

# Suicide Among Regular-Duty Military Personnel: A Retrospective Case-Control Study of Occupation-Specific Risk Factors for Workplace Suicide

Martin J. Mahon, M.B., M.Sc.,  
M.R.C.Psych.

John P. Tobin, M.B., M.R.C.Psych.

Denis A. Cusack, F.R.C.P.I.,  
F.C.I.Arb., B.L.

Cecily Kelleher, F.R.C.P.I., M.D.,  
M.F.P.H.M.

Kevin M. Malone, M.D.,  
F.R.C.P.I., M.R.C.Psych.

**Objective:** The purpose of this study was to examine the epidemiology, phenomenology, and occupation-specific risk factors for suicide among regular-duty military personnel as a model for other professions at risk for workplace suicide.

**Method:** Suicide incidence and methods were determined in a retrospective military cohort comprising all deaths (N=732) of regular-duty military personnel in the Irish Defence Forces between 1970 and 2002. A retrospective, case-control study using pair-matched military comparison subjects was conducted to determine occupation-specific risk factors for suicide, particularly by firearm, among military personnel. Risk factors were subjected to chi-square analysis or independent t tests and entered into a binary logistic regression analysis model.

**Results:** The period-averaged suicide rate for the cohort was 15.3/100,000. Firearm suicides accounted for 53% of the cases. Suicides that took place on duty occurred predominantly when personnel were alone shortly after duty commencement

in the morning. Bivariate and logistic regression analyses identified psychiatric illness and a past history of deliberate self-harm, morning duty (shortly after duty assumption and consequent access to firearms), and a recent medical downgrading as independent risk factors predicting firearm suicide among military personnel.

**Conclusions:** Occupation influences suicide method. Access to and opportunity to use lethal means in the workplace are distinct but related occupation-specific suicide risk factors in the military and in other at-risk professions. In professions where access to lethal means is inevitable, moderating opportunity for suicide is crucially important. In regular-duty military personnel, a medical downgrading, combined with risk factors established in civilians such as younger age, male gender, psychiatric illness, and past self-harm, increases the risk of suicide. The findings may be used to guide military harm-reduction strategies and have applicability in strategies for other professions at risk for workplace suicide.

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Suicide is the second most common cause of death in United States military (1) and accounted for substantial mortality in the Russian military (2), among British veterans of the Falkland Islands war (3), and in the recent Iraq conflict (4). The devastating effect of suicides on unit morale should compel research to guide military authorities in the heretofore little explored areas of suicide risk prediction, management, and reduction. Like other employers, military installations are expected to maintain safe work environments that support employees' health. Existing research comprises studies of suicide rates, typically over brief periods of time (see Table 1), and few studies have reliably examined suicide methods or method-specific predictive factors that are particularly relevant for military authorities. Lower suicide rates might be expected in the military, compared to individuals of similar age in the general population, because of the "healthy worker effect" (19), pre-enlistment selection or screening, and the structured, supportive, often interrelated occupational and so-

cial environments in the military (19, 20). To maintain battle fitness, military forces have well-developed medical services, which together with the cohesiveness of the organization, might protect against suicide. On the other hand, suicide risk could be increased in the military because of access to weaponry, access to marksmanship training, and possible self-selection of more aggressive individuals (21), aggression being a possible suicide risk factor, particularly in young male subjects (22, 23). However, some researchers have suggested that military populations, despite consisting mainly of young men, are no more aggressive than the general population (24), and others have suggested that military training or discipline may moderate impulsivity (21). Military authorities collect abundant demographic, occupational, and medical data, rendering military populations acceptable and rewarding settings in which to explore factors associated with suicide (particularly firearm suicide) in male subjects. We therefore hypothesized that suicide risk in the military, as in other

TABLE 1. Studies of Suicide Rates in Military and Civilian Populations

Country and Author	Year	Period	N	Suicide Rate (per 100,000 population)		Civilian Comparison Population
				Military Personnel	Civilians	
Canada: Wong et al. (5)	2001	1990–1995	63 men	12.2	26.2	Men of comparable age
Finland <sup>a</sup>						
Ponteva (6)	1983	1977–1984	738 men	13.6	46.8	20–24-year-old men
Marttunen et al. (7)	1997	1987–1988	7 men			
France						
Desjeux et al. (8)	1998	1998	40 men			
Galoisy-Guibal and Desjeux (9)	2003	2001	49 men	14		
Italy: Mancinelli et al. (10)	2003	1986–1998	122 men	2.0 in 1989; 1.1 in 1998	7.3 in 1988; 11.5 in 1997	20–24-year-old men
Norway: Hytten and Weisaeth (11)	1989	1977–1984	331 men	13.6	26.1	20–24-year-old men
Poland: Florkowski et al. (12)	2001	1989–1998	437 men	17.3		
Russia: Krupenik (2)	1999	1998		30.0	42.1 in 1994; 39.7 in 2001 <sup>b</sup>	
Sweden <sup>a</sup> : Hytten and Weisaeth (11)	1989	1977–1984	580 men		25.6	20–24-year-old men
Taiwan: Ming and Armed Forces Peitou Hospital (13)	2001	1999		7.6	10.4	
United Kingdom: Fear and Williamson (14)	2003	1984–2002	239 men	11.0	23.1 for men ages 20–24 years; 25.6 for men ages 25–29 years	
United States						
Redmond and Walter (15)	1985	1982–1984 inclusive		10.9		
Sentell et al. (16)	1997	1980–1992	1,144 men; 61 women	13.2 for men; 6.0 for women	23.8 for men; 6.5 for women	
Helmkamp (17)	1995	1980–1992	3,178 men and women	12.5 for men; 5.4 for women	23.79 for men	
Powell et al. (18)	2000	1980–1992		12.5		

<sup>a</sup> Country with conscription into military forces.

<sup>b</sup> Estimate is based on publicly available statistics.

occupations such as health care and policing (25, 26), involves constitutional, environmental, and occupation-specific risk; that military service, like other occupations, influences suicide means (25–28); and that access to, familiarity with (29), and opportunity to use (30) the most lethal means constitute distinct components of that occupational risk.

## Method

The Irish Defence Forces are a nonconscripted, ethnically homogenous military force tasked with maintaining internal security and international peacekeeping with the United Nations. Enlistment occurs from age 17 years, and women have been eligible for enlistment since 1981. Selection criteria include a medical history and examination. Causes of death for all regular-duty Army, Navy, Air Corps, and special forces personnel (N=732) (reserves excluded) from a dynamic cohort in service during the study period (1970–2002) were reviewed. During the study period, the period-averaged number of Irish Defence Forces personnel was 11,880. Causes of death were determined by investigators (M.J.M. and J.P.T.) on the basis of examination of the proceedings of Courts of Inquiry convened under military law to investigate deaths, injuries, and discharges of weapons and examination of military personal/medical files, personal medical records, and civilian and military registers. For incidents that occurred outside of Ireland, proceedings of inquiries conducted by the United Nations were examined. The military files included civilian coroner/inquest and autopsy reports, death certificates, military casualty reports, toxicology and forensic reports, and the accounts of eyewitnesses, partners, relatives, and military colleagues. The conservative standard of proof for suicide “caseness” determinations approximated “beyond reasonable doubt.” “Caseness” interrater

agreement achieved a kappa score of 0.95. In the nested case-control study examining factors associated with suicide, cases were pair-matched for age and gender with contemporaneous (same study period) military comparison subjects randomly chosen from the group of personnel with nonsuicide deaths. Personnel with open-verdict deaths (e.g., deaths by drowning, train accidents, and single-vehicle road traffic accidents) were excluded.

Ethical approval for the study was received from the Mater Misericordiae Hospital Research Ethics Committee and the Irish Defence Forces Command Structure.

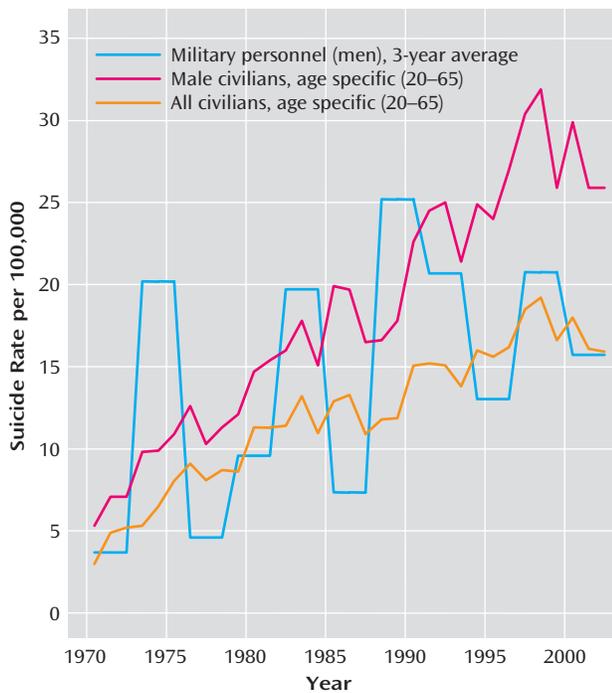
Chi-square tests and Fisher's exact tests (two-tailed) were used in the case-control bivariate analysis. The chi-square test for trend and the chi-square test for proportions were used to analyze ordered and unordered data, respectively. Paired or independent t tests and Mann-Whitney tests were used to compare means. A binary logistic regression analysis model (31) was used to calculate odds ratios for suicide risk. Most analyses were performed with SPSS 11.0 for Windows (SPSS Inc., Chicago).

## Results

### Cohort Study

Table 1 summarizes studies of suicide among military personnel in various countries (5–18). Figure 1 and Figure 2 compare Irish military and civilian suicide rates and methods, respectively. Of the 732 deaths among enlisted Irish Defence Forces personnel in the period 1970–2002 inclusive, 63 (8.5%) were suicides. Nonsuicidal drowning and road traffic accident deaths of military personnel during the study period numbered 38 (5.2%) and 137 (18.7%), respectively. We report period-averaged suicide rates per 100,000 population of 18.3 for male civilians in the 20–65-

FIGURE 1. Suicide Rates Among Irish Defence Forces Personnel and Irish Civilians, 1970–2002<sup>a</sup>



<sup>a</sup> Military personnel ranged in age from 17 to 65 years; civilians ranged in age from 20 to 65 years.

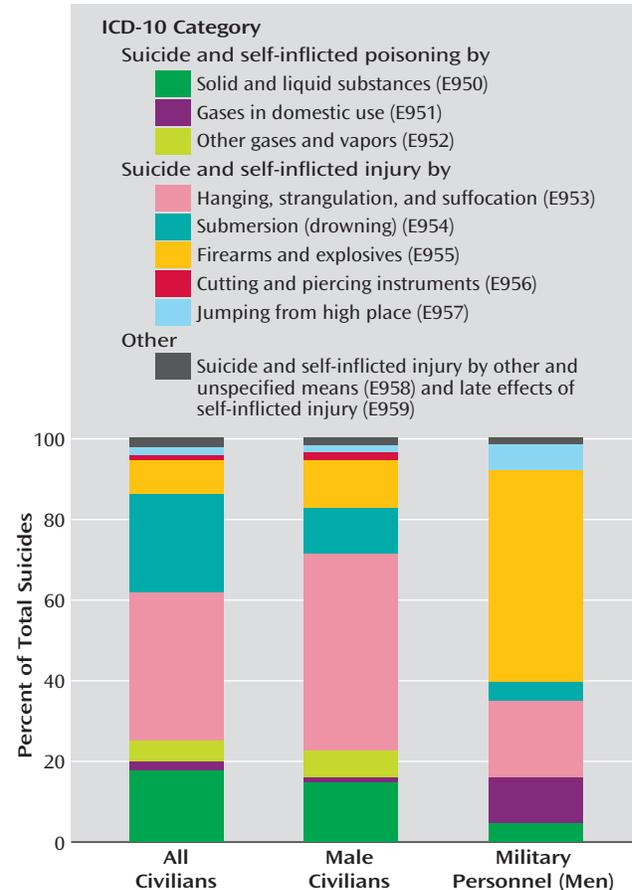
year age group and 15.3 for military personnel (17–65-year age group). Age-band rates (e.g., rates in the 20–24-year, 25–29-year, etc., age groups) were averaged for each year, totaled, and divided by the number of study years. All suicides in the military group involved male personnel, although the period-averaged number of female military personnel was 210 per year.

**Case-Control Studies**

Table 2 details results of the pair-matched case-control bivariate analysis of data for all personnel who died by suicide (N=63) and the comparison subjects with nonsuicide deaths (N=63). The following characteristics were significantly associated with suicide: a psychiatric diagnosis (odds ratio=11.9, 95% confidence interval [CI]=3.3–42.6), a past history of deliberate self-harm (odds ratio=2.1, 95% CI=1.8–2.6), a recent psychiatric assessment (odds ratio=2.2, 95% CI=1.8–2.6), being on morning duty (odds ratio=3.3, 95% CI=1.2–9.7), and being on a military site (odds ratio=4.7, 95% CI=2.1–10.6).

Thirty-three (53%) suicides were by firearm and most involved injuries to the head resulting from firing of a weapon placed in the mouth. Thirty-two (51%) suicides occurred on a military site, and 23 (37%) occurred while the person was on duty. However, almost all suicides on duty (except two drownings of naval personnel) were by firearm and occurred on a military site.

FIGURE 2. Suicide Methods Among Irish Defence Forces Personnel and Irish Civilians, 1970–2002



Bivariate analysis was used to compare the characteristics of the firearm suicide subgroup (N=33) and the comparison group with nonsuicide deaths (N=63). Table 3 lists variables with statistically significant differences. Death by firearm suicide was significantly associated with a psychiatric diagnosis (odds ratio=10.8, 95% CI=2.7–42.9), a past history of deliberate self-harm (odds ratio=3.3, 95% CI=2.4–4.5), a recent psychiatric assessment (odds ratio=3.3, 95% CI=2.4–4.5), a recent medical downgrading (possible medical boarding) (8.9, 95% CI=1.0–83.7), being on duty (odds ratio=6.4, 95% CI=2.5–16.2), being on morning duty (odds ratio=9.1, 95% CI=2.8–30.1), and being on a military site (odds ratio=12.1, 95% CI=4.4–33.2). Medical downgrading consisted of being reclassified to a lower level or grading of physical and mental fitness.

Of the 16 firearm suicides that occurred while the person was on duty, 11 (69%) occurred within 4 hours of duty commencement, suggesting unequal distribution of suicide risk over time within periods of access (Figure 3). (Six suicides that occurred overseas were excluded from this analysis because access to firearms was constant in those settings.) Some firearm suicides that occurred on a military site while the person was off duty involved unauthorized access to weapons.

**TABLE 2. Demographic, Medical, and Occupational Factors and Circumstances of Death for Irish Defence Forces Personnel Who Died by Suicide and Comparison Defence Forces Personnel Who Died From Other Causes, 1970–2002**

Characteristic	Personnel Who Died by Suicide			Comparison Subjects			Analysis		
	N	With Characteristic		N	With Characteristic		p <sup>a</sup>	Unadjusted Odds Ratio	95% CI
		N	%		N	%			
<b>Demographic characteristics</b>									
Single	63	35	56	63	35	56	1.00	1.0	0.5–2.0
Parent	60	24	40	63	27	43	0.75	0.9	0.4–1.8
Age of youngest child (years)	21			27			0.20	0.5	0.14–1.5
≤4		11	52		19	70			
>4		10	48		8	30			
Number of children	23			26			0.10	3.0	0.8–11.3
≤3		19	83		16	62			
>3		4	18		10	39			
Urban origin	63	51	81	63	51	81	1.00	1.0	0.4–2.4
Mandatory education only <sup>b</sup>	17	61	28	26	63	41	0.12	0.6	0.3–1.2
Employed before enlistment	63	47	75	63	54	86	0.12	0.5	0.2–1.2
<b>Clinical characteristics</b>									
Psychiatric diagnosis ever recorded or present at death	59	23	39	59	3	5	0.001	11.9	3.3–42.6
Military psychiatric evaluation ever	58	12	21	59	2	3	0.004	7.4	1.6–35.0
Psychiatric assessment within the last 6 months	58	8	12	59	0	0	0.003	2.2	1.8–2.6
Alcohol use present at death	63	15	24	63	9	14	0.17	1.9	0.8–4.7
Past deliberate self-harm documented	58	6	10	59	0	0	<0.02 <sup>c</sup>	2.1	1.8–2.6
Medical downgrading within the last 3 months	58	6	10	59	1	2	0.06 <sup>c</sup>	6.7	0.8–57.4
Medical assessment within the last 3 months	58	35	60	59	26	44	0.08	1.9	0.9–4.0
<b>Occupational characteristics</b>									
Died on military site	63	32	51	61	11	18	0.001	4.7	2.1–10.6
Died in the morning	55	40	73	58	27	47	0.005	3.1	1.4–6.7
Died on morning duty <sup>d</sup>	44	18	41	35	6	17	<0.03	3.3	1.2–9.7
Disciplinary action ever recorded	61	30	48	63	42	66	<0.05	0.5	0.2–1.0
Died on a weekday	62	37	60	63	31	49	0.24	1.5	0.8–3.1
Died while on duty	63	23	37	63	15	24	0.12	1.8	0.9–4.0

<sup>a</sup> Chi-square or Fisher's exact tests (for analyses in which the expected count was <5 in 20% of cells).

<sup>b</sup> Education is mandatory education until age 11 years.

<sup>c</sup> Fisher's exact test.

<sup>d</sup> Duties begin at 8:30 a.m.

Paired *t* tests comparing the mean numbers of children and ages of the youngest children of the subjects who died by suicide and the comparison subjects were not significant.

Bivariate analysis demonstrated no significant increase in risk of death by suicide, compared to other causes, related to rank or service corps, but a chi-square test for trend of the relative contributions to the number of suicides by rank was highly significant (trend  $\chi^2=73.1$ , *df*=2, *p*<0.001), suggesting that suicides of privates (lowest non-commissioned rank) disproportionately contributed to the total number of suicides. However, a chi-square test of proportions (unordered data) examining relative contribution to the number of suicides by service corps was not significant ( $\chi^2=0.91$ , *df*=2, *p*>0.05). Drowning accounted for two of the five suicides among naval personnel.

During the study period, 10% (*N*=6) of the deaths overseas (where troops are always armed and duties often solitary) were suicides, yet the mean number of overseas trips was not significantly different between the personnel who died by suicide and the comparison subjects (*z*=−1.71, *p*>0.05, Mann-Whitney).

Fifty-one percent (*N*=32) of the suicides occurred in men age 17–25 years, and 30% (*N*=19) occurred in men age

25–34 years. All firearm suicides, including those involving military weapons (*N*=25), occurred when personnel were deliberately alone, thus providing opportunity. Suicidal intent was indicated by 12 men who died by suicide (19%), most of whom used a firearm.

Prodromal signs, e.g., restlessness, isolation, or low mood, were retrospectively noted by colleagues in 24 (38%) cases. Thirty-six (57%) persons who died by suicide had significant life events (mainly relationship and financial difficulties) noted in records of subsequent inquiries.

### Logistic Regression

Factors suggested by the bivariate analyses and the literature and factors that were clinically or occupationally associated with suicide were entered into a binary logistic regression analysis model (31) examining the 33 firearm suicides of particular relevance to military authorities. Precedent exists for attempting to establish factors influencing choice of suicide method (32), particularly in persons who die by firearm suicide (33) and those who survive attempted suicide by firearm (34). Deliberate self-harm and psychiatric illness, which were the only nonindependent variables, were combined into one variable that designated persons with either a psychiatric diagnosis or a past history of deliberate self-harm. The model identified three vari-

**TABLE 3. Demographic, Medical, and Occupational Characteristics of Irish Defence Forces Personnel Who Died by Firearm Suicide (N=33) and Comparison Defence Forces Personnel Who Died From Other Causes (N=63), 1970–2002<sup>a</sup>**

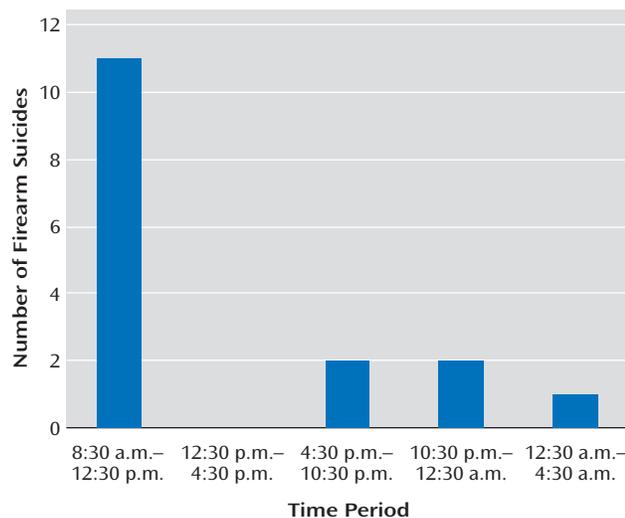
Characteristic	Personnel Who Died by Firearm Suicide			Comparison Subjects			Analysis		
	N	With Characteristic		N	With Characteristic		p <sup>b</sup>	Unadjusted Odds Ratio	95% CI
		N	%		N	%			
Died on military site	33	24	72	61	11	18	0.001	12.1	4.4–33.2
Psychiatric diagnosis ever recorded or present at death	30	11	37	59	3	5	0.001	10.8	2.7–42.9
Medical downgrading within the past 3 months	30	4	13	59	1	2	<0.05 <sup>c</sup>	8.9	1.0–83.7
Died during morning duty	26	17	66	35	6	17	0.001	9.1	2.8–30.1
Died on duty	33	22	67	63	15	24	0.001	6.4	2.5–16.2
Military psychiatric evaluation ever	30	5	17	59	2	3	<0.05 <sup>c</sup>	5.7	1.0–31.4
Past deliberate self-harm documented	30	4	13	59	0	0	<0.02 <sup>c</sup>	3.3	2.4–4.5
Psychiatric assessment within the past 3 months	30	4	13	59	0	0	<0.02 <sup>c</sup>	3.3	2.4–4.5
Died in the morning	31	22	71	58	27	47	<0.03	2.8	1.1–7.1
Indicated suicidal intent before death	33	10	30	63	0	0	0.001	3.74	2.6–5.3

<sup>a</sup> Only statistically significant differences between groups are presented.

<sup>b</sup> Chi-square or Fisher’s exact tests (for analyses in which the expected count was <5 in 20% of cells).

<sup>c</sup> Fisher’s exact test.

**FIGURE 3. Distribution of Firearm Suicides Among On-Duty Irish Defence Forces Personnel (N=16), by Time Period<sup>a</sup>**



<sup>a</sup> Access to weapons occurred with commencement of duty at 8:30 a.m.

ables that accounted for 84.2% of the variation in the data and 83.3% of the firearm suicides ( $\chi^2=1.0$ ,  $df=2$ ,  $p<0.001$ ): psychiatric illness or a history of deliberate self-harm (odds ratio=0.00, 95% CI=0.00–8.3×10<sup>33</sup>), performing morning duty (odds ratio=12.6, 95% CI=2.78–57.27), and a recent medical downgrading (odds ratio=27766.31, 95% CI=0.00–1.17×10<sup>58</sup>). Because suicide is a rare event, the number of study subjects is unavoidably limited; this limitation explains the large confidence intervals and creates the need for cautious interpretation.

## Discussion

### Cohort Study

Notwithstanding the unreliability of Irish civilian suicide rates (35) and easier identification of suicide among

military personnel because of mandatory military inquiries, we report a period-averaged age-adjusted suicide rate among male military personnel that is lower than that of male civilians but higher than that of all civilians. Standardized mortality ratios were not calculated because of the unreliability of civilian data and incompatibilities in the organization of civilian and military data over the study period. Only 44% (N=28) of suicides were so determined by military inquiries, “death due to accidental discharge of weapon” being the commonest conclusion. The lower rate of firearm suicides (53%) among all suicides among Irish military personnel, compared to the rates for U.S. military personnel (61%) (17) and for New York City (92%) (26) and German (71%) (36) police personnel, may reflect tight control of weapon/ammunition access in a military force that is ever conscious of the risk that weapons/ammunition could fall into terrorists’ hands. The smaller proportion of suicidal drownings among military personnel, compared to civilians, may be explained by access to firearms among military personnel. Firearms have been identified as the most lethal means of suicide (37, 38), with suicidal acts involving firearms resulting in death more often than acts involving the second most lethal means, suffocation (37).

### Case-Control Studies

Private rank was significantly overrepresented among the personnel who died by suicide, compared to other ranks (e.g., noncommissioned officers and officers), and this result was similar to international findings (5, 12, 17). Possibly because they had less access to firearms (39), naval personnel who died by suicide more often chose an accessible ubiquitous means, suicidal drowning.

The finding that suicidal intent was articulated by several personnel who eventually died by suicide (N=12) requires cautious extrapolation. Reports of suicidal intent were probably more reliably elicited in inquiries into firearm suicides, as deaths following expression of suicidal in-

tent tended to occur on military installations and while the person was on duty (N=8). These findings may have implications for psychiatric referral/assessment or for a “buddy system,” as deployed in many U.S. units (40), to facilitate earlier detection and intervention.

Evidence-based guidelines in the assessment of suicide risk in weapon-bearing personnel might aid military psychiatrists. Our bivariate analysis, echoing data from other studies, highlights the contribution to military suicide of psychiatric indicators and psychiatric illness (7, 41, 42), particularly alcohol misuse problems (43). The temporal association between suicide and prodromal signs of mental illness (44), relationship difficulties (mostly marital/sexual), civilian legal actions (5, 12, 45), feared medical boarding (discharge) (46), and recent reprimand or punishment were also important. In the Irish forces, as in many others, personnel are referred to psychiatrists by medical officers, not by commanding officers. In our study, personnel with psychiatric diagnoses who died by suicide included 10 subjects with affective disorders (43% of those with psychiatric diagnoses), seven with alcohol misuse (30%), one with anxiety (4.3%), and only two with psychotic spectrum disorders (8.7%). A study of occupational dysfunction due to mental disorder in the U.S. military in the 1990s revealed that by 1995 mental disorders had become the second leading cause of hospitalization (47). The most common primary diagnoses over the study period were substance misuse, adjustment disorders, affective disorders, and personality disorders. Nine percent of outpatient visits were attributed to mental disorder. Hospitalization or outpatient care for mental disorder was highly correlated with military attrition. Reduced suicide rates associated with a suicide intervention program in the U.S. Air Force were recently reported (48). The program prioritized early prevention, early intervention, improved treatment, and risk detection. Fundamental to the approach was the reduction of stigma in order to encourage help-seeking behavior. Military personnel may be reluctant to seek help, because concealment of psychiatric illness at enlistment can result in subsequent administrative discharge (24). In many forces, attempted suicide and deliberate self-harm contravene military law (49). Psychiatrists may be perceived as those who impose occupational restrictions, including perhaps denying access to weaponry (24), thus contributing to a “professional humiliation” factor. In our study, 60% of the subjects who died by suicide had consulted a doctor in the 3 months before death. Incorporation of mental health screening in annual and pre-overseas medical examinations and in all consultations might therefore help foster healthier personnel.

Evidence suggests that reduced access to firearms and other methods lower civilian suicide rates (50–52). Firearms are a necessary military occupational hazard, yet only a few studies of the efficacy of military suicide reduction strategies exist (48, 53–55). Safer workplaces (military sites) should allow only minimal authorized and neces-

sary access to and reduced opportunity to use such occupational hazards as weaponry and ammunition and should prevent personnel from being alone with armed weaponry. Distinctly realizable targets in any risk reduction strategy include reducing the extent of weapon bearing (reducing the number of personnel who carry firearms or the frequency of armed duties), supervision of personnel who bear weapons, and consideration of the weapon bearer’s profile (age, history of psychiatric illness and past self-harm), together with the reduction of occupation-specific stresses. Military authorities should ensure adherence on all installations to the separation of ammunition and weaponry. Stringent protocols should be followed regarding who may have access to either ammunition or weapons or both and regarding the supervision of such personnel. Ammunition accounting protocols and possible use of metal detectors could minimize stockpiling of ammunition or weapons.

The uneven suicide risk distribution over time within periods of weapon access (shown in Figure 3) among military personnel who largely had advance notice of their duty schedule suggests premeditation in anticipation of such access and parallels findings in civilian groups. For example, follow-up of 238,292 U.S. handgun purchasers found that handgun purchase was associated with a substantial increase in firearm suicide risk within a week of the purchase (56). Suicide was the leading cause of death (24.5% of all deaths) in this group in the year after handgun purchase.

Firearm suicide was associated with younger age in a large U.S. civilian study that found that firearm suicide was substantially more likely in persons younger than age 21 and in men (33). Even though only 14% of suicides among male civilians in our study setting occurred in the 20–25-year age group, our finding that a large proportion (up to 50%) of suicides among military personnel occurred in the first 5 years of military service or in the early service period (under age 24 years) is not unique (10–14, 17). Consequently educational and risk reduction strategies (55, 57, 58) should focus on this postenlistment period. Armed duties may represent less risk for more mature soldiers, who are well known to commanding officers, compared to new recruits or young soldiers.

Opportunity to use a lethal means (e.g., solitary armed duty), as distinct from access to lethal means, is an additional important variable. Minimizing suicide risk in weapon bearers could be achieved by reducing unsupervised access to armed weapons. Eliminating solitary armed duties or performing these duties under camera surveillance if they cannot be eliminated might reduce the opportunity for suicide, as evidenced in other settings (59).

We failed to replicate the importance of suicide risk factors suggested by earlier authors, including preenlistment criminality, absent-without-official-leave (AWOL) frequency, history of disciplinary offenses (41), and greater specialty-related firearm familiarity and access, as ob-

served in U.S. forces (29) among U.S. Marines, small arms technicians, and Army infantry soldiers. However, in this study, familiarity with firearms could underpin the higher proportion of firearm suicides among the suicides of military personnel that took place on a military installation, compared to the rate of firearm suicides among suicides in the civilian male population and among military personnel (N=8) who did not use military weaponry and who died off a military site.

A lower incidence of suicides among military personnel overseas might be expected because of the additional health screening of these troops. Nevertheless, peacekeepers face particular stresses, including separation from family/partners, sporadic combat situations in hostile and unfamiliar territories, constant availability for duty, alcohol use, and isolation (60–62). Our analysis revealed no statistically significant differences between the military personnel who died by suicide and the comparison subjects for any measure of overseas or border duty, perhaps replicating studies in peacekeepers (5) and Vietnam draftees (41, 63), despite differences in combat intensity.

### Limitations

Although record-based data were used in this study, the demographic, medical, and most occupational data are both objective and uncontroversial, thus reducing bias. Some occupational variables, e.g., disciplinary action or AWOL frequency, may vary in application and recording in different military units. Not all data were available for each case; for example, it was not possible to collate all toxicology data or discern whether toxicology screens were performed. Strict “caseness” criteria may have underestimated the suicide rate. Inconsistencies in reporting for different overseas mission types and theaters hindered objective determination of the severity of combat exposure. As in all military forces, weapon access is neither universal nor constant, yet it was not possible to calculate a suicide rate corrected for the extent of weapon bearing. Because of the small numbers of suicides in this study group, particularly in some of the service corps, and the absence of suicide among female military personnel, caution is warranted in extrapolation of the data.

### Conclusions

Suicide among military personnel is an informative model with which to explore workplace suicide and occupation-specific suicide risk factors seen in many professions. Our findings suggest that significant factors in workplace suicide include opportunity to use lethal means in occupational settings and the uneven distribution of suicide risk within periods of access to lethal means.

Military authorities could create safer workplaces by reducing the extent of weapon bearing, unnecessary and unauthorized access to weapons, and opportunity to use lethal means for suicide. Attending to the weapon bearer’s

profile, including age and medical and psychiatric indicators, and minimizing the influence of occupation-specific stress could reduce suicide risk. Our findings thus have implications for military health services, military law, enlistment policies, and military inquiries.

Occupation-specific studies of suicide and evidence-based, occupation-specific risk reduction strategies are required in the military and other occupations where access to lethal means is a factor in suicide risk. Suicide reduction strategies centered on access and opportunity (48) have applicability in other at-risk professions and may be more easily implemented in certain workplaces (e.g., military sites, hospitals, police departments), perhaps because of the cohesiveness of those settings and the availability of health care in those settings (12, 27, 48). Research could explore the validity for the workplace of the “substitution hypothesis,” which suggests that although certain method-specific suicide rates may be amenable to reduction, compensatory increases may occur in others (64). However, greater use of less lethal means in suicide attempts might reduce lethality and rates of death by suicide. Research on the effects of suicide reduction strategies in various professions and the applicability of these strategies to professions at higher risk is required (48).

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Received March 9, 2004; revisions received June 14 and Aug. 13, 2004; accepted Sept. 9, 2004. From the Department of Psychiatry and Mental Health Research, St. Vincent’s University Hospital and University College Dublin; St. Bricin’s Military Hospital, Dublin; the Departments of Legal Medicine and of Public Health and Epidemiology, University College Dublin; and County Kildare Coroner’s Office, Naas, County Kildare, Ireland. Address correspondence and reprint requests to Dr. Mahon, Department of Psychiatry and Mental Health Research, St. Vincent’s University Hospital and University College Dublin, Elm Park, Dublin 4, Ireland; docmartins@gmail.com (e-mail).

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