NAVY AND MARINE CORPS PUBLIC HEALTH CENTER

INJURY RATES IN ACTIVE DUTY US MARINES FY 2011

EpiData Center Department Report **February 2012**

In 2005, the Department of Defense (DOD) Military Injury Prevention Program was established by the Defense Safety Oversight Council to investigate and propose interventions that would lead to a significant reduction in injuries and lost time in the military population. The Navy and Marine Corps Public Health Center (NMCPHC) was tasked to provide support and data analysis to the Marine Corps regarding occupational safety and health. This report includes analysis of type and cause of injury for inpatient and outpatient medical encounter records.

Background

Injuries are currently the leading health problem for the US Military, resulting in over 1.8 million medical encounters among more than 800,000 service members annually (USAMSA 2006). Injuries (both battle and non-battle-related) result in the largest number of aero-medical evacuations from Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) (Harmen 2005; Jones 2010). Medical surveillance data from the US Army indicate that unintentional injuries cause about 50% of deaths, 50% of disabilities, 30% of hospitalizations, and 40-60% of outpatient visits (Jones, 1999). In addition to the morbidity, mortality, and health care costs associated with injuries, a 2006 White Paper reported that injuries resulted in approximately 25,000,000 days of limited duty in 2005 (DOD Military Injury Prevention Priorities Working Group (DMIPPWG) 2006). Most published military injury surveillance data has focused on all service branches, with limited service-specific analyses existing to date (DMIPPWG 2006; USAMSA 2006). The Navy and Marine Corps Public Health Center (NMCPHC) EpiData Center Department has completed this annual injury report for fiscal year (FY) 2011 to provide up-to-date information on the burden of injuries among active duty (AD) Marine Corps members.

Methods

Injury data were abstracted from standard inpatient and outpatient medical encounter records for fiscal year 2011 (01 October 2010– 30 September 2011) for all AD Marines, not including recruits. Encounter records with injury diagnoses were identified by International Classification of Disease-9th Revision-Clinical Modification (ICD-9) codes ranging from 800 to 995: injuries and poisonings, excluding complications of surgical and medical care. Injuries were assigned Barell injury codes corresponding to their designated cell in the Barell matrix (Barell et al. 2002; CDC 2009), which classifies injuries according to injury type and anatomic location using ICD-9 codes. Previous studies have used the Barell matrix as a standardized tool for describing injury types and locations (Clark and Ahmad 2006; Aharonson-Danielo et al 2002).

Due to the chronic nature of injuries, individuals often had multiple follow-up medical encounters after their initial injury diagnosis. To avoid counting the same injury multiple times, medical encounters for an individual with the same Barell injury code occurring within 30 days

were removed, which is consistent with DMIPPWG recommendations. Unique cases were identified using a 30 day gap-in-care rule based on encounter/admission dates. Records that occurred within 30 days of a previous record were treated as the same event, and records beyond this gap-in-care identified the next unique event for an individual. One alteration made to these methods however was in the case of an amputation. For the amputation injury type, only one record was included for each person for each different anatomic location assigned in the Barell matrix.

All identified injury records were linked to the Defense Manpower Data Center (DMDC) data to determine the Unit Identification Code (UIC) that the service member was assigned at the time of injury. Injuries that matched to a UIC were placed in the appropriate major subordinate command (MSC) using a UIC listing provided by the USMC to report injury rates by MSC. The injury rate is calculated by dividing the total number of injuries in each MSC by the average monthly population of the MSC, obtained from DMDC.

Injury rates by month were calculated by dividing the total number of injuries identified in a given month by the total number of AD Marines for that month from the DOD Statistical Information Analysis Division (SIAD) personnel records (SIAD 2012). Injury rates by type and location were calculated by dividing the number of injuries of a particular type or location by the total number of injuries occurring in that fiscal year.

Results

There were 70,855 total injuries among inpatient and outpatient records in FY2011. Figure 1 shows the total injury rate by month among AD Marines. December had the lowest injury rate at 24 injuries per 1,000 Marines, followed by February and September, which had 26 injuries per 1,000 Marines each. June had the highest injury rate, with 34 injuries per 1,000 Marines.

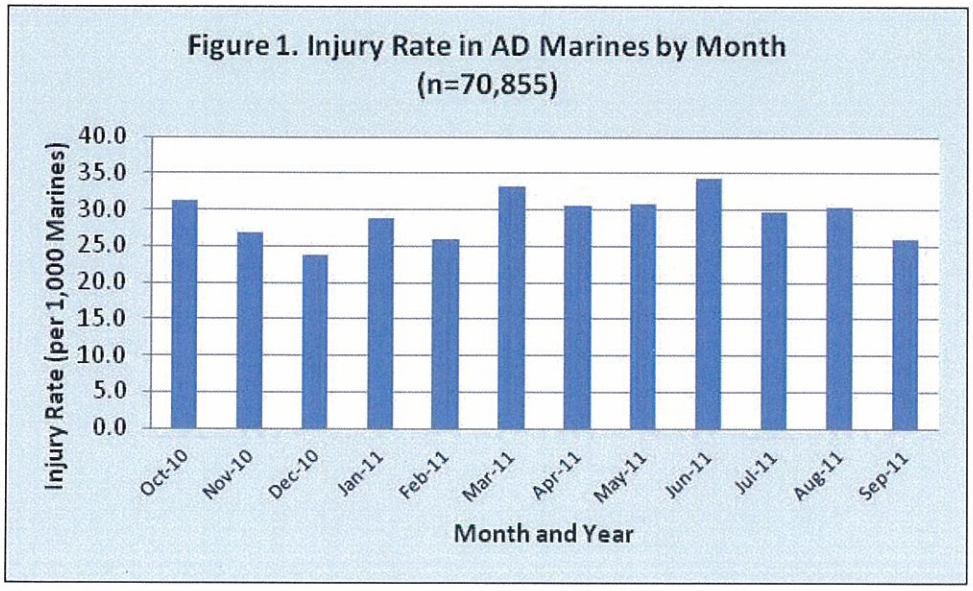


Figure 2 identifies the top ten injury locations. Most injuries occurred in the hand (120 per 1,000 injuries), followed by the lower leg and ankle (117 per 1,000 injuries), and injuries of the shoulder and upper arm (110 per 1,000 injuries).

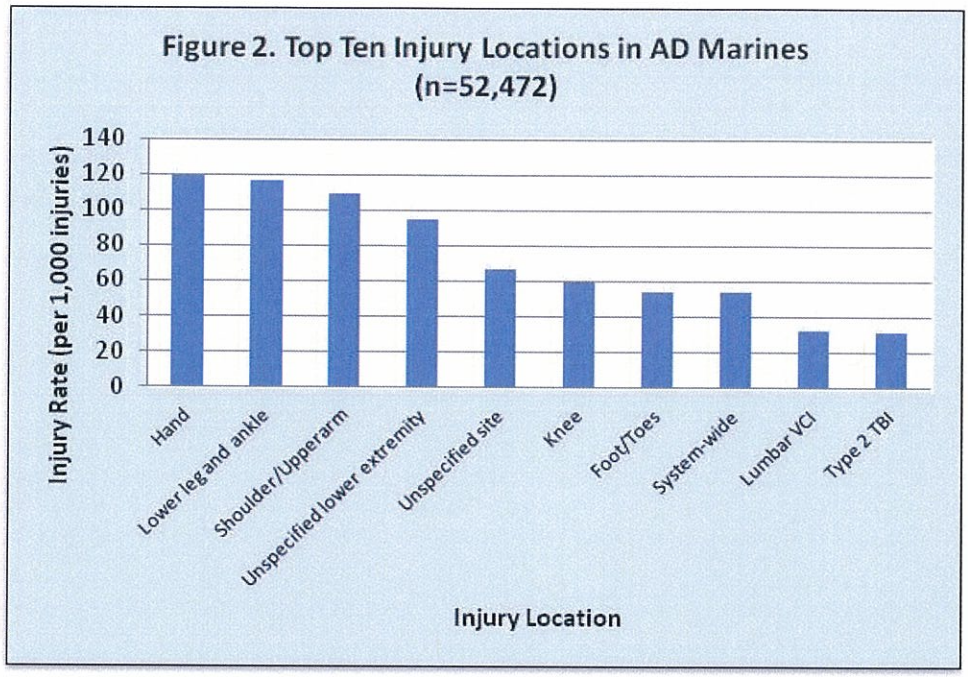
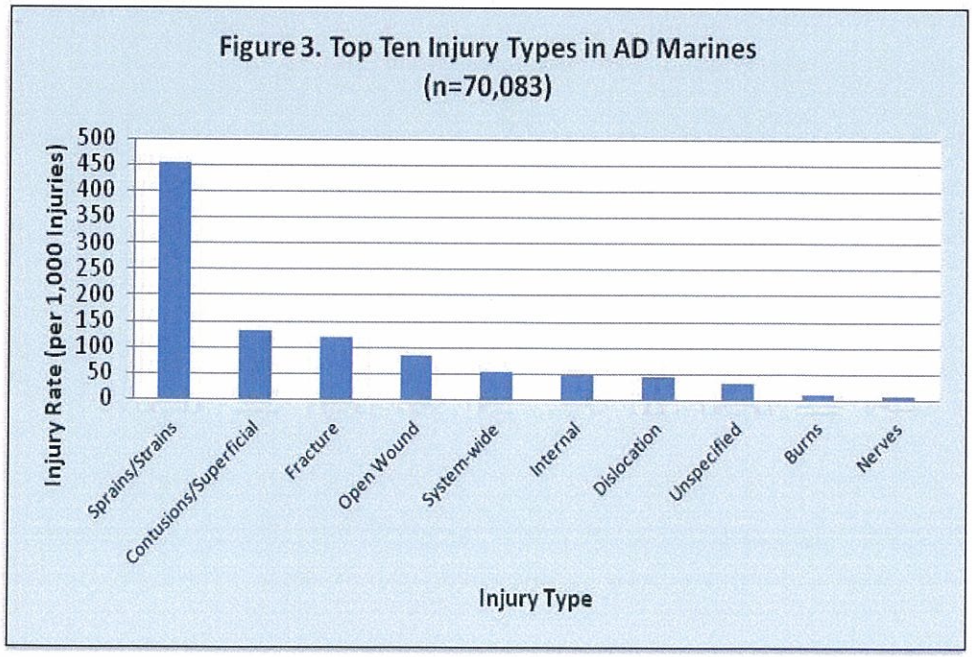
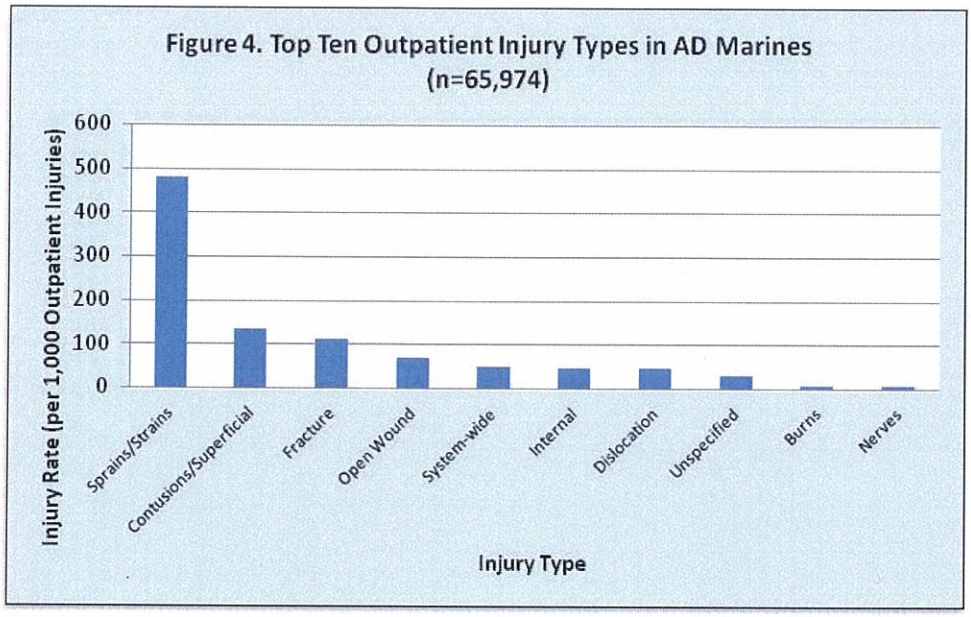


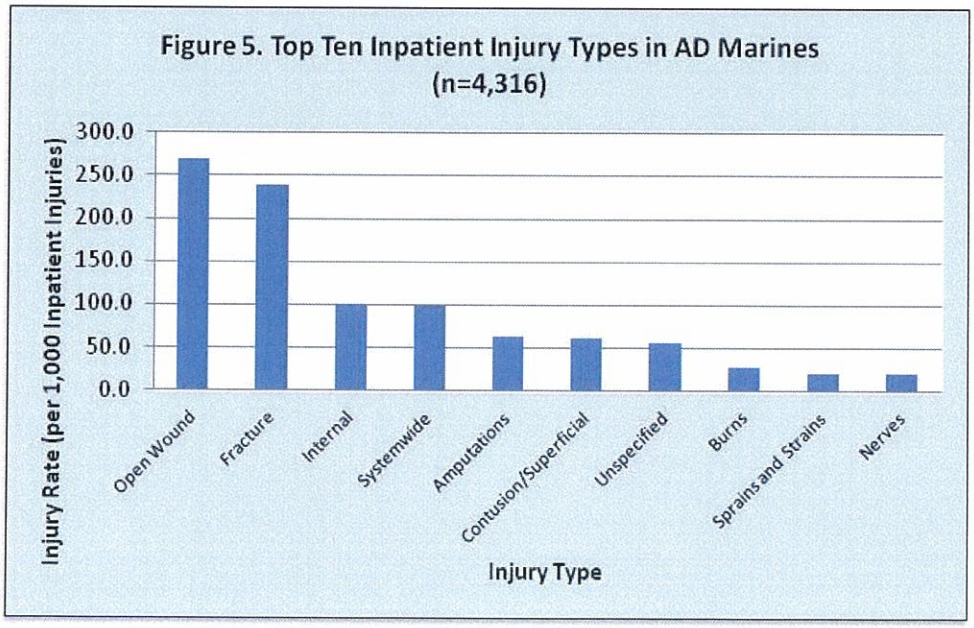
Figure 3 shows that sprains and strains accounted for the largest proportion of injuries (453 per 1,000 injuries), followed by contusions/superficial injuries (132 per 1,000 injuries), fractures (120 per 1,000 injuries), and open wounds (84 per 1,000 injuries) (See Appendix 1 for description of injury types).



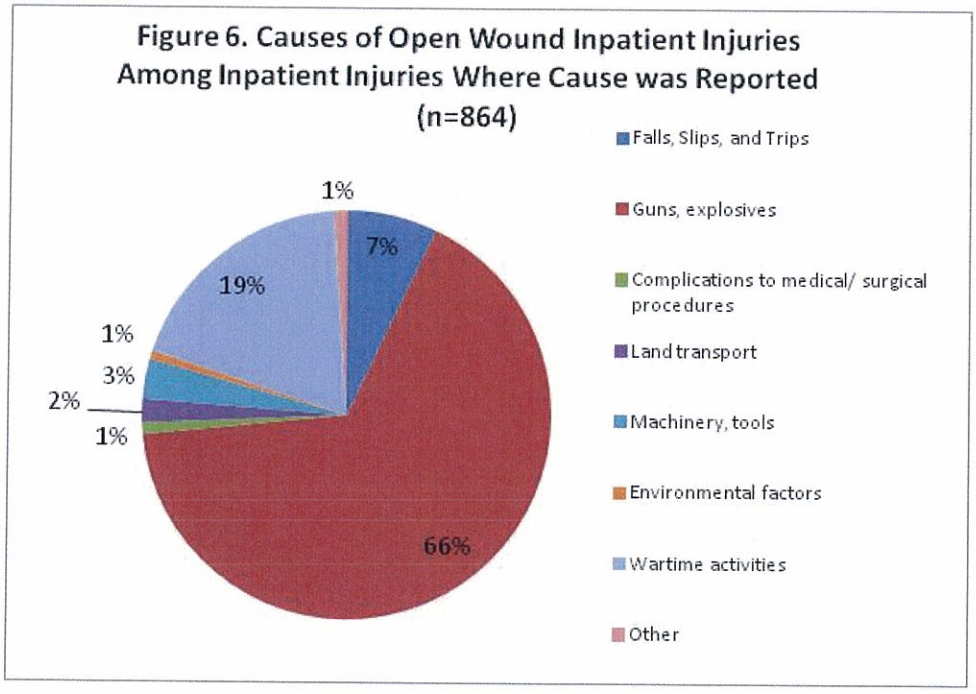
There were 66,361 outpatient injuries in FY2011 (Figure 4) with sprains and strains accounting for 483 per 1,000 outpatient injuries, followed by contusions/superficial injuries at 137 per 1,000 outpatient injuries, fractures at 112 per 1,000 outpatient injuries, and open wound injuries at 72 per 1,000 outpatient injuries.



There were 4,494 inpatient injury discharges (Figure 5), of which 269 per 1,000 inpatient injuries were open wounds, followed by fractures (239 per 1,000 inpatient injuries), internal injuries (102 per 1,000 inpatient injuries), and system-wide injuries (99 per 1,000 inpatient injuries).



Inpatient injury records contain an injury cause field (STANAG code), which classifies injuries according to their causative events. Only 57% of inpatient injuries contained valid entries for STANAG code; however this information may still be of use in identifying the common causative factors that lead to injuries serious enough to result in hospitalization. Strengths and limitations of STANAG codes are outlined in the aforementioned 2006 DMIPPWG white paper (DMIPPWG 2006). Figures 6-10 illustrate the distribution of causes of injuries for the five most frequent injuries resulting in inpatient admission. Most of the injuries represented in the figures were caused by guns and explosives and falls, slips, and trips, with the exception of system-wide injuries. These were most frequently the result of poisons, fire, or hot or corrosive materials or complications to medical/surgical care. It is important to note that injuries that occurred as a result of guns and explosives were unintentional, and the weapon was not used as an instrumentality of war.



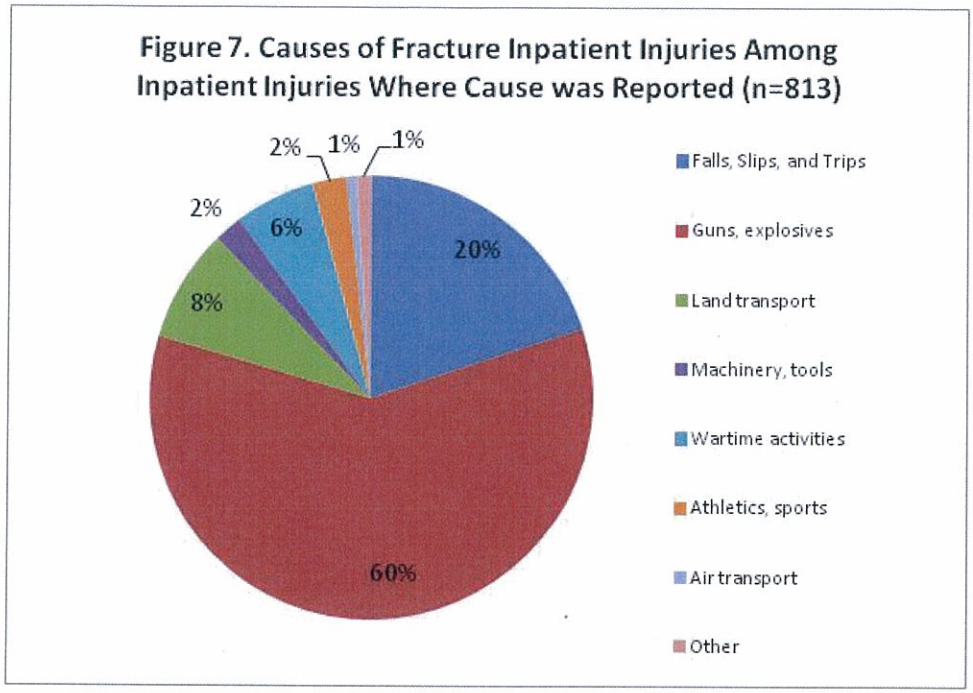


Figure 7. Causes of Fracture Inpatient Injuries Among Inpatient Injuries Where Cause was Reported (n=813)
2%
1%
1%
2%
6%
20%
8%
60%
Falls, Slips, and Trips
Guns, explosives
Land transport
Machinery, tools
Wartime activities
Athletics, sports
Air transport
Other

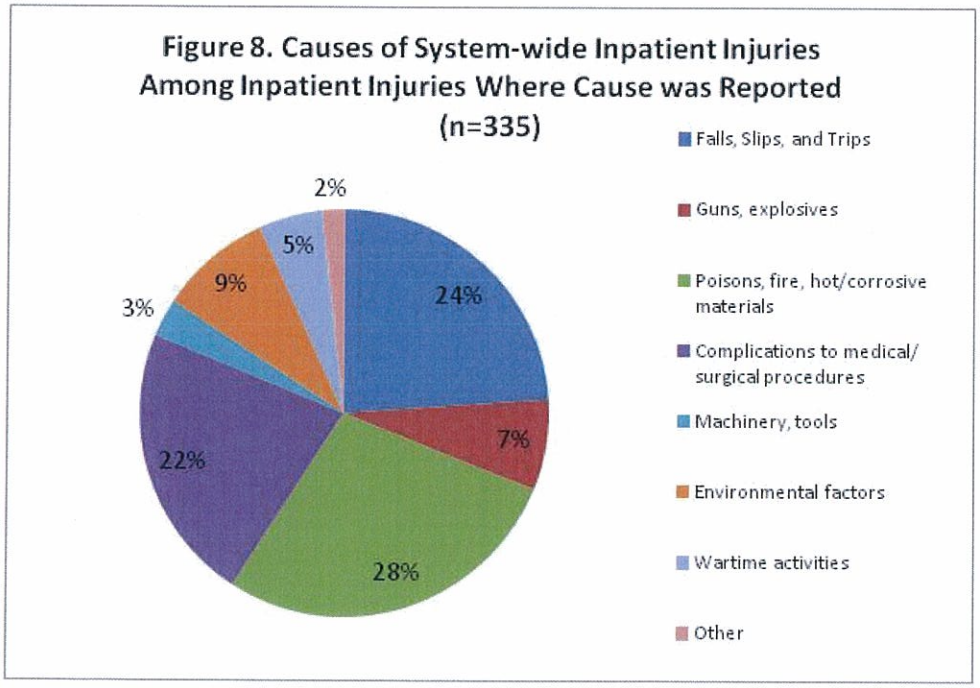


Figure 8. Causes of System-wide Inpatient Injuries Among Inpatient Injuries Where Cause was Reported (n=335)
2%
5%
9%
3%
24%
7%
22%
28%
Falls, Slips, and Trips
Guns, explosives
Poisons, fire, hot/corrosive materials
Complications to medical/ surgical procedures
Machinery, tools
Environmental factors
Wartime activities
Other

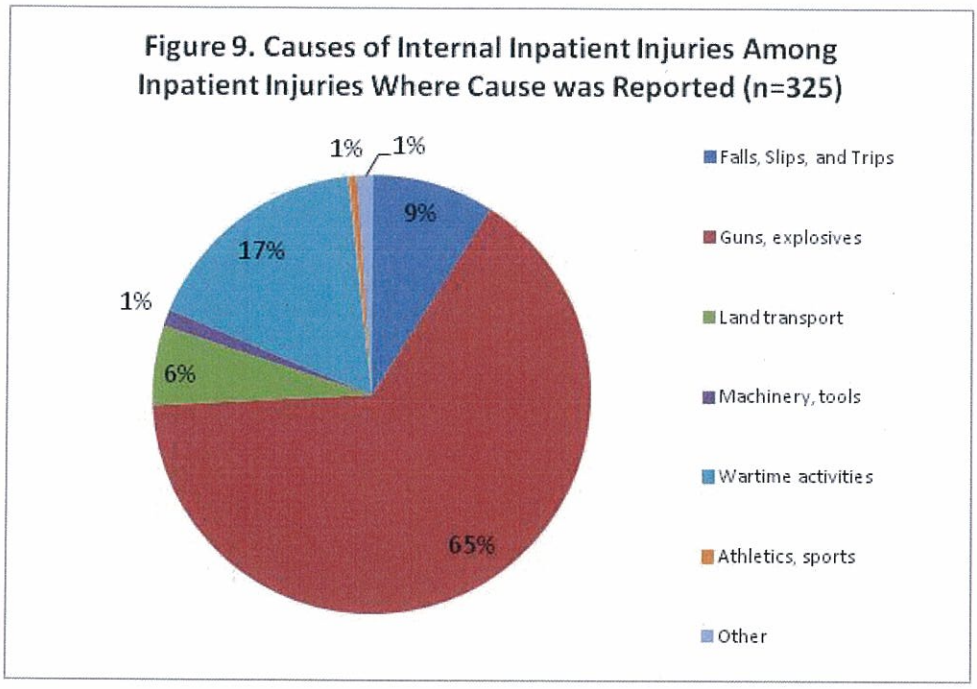


Figure 9. Causes of Internal Inpatient Injuries Among Inpatient Injuries Where Cause was Reported (n=325)
1%
1%
9%
17%
1%
6%
65%
Falls, Slips, and Trips
Guns, explosives
Land transport
Machinery, tools
Wartime activities
Athletics, sports
Other

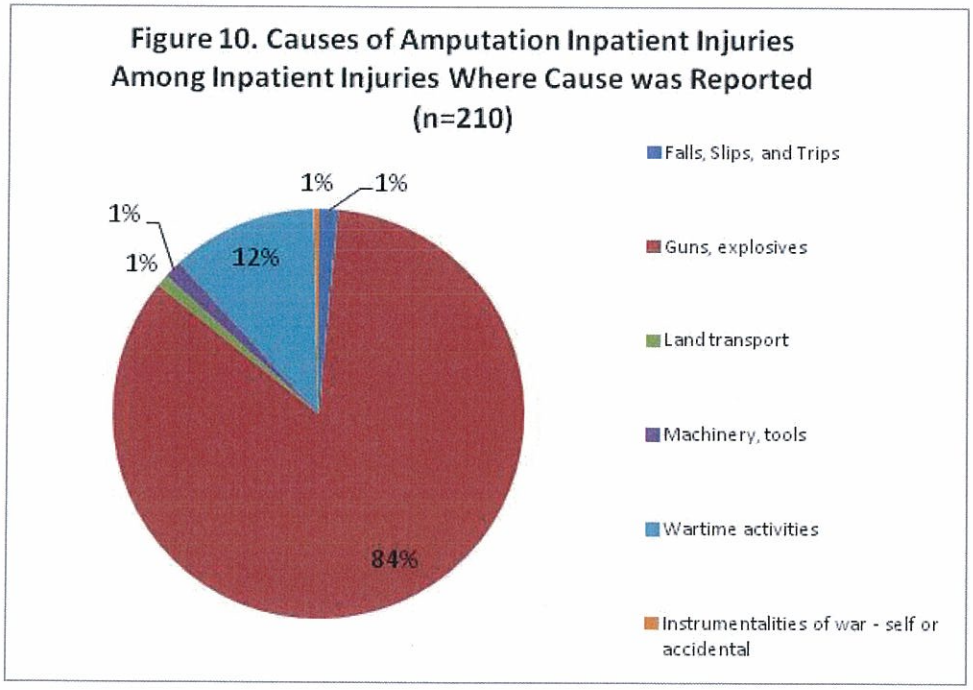
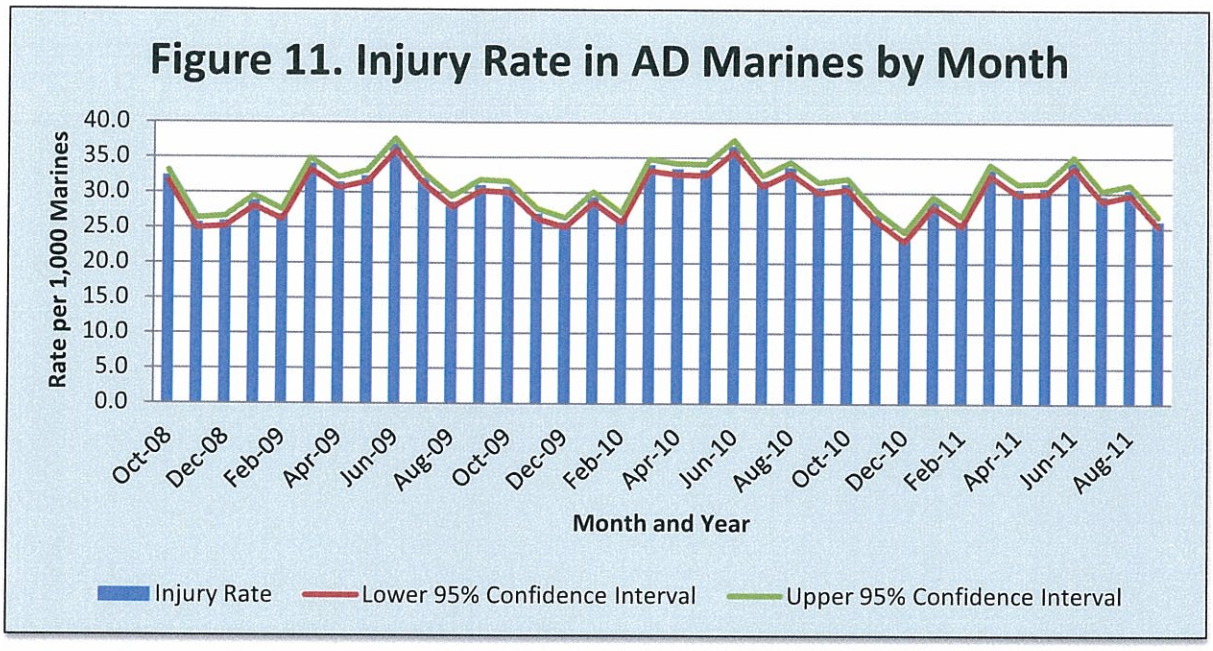


Figure 10. Causes of Amputation Inpatient Injuries Among Inpatient Injuries Where Cause was Reported (n=210)
1%
1%
1%
1%
12%
84%
Falls, Slips, and Trips
Guns, explosives
Land transport
Machinery, tools
Wartime activities
Instrumentalities of war - self or accidental

Figure 11 displays the injury rate in AD Marines over fiscal years 2009 - 2011. The data show a seasonal trend, with more injuries occurring in the warmer months of the year. During the last six months of FY 2011, the monthly injury rate was statistically significantly lower than the last six months of FY 2010. This indicates a decreasing trend in injury rate in the USMC.



Out of 74,321 total injuries from medical encounter records, 70,855 (95%) matched to the DMDC AD database. The UICs identified in DMDC were then matched to a corresponding MSC and Marine Expeditionary Force (MEF). Of the 70,855 injuries with an identified UIC, 44,548 injuries (63%) matched to a MSC. Injuries with missing MSC information are grouped into the Missing category. Appendix 2 includes the number of injuries occurring in each MSC and MEF, the average monthly number of people in each MSC or MEF, and the injury rate for each MSC and MEF per 1,000 Marines.

The overall injury rate in the USMC for FY 2011 was 351 injuries per 1,000 AD service members (95% CI: 349 – 354 injuries per 1,000 AD service members). That was significantly lower than the injury rate in FY 2010 of 373 injuries per 1,000 AD service members (95% CI: 370 – 375 injuries per 1,000 AD service members). MARSOC had the lowest injury rate in FY2011, with 179 injuries per 1,000 AD service members. IMEF, IIMEF, IIIMEF, and MFR had comparable injury rates, with an average of 323 injuries per 1,000 AD service members. The B/P/S command had the highest injury rate with 523 injuries per 1,000 AD service members.

Discussion

Since last fiscal year, the injury rate has decreased slightly in the AD USMC population. However, it is important to note that the proportions of total injuries of the various injury types are similar from FY 2009-2011. This indicates that injury prevention strategies are having the same effect on all injury types, not just for a particular type. There were more injuries in the warmer months of fiscal years 2009-2011, probably due to more Marines participating in outdoor

activities. Our data lack specific activity information, limiting our ability to identify opportunities for prevention. Also important is to continue to emphasize the importance of physical training safety that could reduce sprains and strains, the most common injury type. The most common causes of inpatient injuries were guns and explosives and slips, trips, and falls. Interventions applied to attempt to reduce those events could have the largest impact on lowering the injury rate.

Limitations

The data used in this analysis were from the Composite Health Care System (CHCS). Injuries that occurred on ships, in battalion aid stations, in forward deployed troops, or anywhere without access to CHCS or AHLTA were not included. Any medical visits outside of the military health system (MHS), such as purchased care visits, were also not included because it may take more than a year for the record of the injury to be posted in the data system.

The key to linking a Marine injury to a unit is the UIC that is provided by monthly personnel reports from DMDC. The EDC has contacted USMC Manpower and Reserve Affairs and the USMC Liaison at DMDC to resolve the UICs in the DMDC file with no apparent link to the Total Force Structure Management System. Approximately 37% of all injuries could not be matched to a MEF or MSC. This may lead to an underestimation of total injuries for each command listed in Appendix 2. The population of the MEFs and MSCs used to calculate rates could also be underestimated due to the large amount of personnel data unable to be matched to the MSC by UIC listing.

The injury rate by MEF and MSC in Appendix 2 only includes AD Marines. Due to the changing nature of the Reserves population, we are unable to obtain an accurate population for the Reserve UICs and MSCs, and subsequently could not report valid injury rates for those groups.

References

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Aharonson-Daniel L, Boyko V, Ziv A, Avitzour M, Peleg K. "A new approach to the analysis of multiple injuries using data from a national trauma registry". *Inj. Prev.*2003;9:156-162.

DOD. http://siadapp.dmdc.osd.mil/personnel/MILITARY/miltop.htm. January 2012.

Appendix 1: Description of Injury Types

Type of Injury	Description
Fracture	A break in a bone (closed and open)
Sprains and Strains	Avulsion, hemarthrosis, laceration rupture, sprain, strain and tear of the joint capsule, ligament, muscle or tendon.
Dislocation	Complete displacement or subluxation of joint surfaces
Internal	Concussions, blast injuries, blunt trauma, bruise, crushing, hematoma, laceration, puncture, tear and traumatic rupture of internal organs. Spinal cord injury without evidence of spinal bone injury and shaken infant syndrome.
Open Wound	Includes animal bite, avulsion, cut, laceration and puncture wound
Amputations	Traumatic amputations.
Blood Vessels	Arterial hematoma, avulsion, cut, laceration, rupture, traumatic aneurysm or fistula (arteriovenous) of the blood vessel, secondary to other injuries.
Contusion/Superficial	Includes superficial injuries and bruise/hematoma without fracture or open wound.
Crush	Crushing injury that excludes concussion, fractures and injuries to internal organs.
Burns	Burns from electrical heating appliance, electricity, flame, hot object, lightning, radiation, chemical burns (external and internal), scalds. Excludes friction burns and sunburn
Nerves	Injury to nerves and spinal cord including division of nerve, lesion in continuity, traumatic neuroma, traumatic transient paralysis.
Unspecified	Other and unspecified injuries including NOS.
System-wide and late effects	Foreign bodies entering through orifice, early complications of trauma, late effects of injuries, poisoning and toxic effects of substances, and other and unspecified effects of substances, and other and unspecified effects of external causes.

Appendix 2: Injury Rate by MEF and MSC

Command	Number of Injuries	Average Monthly Population	Rate per 1,000 AD Marines
B/P/S	**3,727**	**7,130**	**522.72**
HQMCIEAST	191	397	481.11
HQMCIWEST	123	217	566.82
MCB JAPAN	152	188	808.51
MCRD	359	499	719.44
MCSF	304	850	357.65
TRANGCOM	2,598	4,979	521.79
I MEF	**15,992**	**49,973**	**320.01**
I MEF HQ	263	800	328.75
1st MARDIV	6,635	23,461	282.81
1st MLG	2,819	9,058	311.22
3D MAW	6,183	16,269	380.05
11TH MEU	0	0	0.00
13TH MEU	5	75	66.67
15TH MEU	15	78	192.31
I Intel	72	232	310.34
II MEF	**14,783**	**47,841**	**309.00**
II MEF HQ	377	1,644	229.32
2D MARDIV	6,464	21,055	307.01
2D MAW	4,249	15,513	273.90
2D MLG	3,558	8,703	408.82
22D MEU	14	77	181.82
24TH MEU	9	68	132.35
26TH MEU	5	73	68.49
II Intel	107	708	151.13
III MEF	**7,141**	**20,195**	**353.60**
III MEF HQ	334	856	390.19
III MEF CE	213	599	355.59
1st MAW	1,853	5,499	336.97
3D MARDIV	1,986	7,042	282.02
3D MLG	2,582	5,520	467.75
III Intel	173	679	254.79
MARFORSTRATCOM	**38**	**99**	**383.84**
MCCDC	38	99	383.84
MARSOC	**120**	**672**	**178.57**
HQ MSOSC	120	672	178.57
MFR	**1,678**	**5,416**	**309.82**
HQ MARFR	307	942	325.90
4th MARDIV	558	2,219	251.46
4th MAW	593	1,510	392.72
4th MLG	220	745	295.30
NCR	**319**	**760**	**419.74**
TRNGCOM	188	523	359.46
WWR	131	237	552.74

Other	27,057	69,527	389.16
COMMARFOREUR	98	231	424.24
HQ, MARFORCOM	294	655	448.85
HQ, MARFORPAC	311	560	555.36
HQ, MARFORSOUTH	47	105	447.62
Missing	26,307	67,976	387.00
Total	**70,855**	**201,613**	**351.44**

If you have additional questions or would like more information, contact:

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