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Understanding the effect of deployment on the risk of fatal motor vehicle crashes: A nested case–control study of fatalities in Gulf War era veterans, 1991–1995

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Abstract

Motor vehicle crashes (MVCs) are an important cause of morbidity and premature loss of life among military personnel during peacetime and particularly following combat. A nested case–control study of fatal MVC occurring between 1991 and 1995 was conducted in a cohort of Gulf War era veterans. Cases were validated MVC deaths in the Fatality Analysis Reporting System. Controls were selected using risk set sampling by gender and year of case ascertainment in a 10:1 ratio. Preliminary results, consistent with previous reports of increased fatal MVC risk among returning combat veterans, showed a crude odds ratio of 1.45 (95% confidence interval 1.27–1.65). Multivariable logistic regression modeling was used to identify important independent predictors, as well as to quantify the influence of deployment on a risk profile for fatal MVC. Because of significant interaction between deployment and inpatient diagnosis of substance abuse, the final model was stratified by deployment status. Results suggest that demographic, military, and behavioral characteristics of deployed healthy warriors are similar to the risk profile for fatal MVC. In addition to young, single, high school-educated, enlisted male personnel, those who served during times of ground combat, particularly in infantry, gun crews, or seamanship occupations, should be targeted for preventive interventions.

Keywords: Motor vehicle; Accident; Gulf War; Military; Mortality; Case–control

1. Introduction

Motor vehicle crashes (MVCs) continue to be an important public health concern in the United States, leading all other causes of death for individuals between 2 and 33 years of age and disproportionately affecting males (68% of all traffic fatalities) (NHTSA, 2003). Over the last decade, both the fatality and injury rates per 100,000 U.S. population have trended downward, with the fatality rate decreasing by 6%, and the injury rate by 19% (NHTSA, 2003). An increase in seat-belt use and a reduction in the rate of alcohol involvement were major contributors to these positive downward trends (NHTSA, 2003).

Despite encouraging population trends, MVCs remain a major health concern in the U.S. military. In 1999, the DDSPWG, 1999*Atlas of Injuries in the U.S. Armed Forces* established the magnitude of this public health problem when it described injury as the leading cause of disabilities, hospitalizations, and outpatient visits in the military, with MVC among the top four categories. Moreover, unintentional injury, largely due to MVC, was identified as one of the leading causes of preventable death across all military services (Jones and Hansen, 2000). Although a study comparing trends in

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age-adjusted MVC-related fatality rates between Army and civilian men from 1980 to 1997 showed reductions of 49.5 and 38.8%, respectively, fatal MVCs continue to exceed all other causes of mortality within the Army (Krull et al., 2004).

We know that MVCs do not occur randomly but are associated with demographic, medical, behavioral, and psychosocial risk factors. In both military and civilian populations, demographic predictors include age (younger age groups), gender (male), educational level (high school and below), and marital status (not married) (Bell et al., 2000; Krull et al., 2004; Tavris et al., 2001). Observed differences in MVC risk have been explained by a differential distribution of risk taking behaviors by age and gender (Turner and McClure, 2003). Among Army service members, being young, in a minority group, and enlisted have been correlated with risky behaviors (not using seatbelts, drinking, and speeding) that predict hospitalization for MVC injury (Bell et al., 2000).

Combat deployment has previously been associated with increased risk of fatal MVC in the post-deployment period. This association was reported among U.S. veterans following both the Vietnam War and the 1991 Gulf War (CDC, 1987; Kang and Bullman, 1996, 2001; Macfarlane et al., 2000). Kang and Bullman (1996) showed a 31% higher risk of death due to MVC among Gulf War deployed veterans compared to non-deployed veterans of the same era. Although this excess mortality among deployed veterans was evident during the first 3 years following return to the U.S., there was no difference between deployed and non-deployed groups 7 years post-deployment (Kang and Bullman, 2001; Kang et al., 2002).

Several explanations have been proposed for the observed excess in deaths due to MVC among returning combat veterans. These include the development of post-deployment mental disorders, such as post-traumatic stress disorder; the effects of symptoms or illnesses due to exposures of war; known risk factors being differentially distributed among those deployed to the Gulf War due to the selection process for deployment; or increased levels of risk taking behaviors resulting from training, wartime experiences, combat exposures, or unmeasured attitudinal factors associated with combat occupations that predate deployment (Kang and Bullman, 1996; Bell et al., 2001). In their review of mortality among U.S. and United Kingdom veterans of the 1991 Gulf War, Kang et al. (2002) discussed potential risk factors for fatal MVC and suggested that an altered perception of risk among combat veterans may translate into increased risk taking behavior.

Among the array of known demographic and military risk factors for MVC, interaction between specific covariates is known to occur. For example, all levels of alcohol consumption can magnify MVC risk among drowsy drivers as well as younger drivers (Bell et al., 2000; NHTSA, 1998; CDC, 2002). In order to evaluate the relative importance of known and potential risk factors for fatal MVC in our population and to better understand deployment as an effect modifier, we leveraged existing data from multiple sources within the Department of Defense (DoD), as well as the Departments of Veterans Affairs (VA) and Transportation (DOT). We selected a population of 1991 Gulf War era veterans for our study to take advantage of an established cohort with an observed excess in motor vehicle crash mortality associated with deployment over the time frame of our study (Kang and Bullman, 1996, 2001). The focus of this article is to assess the effect of independent predictors on fatal MVC risk and the influence of deployment on the association between other covariates and fatal MVC using a nested case–control design.

With large numbers of veterans returning from the current conflicts in Iraq and Afghanistan, and media coverage of the personal tragedy associated with losses due to MVCs in this group (Zoroya, 2005), attention has been refocused on MVCs as an ongoing public health concern. Our results may be used to direct prevention efforts at high risk individuals in order to reduce preventable losses among the large numbers of returning combat veterans.

2. Methods

2.1. Study population

Our nested case–control study methodology, including construction of the analytic data set, is described in detail elsewhere (Hooper et al., 2005). Briefly, our source population was a well-defined cohort of 1,441,807 service members (Kang and Bullman, 1996). This cohort consisted of 695,516 individuals who were deployed to the Gulf War theater of operations between August 1990 and April 1991, referred to as Gulf War veterans (GWV), and an approximately 50% stratified random sample (746,291) of those who served in the military from September 1990 to April 1991 but were not deployed to the Gulf War, referred to as non-deployed veterans (NDV) (Kang and Bullman, 1996).

Our case definition was a death due to MVC arising in our cohort between the date of return to the U.S. for GWV (and May 1, 1991, for NDV) and the end of our study period (December 31, 1995) using the Department of Veterans Affairs (VA) Administration's Beneficiary Identification Records Locator Subsystem, the Social Security Administration's Master Death File, and the National Death Index (Hooper et al., 2005). In addition, the crash-related death must have been included in the Department of Transportation's Fatality Analysis Reporting System database. We identified 1343 eligible cases (with validated cause of death) and selected 13,430 controls based on risk set sampling by sex and year of death and in a ratio of 10 controls per case. Because of our interest in modifiable risk factors among drivers and the small number of female driver cases ($n = 28$ drivers out of 43 female cases), we restricted our final analytic data set to 980 male driver fatalities and 12,807 male controls. The distribution of demographic and military service characteristics for our subset was comparable to our initial study population (Hooper et al., 2005).

2.2. Covariates

2.2.1. Demographic and military covariates

We categorized demographic and military service variables as follows: age (≤25, 26–35, and ≥36 years), race (white, black, and other/unknown), marital status (single, married, other,