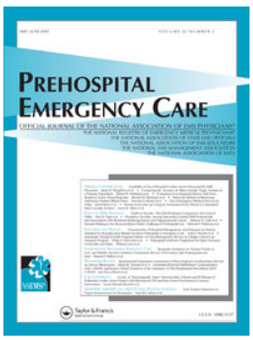

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FOCUS ON EMS PERSONNEL

DEATH BY SUICIDE—THE EMS PROFESSION COMPARED TO THE GENERAL PUBLIC

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ABSTRACT

Background: In 2016, nearly 45,000 deaths in the United States were attributed to suicide making this the 10th leading cause of death for all ages. National survey data suggest that among Emergency Medical Technicians (EMTs), including firefighters and Paramedics, rates of suicide are significantly higher than among the general public. EMTs face high levels of acute and chronic stress as well as high rates of depression and substance abuse, which increase their risk of suicide. **Objective/Aim:** To determine the statewide Mortality Odds Ratio (MOR) of suicide completion among EMTs as compared to non-EMTs in Arizona. **Methods:** We analyzed the Arizona Vital Statistics Information Management System Electronic Death Registry of all adult (≥18) deaths between January 1, 2009 and December 31, 2015. Manual review of decedent occupation was performed to identify the EMT cohort; all other deaths were included in the non-EMT cohort. Using the underlying cause of death as the outcome, we calculated the MOR of both the EMT and non-EMT cohorts. **Results:** There were a total of 350,998 deaths during the study period with 7,838 categorized as suicide. The proportion of deaths attributed to suicide among EMTs was 5.2% (63 of 1,205 total deaths) while the percentage among non-EMTs was 2.2% (7,775/349,793) ($p < 0.0001$). The crude Mortality Odds Ratio for EMTs compared with non-EMTs was [cMOR 2.43; 95% CI (1.88–3.13)]. After adjusting for gender, age, race, and ethnicity, EMTs had higher odds that their death was by suicide than non-EMTs [aMOR: 1.39; 95% CI (1.06–1.82)]. **Conclusion:** In this statewide analysis, we found that EMTs had a significantly higher Mortality Odds Ratio due to suicide compared to non-EMTs. Further research is necessary to identify the underlying causes of suicide among EMTs and to develop effective prevention strategies. **Key words:** suicide; emergency medical technician; EMT; paramedic; first responder; firefighter

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INTRODUCTION

Suicide is the tenth leading cause of death for all ages in the United States and the second leading cause of death for people ages 15–34 (1). In an attempt to address this major public health problem, significant national public health resources have been allocated toward research and prevention of suicide. The National Institute of Health reports that suicide and suicide prevention research funding has increased from $39 million in 2008 to $85 million in 2016 (2). Despite these large-scale efforts, rates of suicide have increased 15.5% since 2008 from 11.9 per 100,000 to 13.9 per 100,000 in 2016 (1).

The risk of suicide is not equal across all occupational fields with notable increased risk among law enforcement professionals and public safety personnel (3–5). It is hypothesized that the increased suicide rate observed among those employed in these occupations may be related to the inherent physical and psychological stressors found in their workplaces (6, 7). Emergency Medical Technicians (EMTs) are exposed to high levels of occupational hazards as well as intense brief and chronic stress (8–10). Chronic stress has been linked to substance abuse, depression, anxiety, burnout, and suicide (11). National survey data suggest EMTs have a tenfold higher incidence of suicidal thoughts and attempts, both of which are strongly associated with suicide completion (12).

While these studies found increased rates of suicidal ideation and attempts, data on completed EMT suicide are scarce. Given the paucity of specific suicide data sources, we analyzed the Arizona Vital Statistics Information Management System Electronic Death Registry (AZ-EDR) to assess the proportion of deaths attributed to suicide among EMTs compared to non-EMTs.

Methods

Study Design

This is a retrospective case-control study analyzing mortality data from the AZ-EDR between January 1, 2009 and December 31, 2015. Access to data was approved by the Arizona Department of Health Services (AZDHS). A regulatory determination that this study is not Human Subjects Research as defined by 45 CFR 46.102(f) was approved by the University of Arizona Human Subjects Protection Program Institutional Review Board.

Study Setting and Population

The AZ-EDR captures information on all deaths that occur in the state of Arizona as well as Arizona resident deaths that occur outside of Arizona. The AZ-EDR is an electronic Oracle database maintained by the AZDHS Bureau of Vital Records. Submission of information to the AZ-EDR is mandated by Arizona Law 36-325 and regulated by the Arizona Administrative Code Title 9 Health Services Chapter 19. Funeral directors provide the personal information found within the AZ-EDR. In some deaths, a funeral home will not be involved. In these situations, the medical facility or medical examiner is responsible for completing the medical and personal information found in the AZ-EDR. In the AZ-EDR, mortality data is coded using *International Classification of Disease-10th Revision* (ICD-10) and the underlying cause of death is coded using ICD-10 external cause of injury codes (E-Codes). The mechanism of underlying cause of death was identified based on the Centers for Disease Control and Prevention external cause of injury mortality matrix (13).

Data Collection and Processing

The AZ-EDR dataset contained information on mortality from 350,998 adult (≥18) deaths between January 1, 2009 and December 31, 2015. AZ-EDR data was retrieved from the Arizona Department of Health Services Oracle database and compiled into SAS tables. The AZ-EDR dataset included demographic variables such as age at death, gender, race, ethnicity, cause of death, and occupation. Deaths were categorized as due to suicide or all other causes. Suicide was defined based on the ICD-10 E-codes of X60 to X84, Y87.0 and U03 (13). The mechanism of suicide, if applicable, was recorded. Those deaths attributed to suicide were then divided based on the decedent's occupation as identified in the death record.

Occupation on death records are recorded in a free text field. All AZ-EDR records during the study period were categorized into 2 groups: EMTs and non-EMTs. EMTs consisted of any occupation providing emergency medical care that required an EMT certification. All occupations including firefighter, fireman, emergency medical technician, EMT, and paramedic were included in the EMT cohort (Appendix 1, see online supplement). Additionally, all occupation free text fields from our population were manually reviewed for occupations involving emergency medical care. Any occupations that were uncertain for needing EMT certification were adjudicated by the investigators. If EMT certification could not be determined from the listed occupation or text, the subject was categorized as non-EMT. All other occupations were included in the non-EMT cohort. Additionally, records with a blank occupation field were included in the non-EMT cohort.

Data Analysis

All analyses were carried out using SAS software version 9.4 (SAS Institute Inc., Cary, NC). Descriptive statistics were used to compare demographic characteristics and method of suicide between the EMT and non-EMT populations. Chi-square testing was used to assess statistical significance between population characteristics. A logistic

regression model was used to determine the mortality odds ratio (MOR) of suicide between the EMT and non-EMT cohorts, adjusting for patient gender, age, race, and ethnicity. The crude Mortality Odds Ratio (cMOR) and adjusted Mortality Odds Ratio (aMOR) are presented with 95% Confidence Intervals (CI). Statistical significance was assessed at an alpha level of 0.05.

The MOR approximates the observed to expected death ratio when death data are available but the population denominator is not known (14). In this study, MOR was used to compare the odds that death was due to a specific cause (suicide) in exposed (EMT) and non-exposed (non-EMT) cohorts. Although the exact number of active and retired EMTs in Arizona is not known, MOR offered an accurate method of determining the likelihood that a death was caused by suicide among this population when compared to the general public.

RESULTS

There were a total of 350,998 deaths entered into the AZ-EDR during the study period: 1,205 EMTs and 349,793 non-EMTs. Of those deaths, there were 63 deaths attributed to suicide in the EMT cohort, representing 5.2% of all EMT deaths compared to 2.2% among non-EMTs ($p < 0.0001$) (Table 1). The crude Mortality Odds Ratio for EMTs compared to non-EMTs was 2.43 [95% CI (1.88–3.13)]. After adjusting for gender, age, race and ethnicity, EMTs still had a significantly higher suicide Mortality Odds Ratio than that of non-EMTs [aMOR: 1.39; 95% CI (1.06–1.82)]. This elevated aMOR represents an increased risk that death was due to suicide in EMTs compared to non-EMTs in this study.

Overall the EMT cohort was younger and had a higher percentage of males (93.5% vs. 52.8%, $p < 0.0001$) than the non-EMT cohort. Additionally, the EMT cohort contained a larger percentage of deaths in the 35–54 year age group (15.8% vs. 10.3%, $p < 0.0001$) (Table 1). The 18–34 year age group contained the highest proportion of suicides to total deaths in both EMT and non-EMTs (23.52% and 16.38%) (Table 2).

We evaluated the mechanisms of suicide and found no significant difference between EMT and non-EMT populations. The 3 most common mechanisms of suicide among EMTs and non-EMTs in Arizona were firearm (67% vs. 57%, $p = 0.1472$), suffocation (24% vs. 21%, $p = 0.1274$), and poisoning (10% vs. 17%, $p = 0.5312$) (Table 3).

TABLE 1. Demographic and event characteristics between EMT and Non-EMT populations

	Non-EMT, *N* (%)	EMT, *N* (%)	Chi-square p-value
Total deaths	349,793	1,205	
Cause of death: Suicide	7,775 (2.2%)	63 (5.2%)	<0.0001
18–34	12,298 (3.5%)	102 (8.4%)	
35–54	36,194 (10.3%)	191 (15.8%)	
55–74	110,621 (31.6%)	381 (31.6%)	
>75	190,680 (54.5%)	531 (44.0%)	
Male	184,987 (52.8%)	1,127 (93.5%)	<0.0001
White non-Hispanic	280,766 (80.2%)	972 (80.6%)	

TABLE 3. Methods of suicide: EMT vs. non-EMT

	Non-EMT		EMT		
Mechanism	*n*	%	*n*	%	Chi-square p-Value
Firearm	4,479	57.6%	42	66.7%	0.1472
Poisoning	1,299	16.7%	6	9.5%	0.1274
Suffocation	1,602	20.6%	15	23.8%	0.5312

TABLE 2. Proportion of deaths (CYs 2009–2015) due to suicide by age: Non-EMT vs. EMT

	Non-EMT			EMT		
Age Group	All deaths	Suicides	Percent (95% CI)	All deaths	Suicides	Percent (95% CI*)
Total	349,793	7,775	2.22% (2.17%–2.27%)	1,205	63	5.22% (3.97%–6.48%)
Age						
18–34	12,298	2,015	16.38% (15.73%–17.03%)	102	24	23.52% (15.29%–31.76%)
35–54	36,194	2,885	7.97% (7.69%–8.24%)	191	26	13.61% (8.74%–18.47%)
55–74	110,621	2,101	1.89% (1.81%–1.97%)	381	9	2.36% (0.83%–3.88%)
>75	190,680	774	0.40% (0.37%–0.43%)	531	4	0.75% (0.01%–1.48%)
Gender						
Female	164,806	1,761	1.06% (1.01%–1.11%)	78	7	8.97% (2.63%–15.31%)
Male	184,987	6,014	3.25% (3.17%–3.33%)	1,127	56	4.96% (3.70%–6.23%)
Race/Ethnicity						
White non-Hispanic	280,766	6,222	2.21% (2.16%–2.27%)	972	46	4.73% (3.39%–6.06%)
Other race	69,027	1,553	2.24% (2.13%–2.36%)	233	17	7.29% (3.95%–10.63%)

*95% confidence interval.

Discussion

Our statewide study showed a significantly higher suicide aMOR for EMTs in Arizona compared to the general public. While we were unable to find prior investigations of suicide MOR in the EMT cohort as a whole, there are 5 previous firefighter-specific mortality studies that found a decreased Standardized Mortality Ratio (SMR) for suicide among firefighters (15–19). SMR differs from MOR in that SMR measures the ratio of observed deaths in a study cohort to expected deaths in a national population with the same age and gender (20). We utilized the MOR because the number of living EMTs during the study period was unknown. Park et al. (21) found that SMRs in occupational mortality studies may underestimate mortality risk and are confounded by health differences between general and occupation-specific subjects. Furthermore, Park et al. found that using MOR instead of SMR may provide a better comparison between occupation-specific cohorts and the general public (21).

The difference in our findings may, in part, be related to the timeframe of which these studies took place (ranging from 1915 to 1999) and significant changes particularly in fire-based EMS practice of prehospital care over time. The Emergency Medical Services Systems Act of 1973 established the framework for developing and funding EMS services across the United States (22). Following the implementation of this act, firefighter services have shifted from a primary firefighting role to one focused on also providing prehospital emergency medical care. Additionally, the National Fire Protection Association reports that total fire department calls for medical aid have increased from 5,045,000 in 1983 to 21,500,000 in 2015. In the same time period, fire calls decreased from 2,988,000 to 1,345,500 (23).

While performing EMS services, EMTs are exposed to suicide completions and suicide attempts at a much higher rate compared to the general population. A study conducted by Kimbrel et al. (2016) found that 100% of firefighter respondents reported at least one suicide exposure (24). Exposure to suicide has also been found to independently increase risk of suicidal ideation (25). In a nationwide survey of firefighters, among self-reported responders to one or more deaths by suicide, there was an age adjusted odds ratio of 1.71 for suicidal ideation and 2.00 for suicide attempts (26). Kimbrel's study appears to show that this risk is cumulative. They found that firefighters with twelve or more suicide exposures had a lifetime suicidal ideation rate of 61.1% compared to 31.6% for those with eleven or fewer (24). Additionally, those with twelve or more exposures had a significantly higher positive screening for suicidal behavior (24).

Other factors that may contribute to our findings include significant and recurrent EMT exposure to occupational stress and traumatic events. These events confer increased risk for mental health morbidities such as post-traumatic stress disorder and alcohol use disorder (27–29). Recent studies have reported binge drinking rates of 34% and 40% in male and female firefighters, respectively (30–32). Additionally, a meta-analysis of 18 studies found a significantly elevated PTSD prevalence rate of 11% among ambulance personnel (33). Post-traumatic stress disorder and alcohol use disorder are each recognized risk factors for suicide and the higher incidence of these morbidities among EMTs further substantiates our findings (34–38).

Elevated occupational stress, alcohol use and suicidal ideation among EMTs coupled with the established connection between these risk factors and suicide support our findings of increased suicide MOR among EMTs. These areas provide clinically useful targets for future research and prevention. Additionally, the increased risk of suicide related to EMS response exposure may provide an effective avenue for identifying EMTs at increased risk of suicide.

With a minimal amount of research specifically on suicide among EMTs, our study has identified an increased MOR for suicide for EMTs compared to non-EMTs. The increased MOR is represented as a ratio of observed to expected deaths due to suicide with a value greater than 1 demonstrating a higher likelihood that their death was by suicide. The aMOR of 1.39 found in the EMT population shows that their exposure to the EMT occupation significantly increased the risk that their death was due to suicide above the general public. Our data indicates that EMT occupations may confer significant previously unknown risk to those that have entered fields to protect and care for others.

Given the previous body of knowledge identifying increased suicidal ideation in this population as well as our findings, additional research toward prevention is needed. Future research should first be conducted to confirm our findings and, then, attempt to identify what aspects of EMT occupations (acute stress, chronic stress, shift work, cultural biases, etc.) are most responsible for suicide risk. Further research stratifying cohorts based on EMT exposure such as urban vs. rural communities, volunteer vs. professional departments, EMS duties, and length of service would help refine our understanding of this critically important topic.

Limitations

There are several limitations in this study. First, reliance on a free text occupational field may have introduced inaccurate classification of occupation. Due to our requirement to maintain anonymity, we were unable to investigate each case individually to fully ascertain job descriptions and formal certification status (e.g., level of EMT certification and whether the individual was currently certified and/or active at the time of their death). Additionally, we are unable to know whether, for example, individuals in the study had multiple certifications/jobs. Because our aim was to describe suicide in prehospital professionals, we chose to include helicopter EMS (HEMS) Registered Nurses in the study. We did this because many are concomitantly certified EMTs; some agencies require dual certification; and, functionally, the 2 prehospital professionals work side by side in the helicopter with near identical shift schedules, professional risks, and stressors. Additionally, 1.7% of death records in this study contained a blank occupational field. The limited function of the occupational field did not allow adjustments in risk factors such as multiple occupations, length of service, employment setting (urban vs. rural), or whether the decedent had retired from an EMT career. Moreover, comorbid suicide risk factors such as previous suicide attempts, substance abuse disorder, and mental health issues were unable to be taken into account in our calculations. Lastly, suicides may be misclassified as "accidental" or "undetermined" in order to protect survivors from the stigma of suicide (39). Therefore, our reliance on official determination of death may have led to an under-representation of the true burden of suicide among our EMT cohort.

CONCLUSIONS

In this statewide analysis, we found a significantly higher crude and adjusted suicide Mortality Odds Ratio among EMTs compared to the general public. These findings highlight the urgent need to elucidate potential EMT suicide risk factors in order to develop effective prevention strategies.

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