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Occupation and Suicide: Colorado, 2004–2006

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Background *Occupation has been identified as a risk factor for suicide. Changes in work environments over time suggest occupations at high risk of suicide may also change. Therefore, periodic examination of suicide by occupation is warranted. The purpose of this article is to describe suicide rates by occupation, sex, and means used in Colorado for the period 2004–2006.*

Methods *To provide information useful in designing suicide prevention programs, the methods used in suicide across occupational groups also are examined. Data from the Colorado Violent Death Reporting System (COVDRS) were obtained for suicides that occurred between 2004 and 2006. Denominators to calculate rates by age, sex, and race used are from the 2000 US Census of the Population data.*

Results *Men had higher suicide rates than women in all occupation categories except computers and mathematics. Among men, those in farming, fishing, and forestry (475.6 per 100,000) had the highest age-adjusted suicide rates. Among women, workers with the highest suicide rates were in construction and extraction (134.3 per 100,000). The examination of lethal means showed that workers in farming, fishing, and forestry had higher rates of suicide by firearms (50.18 per 100,000) compared with other workers. Healthcare practitioners and technicians had the highest rate of suicide by poisoning (14.25 per 100,000). Workers involved in construction and extraction (26.43 per 100,000) had higher rates of suicide by hanging, suffocation, or strangling.*

Conclusions *Significant differences in means of suicide were seen by occupation, which could guide future suicide prevention interventions that may decrease work-related suicide risks.* Am. J. Ind. Med. 56:1290–1295, 2013. © *2013 Wiley Periodicals, Inc.*

KEY WORDS: suicide rates; occupation; high risk

INTRODUCTION

Suicide is a complex and troubling public health concern that is currently the tenth leading cause of death in the United States [Centers for Disease Control and Prevention, 2012]. The age-adjusted suicide rate in Colorado in 2009 was 18.1 per 100,000 [Centers for Disease Control and Prevention, 2012], making it the state with the 6th highest rate of suicide in the United States [American Foundation for Suicide Prevention, 2012]. Understanding the epidemiologic patterns of suicide is important for both clinical care and public health interventions as early recognition and treatment of at-risk individuals and communities may successfully prevent suicide [U.S. Department of Health and Human Services, 2001].

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Suicide may be a hidden occupational risk because suicide is not defined as an occupation-related death unless the worker chose to end his or her life at the place of employment [Chen and Stallones, 2011; Pegula, 2004]. Only 3.5% of all work-related injury deaths were attributed to suicide in the Bureau of Labor Statistics, Census of Fatal Occupational Injuries [Pegula, 2004]. However, many have reported that suicidal behaviors may be affected by occupation [Boxer et al., 1995; Yang and Lester, 1995; Kposowa, 1999; Stack, 2001; van Wijngaarden, 2003; Agerbo et al., 2007; Gallagher et al., 2008]. Approximately 75% of suicides in Colorado occurred in a house or apartment, followed by natural areas, streets or highways, and motor vehicles [Chen and Stallones, 2011], so occupation-related suicides that occur in these settings outside of the workplace may not be identified.

It is clear that examination of occupation as it relates to suicide is worthy of attention. The purpose of this article is to describe suicide rates by occupation, age, and sex in Colorado for the period 2004–2006. The methods used in suicide across occupational groups also are examined to provide information that may be useful in designing and targeting suicide prevention programs.

METHODS

Data from the Colorado Violent Death Reporting System (COVDRS) were obtained for suicides (ICD-10 codes X60–X84, U03, Y87.0) which occurred between 2004 and 2006. The COVDRS is part of the National Violent Death Reporting System (NVDRS). NVDRS is a state based surveillance system that is operating in 18 states and links information from multiple sources including death certificates, police reports, coroners, crime laboratory investigators, and medical examiners [Centers for Disease Control and Prevention, 2012]. Occupation in the COVDRS is reported in text; therefore hand coding was done from the text files based on the 2000 Standard Occupation Classification (SOC) coding system [Bureau of Labor Statistics, 2000]. Five students were involved in the coding of the deaths. Direct matches were identified based on the user manual. If the narrative description did not directly match the occupations listed, the match was classified as an indirect match (Fig. 1). If it was not possible to classify an occupation, the case was not assigned a SOC code. Of the 2,352 suicide deaths, 1,955 were coded as a direct match, 393 were coded as an indirect match and 4 were not coded to any occupation. SOC codes are not available for homemakers, students, and inmates, so separate codes were created for individuals identified in those categories. To assess internal validity and reliability of coding, cases with the same or similar narrative occupations were compared across raters to determine if the same occupation codes had been assigned.

Denominators to calculate rates by age, sex, and race were obtained directly from the Office of the Colorado State

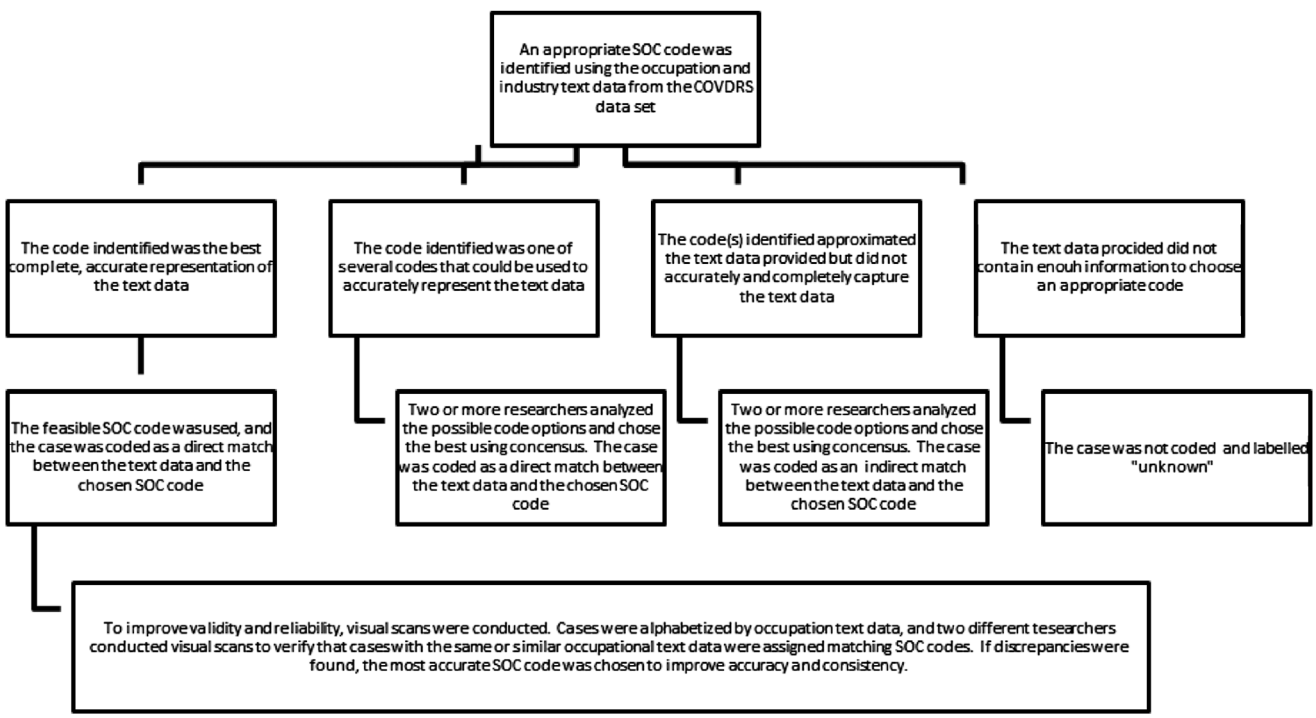

FIGURE 1. Decision tree for coding of occupational data.

Demographer. The denominators are from the 2000 US Census of the Population data. Because information collected on the census includes occupation only for individuals who were 16 years or older, analyses in this study were restricted to individuals aged 16 or older. No denominators were available for military, homemakers, students, and inmates so those groups were not included in the analysis.

Average annual age adjusted rates were calculated separately for men and women and included the white population only due to the small number of suicide deaths in other race/ethnic groups and the low number of suicide deaths in other race/ethnic groups in Colorado (less than 6% of all suicide deaths between 2004 and 2006). The United States 2000 population was used as the standard population for direct adjustment of the rates for men and women.

Crude rates were computed by occupation and sex for the means used. Denominators for the rates were those obtained from the Office of the Colorado State Demographer described above.

RESULTS

Table I contains the distribution of suicides by occupation. Workers with the highest number of suicides were in management (n = 164), sales and related occupations (n = 139), and in construction and extraction (n = 360).

Table II contains suicide age-adjusted rates for white men and women in Colorado. Overall men had higher suicide rates than women in all occupation categories except computers and mathematics. Among women, workers with the highest age-adjusted suicide rates were in construction and extraction (134.3 per 100,000), computers and mathematics (112.7 per 100,000), protective services (89.7 per 100,000), and healthcare practitioners and technicians (43.7 per 100,000). Among men, those in farming, fishing, and forestry (475.6 per 100,000), production (436.7 per 100,000), architecture and engineering (248.2 per 100,000), and healthcare practitioners and technicians (424.1 per 100,000) had the highest age-adjusted suicide rates.

Table III contains average annual suicide rates per 100,000 comparing lethal means of suicide by occupation. Suicide rates are only shown for firearms, hanging, and poisoning because these three means accounted for 50.2%, 23.1%, and 22.0%, respectively, of the suicides in Colorado.

Workers in architecture and engineering (34.46 per 100,000), farming, fishing, forestry (50.18 per 100,000), construction and extraction (46.82 per 100,000), installation, maintenance and repair (32.68 per 100,000), and protective services (28.73 per 100,000) had higher rates of suicide by firearm compared with other workers. Those workers with the lowest suicide rate by firearms were in education, training and library occupations (5.24 per 100,000).

TABLE I. Number and Percent of Suicides by Occupation and SOC Code, Colorado Violent Death Reporting System, 2004–2006

Occupation	SOC code	Number	Percent
Unknown		4	0.2
Management	11	164	7.0
Business and financial operations	13	57	2.4
Computers and mathematics	15	88	3.7
Architecture and engineering	17	95	4.0
Life, physical, and social sciences	19	15	0.6
Community and social services	21	24	1.0
Legal	23	16	0.7
Education, training, and library	25	54	2.3
Arts, design, entertainment, sports, and media	27	52	2.2
Healthcare practitioners and technicians	29	88	3.7
Healthcare support	31	32	1.4
Protective services	33	53	2.3
Food preparation and serving related	35	83	3.5
Building and grounds cleaning and maintenance	37	43	1.8
Personal care and services	39	31	1.3
Sales and related services	41	146	6.2
Office and administrative support	43	139	5.9
Farming, fishing, and forestry	45	43	1.8
Construction and extraction	47	360	15.3
Installation, maintenance, and repair	49	111	4.7
Production	51	114	4.8
Transportation and material moving	53	127	5.4
Military specific occupations	55	26	1.1
Unemployed	69[a]	70	3.0
Inmates	79[a]	6	0.3
Homemaker	89[a]	108	4.6
Student	99[a]	203	8.6
Total		2,352	100.0

[a]Codes created by researchers. Not official SOC codes.

Workers who were healthcare practitioners and technicians had the highest rate of suicide by poisoning (14.25 per 100,000) compared to other workers. Workers in life, physical, and social sciences (2.02 per 100,000) as well as those in the legal (3.01 per 100,000) had lower rates of suicide by poisoning compared to other workers.

Workers involved in food preparation and service (10.48 per 100,000), farming, fishing, forestry (15.05 per 100,000) and those in construction and extraction (26.43 per 100,000) had higher rates of suicide by hanging, suffocation, or strangling compared with other workers. Those workers in office and administrative support (2.33 per 100,000) and in community and social services (0.00 per 100,000) had lower rates of suicide by hanging, suffocation or strangling compared with other workers.

TABLE II. Age Adjusted Rates Per 100,000 by Occupation and Sex, 2004–2006

Occupation	Males (n = 1,536)	Females (n = 337)
Management	53.6	19.8
Business and finance	30.7	6.3
Computers and mathematics	38.4	112.7
Architecture and engineering	248.2	**5.9**
Life, physical, social sciences	106.7	**0.8**
Community and social services	22.6	17.1
Legal	25.4	11.7
Education, training and library	77.9	23.2
Arts, design, entertainment, sports, and media	56.4	31.2
Healthcare practitioners and technicians	424.1	43.7
Healthcare support	47.0	37.9
Protective services	192.7	89.7
Food preparation and serving related	64.1	17.2
Building, grounds cleaning, and maintenance	46.1	12.3
Personal care and services	28.9	19.2
Sales and related services	28.9	13.4
Office and administrative support	42.5	9.8
Farming, fishing, and forestry	475.6	**22.7**
Construction and extraction	220.3	134.3
Installation, maintenance, repair	109.2	**10.5**
Production	436.7	10.4
Transportation and material moving	79.9	10.2
Total	92.9	17.2

Bold rates were based on fewer than five deaths.

TABLE III. Average Annual Suicide Rates Per 100,000 by Lethal Means and Occupation, Colorado 2004–2006

Occupation	Firearms	Poisoning	Hanging/ strangulation/ suffocation
Management	14.70	6.07	4.16
Business and finance	11.79	3.19	3.19
Computers and mathematics	15.66	9.40	7.83
Architecture and engineering	34.46	6.69	7.72
Life, physical, social Sciences	10.10	2.02	3.03
Community and social services	13.39	7.65	0
Legal	8.02	3.01	4.01
Education, training and library	5.24	8.18	3.27
Arts, design, entertainment, sports, and media	11.95	8.81	8.81
Healthcare practitioners and technicians	14.25	14.25	5.15
Healthcare support	13.85	9.23	4.62
Protective services	28.73	4.66	4.66
Food preparation and serving related	19.48	6.29	10.48
Building, grounds cleaning, and maintenance	14.55	3.64	5.45
Personal care and services	5.90	5.37	5.37
Sales and related services	9.34	5.31	5.31
Office and administrative support	8.49	4.30	2.33
Farming, fishing, forestry	50.18	5.02	15.05
Construction and extraction	46.82	11.08	26.43
Installation, maintenance, repair	32.68	4.79	10.02
Production	22.06	8.06	8.06
Transportation and material moving	24.30	9.93	6.85
Total	21.52	9.50	10.00

DISCUSSION

Consistent with other reports of female to male ratios, suicide rates among male workers in Colorado were 2–6 times higher than among female workers [Boxer et al., 1995; Yang and Lester, 1995; Kposowa, 1999; Stack, 2001; Gallagher et al., 2008]. Results from the analyses we conducted support the notion that workers in certain occupations may be at higher risk of suicide due to a range of work exposures and to work related stress [Ostry et al., 2007; Bartram and Baldwin, 2010; Takusari et al., 2011].

Different types of suicide prevention programs may be required to reach high-risk groups. For example, food preparation and service workers may be reached through their worksites, but mounting a campaign to reach construction and extraction workers or farming, fishing, and forestry workers would require a different approach since these workers may be more dispersed and more difficult to reach. For both women and men, health care workers and healthcare support workers have high suicide rates. A suicide prevention program targeting these workers might be successful in the workplace, with the exception of home health-aids.

A widely studied factor often discussed in relation to risk is the availability of lethal means, which has an impact on prevalence rates and method-specific suicide prevalence rates [Ohberg, 1998]. Modern conceptualizations of availability of means also take into account other factors, such as knowledge, experience, and familiarity of the means, meaning and symbolism of methods, and social influence of media and friends and family [Maris et al., 2001]. Due to their medical expertise, healthcare workers have some familiarity with lethal means, as well as familiarity with death, which has been associated with increased suicide among veterinarians [Bartram and Baldwin, 2010].

Certain occupational groups have access to and knowledge of lethal means of suicide, and this may increase those groups' risk for suicide. This hypothesis is supported by the current study that indicates method-specific suicide risk elevations were present among specific occupational groups.

In a previous study, chemists were more likely to select poisons as a means (49% of the suicides, compared with 6% among US white males) [Boxer et al., 1995]. Research has also demonstrated that physicians use drugs as a suicide method significantly more than the general population. One study found that physicians used drugs in 57% of suicides—the majority of which involved the use of prescription drugs—while self-poisoning with drugs was used in 26.6% of suicides in the general population (OR 3.65, 95% CI = 2.85–4.68) [Hawton et al., 2000]. In this study, the health care practitioners and technicians were more likely to use poisoning than other workers.

Additional examples of research supporting the availability of means hypothesis as it relates to occupation pertain to farmers. In a sample in Australia, firearms (principally shotguns and hunting rifles) were the means of suicide in 51% of white male deaths on farms, compared to 23% for the male Australian population during the same sampling period [Page and Fragar, 2002]. The results from this study are consistent with the findings from Australia. Farming, fishing, and forestry workers were more likely to use firearms as the means of suicide than were other workers. Also supporting the notion that people choose means with which they are familiar is the result in this study that protective service workers were more likely to use firearms compared to other workers. Economic factors may also influence means of suicide. For example, business and finance workers were more likely to choose firearms than other means, perhaps because these workers can afford to purchase firearms. Supportive of the economic explanation for selection of means is the result that food preparation and serving workers and construction and extraction workers were more likely than others to hang, strangle or suffocate themselves.

Research also suggests a rising use of pesticides as a means of suicide among farming populations in India [Alex et al., 2007] and Sri Lanka [Abeyasinghe and Gunnell, 2008]. It has been suggested that reducing access to pesticides will have a significant impact on pesticide suicide death rates [Konradsen et al., 2006; Mishara, 2007]. The farming, fishing, and forestry workers in Colorado had a significantly lower likelihood of a poisoning than other workers reflecting the large cultural, social and economic differences between workers in developing and developed countries.

Examination of suicide rates in occupational groups offers an important opportunity to develop targeted suicide prevention messages. Although this was a short period, there were very different patterns of suicide among the occupational groups. It may be that using a different period or population would result in different occupations with higher rates of suicide. In fact, that might be expected because there are so many factors that change over time in relation to suicide risk. Suicide rates vary by age [Nock et al., 2008]; therefore, we used age adjusting as there may also be differences in age distribution across occupations. Additionally, we examined suicide rates in occupation groups in Colorado only. Colorado has higher suicide rates than many other states [American Foundation for Suicide Prevention, 2012], and we cannot know how this high suicide rate influenced our results. Other states may have different distributions of population by occupation as well so across state comparisons might be useful.

This study has several limitations. COVDRS links information on suicide decedents from multiple sources [Centers for Disease Control and Prevention, 2012]. The completeness of the case information relies on partnerships between the Colorado Department of Health and the Environment NVDRS team, law enforcement personnel, and medical examiners. Data completeness may vary based on the data-sharing partnerships in different areas of the state. Additionally, COVDRS coding may vary based on abstractor experience. To help standardize coding, abstractors receive extensive coding training and help desk support. Colorado conducts blinded reabstraction of cases to test consistency and further identify training needs. Occupation was hand-coded by the research team. While comparisons of codes across coders were made to try to ensure accurate and consistent coding, the coders had limited previous exposure to coding and there is a possibility of some miscoding of occupation. However, any miscoding likely was non-differential misclassification. Finally, this was a cross sectional study on suicide decedents and cannot provide information on individuals who have attempted suicide or have had suicidal thoughts. As such, it cannot answer questions regarding causal pathways but can only suggest some areas for future longitudinal studies that can address the differing risk by occupation and potential suicide prevention interventions that may decrease work-related suicide risks.

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