ul style="list-style-type: none"> <li>● Current depressed mood; crisis during previous 2 weeks=26.1%</li> <li>● Job problem; financial problem; physical health problem=21.7%</li> <li>● Other relationship problem; current mental health problem; intimate partner problem=17.4%</li> </ul>	<ul style="list-style-type: none"> <li>● Precipitated by another crime=64.7%</li> <li>● Other argument, abuse, conflict=14.7%</li> <li>● Intimate partner violence=11.8%</li> </ul>	<ul style="list-style-type: none"> <li>● Firearm=68.0%</li> <li>● Hanging, strangulation, suffocation=16.0%</li> <li>● Poisoning=8.0%</li> </ul>	<ul style="list-style-type: none"> <li>● Firearm=83.3%</li> <li>● Sharp instrument=8.3%</li> <li>● Blunt instrument; hanging, strangulation, suffocation=3.6%</li> </ul>

Note: Circumstance data available for 67% of the suicide cases and 46% of the homicide cases. Circumstances and lethal means are not mutually exclusive.

<sup>a</sup>Occupations with high risk for suicide.

<sup>b</sup>Occupations with high risk for homicide.

whereas suicide by poisoning was highest among health-care practitioners and technicians.

Mental health problems or current depressed mood were among the leading circumstances of suicide for Georgia farming, fishing, and forestry workers and construction and extraction workers. In addition to the stigma associated with mental health problems and help-seeking, having access to mental health services may be a challenge for workers in these occupations. For instance, farmers in rural areas may be isolated<sup>26</sup> and not have access to mental health providers, and it can be difficult for them to take time away from the farm.<sup>6,7,27</sup> Increased access to mental health and suicide preventive intervention services are needed for workers.<sup>1,6,7,18,28,29</sup> Workplace suicide prevention programs can impact communities and change social norms as participants are likely to share their new knowledge with coworkers, family, and friends.<sup>7,29,30</sup> Because nearly half of suicidal individuals make contact with a primary care provider within a month preceding the suicide, more-available and less-stigmatized intervention services might be available through primary care physicians and other health workers who can be trained to recognize risks for suicide and routinely screen for depression.<sup>31</sup>

Georgia workers in food preparation and serving occupations, building and grounds cleaning and maintenance occupations, and production occupations were also most at risk of being victims of homicide. Based on the literature, risk factors related to these occupations include working alone or in isolated areas, working where alcohol is served, handling money and valuables, working late at night, and working in public places where there is limited access control and security.<sup>8,32,33</sup> The majority of at-work homicides in this study were related to other crimes such as robbery or suspected drug dealing. Intimate partner violence was the third-leading homicide circumstance among Georgia workers, regardless of whether the incident occurred at the workplace. Workers would benefit from trainings in predicting and responding to conflict and understanding and disclosing intimate-partner violence.<sup>33,34</sup> The Occupational Safety and Health Administration recommends employers have a plan in place for appropriate, early intervention.<sup>32</sup> This includes adopting a workplace violence policy, implementing violence prevention programs, and providing regular training in preventive measures for all current and new employees, supervisors, and managers.<sup>1,6–8,18,32</sup>

The workplace may not always be the stressor that leads to an incident of violent death.<sup>6,8,35</sup> In this study, about half of violent deaths occurring at the workplace were not due to work-related circumstances but were related to other issues such as depression or intimate partner violence. Conversely, a violent death may be

related to the job but occur elsewhere. For these reasons, employers should consider offering broad trainings on suicide signs and symptoms, intimate partner violence, and warning signs of depression and substance abuse.

Similar to NVDRS, the Census of Fatal Occupational Injuries uses multiple data sources, including death certificates, news media, Occupational Safety and Health Administration reports, law enforcement reports, and CME reports, to obtain more complete and accurate counts of fatalities.<sup>6,36</sup> The Census of Fatal Occupational Injuries provides the official count of work-related fatalities; however, it only captures cases that occur at the workplace.<sup>36</sup> NVDRS can be a valuable resource for further exploring work-relatedness of homicide and suicide cases regardless of location. Through further exploration of narratives available through the GVDRS, the authors were able to observe cases (36 of the first 1,000) occurring outside of the workplace that were work-related.

### Limitations

There were some limitations to this study. Homicides and suicides are often under-reported on death certificates<sup>6,33</sup>; however, CME and law enforcement reports were reviewed to confirm the manner of death. Variations in abstractor coding of violent death cases may exist and some of the reports obtained from CMEs or law enforcement were not comprehensive; thus, circumstance information was missing for some records. The effect of this missing information on the proportion of circumstances is unknown. In addition, determining work-relatedness or location of a violent death incident can be difficult when the work relationship is not clearly described in the reports.<sup>6,8</sup> The CPS data used for the denominators in rate calculations are subject to sampling and non-sampling error.<sup>21</sup> Because the occupation-specific mortality rates were unadjusted in this study, they may be affected by potential confounding factors such as age, sex, race, education, or income. However, SMRs were used to compare the violent death mortality risk of each occupation group with the risk of a standard population. As the population distribution by occupation differs by state, other state violent deaths by occupation may differ from the observations of this study. Lastly, this study does not provide information on suicide and homicide attempts or ideations, nor does it provide evidence for what causes violent deaths by occupation.

### Conclusions

Use of NVDRS provides a unique opportunity to analyze suicides and homicides regardless of location and distinguish at-work incidents from work-related incidents. Findings of the most at-risk occupations and



circumstances for suicides and homicides, as observed in this study, can be used to more effectively target preventive intervention resources. This can be accomplished through a broad collaborative approach that includes providing suicide and violence prevention trainings at workplaces as well as using community-based resources and organizations that workers have interactions with outside of the workplace.<sup>1,18,30</sup> Such an approach could involve several entities in the community, including existing suicide prevention action networks and violence prevention task forces, businesses, social services, healthcare providers, schools, faith organizations, industry-specific associations, law enforcement, and government.<sup>1,18</sup> These entities can all play a role in identifying, educating, referring, or counseling workers who are at risk.

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## Appendix

### Supplementary data

Supplementary data associated with this article can be found at <http://dx.doi.org/10.1016/j.amepre.2016.07.025>.