

## **U.S. Army Medical Command Injury Summary, Active Duty Personnel, 2014**

**PHR No. S.0023116-16**

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## **1 Summary**

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### **1.1 Purpose**

To present and summarize existing medical surveillance data for U.S. Army Medical Command (MEDCOM) personnel as a basis for injury prevention program and policy planning, including:

- Defining the relative impact of injury compared to other medical conditions among U.S. Army Medical Command (MEDCOM) personnel in 2014.
- Describing the details of injuries among MEDCOM personnel, including leading injury causes, injury types, and affected body regions.

### **1.2 Results/Findings**

Since 2008, MEDCOM personnel have experienced the highest injury rates among all Major Army Commands (MACOMs). In 2014, the injury rate for MEDCOM personnel was 1,528 injuries per 1,000 person-years.

In 2014, injuries accounted for 23 percent of all medical encounters among active duty MEDCOM personnel, affecting 21,893 Soldiers. While injuries were the fourth leading cause (6.9 percent) of hospitalization among MEDCOM personnel in 2014, they were the leading cause (21.6 percent) of outpatient visits. Of the 48,191 total injuries among active duty MEDCOM personnel in 2014, 99.5 percent were treated on an outpatient basis.

The leading causes of injury hospitalization were land transport-related injuries (27.4 percent), athletics/sports (15.1 percent) and medical complications (11.0 percent). The leading causes of injury outpatient visits were overexertion (27.2 percent), falls (16.2 percent) and being struck by/against an object or person (14.7 percent).

The most common types of acute injury were sprains/strains (47.2 percent), contusion/superficial injuries (13.9 percent) and open wounds (9.2 percent). The injured body regions most commonly requiring medical care were lower extremity (36.8 percent), upper extremity (26.7 percent) and torso (8.0 percent). The most common types of injury-related musculoskeletal conditions were inflammation and pain due to overuse (86.5 percent), joint derangement (7.6 percent) and joint derangement with neurological involvement (4.3 percent). Body regions most commonly affected were the lower extremity (38.5 percent), vertebral column (36.2 percent) and upper extremity (19.5 percent).

### **1.3 Conclusions and Recommendations**

Among active duty MEDCOM personnel, injuries ranked second only to mental health conditions in 2014 medical encounters, representing a significant burden to this population. Overexertion and falls represent the leading causes of injuries. Injuries among the active duty MEDCOM population were more commonly seen in the lower extremities, whereas civilian hospital personnel suffer more

frequent injuries to the back, arms/hands, and neck/shoulders. Overall, injuries among active duty MEDCOM personnel are more similar to those of other active duty Army personnel than to those of civilian hospital personnel.

Strategies to reduce modifiable risk factors for injury, such as those attributable to overexertion and falls, in the context of job responsibilities and tasks among active duty MEDCOM personnel should be identified. The literature should be reviewed to identify existing strategies that could be implemented in a MEDCOM environment. Commanders can conduct surveys of their staff, as was done at the General Leonard Wood Army Community Hospital, to quantify injury incidence among both military and civilian staff at specific medical treatment facilities and identify leading causes and at-risk populations that could become the focus of local health promotion and prevention efforts. Findings related to new programs that are put in place to address injuries among active duty MEDCOM personnel should be evaluated and disseminated. Monitoring of injuries among active-duty MEDCOM personnel should be continued, and this report updated accordingly.

## **2 References**

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The references cited in this report appear in Appendix A.

## **3 Authority**

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Under Army Regulation (AR) 40–5, Section 2–19, the Army Public Health Center (Provisional) (APHC (Prov)), formerly known as the U.S. Army Public Health Command (USAPHC), is responsible for providing support for Army preventive medicine activities, including review and interpretation of surveillance data and identification and characterization of health problems as a foundation for injury prevention planning and policy efforts.

## **4 Background**

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Injuries pose a major public health problem in the U.S. Army, impacting almost 300,000 active duty Army Soldiers annually and leading to over 1.4 million medical encounters (Marshall et al., 2014). From 2008 to 2011, unintentional injury (accidents) was the leading cause of death among active duty U.S. Army Soldiers, followed by combat-related deaths (Mancha et al., 2014).

A public health approach to injury prevention in the military first involves utilizing data to define the magnitude and scope of injuries (Jones et al., 2010). The Defense Medical Surveillance System (DMSS), a central repository of all inpatient and outpatient medical encounters for U.S. military personnel (Rubertone and Brundage, 2002), provides the data necessary to assess injuries in the active duty Army population. Analysis of surveillance data from the DMSS is essential for monitoring injury trends, detecting unexpected changes in injury occurrence, and establishing injury prevention priorities (Jones et al., 2010).

DMSS data has indicated that since 2008, MEDCOM personnel have experienced higher injury rates than personnel in all other MACOMs (Armed Forces Health Surveillance Branch, 2014). This is a concern, given that MEDCOM personnel are essential to maintaining the Health of the Force and serve in multiple roles ranging from patient care in a hospital environment to advisors and

essential support staff for Army operational units. MEDCOM comprises eight Corps: Civilian, Dental, Enlisted, Nurse, Medical, Medical Service, Medical Specialist, and Veterinary (Army Medicine, 2015). Overall, MEDCOM manages a \$13 billion budget and cares for 3.95 million beneficiaries, including active duty Army personnel, Retirees, and their Family members (Army Medicine, 2015). On any given day, MEDCOM personnel provide medical services to roughly 42,000 patients, administer 5,900 immunizations, make about 54,000 outpatient pharmacy prescriptions, and inspect 23 million dollars' worth of food (Army Medicine, 2015).

This report (1) defines the relative impact of injury compared to other medical conditions among MEDCOM personnel in 2014 and (2) describes the details of injuries among MEDCOM personnel in 2014, including leading injury causes, injury types, and affected body regions.

## **5 Methods**

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### **5.1 Data Collection**

Existing medical surveillance data from the DMSS was obtained to describe the nature of the injury problem among active duty MEDCOM personnel. In May 2015, the Armed Forces Health Surveillance Center provided aggregate summaries of DMSS data for fatalities, hospitalizations, and outpatient visits among active duty MEDCOM personnel in calendar year 2014.

Hospitalization (inpatient) and outpatient visit data in DMSS are extracted from the Military Health System (MHS) Executive Information and Decision Support data systems. These data include treatment received within the MHS, as well as that received outside the MHS but paid for by the U.S. military. All data on medical conditions other than injuries are reported according to the 17 major diagnosis code groups as outlined in the International Classification of Disease, Ninth Revision, Clinical Modification (ICD-9-CM) (National Center for Health Statistics, 2008).

Injuries resulting in hospitalization and outpatient treatment were defined as recommended for military injury monitoring (DoD Military Injury Metrics Working Group, 2002) and consisted of ICD-9-CM diagnosis codes from the 800–999 code series for acute (traumatic) injuries, selected 710–739 codes for injury-related (chronic) musculoskeletal conditions such as stress fractures and tendinitis, and selected 320–389 codes for nervous system and sense organ conditions such as traumatic eye injuries and carpal tunnel syndrome. See Appendix B for a complete list of specific ICD-9-CM codes used. Unless otherwise specified, a “60-day” unique hospitalization/outpatient rule was established for this analysis in order to reduce the effect of follow-up injury visits and potential overestimation of frequencies and rates. The rule states that multiple visits for the same 3-digit ICD-9-CM diagnosis within 60 days of the initial visit will be counted as only one visit.

### **5.2 Data Analysis and Presentation**

Injury rates over a 10-year period (2005 to 2014) are presented for the overall Army and each MACOM [MEDCOM; U.S. Army Training and Doctrine Command (TRADOC); U.S. Army Europe (USAREUR); U.S. Army Forces Command (FORSCOM); U.S. Army Pacific (USARPAC); U.S. Army Special Operations Command (USASOC); Eighth United States Army (EUSA)]. MACOM assignment is determined based on individual Soldier assignment information obtained from the



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Defense Manpower Data Center (DMDC). At the time of analysis, DMDC MACOM information was matched with Soldier medical encounter and person-time data. Medical encounter and person-time data were then aggregated by MACOM and reported as such.

In this report, the relative burden of injuries and diseases is characterized by three indicators: (1) the total number of medical encounters for each major diagnosis group, (2) the number of individuals with one or more of a particular diagnosis for each major diagnosis group (visits for duplicate diagnoses excluded), and (3) the number of hospital bed days attributed to each major diagnosis group.

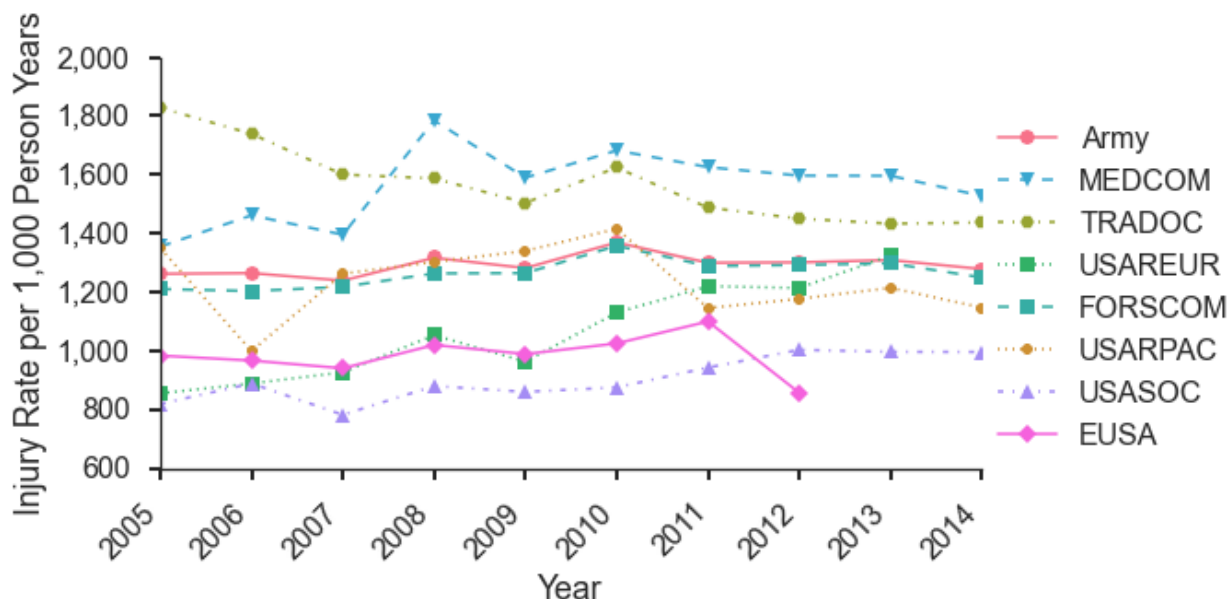
Causes of injury hospitalizations are coded at the military treatment facility according to the coding scheme outlined in the North Atlantic Treaty Organization (NATO) Standardization Agreement (STANAG) No. 2050, 5<sup>th</sup> Edition (Military Agency for Standardization, 1989). The coding system is employed for coding all injury hospitalizations in the MHS (Amoroso et al., 2000). The STANAG codes are four-digit codes describing the intent/situation of the injury incident, injury cause and location at which the injury occurred. This report includes injury hospitalizations coded as “accidental” (a STANAG trauma code, or first digit, of 5-9), hereafter referred to as unintentional injuries. The distribution of the cause of injury (defined using the second through fourth digits of the STANAG code) is presented.

Injury matrices (Barell et al., 2002) and injury-related musculoskeletal conditions (Hauret et al., 2010) further describe the acute injuries and injury-related musculoskeletal conditions. The matrices report ICD-9-CM code frequencies by type of injury (listed horizontally, across the top of the chart) and body region (listed vertically, along the left side of the chart). Prior to the onset of this study, the APHC (Prov) Public Health Review Board approved the use of routine surveillance data as public health practice.

## 6 Results

### 6.1 Injury Rates by Major Army Command

Figure 1 illustrates the 10-year injury rates for the U.S. Army overall and for each MACOM.



Notes:  
 Rates of injury to active-duty personnel were adjusted to remove deployed injury and deployed person-time  
 Data source: DMSS, 2015; prepared by APHC (Prov), Injury Prevention Program

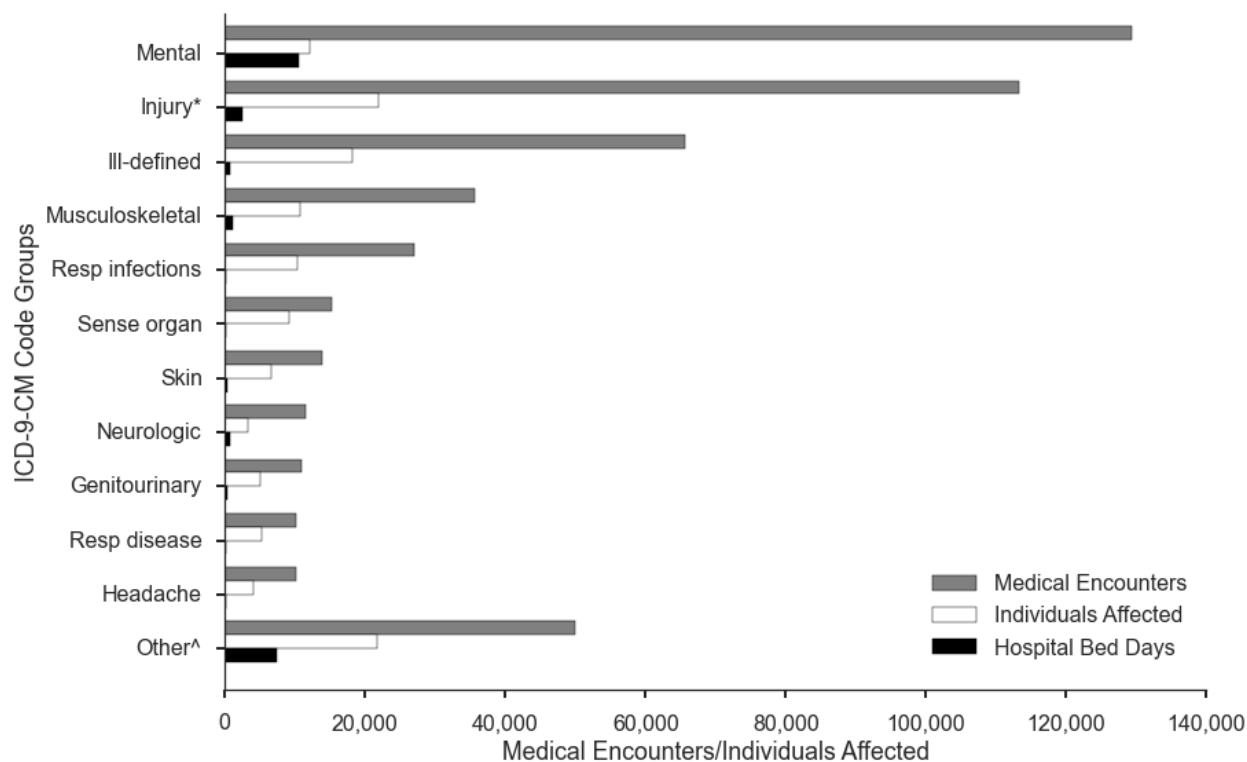
**Figure 1. Injury Rates by MACOM, 2005-2014**

Figure 1 comments:

- Rates do not include injuries treated during deployment, and denominators were adjusted for deployed person-time.
- Since 2008, MEDCOM personnel have experienced a rate above the Army average and the highest injury rates among all MACOMs.
  - In 2014, the injury rate for MEDCOM personnel was 1,528 injuries per 1,000 person-years, indicating that, on average, each MEDCOM Soldier received treatment for 1.5 injuries in 2014.
  - In 2014, the lowest injury rate was among USASOC personnel: 996 injuries per 1,000 person-years.

## 6.2 Army MEDCOM Hospitalizations and Outpatient Visits by Diagnosis

Figure 2 illustrates the frequency of injuries and illnesses among active duty MEDCOM personnel in 2014 by primary diagnosis group (ICD-9-CM code groups).



Notes:

\* Diagnosis group Injury contains both injury and injury-related musculoskeletal conditions, consistent with definition recommended by the DOD Military Injury Metrics Working Group

^ "Other" includes all ICD-9-CM code groups with fewer than 10,000 medical encounters

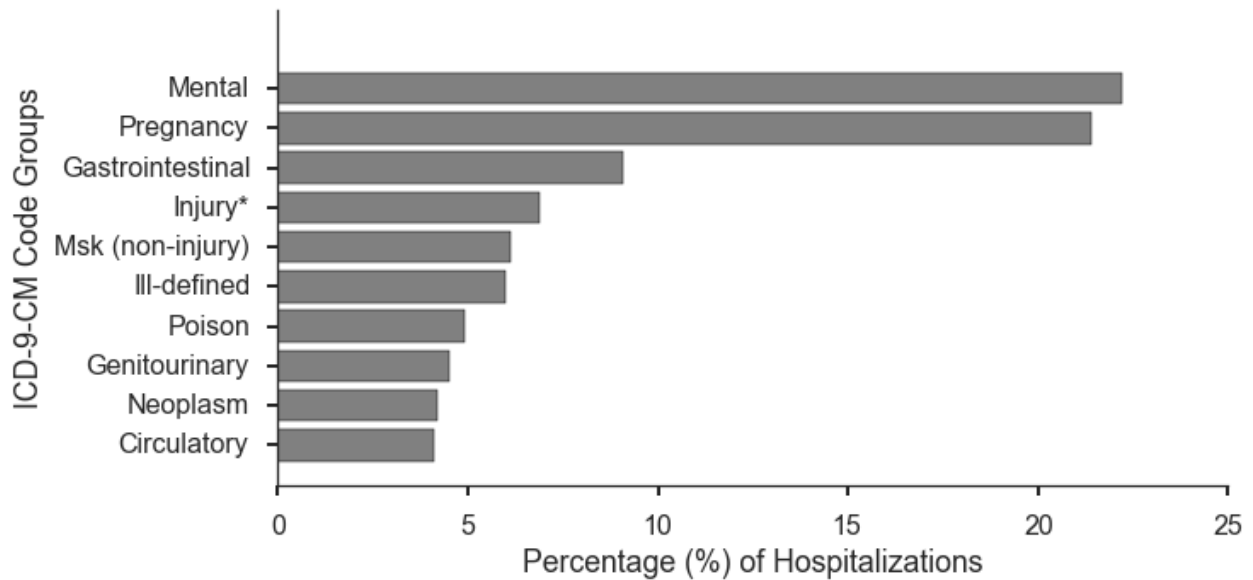
Data source: DMSS, 2015; prepared by APHC (Prov) Injury Prevention Program

**Figure 2. Injury and Injury-Related Musculoskeletal Conditions, Active Duty MEDCOM Personnel, 2014**

Figure 2 comments:

- In 2014, there were 492,796 medical encounters (hospitalizations and outpatient visits) among MEDCOM personnel.
  - Injuries accounted for 23 percent of all medical encounters (n=113,300).
  - Injuries affected 21,893 MEDCOM personnel (17%).
  - Mental disorders required the most hospital bed days (n=10,509), followed by injuries (n=2,597).
- While there were more mental health medical encounters and hospital bed days, injuries affected more MEDCOM personnel.
- In 2014, there were 5 accidental injury deaths among MEDCOM personnel, representing 14 percent of all fatalities among MEDCOM personnel (data not shown).

Figure 3 displays the percent of hospital admissions in 2014 by primary diagnosis group (ICD-9-CM code groups) among active duty MEDCOM personnel.



Notes:

\* Diagnosis group "Injury" contains both injuries and injury-related musculoskeletal conditions, consistent with definition recommended by DOD Military Injury Metrics Working Group.

Total number of incident hospitalizations = 3,814

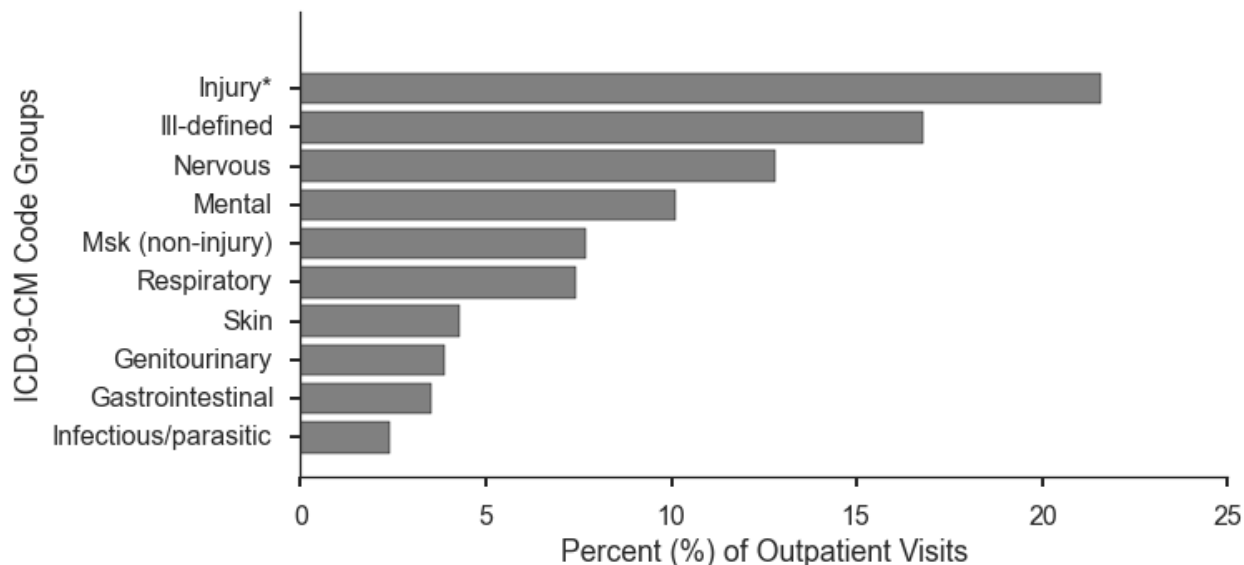
Data source: DMSS, 2015; prepared by APHC (Prov) Injury Prevention Program

**Figure 3. Injuries and Illnesses Resulting in Hospitalization, Top 10 ICD-9-CM Categories, Active Duty MEDCOM Personnel, 2014**

Figure 3 comments:

- Out of 3,814 hospitalizations, three diagnosis groups accounted for over half of all admissions: mental disorders (22.2 percent), pregnancy-related issues (21.4 percent) and gastrointestinal-related issues (9.1 percent).
- In 2014, injury and injury-related musculoskeletal conditions were the fourth leading cause of hospitalizations (6.9 percent, n=263).
- Forty-seven percent of injury and musculoskeletal hospitalizations were due to acute traumatic injuries, while 53 percent were due to injury-related musculoskeletal conditions.

Figure 4 shows the percent of outpatient visits in 2014 by primary diagnosis group (ICD-9-CM code groups) among active duty MEDCOM personnel.



Notes:

\* Diagnosis group "Injury" contains both injuries and injury-related musculoskeletal conditions, consistent with definition recommended by DOD Military Injury Metrics Working Group.

Total number of incident outpatient visits = 222,177

Data source: DMSS 2015; prepared by APHC (Prov) Injury Prevention Program

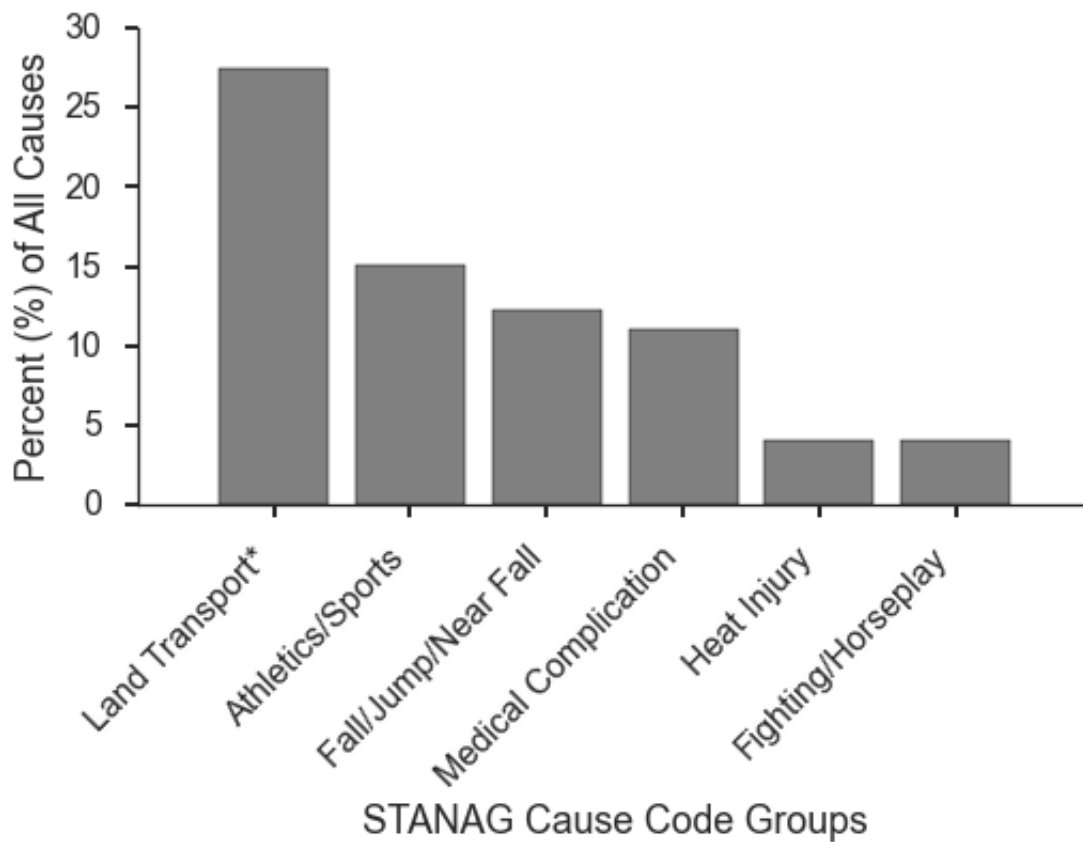
**Figure 4. Injuries and Illnesses Resulting in Outpatient Visits, Top 10 ICD-9-CM Categories, Active Duty MEDCOM personnel, 2014**

Figure 4 comments:

- Of the 222,177 outpatient visits made by active duty MEDCOM personnel in 2014, 47,928 (21.6 percent) were injury-related.
- Injuries and injury-related musculoskeletal conditions were the leading causes of outpatient treatment, followed by ill-defined signs and symptoms (16.8 percent), nervous system conditions (12.8 percent) and mental disorders (10.1 percent).
- These data indicate that most injuries (99.5%) among active duty MEDCOM personnel were treated on an outpatient basis.
- Thirty percent of injury visits were due to acute traumatic injuries, 68 percent were injury-related musculoskeletal conditions and 2 percent were nervous system injuries.

### 6.3 Army MEDCOM Injury Causes and Types

Figure 5 illustrates the percent distribution of leading causes of unintentional injury hospitalizations among active duty MEDCOM personnel in 2014 by specific NATO STANAG 2050 injury cause codes.



Notes:

\* "Land Transport" includes both traffic- and non-traffic-related and military and nonmilitary vehicle incidents.

Total number of cause-coded unintentional injury hospitalizations = 73

Data source: DMSS, 2015; prepared by APHC (Prov) Injury Prevention Program

**Figure 5. Leading Causes of Unintentional Injury Hospitalizations by STANAG Code Groupings, Active Duty MEDCOM Personnel, 2014**

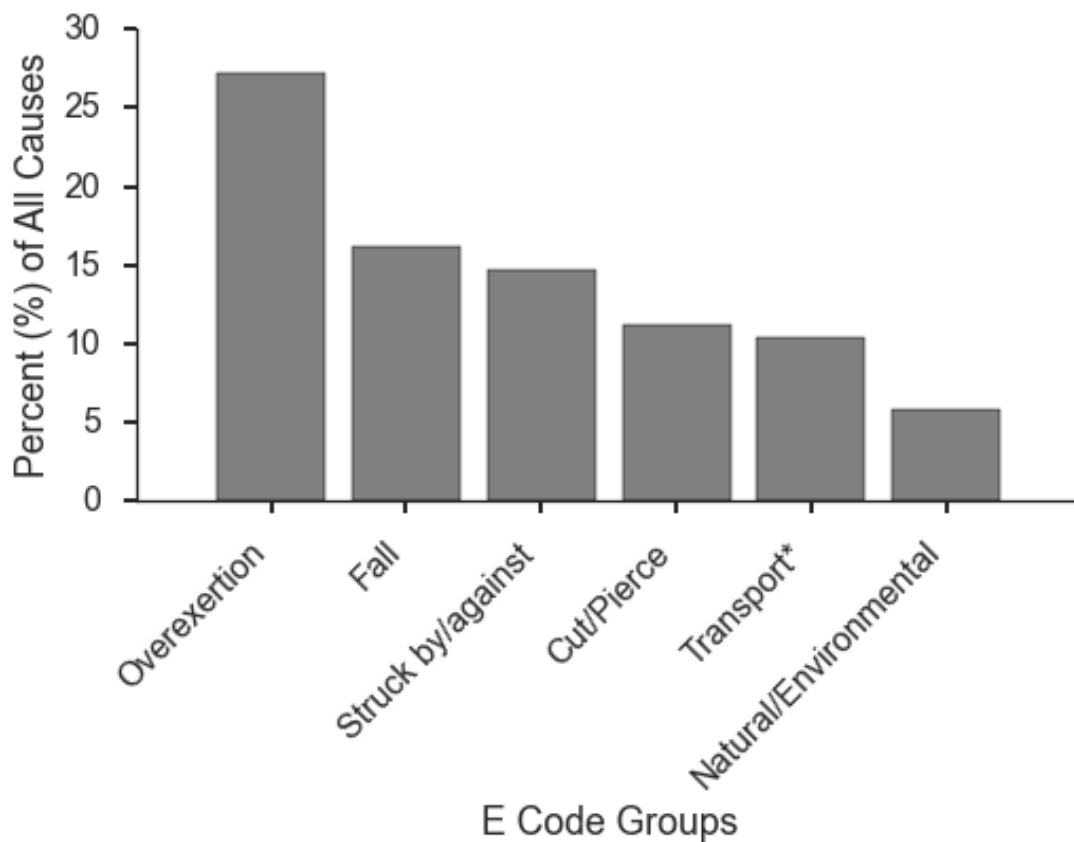
Figure 5 comments:

- The leading cause of hospitalization for unintentional injury was land transport-related injuries (27.4 percent). Land transport includes traffic- and nontraffic-related and military and nonmilitary vehicle incidents. While this category also includes accidents involving bicycles and railways, the majority of land transport-related injuries were linked to motor vehicles.
- The next leading causes of unintentional injury hospitalizations were sports (15.1 percent), falls/jumps/near falls (12.3 percent) and medical complications (11.0 percent).
- Approximately 24 percent of incident injury-related hospitalizations (ICD-9-CM codes 800–999) received a cause code.

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- Current intervention strategies to address many of these issues are as follows:
  - Motor vehicle accident-related injury interventions:
    - Seatbelt use (Bell et al., 2000; Dinh-Zarr et al., 2001; National Center for Injury Prevention and Control, 2011)
    - Lower blood alcohol concentration (BAC) laws (Shults et al., 2001)
    - Higher legal drinking age (Shults et al., 2001)
  - Sports injury interventions:
    - Ankle braces (Janssen et al., 2014; McGuine et al., 2011; Sitler et al., 1994)
    - Breakaway baseball and softball bases (Pollack et al., 2005)
    - Mouthguards for football, basketball (Knapik et al., 2007)
    - Protective eyewear (Cass, 2012; Goldstein and Wee, 2011; Leivo et al., 2015)
  - Helmets (Al-Habib et al., 2012; Rowson et al., 2014)
  - Falls (Bell et al., 2008; Canham-Chervak et al., 2015)

Figure 6 illustrates the percent distribution of leading causes of injury outpatient visits among active duty MEDCOM personnel in 2014.



Notes:

\* "Transport" is inclusive of traffic and non-traffic, motorcyclist, pedal cyclist and pedestrian, unspecified transport.

Total number of cause-coded unintentional injury outpatient visits = 4,752

Data source: DMSS, 2015; prepared by APHC (Prov) Injury Prevention Program

**Figure 6. Leading Causes of Injury Outpatient Visits, Active Duty MEDCOM Personnel, 2014**

Figure 6 comments:

- The leading causes of injury outpatient visits with cause codes were overexertion (27.2 percent), falls (16.2 percent) and being struck by/against an object or person (14.7 percent).
- Approximately 30 percent of incident injury-related outpatient visits (ICD-9-CM codes 800–999) received a cause code.



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Table 1. Frequency of Acute Traumatic Injuries by Location and Diagnosis (Barell Matrix\*), Active Duty MEDCOM Personnel Hospitalizations and Outpatient Visits, 2014

|                            |                          |                              | DIAGNOSIS |             |                     |          |               |             |                 |                           |       |       |        |             |                               | Total | % by body region |
|----------------------------|--------------------------|------------------------------|-----------|-------------|---------------------|----------|---------------|-------------|-----------------|---------------------------|-------|-------|--------|-------------|-------------------------------|-------|------------------|
|                            |                          |                              | Fracture  | Dislocation | Sprains/<br>Strains | Internal | Open<br>Wound | Amputations | Blood<br>Vessel | Contusion/<br>Superficial | Crush | Burns | Nerves | Unspecified | System-wide<br>& late effects |       |                  |
| BODY REGION                | Head and Neck            | Traumatic Brain Injury (TBI) | 0         | 0           | 0                   | 0        | 0             | 0           | 0               | 0                         | 0     | 0     | 0      | 0           | 155                           | 0     | 5.4%             |
|                            |                          | Type 1 TBI                   | 3         | 0           | 0                   | 318      | 0             | 0           | 0               | 0                         | 0     | 0     | 0      | 0           | 0                             | 0     |                  |
|                            |                          | Type 2 TBI                   | 5         | 0           | 0                   | 291      | 0             | 0           | 0               | 0                         | 0     | 0     | 0      | 0           | 0                             | 0     |                  |
|                            |                          | Type 3 TBI                   | 0         | 0           | 0                   | 0        | 0             | 0           | 0               | 0                         | 0     | 0     | 0      | 0           | 0                             | 0     |                  |
|                            |                          | Other Head, Face, Neck       | 0         | 0           | 0                   | 0        | 55            | 0           | 0               | 0                         | 0     | 0     | 4      | 0           | 0                             | 0     | 6.1%             |
|                            |                          | Face                         | 74        | 4           | 0                   | 0        | 159           | 0           | 0               | 0                         | 0     | 2     | 0      | 0           | 0                             | 0     |                  |
|                            |                          | Eye                          | 0         | 0           | 0                   | 0        | 17            | 0           | 0               | 273                       | 0     | 10    | 1      | 0           | 0                             | 0     |                  |
|                            |                          | Neck                         | 0         | 0           | 0                   | 0        | 4             | 0           | 0               | 0                         | 0     | 0     | 2      | 0           | 0                             | 0     |                  |
|                            | Head, Face, Neck Unspec. | 0                            | 0         | 0           | 0                   | 0        | 0             | 0           | 1               | 183                       | 2     | 0     | 0      | 81          | 0                             | 0.3%  |                  |
|                            | Spinal Cord (SCI)        | 5                            | 0         | 0           | 6                   | 0        | 0             | 0           | 0               | 0                         | 0     | 0     | 0      | 0           | 0                             |       |                  |
|                            | Thoracic/Dorsal SCI      | 7                            | 0         | 0           | 1                   | 0        | 0             | 0           | 0               | 0                         | 0     | 0     | 0      | 0           | 0                             |       |                  |
|                            | Lumbar SCI               | 3                            | 0         | 0           | 2                   | 0        | 0             | 0           | 0               | 0                         | 0     | 0     | 0      | 0           | 0                             |       |                  |
|                            | Sacrum Coccyx SCI        | 0                            | 0         | 0           | 1                   | 0        | 0             | 0           | 0               | 0                         | 0     | 0     | 0      | 0           | 0                             |       |                  |
|                            | Spine, Back Unspec. SCI  | 3                            | 0         | 0           | 12                  | 0        | 0             | 0           | 0               | 0                         | 0     | 0     | 0      | 0           | 0                             |       |                  |
|                            | Vertebral Column (VCI)   | 11                           | 4         | 360         | 0                   | 0        | 0             | 0           | 0               | 0                         | 0     | 0     | 0      | 0           | 0                             |       | 7.3%             |
|                            | Cervical VCI             | 22                           | 0         | 145         | 0                   | 0        | 0             | 0           | 0               | 0                         | 0     | 0     | 0      | 0           | 0                             |       |                  |
|                            | Thoracic/Dorsal VCI      | 18                           | 3         | 436         | 0                   | 0        | 0             | 0           | 0               | 0                         | 0     | 0     | 0      | 0           | 0                             |       |                  |
|                            | Lumbar VCI               | 16                           | 3         | 21          | 0                   | 0        | 0             | 0           | 0               | 0                         | 0     | 0     | 0      | 0           | 0                             |       |                  |
|                            | Sacrum Coccyx VCI        | 5                            | 0         | 0           | 0                   | 0        | 0             | 0           | 0               | 0                         | 0     | 0     | 0      | 0           | 0                             | 8.0%  |                  |
|                            | Spine, Back Unspec. VCI  | 40                           | 2         | 85          | 8                   | 4        | 0             | 1           | 65              | 0                         | 0     | 0     | 0      | 0           | 0                             |       |                  |
|                            | Torso                    | 0                            | 0         | 0           | 16                  | 20       | 0             | 0           | 13              | 0                         | 1     | 2     | 0      | 0           | 0                             |       |                  |
|                            | Chest (thorax)           | 23                           | 2         | 367         | 4                   | 9        | 0             | 0           | 4               | 1                         | 1     | 0     | 0      | 0           | 0                             |       |                  |
|                            | Abdomen                  | 0                            | 0         | 0           | 0                   | 5        | 0             | 0           | 69              | 0                         | 9     | 1     | 211    | 0           | 0                             |       |                  |
|                            | Pelvis, Urogenital       | 0                            | 0         | 0           | 0                   | 7        | 0             | 0           | 43              | 0                         | 2     | 0     | 0      | 0           | 0                             |       |                  |
|                            | Trunk                    | 0                            | 0         | 142         | 0                   | 0        | 0             | 0           | 0               | 0                         | 0     | 0     | 0      | 0           | 0                             |       |                  |
|                            | Back, Buttock            | 57                           | 108       | 1,138       | 0                   | 8        | 6             | 0           | 64              | 0                         | 4     | 0     | 113    | 0           | 0                             |       | 26.7%            |
|                            | Upper                    | 77                           | 9         | 58          | 0                   | 44       | 3             | 0           | 35              | 1                         | 12    | 0     | 0      | 0           | 0                             |       |                  |
|                            | Shoulder, Upper Arm      | 282                          | 36        | 439         | 0                   | 672      | 13            | 0           | 302             | 18                        | 39    | 0     | 90     | 0           | 0                             |       |                  |
| Forearm, Elbow             | 1                        | 0                            | 0         | 0           | 11                  | 3        | 7             | 65          | 0               | 12                        | 62    | 50    | 0      | 0           |                               |       |                  |
| Wrist, Hand, Fingers       | 19                       | 5                            | 621       | 0           | 0                   | 0        | 0             | 31          | 0               | 0                         | 0     | 0     | 0      | 0           | 36.8%                         |       |                  |
| Other & Unspec.            | 23                       | 0                            | 0         | 0           | 0                   | 19       | 0             | 11          | 1               | 1                         | 0     | 0     | 0      | 0           |                               |       |                  |
| Lower                      | 12                       | 243                          | 257       | 0           | 0                   | 0        | 0             | 76          | 0               | 1                         | 0     | 0     | 0      | 0           |                               |       |                  |
| Hip                        | 192                      | 6                            | 1,096     | 0           | 0                   | 32       | 0             | 48          | 4               | 3                         | 0     | 0     | 0      | 0           |                               |       |                  |
| Upper leg, Thigh           | 235                      | 6                            | 182       | 0           | 84                  | 3        | 0             | 285         | 9               | 7                         | 0     | 0     | 0      | 0           |                               |       |                  |
| Knee                       | 22                       | 0                            | 1,054     | 0           | 128                 | 58       | 9             | 135         | 4               | 10                        | 0     | 354   | 0      | 0           |                               |       |                  |
| Lower leg, Ankle           | 0                        | 0                            | 0         | 0           | 0                   | 0        | 0             | 0           | 0               | 0                         | 0     | 0     | 0      | 0           | 2.4%                          |       |                  |
| Foot, toes                 | 25                       | 3                            | 385       | 3           | 90                  | 0        | 1             | 300         | 0               | 62                        | 16    | 108   | 0      | 0           |                               |       |                  |
| Other & Unspec.            | 0                        | 0                            | 0         | 0           | 0                   | 0        | 0             | 0           | 0               | 0                         | 0     | 0     | 0      | 0           |                               |       |                  |
| Other, Unspecified         | 0                        | 0                            | 0         | 0           | 0                   | 0        | 0             | 0           | 0               | 0                         | 37    | 0     | 0      | 0           |                               |       |                  |
| Unspec. Site               | 25                       | 3                            | 385       | 3           | 90                  | 0        | 1             | 300         | 0               | 62                        | 16    | 108   | 0      | 0           |                               |       |                  |
| System-wide & late effects | 0                        | 0                            | 0         | 0           | 0                   | 0        | 0             | 0           | 0               | 0                         | 0     | 0     | 339    | 0           |                               |       |                  |
| Total                      | 1,180                    | 434                          | 6,786     | 662         | 1,317               | 137      | 19            | 2,002       | 40              | 176                       | 125   | 1,162 | 339    | 14,379      | 100%                          |       |                  |
| % Total                    | 8.2%                     | 3.0%                         | 47.2%     | 4.6%        | 9.2%                | 1.0%     | 0.1%          | 13.9%       | 0.3%            | 1.2%                      | 0.9%  | 8.1%  | 2.4%   | 100%        |                               |       |                  |

\* ICD-9-CM codes 800–999

Data source: DMSS, 2015; prepared by APHC (Prov) Injury Prevention Program

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The Barell Matrix (Barell et al., 2002) categorizes acute injuries by injury diagnosis and body region. Table 1 includes acute injuries among MEDCOM personnel in 2014 that required hospitalization or outpatient visits.

### Table 1 comments:

- In 2014, 14,379 acute, traumatic injuries (ICD-9-CM codes 800–999) requiring hospitalization or outpatient visits of active duty MEDCOM personnel could be classified in the Barell Matrix. This represents 99 percent of all acute injuries among MEDCOM personnel.
- The most common types of injury were sprains/strains (47.2 percent), contusion/superficial injuries (13.9 percent), open wounds (9.2 percent) and fractures (8.2 percent).
- The body regions most commonly affected were lower extremity (36.8 percent), upper extremity (26.7 percent), torso (8.0 percent) and spine and back (7.5 percent).
- The leading specific injuries were sprains/strains of the shoulder/upper arms (7.9 percent), sprains/strains of the lower leg and/or ankle (7.6 percent) and sprains/strains of other and unspecified lower extremities (7.3 percent).

**Table 2. Frequency of Injury-related Musculoskeletal Conditions (Primarily Overuse Injuries<sup>\*</sup>) by Location and Diagnosis, Active Duty MEDCOM Personnel Hospitalizations and Outpatient Visits, 2014**

| Injury Location    |                              | DIAGNOSIS                       |                   |   |                 |                         |             |      | Total  | % by body region |       |
|--------------------|------------------------------|---------------------------------|-------------------|---|-----------------|-------------------------|-------------|------|--------|------------------|-------|
|                    |                              | Inflammation and Pain (Overuse) | Joint Derangement | Joint Derangement with Neurological Involvement | Stress Fracture | Sprains/Strains/Rupture | Dislocation |      |        |                  |       |
| <b>BODY REGION</b> | <b>Vertebral Column</b>      | Cervical                        | 2,419             | 262   | 398             | 0                       | 0           | 0    | 3,079  | 36.2%            |       |
|                    |                              | Thoracic/Dorsal                 | 0                 | 28  | 472             | 0                       | 0           | 0    | 500    |                  |       |
|                    |                              | Lumbar                          | 5,635             | 769   | 295             | 0                       | 0           | 0    | 6,699  |                  |       |
|                    |                              | Sacrum, Coccyx                  | 432               | 0   | 0               | 0                       | 0           | 0    | 432    |                  |       |
|                    |                              | Spine, Back Unspecified         | 954               | 103   | 18              | 9                       | 0           | 0    | 1,084  |                  |       |
|                    | <b>Upper Extremity</b>       | Shoulder                        | 3,970             | 335   | 0               | 0                       | 46          | 26   | 4,377  |                  | 19.5% |
|                    |                              | Upper arm, Elbow                | 738               | 9   | 0               | 0                       | 0           | 0    | 747    |                  |       |
|                    |                              | Forearm, Wrist                  | 853               | 34  | 0               | 0                       | 0           | 0    | 887    |                  |       |
|                    |                              | Hand                            | 316               | 7   | 0               | 0                       | 10          | 1    | 334    |                  |       |
|                    | <b>Lower Extremity</b>       | Pelvis, Hip, Thigh              | 2,016             | 94  | 0               | 2                       | 5           | 1    | 2,118  |                  | 38.5% |
|                    |                              | Knee, Lower leg                 | 4,959             | 477   | 0               | 105                     | 207         | 7    | 5,755  |                  |       |
|                    |                              | Ankle, Foot                     | 4,275             | 351   | 0               | 26                      | 17          | 1    | 4,670  |                  |       |
|                    | <b>Others and Unspecifie</b> | Other specified/Multiple        | 141               | 6   | 0               | 7                       | 5           | 2    | 161    |                  | 5.9%  |
|                    |                              | Unspecified Site                | 1,487             | 11  | 207             | 53                      | 8           | 0    | 1,766  |                  |       |
|                    | <b>Total</b>                 |                                 | 28,195            | 2,486   | 1,390           | 202                     | 298         | 38   | 32,609 |                  | 100%  |
|                    | <b>% Total</b>               |                                 | 86.5%             | 7.6%  | 4.3%            | 0.6%                    | 0.9%        | 0.1% | 100%   |                  |       |

\* ICD-9-CM codes 710–739

Data source: DMSS, 2015; prepared by APHC (Prov) Injury Prevention Program

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Table 2 categorizes, by selected ICD-9-CM code injury diagnosis groups and body region affected, the injury-related musculoskeletal conditions (Hauret et al., 2010) among active duty MEDCOM personnel in 2014 that required hospitalization or outpatient visits.

### Table 2 comments:

- This matrix classified 32,609 hospitalizations and outpatient visits for injury-related musculoskeletal conditions (ICD-9-CM codes 710–739) among MEDCOM personnel. This represents 99 percent of all musculoskeletal injuries among MEDCOM personnel.
- The most common types of injury-related musculoskeletal conditions were inflammation and pain due to overuse (86.5 percent), joint derangement (7.6 percent) and joint derangement with neurological involvement (4.3 percent).
- The lower extremity (38.5 percent) was the body region most affected by injury-related musculoskeletal conditions, followed by vertebral column/back (36.2 percent) and upper extremity (19.5 percent).
- The leading specific injury-related musculoskeletal conditions were inflammation and pain due to overuse of the lumbar region (17.3 percent), inflammation and pain of the knee and/or lower leg (15.2 percent) and inflammation and pain of the ankle and/or foot (13.1 percent).

## 7 Discussion

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This analysis provides the first summary of existing medical surveillance data on injuries among active duty MEDCOM personnel, information that is needed to inform injury prevention program and policy planning.

### 7.1 MEDCOM Injury Medical Encounters

In 2014, injury was the second leading cause of medical encounters among active duty MEDCOM personnel and affected the greatest number of MEDCOM personnel compared to any other medical condition. Injury and injury-related musculoskeletal conditions were the leading cause of outpatient visits and the fourth leading cause of hospitalizations. The present findings are consistent with previous reports showing the relative importance of injuries as a cause of morbidity and mortality among all active duty Army personnel (Jones et al., 2010; Marshall et al., 2014) as well as civilian hospital personnel (Bell et al., 2008; Boden et al., 2012; Dawson et al., 2007; Jabbour et al., 2015; Oude Hengel et al., 2011; Perhats et al., 2012; Rodriguez-Acosta et al., 2009).

Among U.S. workers, private sector healthcare personnel have the third highest nonfatal occupational injury rates, behind the agriculture, forestry, fishing, and hunting sector and the transportation and warehousing sector (Bureau of Labor Statistics, 2015a). More specifically, nursing assistants incurred the highest number of musculoskeletal disorders among all occupations reviewed by the Bureau of Labor Statistics in 2014; musculoskeletal disorders accounted for 54 percent of all nonfatal occupational injuries and illnesses among nursing assistants (Bureau of Labor Statistics, 2015c). The 2014 rate for overexertion and bodily reaction among nursing assistants was 204.6 per 10,000 full time workers, which was five times greater than the rate of overexertion and bodily reaction-related injuries among all U.S. workers (Bureau of Labor Statistics, 2015c). Injury-related musculoskeletal conditions are also common among other civilian hospital personnel; a systematic review of musculoskeletal complaints among hospital physicians found that between 33 and 68 percent of hospital physicians experience low back pain annually (Oude Hengel et al., 2011). A matched case-control study of 5,080 registered nurses and hospital unit support staff suggested potential causes; the study found a trend of increasing odds of injury with increasing number of consecutive workdays and cumulative work shifts and hours (Hopcia et al., 2012).

The injury rate for U.S. civilian hospital employees in 2014 was 5.8 injuries per 100 full-time workers (Bureau of Labor Statistics 2015b). Additionally, in 2014, civilian healthcare practitioners experienced 1 nonfatal occupational injury and illness per 100 full-time workers, and healthcare support occupations experienced 2.2 nonfatal occupational injuries and illnesses per 100 full-time workers (Bureau of Labor Statistics, 2015c). At this time, it is unfortunately not possible to compare MEDCOM rates with civilian rates due to differences in data capture and rate calculations. For example, the BLS routinely combines occupational injuries and illnesses in its reporting of rates by industry and occupation. In addition, injuries captured in military medical surveillance systems include all injuries for which treatment was sought and cannot be specifically limited to those occurring in the work (hospital) environment.

## 7.2 MEDCOM Injury Causes and Types

Land transport (27.4 percent), athletics/sports (15.1 percent) and falls (12.3 percent) were the leading causes of unintentional injury that resulted in hospitalization among MEDCOM personnel in 2014. These data are similar to the leading causes of unintentional injury hospitalizations among all active duty Army personnel (Marshall et al., 2014). Previous studies have noted that motor vehicle crashes are a leading cause of serious injury among military populations (Jones et al., 2010; Pollack et al., 2013), and in 2006, the rate of hospitalized injuries due to land transport accidents was higher in the Army than in all other Department of Defense (DOD) branches (Jones et al., 2010). Also, active duty Army personnel had the highest rate of injuries due to athletics/sports among all DOD branches in 2006 (Jones et al., 2010). The same leading causes are also found during deployment. An analysis of data on 27,563 Soldiers in Iraq and 4,165 in Afghanistan found the leading causes of air-evacuated non-battle injuries were sports/physical training (19-21 percent), falls and jumps (18 percent) and motor vehicle-related incidents (12-16 percent) (Hauret et al., 2010).

Overexertion (27.2 percent) and falls (16.2 percent) were the leading causes of unintentional injuries that resulted in outpatient visits among active duty MEDCOM personnel. These results are similar to outpatient injury causes among all active duty Army Soldiers; in 2012, overexertion accounted for 27.2 percent of outpatient visits, and falls accounted for 15.9 percent of all Army outpatient visits for new injuries (Marshall et al., 2014). Overexertion injuries are likely due to military physical training, including running and road marching (Kaufman et al., 2000). A survey of employees at the General Leonard Wood Army Community Hospital found that 36 percent of injuries among active duty Army hospital staff were attributed to overuse and repetitive activities, specifically running (Army Public Health Center (Prov), 2016). Falls have also consistently been identified as a leading cause of injury in the military (Jones et al., 2010). In 2006, active duty Army personnel had the second highest rate of injuries due to falls/jumps among all DOD branches (Jones et al., 2010). Among Soldiers deployed to Iraq and Afghanistan 18 percent of non-battle injuries were due to falls/jumps, which made falls/jumps the second most common cause of injury in both of these deployed populations (Hauret et al., 2010).

A survey of employees at the General Leonard Wood Army Community Hospital determined that physical training was the leading activity resulting in injury for active duty personnel while walking or hiking was the leading activity for civilian personnel (Army Public Health Center (Prov), 2016). Therefore, the mechanisms of injury among active duty MEDCOM personnel may differ from those of civilian hospital personnel. Civilian studies of hospital employees have identified the most common mechanisms of injury to be overexertion, lifting, slips, trips, and falls, and being struck by or against an object (Bell et al., 2008; Boden et al., 2012; Jabbour et al., 2015; Perhats et al., 2012; Pompeii et al., 2008; Rodriguez-Acosta et al., 2009; Scott and Newman, 2013). Studies have also indicated that some of the injuries among civilian hospital personnel are due to patient moving and lifting (Bell et al., 2008; Perhats et al., 2012; Pompeii et al., 2008).

The leading acute injuries identified in this report were sprains/strains (47.2 percent), contusions/superficial injuries (13.9 percent) and fractures (8.2 percent). These data are comparable to acute injuries among all active duty Army personnel; in 2012 the same top three acute injuries treated on an outpatient basis were identified (sprains/strains, contusions/superficial

injuries and fractures) (Marshall et al., 2014). These data are also similar to injuries experienced by Army hospital personnel at the General Leonard Wood Army Community Hospital (Army Public Health Center (Prov), 2016). Among the staff of this hospital, sprains/strains were the most common injury type (29 percent) (U.S. Army Public Health Center (Prov), 2016). The leading category of chronic musculoskeletal conditions among Army MEDCOM personnel was inflammation and pain due to overuse (86.5 percent). This is comparable to all active duty Army Soldiers; in 2012, 87 percent of chronic musculoskeletal injuries treated on an outpatient basis were for inflammation and pain due to overuse (Marshall et al., 2014). Also among civilian hospital personnel, the most common types of injury are sprains/strains, pain/inflammation and contusions (Boden et al., 2012; Jabbour et al., 2015; Perhats et al., 2012; Rodriguez-Acosta et al., 2009).

The leading body region affected among active duty MEDCOM personnel was the lower extremity for both acute injuries (36.8 percent) and chronic musculoskeletal conditions (38.5 percent). Similarly, among all active duty Army personnel and the General Leonard Wood Army Community Hospital staff, the most common body area affected was the lower extremity (Marshall et al., 2014; Army Public Health Center (Prov), 2016). Among civilian hospital personnel, prior studies have noted the back, arms/hands, and neck/shoulder as leading body parts affected by injury (Boden et al., 2012; Caruso and Waters, 2008; Jabbour et al., 2015; Oude Hengel et al., 2011; Perhats et al., 2012; Rodriguez-Acosta et al., 2009). Injured body regions among active duty MEDCOM personnel are more similar to those of other active duty Army Soldiers than to those of civilian hospital personnel.

### **7.3 Strengths and Limitations**

Strengths of this analysis included that the data received from DMSS consisted of all medical encounters of active duty U.S. military personnel occurring in military as well as civilian medical treatment facilities (Rubertone and Brundage, 2002). The data were collected from a large patient population (active duty personnel with access to MHS care), thereby enabling stratification by MACOM, and all medical encounters were subject to standardized and routine recordkeeping and coding.

Limitations included that the MEDCOM data represents eight Medical Corps, which may have distinct injury risks and expected incidence of injury. The MEDCOM injury rates presented in this report should be interpreted with the knowledge that an *ad hoc* investigation suggested that 20 percent of the MEDCOM population was assigned to Warrior Transition Units (WTUs) in 2013 (Armed Forces Health Surveillance Branch, 2013). Soldiers assigned to WTUs include wounded, ill, and injured active duty Soldiers who require at least six months of rehabilitative care (U.S. Army, 2015); inclusion of this population may have inflated the MEDCOM rates. Also, cause coding is not mandatory for outpatient visits; as a result, less than 10 percent of MEDCOM injury visits were cause-coded. Improvements to injury cause coding are needed to provide robust data for the establishment of data-driven injury prevention priorities, tracking of effects of prevention programs implemented to address specific causes and comparison to data on causes of injury among civilian hospital personnel. In addition, Army medical facilities employ many civilian staff, and as such this report represents a subset of the Army medical employee population. Injury types and causes have been shown to differ between military and civilian staff (Army Public Health Center (Prov), 2016), therefore broader explorations of causes of injury at Army medical facilities are warranted.

However, this study has provided evidence that injuries among active duty MEDCOM personnel need to be further explored. Future studies should consider focusing on MEDCOM, its subordinate units, and its occupational specialties.

## **8 Conclusions**

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Among active duty MEDCOM personnel, injuries ranked second only to mental health conditions in 2014, representing a significant burden to this population. Overexertion and falls represent the leading causes of injuries. Injuries among the active duty MEDCOM population were more commonly seen in the lower extremities, whereas civilian hospital personnel suffer more frequent injuries to the back, arms/hands and neck/shoulders. Overall, injuries among active duty MEDCOM personnel are more similar to those of other active duty Army personnel than to those of civilian hospital personnel.

## **9 Recommendations**

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Strategies to reduce modifiable risk factors for injury, such as those attributable to overexertion and falls, in the context of job responsibilities and tasks among active duty MEDCOM personnel should be examined. The literature should be reviewed to identify existing strategies that could be implemented in a MEDCOM environment. Commanders can conduct surveys of their staff, as was done at the General Leonard Wood Army Community Hospital, to quantify injury incidence among both military and civilian staff at specific medical facilities and identify leading causes and at-risk populations that could become the focus of local health promotion and prevention efforts. Findings related to new programs that are put in place to address injuries among active duty MEDCOM personnel should be evaluated and disseminated. Monitoring of injuries among active duty MEDCOM personnel should be continued, and this report updated accordingly.

## **10 Point of Contact**

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The APHC (Prov) IPP is the point of contact for this project, e-mail [usarmy.apg.medcom-phc.mbx.injuryprevention@mail.mil](mailto:usarmy.apg.medcom-phc.mbx.injuryprevention@mail.mil), or phone number 410-436-4655, DSN 584-4655. Specific questions may be directed to author(s) listed at the front of this report.

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## Appendix A

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## Appendix B

### INJURY DIAGNOSIS CODES (ICD-9-CM CODES<sup>†</sup>) BY ANATOMICAL REGION

#### Head and neck

363.61 363.63 364.04 364.41 364.76 364.77 365.65 366.20 379.32 379.33 379.34 525.11 722.0  
722.71 723.1 723.4 800 801 802 803 804 805.0 805.1 806.0 806.1 807.5 807.6 830 839.0 839.1  
847.0 848.0 848.1 848.2 850 851 852 853 854 870 871 872 873 874 900 910.0 910.1 910.2  
910.3 910.6 910.7 910.8 910.9 918 920 921 925 930 931 932 933 935.0 940 941 947.0 950 951  
952.0 953.0 954.0 957.0 959.0

#### Shoulder and arm

354.1 354.2 354.3 716.11 716.12 716.13 718.01 718.02 718.03 718.11 718.12 718.13 718.31  
718.32 718.33 718.81 718.82 718.83 718.91 718.92 718.93 719.01 719.02 719.03 719.11  
719.12 719.13 719.41 719.42 719.43 726.0 726.1 726.2 726.3 727.61 727.62 733.11 810 811  
812 813 818 831 832 840 841 880 881.00 881.01 881.10 881.11 881.20 881.21 887 903.0  
903.1 912.0 912.1 912.2 912.3 912.6 912.7 912.8 912.9 923.0 923.1 927.0 927.1 943 953.4  
955.0 955.1 955.2 955.3 955.4 955.5 955.7 955.8 955.9 959.2

#### Hand and wrist

354.0 716.14 718.04 718.14 718.34 718.84 718.94 719.04 719.14 719.44 726.4 727.63 727.64  
733.12 814 815 816 817 833 834 842 881.02 881.12 881.22 882 883 885 886 903.4 903.5  
914.0 914.1 914.2 914.3 914.6 914.7 914.8 914.9 915.0 915.1 915.2 915.3 915.6 915.7 915.8  
915.9 923.2 923.3 927.2 927.3 944 955.6 959.4 959.5

#### Leg

716.15 716.16 718.05 718.15 718.35 718.85 718.95 **719.05** 719.15 **719.45 726.5 727.65 733.14**  
**733.15 733.93** 808.0 808.1 820 821 823 835 **843 844.3** 890 897 904.0 904.1 904.2 904.3 904.5  
924.0 924.10 928.0 928.10 945.00 945.04 945.06 945.09 945.10 945.14 945.16 945.19 945.20  
945.24 945.26 945.29 945.30 945.34 945.36 945.39 945.40 945.44 945.46 945.49 945.50  
945.54 945.56 945.59 956 959.6

#### Knee

**717** 718.36 718.86 **719.06** 719.16 **719.46 726.6 727.66** 822 836 **844.0 844.1 844.2** 924.11  
928.11 945.05 945.15 945.25 945.35 945.45 945.55

#### Ankle and foot

716.17 718.07 718.17 718.37 718.87 718.97 **719.07** 719.17 **719.47 726.7 727.67 727.68 728.71**  
**733.94 734** 824 825 826 837 838 **845** 892 893 895 896 904.6 917.0 917.1 917.2 917.3 917.6  
917.7 917.8 917.9 924.2 924.3 928.2 928.3 945.01 945.02 945.03 945.11 945.12 945.13 945.21  
945.22 945.23 945.31 945.32 945.33 945.41 945.42 945.43 945.51 945.52 945.53

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Chest, back, and abdomen

720.2 721.7 722.1 722.72 722.73 **724.2** 724.3 724.4 **724.5 724.9** 733.13 805.2 805.3 805.4  
805.5 805.6 805.7 806.2 806.3 806.4 806.5 806.6 806.7 807.0 807.1 807.2 807.3 807.4 808.2  
808.3 808.4 808.5 808.8 808.9 809 839.2 839.3 839.41 839.42 839.51 839.52 839.61 839.71  
**846** 847.1 **847.2 847.3 847.4 847.9** 848.3 848.4 **848.5** 860 861 862 863 864 865 866 867 868  
869 875 876 877 878 879.0 879.1 879.2 879.3 879.4 879.5 879.6 879.7 901 902 911.0 911.1  
911.2 911.3 911.6 911.7 911.8 911.9 922 926 934 935.1 935.2 936 937 938 939 942 947.1  
947.2 947.3 947.4 952.1 952.2 952.3 952.4 953.1 953.2 953.3 953.5 954.1 954.8 954.9 959.1  
959.11 959.12 959.19

Environmental

363.31 370.24 388.10 388.11 388.12 692.71 692.76 692.77 910.4 910.5 911.4 911.5 912.4  
912.5 913.4 913.5 914.4 914.5 915.4 915.5 916.4 916.5 917.4 917.5 919.4 919.5 990 991 992  
993 994

Unspecified

716.10 716.18 716.19 718.00 718.08 718.09 718.10 718.18 718.19 718.30 718.38 718.39  
718.80 718.88 718.89 718.90 718.98 718.99 **719.00 719.08 719.09** 719.10 719.18 719.19  
**719.40 719.48 719.49** 722.2 722.70 **726.8 726.9 727.2 727.3** 727.60 727.69 728.83 **729.1** 729.2  
**733.10 733.16 733.19 733.95** 805.8 805.9 806.8 806.9 819 827 828 829 839.40 839.49 839.50  
839.59 839.69 839.79 839.8 839.9 **844.8 844.9 848.8 848.9** 879.8 879.9 884 891 894 903.2  
903.3 903.8 903.9 904.4 904.7 904.8 904.9 913.0 913.1 913.2 913.3 913.6 913.7 913.8 913.9  
916.0 916.1 916.2 916.3 916.6 916.7 916.8 916.9 919.0 919.1 919.2 919.3 919.6 919.7 919.8  
919.9 923.8 923.9 924.4 924.5 924.8 924.9 927.8 927.9 928.8 928.9 929 946 947.8 947.9 948  
949 952.8 952.9 953.8 953.9 957.1 957.8 957.9 959.13 959.14 959.3 959.7 959.8 959.9 995.81  
995.83 995.85

*Note: Bolded codes represent lower extremity overuse injuries.*

† *The International Classification of Diseases, Ninth Revision, Clinical Modification, (ICD-9-CM) is a standardized classification system used for coding and classifying diseases, injuries, and conditions diagnosed in the United States.*