



Road traffic accidents in Scottish military veterans

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ARTICLE INFO

Keywords:

Road traffic accidents
Land transport accidents
Risk factors
Military veterans
Retrospective cohort studies

ABSTRACT

Road traffic accidents (RTA) are recognised to be an important cause of death and injury in serving military personnel but little is known about the risk in veterans. We used data from the Scottish Veterans Health Study to examine the risk of RTA in a large national cohort of veterans, in comparison with people who had never served. We conducted a retrospective cohort study of 57,000 veterans and 173,000 non-veterans, followed up for up to 30 years, using survival analysis to compare risk of RTA injury. Subgroup analysis was used to explore trends by birth cohort and length of service. Overall, veterans had a higher risk of RTA (Cox proportional hazard ratio (HR) 1.17, 95% confidence intervals (CI) 1.14–1.20). The risk was highest in the veterans with the shortest service (early service leavers), including those who did not complete initial military training (HR 1.31, 95% CI 1.23–1.40). The mean age at first RTA was 34 years, irrespective of age at leaving service, and the greatest increase in risk was in veterans born in the 1960s, but veterans born after 1970 showed no increase in risk. We have therefore demonstrated that the increased risk of RTA observed in serving military personnel persists in veterans through the fourth decade of life. The high risk in early service leavers is likely to be related to risk factors other than military service, including previous childhood adversity. Recent Ministry of Defence road safety programmes may now be reducing the long-term risk of RTA injury.

1. Introduction

Road traffic accidents (RTA) were the commonest cause of death in serving UK military personnel until 2007, when the percentage was first exceeded by deaths due to hostile action, notwithstanding the increase in operational tempo in Iraq and Afghanistan which had been ongoing since 2001 (Defence Statistics (Health), 2011). The majority of the deaths were in off-duty personnel and predominantly in male soldiers under the age of 30 years. Injuries due to RTA were also a major contributor to medical retirement from the Armed Forces. A number of road safety initiatives aimed at serving personnel were introduced from 2006, and the rate of RTA death has been falling since 2004–2006, from a peak of 28 per 100,000 across all three Services (Naval Service, Army, and Royal Air Force) in 1991–1993 to 10 per 100,000 in 2013–2015. Army rates have always been highest, reaching 38 per 100,000 in 1989–1991 and falling to 12 per 100,000 in 2013–2015. Despite this improvement, the overall risk of death from RTA in military personnel remains elevated in comparison with the UK population, standardised mortality ratio (SMR) 174. For comparison the highest risk is in pedestrians with SMR being equal to 271, followed by motorcycle

accidents where the SMR is 234 and motor vehicle accidents with an SMR of 137 (Defence Statistics (Health), 2016).

Armed Forces personnel have been shown to exhibit risk-taking behaviour in a range of settings (Fear et al., 2007; Thandi et al., 2015), and in a randomly-selected cohort of military personnel surveyed between 2004 and 2006, 19% of personnel were classified as risky drivers (Fear et al., 2008), although there is evidence that this is now reducing (Sheriff et al., 2015). Risk factors included being young, male, in the Army, having a combat role, and having a history of childhood adversity (Fear et al., 2008). The risk of RTA has been shown to increase after operational deployment (Lincoln et al., 2006), although it declines with time elapsed since return (Macfarlane et al., 2005). The UK Ministry of Defence (MOD) has implemented a programme of road safety education for personnel returning from deployment since 2006.

Despite extensive data on the risk of RTA in serving personnel, little is known about the level of risk in veterans. Furthermore most studies on RTA have examined deaths, and data on non-fatal injuries are more sparse. We used data from the Scottish Veterans Health Study to examine the risk of injury and death from RTA in a large cohort of veterans drawn from the full range of backgrounds and covering a wide

Abbreviations: CI, confidence intervals; ESL, early service leaver; HR, hazard ratio; ICD, International Classification of Diseases; ISD, Information Services Division, NHS Scotland; LTA, land transport accident; MOD, Ministry of Defence (UK); NHS, National Health Service (UK); NHSCR, National Health Service Central Registry (Scotland); RTA, road traffic accident; SES, socio-economic status; SIMD, Scottish Index of Multiple Deprivation; SMR, standardised mortality ratio; SMRnn, Scottish Morbidity Record [number]; US, United States (of America)

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range of periods and lengths of service, in comparison with the general Scottish population.

2. Methods

2.1. General

The Scottish Veterans Health Study is a retrospective cohort study, conducted by the authors, which examines long-term health outcomes in military veterans in comparison with non-veterans. The study population includes all 56,570 military veterans resident in Scotland who were born between 1945 and 1985 and who were registered with National Health Service (NHS) Scotland both before and after service, and a comparison group of 172,753 individuals having no record of service. The comparison group was selected from NHS central records by matching on age, sex and postcode sector of residence (mean population 5000) to select three non-veterans for each veteran. The demographic characteristics of the study cohort have been reported elsewhere (Bergman et al., 2014).

The current study focussed on fatal and injury RTA. Demographic data were obtained from electronic NHS registration records and were linked at an individual level to routine acute hospital data (Scottish Morbidity Record SMR01) and death certificates to provide information on injury and death due to RTA. The electronic NHS record provided dates of entering and leaving the Armed Forces for veterans. The maximum period of follow-up was from 1 January 1981 (or date of leaving the Armed Forces, for veterans, if later) to 31 December 2012. The data extract was pseudo-anonymised, and approval for the study was given by the Privacy Advisory Committee of the Information Services Division, NHS Scotland.

2.2. Socio-economic status

SIMD is an area-based measure of deprivation derived from measures across a number of domains encompassing income, employment, health, education (including skills and training), housing, crime, and access to services. The data are derived from a wide range of sources including benefits claims, criminal justice statistics, healthcare data, and educational performance records. The SIMD has been used to derive quintiles of socioeconomic status (SES) for the Scottish population; ranging from 1 (most deprived) to 5 (least deprived). Details of the Scottish Index of Multiple Deprivation (SIMD) are published by the Scottish Government (Scottish Government, 2012). SIMD is calculated for 6505 datazones (mean population 800) in Scotland, based on postcode of residence. We categorised the cohort participants according to these quintiles using the postcode of residence.

Table 1

Cox proportional hazards model of the association between veteran status, sex, age at RTA, length of service, and risk of RTA, landmark age 18 years.

		Univariate			Multivariate ^a		
		HR	95% CI	P value	HR	95% CI	P value
Overall	All RTA	1.17	1.14–1.20	< 0.001	1.17	1.13–1.20	< 0.001
	Men	1.18	1.15–1.22	< 0.001	1.18	1.15–1.22	< 0.001
	Women	1.07	0.99–1.17	0.104	1.05	0.97–1.14	0.242
RTA death	All	0.90	0.68–1.18	0.441	0.88	0.67–1.17	0.387
	Age at RTA						
	All ages	1.17	1.14–1.20	< 0.001	1.17	1.13–1.20	< 0.001
	≥ 40 years	1.04	0.98–1.10	0.231	1.03	0.98–1.10	0.254
Length of service ^b	ESL (did not complete training)	1.31	1.23–1.40	< 0.001	1.30	1.22–1.38	< 0.001
	Trained ESL	1.28	1.22–1.34	< 0.001	1.27	1.21–1.33	< 0.001
	4–12 years	1.13	1.09–1.17	< 0.001	1.13	1.08–1.17	< 0.001
	> 12 years	0.99	0.91–1.07	0.793	0.99	0.92–1.07	0.850

HR hazard ratio; CI confidence interval; ESL early service leavers.

^a Adjusted for Scottish Index of Multiple Deprivation.

^b Intervals correspond to common lengths of military service.

2.3. Definitions

Injury or death due to RTA was defined as ICD-10 code V00–V99, or ICD-9 code E810–E819 or E820–E825, at any position in the hospital record or in the death record. Only the first occurrence in the hospital record was captured in order to avoid confounding arising from repeated admissions arising from the same accident. ‘Early Service Leavers’ (ESL) were tightly defined as veterans having 2.5 years’ service or less in order not to incorrectly classify those who had completed the earlier minimum term of 3 years, whilst those having 0.4 years’ service or less were categorised as not having completed initial training (Bergman et al., 2016).

2.4. Statistical analysis

Cox proportional hazard models were used to examine the association between veteran status and cumulative risk of injury or death from RTA, using age as the time dependent variable, age at first recorded occurrence of RTA as the event time and age at death (if no RTA) as the censor time. Cox proportionality assumptions were tested using methodology based on Schoenfeld residuals (Grambsch and Therneau, 1994). A landmark analysis was performed using age 18 years as the starting point in order to prevent confounding by childhood RTAs which precluded military service among the comparison group. The *a priori* rejection level was set at 0.05. The models were run univariately and then repeated adjusting for the potential confounding effect of SES quintile. The analyses were repeated stratifying by grouped year of birth to examine potential birth cohort effects. All analyses were performed using Stata v12.1 (©1985–2011 StataCorp).

3. Results

3.1. Main findings

After data cleansing to remove records with incomplete or invalid data, 56,205 (99.3%) veterans and 172,741 (99.9%) non-veterans were included in the analyses. The veterans included 5235 (9.2%) women, reflecting the male/female ratio of the military population. The mean period of follow-up was 29.3 years, and there was a total of 6.7 million person-years of follow-up (measured in years) among veterans and non-veterans combined.

Over the period of follow-up, there were 7702 (13.70%) road traffic accident casualties among the veterans, compared with 23,907 (13.84%) in non-veterans. The overall risk was higher in veterans taking into account their generally shorter follow-up time, from the conclusion of their military service, as demonstrated by the Cox proportional hazard ratio (Table 1). The risk was similar after adjusting for

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