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SUICIDE IN THE U.S. MARINE CORPS, 1990-1996

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Executive Summary

Background

From 1980 to 1992, the United States Marine Corps (USMC) had the highest suicide rate of any military branch. Epidemiologic studies of suicide in the military have not controlled for the higher suicide rates of the unemployed expected in comparative national populations.

Approach

This study compared the observed number of suicides among U.S. Marine Corps personnel during 1990 to 1996 with the expected number based on rates for the employed general U.S. population. Standardized mortality ratios were calculated to identify demographic groups with higher or lower than expected numbers of suicides. The scan statistic and the Knox technique were used to evaluate potential suicide cluster patterns.

Results

Overall, the number of suicides in the Marine Corps ($n = 213$) were fewer than the expected number ($n = 225$). Hispanic and other ethnic group males and women Marines had greater than expected numbers. Evidence for suicide clustering in time and space was equivocal.

Conclusions

Future studies will focus on contemplation and predictors of suicide attempts to further characterize suicidal risk in the military and help focus suicide awareness and prevention programs on those unique aspects of military suicide.

Introduction

From 1980 to 1992, the United States Marine Corps (USMC) had the highest suicide rate of any military branch.¹ Despite its fewer numbers, the Marine Corps completed suicide rate of 14 per 100,000 compared with the Navy's rate (the lowest of the services) of 11 per 100,000.^{1,2} During the period from October 1979 to March 1997, there were 475 self-inflicted deaths in the Marine Corps, making suicide the second leading cause of death, after accidents.³ This contrasts with the other 3 uniformed services in which it is the third leading cause, after accidents and illness.

Overall in the military, while the rates of death from accidents, homicide, and illness steadily decreased, the rate of suicide in the military increased about 25% between 1980 and 1993.² Despite these figures, some investigators have concluded that because rates for military suicide are lower than rates in the U.S. general population, "the Department of Defense does not have a major problem with suicide by active-duty members."⁴ However, studies of military suicide have not taken into account that all active-duty personnel are employed and that because there is an association between suicide and unemployment, suicide rates in the military would, when adjusted for other variables, be expected to be lower than in the general population.^{5,6} Further, recent evidence suggests that suicide rates among U.S. Navy personnel are increasing relative to those in the general population and that there may be a clustering of suicides.^{7,8}

To properly evaluate the suicide rate in the military in relation to the general population, and to determine whether rates of suicide in the Marine Corps are significant enough to justify increased research and intervention efforts, an adjustment for employment needed to be made. Therefore, the aim of the present study was to compare

Marine Corps suicide rates with national suicide rates for the employed and to examine clustering in time and space in Marine Corps suicides using methods similar to those used in assessing Navy suicides.⁷ Further, most previous studies of suicide incidence have used rates per 100,000 to compare Marine Corps and national suicides.^{1,4,9-11} The present study emphasized the comparison of observed suicide rates with those expected if the Marine Corps had the same suicide rates among demographic groups as the general U.S. population. Since suicide rates vary by demographic distributions, and military demographic distributions are very different from those in the general population, these factors were also considered. In particular, suicide rates vary greatly between ethnic groups (white non-Hispanics have the highest rates), gender (males have much higher rates than females), and age group (within most ethnic groups older people have higher rates).¹² Also, the number of Marine Corps personnel has declined from 1990 (196,652) to 1996 (174,883) and some demographic shifts have occurred (for both men and women the percentage of Hispanics has increased by about 5%, and the percentage of African Americans has decreased by about 4%).¹³ Thus, the analysis in the present study allowed for the computation of the expected number of suicides within any demographic group by summing expected values over the other groups, thereby adjusting for such variables.

Methods

Data Collection

For each suicide occurring between 1990 and 1996 in the Marine Corps, the Report of Casualty (DD Form 1300) was obtained. This form is the official record of death for all active-duty military personnel and contains demographic data, as well as details regarding rank, salary, and the manner of death. The data from these forms were

entered into a computer file and analyzed using the SAS statistical package (SAS Institute, Inc., Cary, NC). Marine Corps Headquarters provided Marine Corps population data. National population data were obtained from the U.S. Department of Health and Human Services annual publication, "Health, United States 1995" (and previous editions).¹²

Data Analysis

Crude and age-adjusted rates were compared with U.S. rates for each year. Age-adjusted rates were calculated by the indirect standardization method.¹⁴ To make a valid comparison between the number of suicides that occurred with the number that might be expected according to rates in the general U.S. population, a breakdown of Marine personnel was made for each of the 7 years in question. Personnel data were cross-tabulated by age group, ethnic group (White non-Hispanic, Hispanic, African American, other [consisting of Asians, Pacific Islanders, and Native Americans]), and gender. For each cross-classification the expected number of suicides was computed using national rates for that subgroup.¹² Standardized mortality ratios (SMRs) and 95% confidence intervals (CIs) were computed for all subgroups with more than 5 in an individual cell.¹⁴ This precluded their use for analyses of female suicides due to their small numbers. SMRs over 100 indicated a military rate greater than expected compared with the general population.

Although detailed suicide rates among the employed do not exist, data from the U.S. National Longitudinal Mortality study, a prospective study of 1.3 million people undertaken in 1985, were used to adjust the expected suicide rates for employment status.¹⁵ Based on this adjustment, described in detail elsewhere,⁷ suicide rates among

employed males were estimated to be 80% of the rate among all males and 70% of the rate among all women.

To establish whether events occurred evenly throughout the time interval under consideration, or whether there was evidence of their being grouped or clustered, a standard statistic for testing for evidence of clustering--the scan statistic--was computed.¹⁶ With the scan statistic, a time period (T) and the total number of events of interest (N) that occur in the time period were determined. A time "window" (W) was selected and the time period was scanned, starting at the beginning. The largest number of events (n) occurring in any subinterval of length (W) was observed. Wallenstein and Neff¹⁶ provided an approximation for the probability of observing n or more events in a window of length W. A large n led to a small p value, which was interpreted as evidence of clustering.

The Knox method was used to detect evidence of suicides occurring in both the same location and close in time.¹⁷⁻²⁰ Using the Knox method a 2 x 2 table was compiled in which the total number of pairs of suicides were tabulated according to the following cross-classification: those that were close in both time and location, close in time but not in location, close in location but not in time, and neither close in time nor location. Two suicides were defined to be close in location if they occurred at the same duty location, and close in time if they occurred within 14 days of each other.

Results

Demographic Analysis

During the period from 1990 to 1996, 213 suicides occurred in the Marine Corps. As expected, the highest proportion of suicides were committed by Caucasians (69%),

followed by African Americans (13.6%), Hispanics (9.8%) and Others (7.5%). Table 1 shows the distribution of the total number of suicides by ethnic and age group. About half of the suicides occurred in the 20-24 years age group across all ethnic groups. Fewer suicides were observed than would be expected (adjusting for ethnicity and sex) for all age groups, though the differences between observed and expected were less among personnel under 25 years old (not shown).

Table 2 gives the number of suicides in each year with the unadjusted (crude) and age-adjusted rates per 100,000. The rates for the U.S. population are included for comparison. Considerable variability was observed in the Marine Corps crude rate from a high of 20.7 in 1993 to a low of 11.3 in 1991. There was no evidence of a consistent increase occurring in the last 7 years among Marine Corps suicides. The Marine Corps population is younger than the U.S. population, and age-adjusted rates were therefore lower than crude rates. The fact that both crude and age-adjusted rates were generally higher than the rates for the general population is accounted for by differences in the sex distributions (i.e., the Marine Corps is about 95% male, and male suicide rates are higher than female rates, regardless of ethnic group).

Table 3 shows the observed number of suicides by year, sex, and ethnic group. The expected number of suicides (adjusted for age and employment) are given in parentheses. For the period as a whole, the number of Marine Corps suicides was less than expected, in relation to the general population. However, in 4 of the last 7 years, overall observed rates were higher than expected. Although 2 of those years were the most recent years of 1995 and 1996, there was no clear evidence of a consistent trend. One would expect nearly all suicide cases in the Marine Corps to be male, and this was in

fact the case. It should be noted that even though there were only 5 female suicides in the period from 1990 to 1996 (3 Caucasians and 2 Hispanics), that rate was still higher than the expected number of female suicides (2.6 adjusting for age and ethnic group). In addition, in 2 ethnic groups among men the observed number of suicides exceeded the expected number: the Hispanic group, and the "Other" group. The SMRs for these groups were 156 (CI = 94-244) and 189 (CI = 108-306), respectively; the SMRs for Caucasian and Black men were 83 (CI = 70-98) and 98 (CI = 66-142), respectively. To examine the effect of adjusting for employment, age-adjusted expected rates with and without the employment adjustment were computed (bottom of Table III). Although the employment adjustment uniformly decreased the expected rates, the relationships between observed and expected rates remained the same.

Nearly all of the suicides were committed by enlisted persons, mainly at the lower end of the pay scale. Though officers constituted 10% of the Marine Corps, they accounted for only 3% of the suicides. On the other hand, while 44% of the Marine Corps were in the E1-E3 pay group, this group accounted for 55% of the suicides, E4-E6 contributed 35%, and E7-E9 contributed 7%. Table 4 shows the method of suicide committed by men in the Marine Corps during the studied time period. The percentage of suicides by firearms (73.6%) was notably high, and it was higher than the percentage of male Navy suicides involving guns (55.4%) over a similar period.⁷ In the U.S. population, the percentage of male suicides by handgun is 61%.¹

Temporal Trends and Cluster Analyses

Analyses of temporal trends indicated that while there was no statistical evidence for suicides being concentrated during any particular month, of the 207 suicides for which

day of death was recorded, 76 (37%) were on a Sunday or a Monday, and there was statistical evidence that suicides were not equally likely to occur on each day of the week ($X^2_6 = 15.27, p = .018$).

In applying the scan statistic, the days from January 1, 1990 to December 31, 1996 were numbered from 1 to 2557. The records showed that the largest number of suicides occurring in any subinterval occurred on the following days: 1088, 1088, 1094, 1097, 1097, 1099, 1100, and 1101. Thus, in a window of $W = 14$ days, 8 suicides occurred. According to Wallenstein and Neff's approximation,¹⁶ with a total of $N = 205$ (those for which the exact date of death were recorded) suicides occurring over a period of $T = 2557$ days, the probability was .0232. Also, 10 suicides occurred between days 104 and 134, inclusively. Using $W = 31$ (one month) and $n = 10$, a p value of .1142 was obtained. Unfortunately, the p value is heavily dependent on the value of W that is chosen. Therefore, results were somewhat ambiguous but suggested that there was some statistical evidence of clustering in time.

Using the Knox technique, data included 176 Marine suicides between 1990 and 1996 that occurred at a duty station and for which a date of death was recorded. The total number of pairs of suicides was $176 \times 175 / 2 = 15,400$. Under the assumption of Knox's test statistic that proximity in time is independent of proximity in space and that the probability of events coinciding in time and space is the product of the respective probabilities of their occurring in the same temporal frame, and occurring in the same spatial frame,¹⁷ the expected number of suicides coinciding in both time and space was estimated to be $(195 \times 1406) / 15400 = 17.803$. Assuming that the number of events had a Poisson distribution with this parameter, a p value was computed by calculating $P(Y \geq$

22), where Y had a Poisson distribution with parameter $\lambda = 17.803$. This probability equaled 0.1876, not particularly strong evidence of a space/time clustering effect.

Discussion

Overall, Marine Corps suicides were less than expected in the general population and, unlike recent analyses of Navy suicides,⁷ showed no consistent trend toward increasing in the last several years. However, some demographic groups appear to have suicide rates that are higher than would be expected. In particular, these groups were Hispanic men, Other ethnic group men, and women across ethnic categories, although the number of female suicides was too small to draw valid conclusions. It is difficult to make an inference about the other ethnic group males, since it is a heterogeneous group consisting of Native Americans who have high suicide rates, and Asians and Pacific Islanders who have much lower rates. Unfortunately, it is rarely possible to determine from the DD1300 form to which particular subgroup the subject belongs. Further investigation of these potentially high-risk groups is needed.

Insofar as the method of suicide is concerned, it is well known that among men, most suicides involve firearms. This was also true among Marine Corps male suicides. Consistent with previous findings, a greater proportion of enlisted Marines committed suicide, and they had a strong predisposition to the use of firearms,^{9,10,21} presumably because they are more readily available.²²

The examination of temporal trends and cluster effects are of importance in directing limited military resources to where intervention and prevention efforts are most likely to have an impact and save lives. Unfortunately, results of the cluster analyses in this study were equivocal, with some evidence of a cluster effect in time, but not in time

and space. This is in contrast to results obtained in analyses of Navy suicides in which no evidence was found for clustering in time only,^{7,23} but some evidence was found for clustering in both time and space.^{7,24} Such results may be due to differences in how Marine Corps suicide location was recorded or coded (i.e., assigned duty station or actual suicide location). Future studies will examine clustering among Navy and Marine Corps suicide attempts in an effort to clarify these relationships with larger sample sizes and similar methodologies.

Other limitations of the present study include possible missed cases. Suicide underreporting is a possibility in all such studies; however, there is no evidence of bias such that missing cases were not equally distributed throughout the time period.

A unique aspect of this study is its attempt to control for employment effects when comparing military with national suicide rates. It is critical to the determination of the magnitude of suicide as a problem with unique risks to the military, that its assessment includes important covariates. Unfortunately, since national suicide statistics do not include current employment status, the method of employment adjustment in the present study can only be considered an estimate. Nevertheless, these analyses suggest that the Marine Corps may present a greater risk of suicide for certain demographic subgroups and help generate a high-risk profile that consists of a low-ranking enlisted woman or Hispanic or Pacific Islander male with access to a handgun. Together, with previous findings of psychosocial risk factors that include psychiatric illness,^{9,25} interpersonal separation,²⁵ high levels of stress (especially during boot camp),²⁶ and legal or administrative difficulties,²¹ and of occupational risks that include being a tank crewman, small-arm technician, or infantryman,²⁷ a more complete profile of the Marine

at risk for suicide can be targeted for prevention efforts. The temporal trend analyses presented in this study which showed evidence of clustering over time, and an elevated rate on Sunday or Monday, have implications for prevention efforts and deserve further study.

Comment

A downsized military must rely on 100% of its fighting force and ensure its optimal functioning. A suicidal Marine is not functioning at his or her best. Considering that for every person completing suicide, there are an estimated 8 others attempting it²⁶ and an unknown number contemplating it, this study has only addressed the tip of the iceberg of emotional unpreparedness. Future studies will focus on contemplation and predictors of suicide attempts to further characterize suicidal risk in the military and help focus suicide awareness and prevention programs on those unique aspects of military suicide.

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TABLE I

USMC SUICIDES* BY AGE, ETHNIC GROUP, 1990-1996

Age Group	White (non-		African		Total
	Hispanic)	Hispanic	American	Other	
≤19	24 (16.3)	3 (14.3)	1 (3.4)	2 (12.5)	30 (14.1)
20-24	80 (54.4)	10 (47.6)	15 (51.7)	8 (50.0)	113 (53.1)
25-34	34 (23.1)	5 (23.8)	9 (31.0)	4 (25.0)	52 (24.4)
35-44	8 (5.4)	3 (14.3)	3 (10.3)	2 (12.5)	16 (7.5)
45-54	1 (0.7)	0 (0)	1 (3.4)	0 (0)	2 (0.9)
Total	147 (100.0)	21 (100.0)	29 (100.0)	16 (100.0)	213 (100.0)

*Numbers in parentheses are expressed as percentages.

TABLE II

USMC AND US CRUDE AND AGE ADJUSTED SUICIDE RATES,* 1990-1996

Year	1990	1991	1992	1993	1994	1995	1996
USMC suicides	39	22	26	37	25	33	31
USMC crude rate	19.9	11.3	14.1	20.7	14.4	18.9	17.7
US crude rate	12.4	12.2	12.0	12.1	12.4	N/a	N/a
Age-adjusted USMC rate	16.3	9.3	11.4	16.6	11.5	15.1	14.3
Age-adjusted US rate	11.5	11.3	11.1	11.3	11.5	**	**

*per 100,000

**Data not available.

TABLE III

USMC SUICIDES BY SEX AND ETHNIC GROUP ADJUSTED FOR EMPLOYMENT AND AGE*

	Male				Female				Total
	White	Hispanic	Black	Other	White	Hispanic	Black	Other	
1990	25 (26.47)	6 (1.54)	4 (5.04)	3 (1.19)	0 (0.22)	1 (0.01)	0 (0.05)	0 (0.01)	39 (34.53)
1991	14 (26.40)	1 (1.62)	6 (4.85)	1 (1.19)	0 (0.20)	0 (0.01)	0 (0.05)	0 (0.01)	22 (34.34)
1992	23 (25.30)	0 (1.61)	3 (4.37)	0 (1.20)	0 (0.19)	0 (0.01)	0 (0.04)	0 (0.01)	26 (32.74)
1993	23 (24.50)	3 (1.68)	6 (4.02)	4 (1.21)	0 (0.17)	1 (0.02)	0 (0.04)	0 (0.01)	37 (31.65)
1994	18 (23.87)	1 (1.76)	5 (3.77)	1 (1.20)	0 (0.17)	0 (0.02)	0 (0.04)	0 (0.01)	25 (30.83)
1995	19 (23.58)	5 (1.94)	3 (3.71)	4 (1.24)	2 (0.18)	0 (0.02)	0 (0.04)	0 (0.02)	33 (30.72)
1996	22 (23.19)	3 (2.01)	2 (3.71)	3 (1.25)	1 (0.19)	0 (0.02)	0 (0.04)	0 (0.02)	31 (30.42)
Total	144 (173.31)	19 12.16)	29 (29.47)	16 (8.48)	3 (1.32)	2 (0.12)	0 (0.29)	0 (0.10)	213 (225.24)
Total**	216.64	15.2	36.83	10.6	1.88	0.17	0.41	0.15	281.9

*Observed numbers with civilian expected numbers (in parentheses)

** Number of expected cases (age-adjusted) without adjustment for employment

TABLE IV

USMC MALE SUICIDES, 1990-1996, BY METHOD

	Gun	Hanging	Asphyx	Overdose	Other	Total
Number	153	33	8	6	8	208
Percent	73.6	15.9	3.8	2.9	3.8	100.0

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