

## Motor Vehicle-related Deaths, U.S. Armed Forces, January 1998-September 2009

Motor vehicle accidents are the leading cause of death among U.S. military members during peacetime. During the four years prior to operations in Iraq and Afghanistan, one-third of service member deaths were caused by motor vehicle accidents. Since the beginning of those operations, there have been nearly as many deaths of service members due to “transportation accidents” as war-related injuries.<sup>1</sup>

Many military members are young, single, male, and high-school educated; these characteristics are associated with high risk of dying in motor vehicle crashes.<sup>2,3</sup> Compared to their older counterparts, young military members have less driving experience and are more likely to take risks while driving (such as to drive without seatbelts or while under the influence of alcohol).<sup>3</sup> However, because military service is inherently dangerous, and because all U.S. military members are volunteers, they may be more willing to take risks, independently of age.

Motorcycles are used by many U.S. military members for transportation and recreation; of note, motorcyclists are 37 times more likely than passenger car occupants to die in road accidents.<sup>4</sup> Also, driving and riding in military motor vehicles during training and operational missions can be hazardous — particularly, in unfamiliar and intrinsically unsafe settings (e.g., blackout conditions; inclement weather; narrow roadways, bridges, and overpasses).<sup>5,6</sup>

This report summarizes numbers, rates, trends and correlates of risk of fatal motor vehicle accidents among U.S. military members.

**Table 1.** Motor vehicle deaths by “underlying cause of death” category, January 1998-September 2009

Underlying cause of death	Total service members	
	No.	%
Motorcyclist involved in any accident except collision with railway train	921	22.8
Other and unspecified motor vehicle accidents	918	22.8
Occupant of car pickup truck or van in collision with other motor vehicle	571	14.2
Occupant of motor vehicle in collision with non-motorized vehicle, pedestrian, fixed object	498	12.4
Occupant of motor vehicle in noncollision accident	466	11.6
Occupant of special-use motor vehicle in any accident (include military vehicle)	392	9.7
Pedestrian in collision with motor vehicle	223	5.5
Pedal cyclist in collision with motor vehicle	17	0.4
Other motor vehicle accident involving collision with railway train	10	0.2
Other and unspecified land transport accidents	10	0.2
Occupant of heavy transport vehicle or bus in collision with other motor vehicle	5	0.1
Total	4,031	100

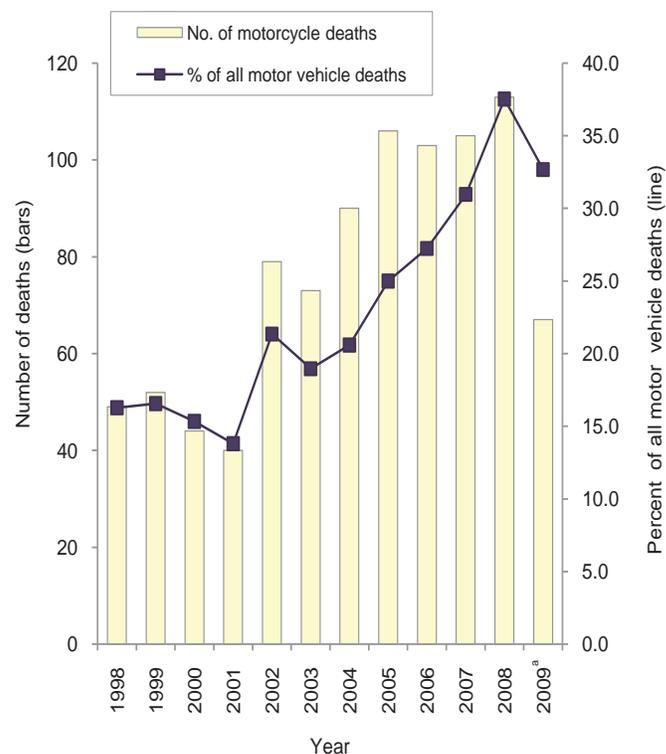
### Methods:

The surveillance period was 1 January 1998 to 30 September 2009. The surveillance population included all individuals who served on active duty as a member of the active or Reserve component of the Army, Navy, Air Force, or Marine Corps any time during the surveillance period.

Motor vehicle-related deaths of service members while on active duty were ascertained from records maintained in the DoD Medical Mortality Registry of the Armed Forces Medical Examiner System and routinely provided to the Armed Forces Health Surveillance Center for integration in the Defense Medical Surveillance System (DMSS). For this analysis, a motor vehicle-related death was defined by a casualty record with an “underlying cause of death” code (Table 1) corresponding to a collision or non-collision motor vehicle accident. Motor vehicle deaths that were considered “intentional” (i.e., suicide, homicide, war-related) were excluded.

Summary measures were numbers of motor vehicle deaths in the surveillance population overall (i.e., active and Reserve component members who died while on active duty) and mortality rates. For members of the active component, mortality rates were calculated as deaths per 100,000 person-

**Figure 1.** Number and percent (of all motor vehicle deaths) of motorcycle-related deaths, active and Reserve component, U.S. Armed Forces, January 1998-September 2009



\*Through September

**Table 2.** Demographic and military characteristics of individuals who died in motor vehicle accidents, active and Reserve components, with rates (per 100,000 person-years of service) for active component only, U.S. Armed Forces, January 1998-September 2009

	Active and Reserve components	Active component	
	No.	No.	Rate <sup>a</sup>
Total	4,031	3,414	21.1
<b>Service</b>			
Army	1,820	1,380	23.9
Navy	797	754	17.9
Air Force	671	589	14.3
Marine Corps	743	691	33.0
<b>Sex</b>			
Male	3,732	3,183	23.0
Female	297	229	9.7
<b>Race ethnicity</b>			
White, non-hispanic	484	2,001	19.7
Black, non-hispanic	1,878	720	24.1
Other	739	693	22.4
<b>Age</b>			
<20	484	420	32.8
20-24	1,878	1,685	31.5
25-29	739	641	18.8
30-39	678	534	11.8
40+	251	133	8.1
<b>Military occupation</b>			
Combat	1,038	899	27.1
Health	194	166	12.2
Admin/supply	904	697	18.4
Other	1,895	1,652	21.3

<sup>a</sup>Death rate per 100,000 person-years of service

years of active military service during the surveillance period. Mortality rates were summarized using person-years at risk (rather than individuals at risk) because the U.S. military is a dynamic cohort — each day, many individuals enter and many others leave service. Thus, in a given year, there are many more individuals with any service than there are total person-years of active service; the latter was considered a more consistent measure of exposure to mortality risk for service members. Reserve component members were not included in rate calculations because the start and end dates of their active duty service periods were not available.

### Results:

From 1998 through September 2009, 4,031 service members died from motor vehicle accidents (MVAs) while on active duty (Table 1). Nearly one-fourth (n=921; 23%) of all service members who died in motor vehicle accidents were riding motorcycles. Remarkably, the proportion of all MVA-related deaths that were due to motorcycle accidents increased from 14% (n=40) in 2001 to 38% (n=113) in 2008 (Figure 1).

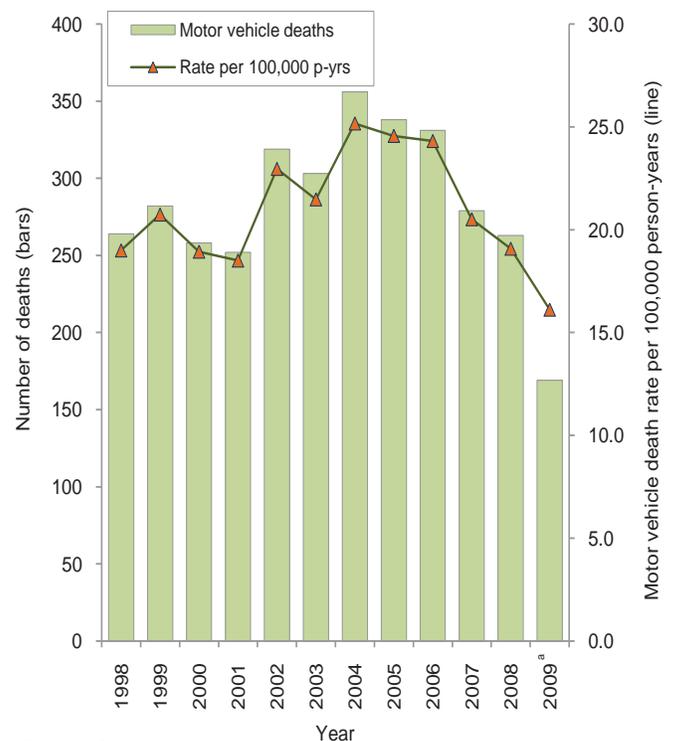
Of all non-motorcycle-related deaths from MVAs, approximately 15% (n=466) were related to “non-collision” accidents (e.g., rollovers, fires, loss of control); 13% (n=392) affected occupants of special-use (including military) vehicles; and 8% affected pedestrians (n=223) or bicyclists (n=17) who were hit by motor vehicles (Table 1).

Of all military members who died in motor vehicle accidents during the period, 85% (n=3,414) were in the active component (Table 2). Among active component members, the crude MVA-related fatality rate was 21.1 per 100,000 person-years (p-yrs). The highest MVA-related death rates affected service members who were in the Marine Corps (33.0 per 100,000 p-yrs), younger than 20 years (32.8 per 100,000 p-yrs), and in combat occupations (27.1 per 100,000 p-yrs). The MVA-related death rate declined with increasing age and was 2.4-times higher among males than females (Table 2).

Among active component members, numbers and rates of MVA-related deaths were generally stable from 1998 to 2001, increased from 2001 to 2004, slightly declined from 2004 to 2006, and sharply declined from 2006 through 2009 (Figure 2). The mean of MVA-related deaths per year during the period was 285; however, the range was wide. The most MVA-related deaths in a year were in 2004 (n=356; rate: 25.2 per 100,000 p-yrs) and the fewest in 2009 (through September) (n=169; rate: 16.1 per 100,000 p-yrs) (Figure 2).

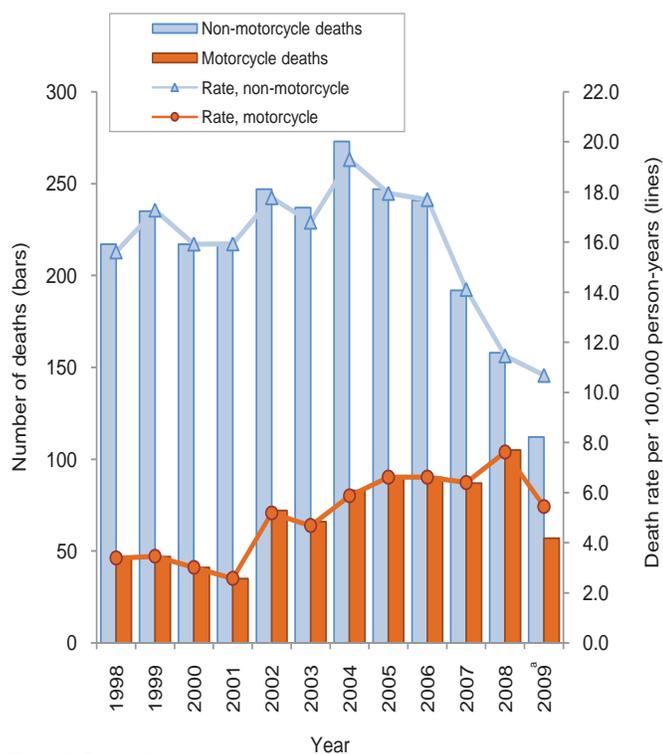
Among active component members, trends of motorcycle- and other motor vehicle-related deaths differed substantially over the period (Figure 3). Motorcycle-related death rates

**Figure 2.** Motor vehicle deaths per year among members of the active component, U.S. Armed Forces, January 1998-September 2009



<sup>a</sup>Through September

**Figure 3.** Motor vehicle deaths, by year and underlying cause (motorcycle vs. non-motorcycle accidents), active component, U.S. Armed Forces, January 1998-September 2009



<sup>a</sup>Through September

doubled from 2001 (2.6 per 100,000 p-yrs) to 2002 (5.2 per 100,000 p-yrs) and increased by nearly 50% from 2002 to 2008 (7.6 per 100,000 p-yrs). In sharp contrast, MVA-related deaths not involving motorcycles declined by 42% from 2004 (n=273) to 2008 (n=158) (Figure 3). In 1998, motorcycle accidents accounted for 16% of all fatal MVAs among U.S. military members of all components; in 2008, they accounted for 38% of all fatal MVAs among U.S. military members (Figure 1).

Of the services, the Marine Corps had the highest rates of MVA-related deaths overall (33.0 per 100,000 p-yrs) and motorcycle-related deaths specifically (6.8 per 100,000 p-yrs) during the entire period. The MVA-related death rate overall was higher in the Army (23.9 per 100,000 p-yrs) than the Navy (17.9 per 100,000 p-yrs); however, the motorcycle-related death rate was higher in the Navy (5.3 per 100,000 p-yrs) than the Army (4.8 per 100,000 p-yrs). Of note, in 2008 (the year with the most motorcycle-related deaths), motorcycle-related death rates were 11.3, 9.2, 7.3 and 4.3 per 100,000 person-years in the Marine Corps, Navy, Army and Air Force, respectively (data not shown).

Alcohol was reported as a factor in 9.5% of all MVA-related deaths overall and 7.8% of all fatal motorcycle accidents (data not shown). Forty-three percent (n=1,728) of service members who died from motor vehicle accidents had documented medical encounters (hospitalizations: 20%; ambulatory visits: 23%) within 7 days before the dates of their

deaths; of these individuals, 530 (31%) had primary (first-listed) diagnoses of serious injuries to the head. Head injuries (including skull fracture, intracranial injury and cerebral hemorrhage) accounted for five of the six most frequent injuries (at the 3-digit level of the ICD-9-CM) documented during medical encounters preceding MVA-related deaths (data not shown).

Data summaries by Stephen B. Taubman, PhD, Data Analysis Group, AFHSC.

#### Editorial comment:

This report reiterates the importance of motor vehicle accidents as a significant cause of deaths of U.S. service members. The most striking finding, however, is the sharp increase in the proportion of all MVA-related deaths that are due to motorcycle accidents. In 2008, 38% of all U.S. service members in active service (and 40% of all active component members) who were killed in motor vehicle accidents were riding motorcycles; in 2001, only 14% of all MVA-related deaths of service members were due to motorcycle accidents.

The recent sharp increase in motorcycle-related deaths has been noted and aggressively countered by the Services. For example, Service and local safety centers highlight vehicle safety in publications, messages, educational, and training materials; installations require training and proficiency testing before issuing permits for on-post motorcycle use; and some installations provide controlled, supervised venues for high performance uses of motorcycles and other vehicles. The effects of such efforts should be closely tracked; effective interventions should be identified and documented to enable broader implementation.

There are limitations to the analysis that should be considered when interpreting the results. For example, at the time of the analysis, records of deaths of U.S. service members were available only through September 2009; also, final determinations of underlying causes were pending for approximately 8% of deaths in 2009. Hence, numbers of MVA-related deaths, overall and by causes, during the most recent calendar year of interest for the analysis are incomplete. Also, this analysis did not include MVA-related deaths of Reserve component members who were not "on active duty" at the times of their accidents or deaths secondary to but long after motor vehicle accidents that occurred during active service (e.g., medically retired service members). Because such deaths were not included, the mortality impact of motor vehicle accidents on the total force is significantly higher than documented here.

Finally, this overview summarizes numbers, rates, trends, and demographic and military characteristics of U.S. military members who died from motor vehicle accidents. A future MSMR report will document temporal

characteristics of fatal motor vehicles accidents of military members (e.g., seasons of the year, days of the week, relationships to federal holidays).

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