External-cause mortality among 21 609 Norwegian male military peacekeepers deployed to Lebanon between 1978 and 1998

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Abstract

Objective: To investigate external-cause mortality among 21 609 Norwegian male military peacekeepers deployed to Lebanon during 1978–1998.

Methods: The cohort was followed from first day of deployment through 2013, and mortality during deployment and post discharge was assessed using standardized mortality ratios (SMR) calculated from national rates in Norway. Poisson regression was used to see the effect of high- versus low-conflict exposure.

Results: For the total cohort, external-cause mortality was within expected values during deployment (SMR=0.80) and post discharge (SMR=1.05). In the low-conflict exposure group, a lower mortality from all external causes (SMR=0.77), transport accidents (SMR=0.55), and accidental poisoning (SMR=0.53) was seen. The high-conflict exposure group showed an elevated mortality from all external causes (SMR=1.20), transport accidents (SMR=1.51), and suicide (SMR=1.30), but these risks were elevated only during the first 5 years after discharge. This group also showed elevated mortality from all external causes (RR=1.49), and for transport accidents (RR=3.30) when compared with the low-conflict exposure group.

Conclusions: Overall external-cause mortality among our peacekeepers was equal to national rates during deployment and post discharge. High conflict exposure was associated with elevated mortality from all external causes, transport accidents, and suicide during the first 5 years after discharge from service.

Key words: suicide, transport accidents, mortality, military, Lebanon

What this paper adds

- Previous studies have shown that military personnel deployed to war zones have elevated risk of external cause mortality, particularly mortality from transport accidents and suicide, compared with contemporary veterans not deployed to such areas
- In our study, we used time period of peacekeeping service in Lebanon as a proxy for high- and low conflict exposure
- In the overall cohort, external-cause mortality was equal to national rates post discharge
- We observed increased risks of mortality from all external causes, from transport accidents, and from suicide in the high-conflict exposure group, but only in the first 5 years after discharge. External cause mortality was below national rates in the low-conflict exposure group
- Our results have implications for present and future peacekeeping missions in terms of awareness of negative effects of conflict exposure, especially during the first 5 years after discharge from peacekeeping service

LIST OF ABBREVIATIONS AND ACKRONYMS

CI: confidence interval

HSE: healthy soldier effect

ICD-10: International Classification of Diseases, 10th revision

PTSD: posttraumatic stress disorder

RR: rate ratio

SMR: standardized mortality ratio

UNIFIL: United Nations Interim Force in Lebanon

INTRODUCTION

Military personnel tend to have better health than the general population, which is explained by multiple episodes of selection that take place before and during military service, a demand to stay physically fit while in service, and better access to medical services during and after service.[1 2] As a consequence, a "healthy soldier effect" (HSE) in terms of lowered all-cause mortality is often seen when military cohorts are compared with general populations.[3 4] While selection for physical fitness might contribute to persistent lowered disease mortality, deployment to conflict areas and war zones can include psychological stresses and a certain willingness to take risks, which might counteract the HSE for external-cause mortality (i.e., mortality due to accidents and injuries). Both military combatants and peacekeepers are exposed to high rates of traumatic events during deployment,[5] for peacekeepers such events include gunfire and shelling, engagement in dangerous patrols, risk of combat-related injuries, witness of large-scale violence, and rejection by the local population.[6 7] Predeployment screening to predict psychological vulnerability has proven difficult [2 8], and exposure to traumatic stress through deployment to conflict zones is associated with an increased risk of injury-related mortality post discharge.[9 10] Several studies involving deployed military cohorts have shown that their mortality due to external causes was either similar to[3 4 11] or exceeded that seen in the general population.[12] When military personnel deployed to conflict areas are compared with Era veterans (i.e., those who served elsewhere during the same time period), external-cause mortality, including death due to transport accidents,[1 9 13-15] accidental poisoning, and drug-related deaths,[14] is often significantly elevated.

An elevated risk of suicide post discharge has also been observed among veterans;[16-19] depression,[20] posttraumatic stress disorder (PTSD)[16] and being wounded by hostile forces[21] seem to increase this risk.

Our cohort consists of 21 609 Norwegian male military peacekeepers deployed to the United Nations Interim Force in Lebanon (UNIFIL) between 1978 and 1998. In a previous study of disease-related mortality in this cohort, we found a HSE for all-cause mortality due to low mortality from diseases. However, no HSE was seen for external-cause mortality; instead a 29% excess was seen during the first 5 years of follow-up.[22] The aim of the present study is to further investigate external-cause mortality, such as transport accidents and suicide, in the same cohort. We compared external-cause mortality during deployment and post discharge with national rates in Norway. In the post-discharge period we also looked at the effect of time since discharge from service in Lebanon, and the effect of high and low conflict exposure.

MATERIALS AND METHODS

The study population, outcome registries, and methodology was described in a previous study on this same cohort[22] and is repeated only briefly. The study cohort was established by The Norwegian Armed Forces Human Resources and Conscription Centre and counts 21 609 Norwegian male military peacekeepers deployed to Lebanon during 1978–1998. The year of birth in the cohort ranged from 1921 to 1978, and median age at start of service in Lebanon was 22.8 years (interquartile range 5.3). Average duration of service in Lebanon was 10 months (Table 1).

Table 1. Demographic and service characteristics of the cohort of Norwegian male military peacekeepers deployed to Lebanon during 1978–1998.

Characteristics	**N**	**%**
Overall cohort (Norwegian citizenship at start of service)	21 609	100
No. of deployments to Lebanon		
1 deployment	12739	59.0
2 deployments	6346	29.4
3 or more deployments	2524	11.7
Died during service period	23	
Emigrated during service period	9	
Total post-discharge cohort	21 577	100
High-conflict exposure group	12 349	57.2
Low-conflict exposure group	9228	42.8
Died during follow-up	1190	5.5
Emigrated during follow-up	529	2.5
	Range	Median (IQR)
Year of birth	1921–78	1963 (10)
Age at first deployment (years)	18–59	22.8 (5.3)
Age et end of follow-up (years)	21–91	50.3 (10.4)
Length of follow-up (years), post-discharge cohort	0–35	24.6 (9.5)

IQR, Interquartile range

Within the cohort we looked at mortality during deployment (from the first day of service in Lebanon until 31 days after last recorded day of service) and post discharge (from 31 days after the last recorded day of service in Lebanon until 31 December 2013). We also assumed that peacekeepers who served during high-conflict periods were exposed to higher levels of

stress and psychological trauma, due to a higher risk of being injured or killed and the perception of civilian suffering, than those who served in low-conflict periods. Thus we divided the cohort into high- and low-conflict exposure groups. In the post-discharge period, the high-conflict exposure group included 12 349 men who ever served from the start of UNIFIL between March 1978 and February 1987 and/or during the Israeli operations in 1993 (July 25th–31st) and 1996 (April 11th–27th). The low-conflict exposure group included 9228 men who served in Lebanon but never during those periods (Table 1).

Data on vital status and emigration was retrieved through linkage to the National Population Register, based on the unique personal identification number given to all Norwegian citizens. Underlying cause of death and date of death was obtained through linkage to the Cause of Death Registry. Deaths were classified in this registry according to the International Classification of Diseases (ICD), 8th (1978–85), 9th (1986–95) and 10th (1996–2013) revisions, grouped according to the 65 European Shortlist key causes of death, and expressed in ICD-10 codes in this report. All cohort members were followed up for mortality until date of emigration or until the end of follow-up (31 December 2013), whichever came first.

Statistical analyses

Standardized mortality ratios (SMRs) were computed by dividing the observed number of deaths by the expected number of deaths, which were computed from national 5-year age-specific and 1-year period-specific rates among all Norwegian men. Ninety-five percent confidence intervals (CI) were computed on the assumption of a Poisson distribution of the observed deaths. During deployment, we calculated SMRs for all-cause mortality, mortality from all external causes, and mortality from suicide. SMRs were calculated for all-cause mortality, mortality from all external causes, accidents, and suicide post discharge, overall

and for three separate post-discharge periods (0–4, 5–9, and ≥10). Corresponding post-discharge SMRs were also calculated for the high- and low-conflict exposure groups. Poisson regression analysis was used to compare SMRs by conflict exposure group, with observation period and age at risk included in the models. Relative risks, expressed as rate ratios (RR) were calculated for the high-conflict exposure group using the low-conflict exposure group as a reference. SPSS v. 22 and Stata 13 (StataCorp LP, College Station, TX, USA) software packages were used for statistical analysis. We chose a p value smaller than 0.05 to indicate statistical significance.

RESULTS

The overall cohort

Mortality during deployment

The 23 deaths observed during deployment was almost half that observed in national rates (SMR=0.53, 95% CI 0.34–0.80). Eighteen of the deaths in the cohort were from external causes, of which six were accidents (mostly transport accidents) and four were suicide. The remaining eight deaths were directly related to combat (helicopter crash, enemy fire), of which seven occurred during high-conflict periods. The SMRs for all external causes and for suicide were 0.80 (95% CI 0.47 to 1.26) and 0.47 (0.13 to 1.21), respectively (Table 2).

Post-discharge mortality

All-cause mortality post discharge was lower than expected (SMR=0.85 95% CI 0.81 to 0.91), although the number of deaths from external causes (n=327 deaths) was similar to the expected number based on general population data (SMR=1.05). Accidents accounted for 171 of these deaths, of which half (84) were due to transport accidents. Neither mortality from accidents nor mortality from any of the subcategories of accidents we investigated showed significant excess mortality, but transport accident mortality was 18% above national rates (95% CI 0.94 to 1.47). On the other hand, accidental poisoning was significantly reduced by one-third (SMR=0.68 95% CI 0.46 to 0.96). The 140 observed cases of suicide yielded an excess risk of 17%, which was close to statistical significance (95% CI 0.99 to 1.38) (Table 2). Looking at the SMRs in the three separate post-discharge periods revealed a significant, increased risk of mortality from all external causes (SMR=1.42 95% CI 1.14 to 1.75), transport accidents (SMR=1.47 95% CI 1.01 to 2.08), and suicide (SMR=1.48 95% CI 1.04 to 2.04) during the first 5 years post discharge, while no excess risk was seen thereafter. However, only small fluctuations in mortality was seen for the 5–9 and ≥10 years of follow-

up, and we therefore present data for the first 5 years (0-4 years) and the subsequent periods combined ("5+ years") in Tables 2 and 3.

Table 2. All-cause and external-cause mortality during deployment (N=21 609, 31 383 person years) and post discharge (N=21 577, 530 306 person years) among Norwegian male peacekeepers deployed to Lebanon during 1978–1998. Follow-up: 1978–2013. Standardized mortality ratio (SMR) adjusted for age and time period with 95% confidence intervals (CI). Overall post-discharge SMRs are presented, as well as 5-year and 5+ year post-discharge SMRs.

	Cause of death	ICD-10	Follow-up period Years	Obs	Exp	SMR	95% CI
Deaths during deployment	All causes	A00–Y99	All	23	43.06	0.53	0.34 to 0.80
	All external causes	V01–Y89	All	18	22.52	0.80	0.47 to 1.26
	Suicide	X60–84,Y87.0	All	4	8.49	0.47	0.13 to 1.21
Post-discharge deaths	All causes	A00–Y99	All	1190	1391.93	0.85	0.81 to 0.91
	All external causes	V01–Y89	All	327	310.83	1.05	0.94 to 1.17
			0–4	89	62.75	1.42	1.14 to 1.75
			5+	238	248.07	0.96	0.84 to 1.09
	Accidents	V01–X59, Y85–86	All	171	180.40	0.95	0.81 to 1.10
			0–4	45	35.02	1.28	0.94 to 1.72
			5+	126	145.37	0.87	0.73 to 1.03
	Transport accidents	V01–V99, Y85	All	84	70.97	1.18	0.94 to 1.47
			0–4	32	21.70	1.47	1.01 to 2.08
			5+	52	49.27	1.06	0.79 to 1.39
	Accidental falls	W00–19	All	19	17.40	1.09	0.66 to 1.71
	Accidental poisoning	X40–49	All	31	45.81	0.68	0.46 to 0.96
	Suicide	X60–84,Y87.0	All	140	119.36	1.17	0.99 to 1.38
			0–4	37	24.95	1.48	1.04 to 2.04
			5+	103	94.41	1.09	0.90 to 1.32
	Homicide, assault	X85–Y09,Y87.1	All	11	8.16	1.35	0.67 to 2.41
	Events of undetermined intent	Y10–34,Y87.2	All	3	2.64	1.14	0.23 to 3.33

ICD-10=International Classification of Diseases, 10th revision; Obs=observed number of cases; Exp=expected number of cases.

Table 3. External-cause post-discharge mortality among 21 577 Norwegian male military peacekeepers deployed to Lebanon during 1978–1998 by conflict exposure group. Standardized mortality ratios (SMRs) adjusted for age and time period with 95% confidence intervals (CI) are presented for the whole follow-up (1978–2013, 530 306 person years), and for the first 5 years and 5+ years separately.

Cause of death	ICD-10	Follow-up period	Conflict exposure group							
			Low				High			
		Years	Obs	Exp	SMR	95% CI	Obs	Exp	SMR	95% CI
All external causes	V01–Y89	All	81	105.44	0.77	0.61 to 0.95	246	205.39	1.20	1.05 to 1.36
		0–4	21	24.02	0.87	0.54 to 1.34	68	38.74	1.76	1.36 to 2.23
		5+	60	81.42	0.74	0.57 to 0.96	178	166.65	1.07	0.92 to 1.24
Accidents	V01–X59, Y85–86	All	41	60.24	0.68	0.49 to 0.92	130	120.16	1.08	0.90 to 1.28
		0–4	8	12.52	0.64	0.28 to 1.26	37	22.50	1.64	1.16 to 2.27
		5+	33	47.71	0.69	0.48 to 0.97	93	97.66	0.95	0.77 to 1.17
Transport accidents	V01–99, Y85	All	13	23.84	0.55	0.29 to 0.93	71	47.13	1.51	1.18 to 1.90
		0–4	3	7.88	0.38	0.08 to 1.11	29	13.82	2.10	1.41 to 3.01
		5+	10	15.96	0.63	0.30 to 1.15	42	33.31	1.26	0.91 to 1.70
Accidental falls	W00–19	All	7	3.92	1.78	0.72 to 3.67	12	13.47	0.89	0.46 to 1.56
Accidental poisoning	X40–49	All	10	19.00	0.53	0.25 to 0.97	21	26.80	0.78	0.48 to 1.20
Suicide	X60–84,Y87.0	All	39	41.77	0.93	0.66 to 1.28	101	77.59	1.30	1.06 to 1.58
		0–4	13	10.44	1.25	0.66 to 2.13	24	14.51	1.65	1.06 to 2.46
		5+	26	31.33	0.83	0.54 to 1.22	77	63.08	1.22	0.97 to 1.53

ICD-10=International Classification of Diseases, 10th revision; Obs=observed number of cases; Exp=expected number of cases

Conflict exposure groups

Post-discharge mortality

The risk of mortality from all external causes post-discharge deviated significantly from unity in both conflict exposure groups; it was elevated in the high-conflict group (SMR=1.20 95% CI 1.05 to 1.36) and reduced in the low-conflict group (SMR=0.77 95% CI 0.61 to 0.95) (Table 3). The risk of mortality from accidents was lower than national rates in the low-conflict group (SMR=0.68 95% CI 0.49 to 0.92) and similar to national rates in the high-conflict group; however, the latter group showed a statistically significant increased risk in the first 5 years post discharge (SMR=1.64,95% CI 1.16 to 2.27). For the subcategory of transport accidents, there was a sharp contrast between the 51% (95% CI 1.18 to 1.90) elevated risk in the high-conflict group and the 45% (95% CI 0.29 to 0.93) reduced risk in the low-conflict group when they were compared with national rates. In the high-conflict exposure group, the risk doubled in the first 5 years after discharge (SMR=2.10 95% CI 1.41 to 3.01), but no excess risk was seen thereafter (SMR=1.26 95% CI 0.91 to 1.70). There were 101 cases of suicide in the high-conflict exposure group. When compared to the 77.6 expected cases, this gave an elevated SMR of 1.30 (95% CI 1.06 to 1.58), but this risk was elevated only during the first 5 years after discharge (SMR=1.65 95% CI 1.06 to 2.46). In the low-conflict group, the suicide risk was similar to national rates throughout the entire follow-up period (N=39, SMR=0.93). The Poisson regression analysis showed a significant, higher mortality risk from all external causes (RR=1.49), from accidents (RR=1.72), and from the subcategory of transport accidents (RR=3.30) in the high-conflict exposure group when compared to the low-conflict exposure group, while the 21% higher risk of suicide was not statistically significant (RR=1.21 95% CI 0.81 to 1.78) (Table 4).

Table 4. Relative risks expressed as rate ratios (RRs) for selected external causes of death among men in the high-conflict exposure group, using the low-conflict exposure group as the reference category and Poisson regression analysis adjusted for observation period and age with 95% confidence intervals (CI). Follow-up 1978–2013

Causes of death	ICD-10	RR	95% CI
All external causes	V01–Y89	1.49	1.14 to 1.93
Accidents	V01–X59, Y85–86	1.72	1.20 to 2.46
Transport accidents	V01–99, Y85	3.30	1.82 to 5.99
Accidental falls	W00–19	0.96	0.37 to 2.50
Accidental poisoning	X40–49	0.84	0.38 to 1.86
Suicide	X60–84,Y87.0	1.21	0.81 to 1.78

ICD-10=International Classification of Diseases, 10th revision.

DISCUSSION

External-cause mortality during deployment did not differ from the external-cause mortality seen in national rates. There was an increased risk of post-discharge mortality from all external causes, from transport accidents, and from suicide, but only in the first 5 years after discharge. Mortality from accidental poisoning was lowered by one-third. When stratified by conflict exposure, the low-conflict exposure group showed a lower mortality for all external causes, transport accidents, and accidental poisoning. In the high-conflict exposure group, excess risk of mortality from all external causes, specifically from transport accidents and suicide, was seen, but the excess risk disappeared 5 years after discharge from service in Lebanon. When compared to the low-conflict group, the high-conflict group had a higher risk of dying from all external causes, from accidents overall, and from transport accidents, while the increased risk of suicide we observed was not statistically significant.

The lack of HSE for external-cause mortality we observed in our post-discharge cohort is in line with other studies, including a meta-analysis comprising seven deployed military cohorts.[3 4] The increased risk of death from transport accidents we report here in the high-conflict exposure group during the first 5 years after discharge is also consistent with other

findings. When compared with their respective Era cohorts, the elevated risk of death from transport accidents observed among Gulf War veterans from the United Kingdom[15] and of motor vehicle accidents among Gulf War veterans[23] and Vietnam veterans from the United States[14] seen in comparison was confined to the first 5 years after discharge. Among United Kingdom veterans deployed in the 2003 Iraq War, Fear et al.[24] observed that risky driving (not wearing a seatbelt, speeding, or both) post discharge was associated with increasing exposure to traumatic events during deployment. When analyzing data from 947 motor vehicle accident-related deaths during the first 2.4 years of follow-up in Gulf War and non-Gulf War veterans from the United States,[1] Gulf War veterans used seat belts and wore motorcycle helmets less often, sped more often, were more likely to have consumed alcohol, and to have previous convictions for driving under the influence.[25] According to the authors, this pattern supported the speculation that Gulf veterans, as survivors of war, would perceive the degree of risk differently than non-war veterans and may therefore engage in more risk-taking behavior.

The same reasoning might apply to our cohort. The exposure to war, combat and/or a high level of conflict is probably more important than military selection before deployment. According to Watanabe and Kang,[26] the excess risk of external-cause mortality in United States Marines who were Vietnam veterans compared to Marines who served elsewhere cannot be explained only by the selection process for military service, because they were not drafted but self-selected volunteers. However, those who enlist for service in conflict areas/war zones might be more willing to take risks than those who enlist for service elsewhere. In our study, self-selection is probably of minor importance, as the definition of conflict exposure groups is related to time-periods and not the zone/area in Lebanon.

The increased risk of suicide in our high-conflict exposure group is in line with observation from other cohorts deployed to conflict areas. According to a review by Institute

of Medicine, there is sufficient evidence of an association between deployment to a war zone and suicide in the first few years after return from deployment.[10] Among United States veterans deployed to Iraq and Afghanistan, all-cause mortality was lowered, but the risk of suicide was elevated (SMR=1.38). However, this study also found similar results among non-deployed veterans.[18] Compared with non-veterans in the general population of the United States, Kaplan and co-workers found that male veterans were more likely to die of suicide (hazard ratio=2.13) but not of accidents and homicide.[19] The authors also observed that impaired functional status increased the risk of suicide. The risk factors for suicide include mental disease and depression, chronic physical illness, and exposure to a traumatic event.[27] Among Korean Vietnam veterans who participated in surveys in 2001, severely depressed participants had a three-fold higher risk of suicide than those who reported no, or only moderate depression.[20] The increased risk in our cohort might be explained by indirect evidence of possible pathways between combat exposure and increased suicide risk via the link between PTSD and observations of increased suicide risk among veterans with PTSD.[16 18] Unfortunately, we did not have information of PTSD among our cohort members.

The level of conflict exposure was correlated with successive time periods, as the high-conflict period included the first 9 years of engagement in Lebanon. A confounding effect of period, during which the mortality of the general population, and selection and training for deployment might have changed should be considered. A "cohort effect", i.e., the variation in the risk of a health outcome according to the year of birth, which might coincide with shifts in the population exposure to risk factors over time[28] was minimized as the effect of period was incorporated in the resulting SMRs. In a recent survey conducted among our cohort members, 4 out of 5 respondents reported sufficient training before deployment. Respondents who served during the first years in Lebanon more often reported exposure to traumatic events than those who served during the last years, and a positive correlation between such exposure

and mental health problems later in life was found.[29] These results are consistent with our definition of the conflict exposure groups, and probably also with the increased mortality from transport accidents and suicide in the high conflict exposure group.

CONCLUSIONS

In the overall cohort, external-cause mortality was equal to national rates during service in Lebanon and post discharge. We observed increased risks of post-discharge mortality from all external causes, from transport accidents, and from suicide in the high-conflict exposure group, but only in the first 5 years after discharge. Our results have implications for present and future peacekeeping missions in terms of awareness of negative effects of conflict exposure, especially during the first few years post discharge.

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Competing interests

None declared

Ethics approval

Approval for this study was obtained from the Regional Committees for Medical and Health Research Ethics of Southern Norway.

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