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The Cost of Army Injuries: Lower Extremity Fractures among Active Duty Soldiers, CY 2017

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14. ABSTRACT

This report describes the results of implementing a methodology for examining the economic burden of injuries to the U.S. Army. Focusing on lower extremity fractures, the results indicate the cost to the Army for these injuries in 2017 was approximately $116M. Direct medical expenses totaled $24M; and indirect medical costs totaled $92M ($900K lost duty due to hospital stays; $91M limited duty). Foot and toe injuries along with lower leg and ankle injuries accounted for 26,213 medical encounters (89%) and more than $103M of overall costs ($116M). Costs vary by location of care. In outpatient settings, initial visits for foot and toe injuries accounted for the highest total cost: $49M overall. Direct medical costs totaled $1.2M, and indirect medical costs (limited duty) were $48M. Foot and toe injuries also had the highest estimated limited duty days (353,520) and average cost per encounter ($17K), while lower leg and ankle injuries had the greatest number of encounters (13,708). In contrast, among lower extremity fractures treated in inpatient settings, the highest average cost per encounter was for hip injuries ($43K). Lower leg and ankle fractures treated in inpatient settings had the greatest number of initial encounters (281), highest estimated limited duty days (33,720), and highest costs, at just over $9M ($4.8M in direct medical costs and $4.5M in indirect medical costs). This project outlines a methodology for future Army injury cost estimates. The finding that the majority of costs related to fractures is due to estimated days of lost or restricted duty and associated loss of productivity validates the need to include indirect costs estimates as a part of injury overall cost calculations.

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CY 2017

1 PURPOSE

To develop a cost-of-injury (COI) methodology to estimate direct (medical) and indirect (medical and productivity) costs of Army Active Component (AC) injuries, beginning with lower extremity fractures occurring in calendar year (CY) 2017. This report represents Phase 1 of a multi-phase analysis plan.

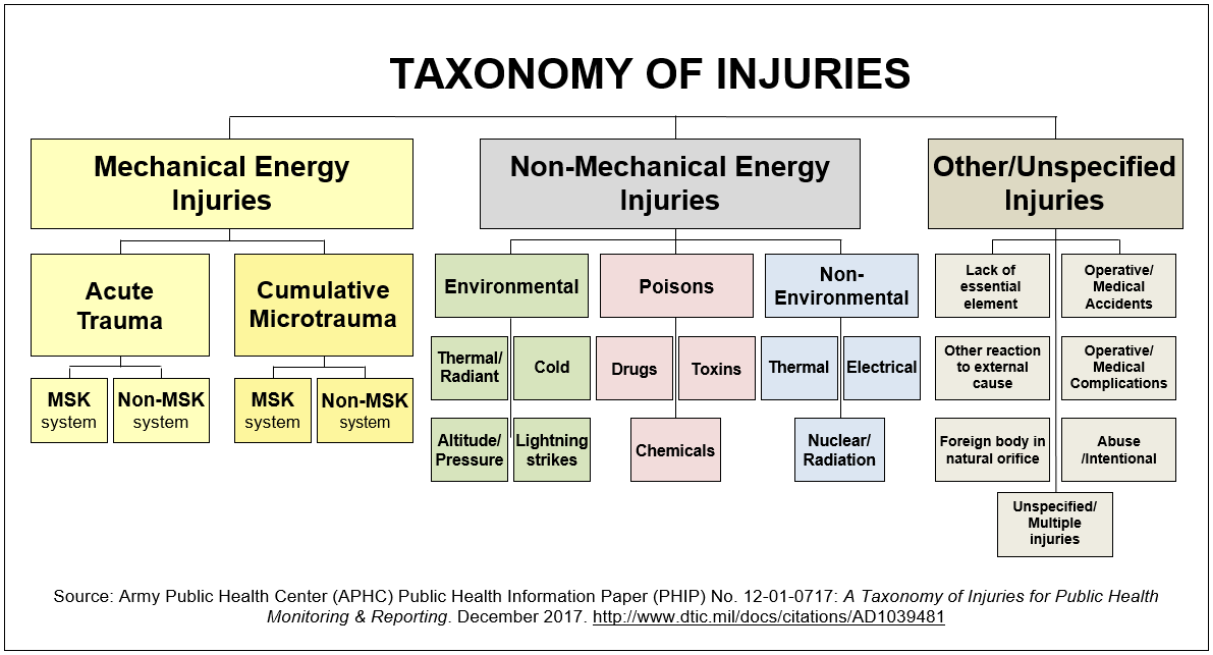
2 REFERENCES

See Appendix A for a listing of references used within this report.

3 BACKGROUND

3.1 Injuries in the U.S. Army

Injury is defined as physical damage or interruption to normal tissue function caused by an external transfer of energy (e.g., mechanical, thermal, radiant, chemical, or electrical energy) that exceeds the threshold of tissue tolerance. Figure 1 demonstrates the taxonomic categories of injury types as defined by the U.S. Army Public Health Center (APHC) (APHC 2017, 2018b; Hauschild 2019).



Source: Army Public Health Center (APHC) Public Health Information Paper (PHIP) No. 12-01-0717: *A Taxonomy of Injuries for Public Health Monitoring & Reporting*. December 2017. http://www.dtic.mil/docs/citations/AD1039481

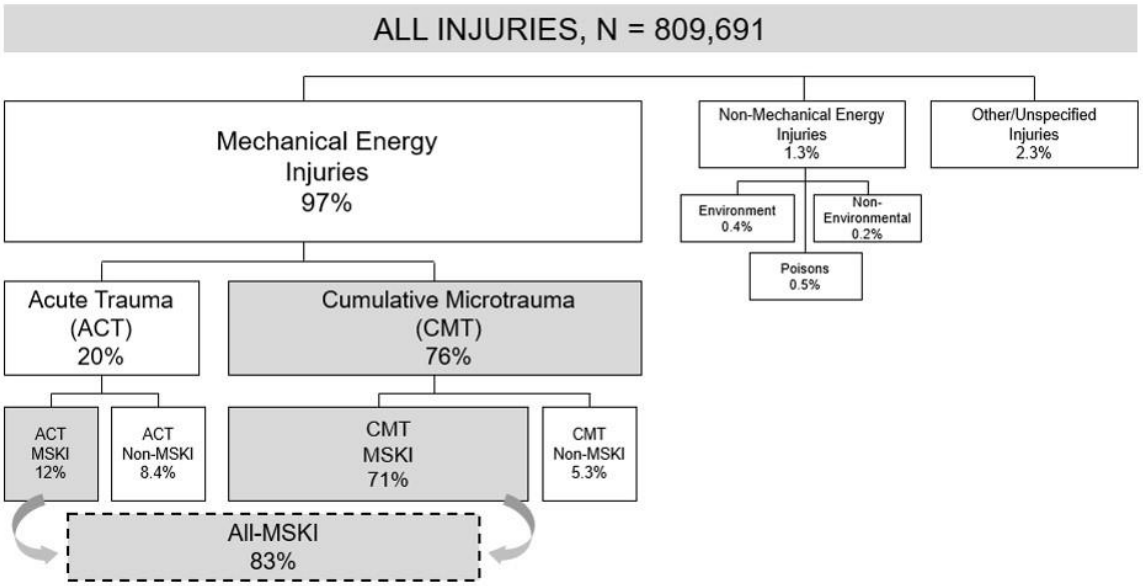
Figure 1. Army Taxonomy of Injuries

Injuries have long presented the most significant challenge to the Army's ability to optimize medical readiness and Soldier health (Nindl et al. 2013; Jones 2010, National Research Council 2006). The likelihood of a Soldier experiencing an injury is high; over half of all Soldiers experience a new injury every year (APHC 2019). Annually, over 1,800 new injuries are diagnosed per 1,000 person-years (APHC 2019). Within U.S. Army populations, evidence has consistently shown higher injury rates among older age groups (Armed Forces Health Surveillance Branch 2016) and differences in injury rates by genders. Women in the military experience roughly 1.6 to 2.4 times higher rates of injury than men, depending on unit and other factors (Nindl et al. 2016; Jones et al. 2018). However, when levels of physical fitness are controlled, men and women of similar fitness levels have similar risks of injury (Nindl et al. 2016; Bell et al. 2000; Canham et al. 1996; U.S. Army Research Institute of Environmental Medicine 1988).

Based on assessments of Active Duty (AD) Soldiers' medical encounters in both CY 2016 and 2017[1], the vast majority of Army injuries (97%) are due to the transfer of mechanical energy. Mechanical energy injuries fall into two categories: acute injuries caused by a single sudden, high force; and cumulative micro-traumatic injuries, which result from accumulated damage from repetitive lesser forces. Cumulative micro-traumatic injuries, frequently associated with the physical training and repetitive physical tasks that Soldiers conduct on a regular basis, are often referred to as "overuse" injuries. Approximately 70% of Army injuries are cumulative micro-traumatic injuries (APHC 2017a, 2019; Hauschild et al. 2019).

Most injuries to Soldiers are to the musculoskeletal system (MSK), including injuries to bones, muscles, tendons, ligaments and joints, synovia, and bursa (APHC 2017a). In CY 2017, 83% of injuries affected the MSK system, of which 71% were cumulative micro-traumatic and 12% were acute; almost one half (47%) of injuries were to the lower extremities (Figure 2). Previous studies have similarly reported high rates of injuries in the lower extremities among military populations (Hauschild et al. 2018; Marshall et al. 2014; Hauret et al. 2010; Ruscio et al. 2010).

[1] Though distributions were the same, CY 2016 analysis of Army data included all AC with Reserve and National Guard (NG) resulting in over 1.1 million injury incidents; CY 2017 analysis was limited to AD Soldier (no Reserve or NG) resulting in 800,000 incident injuries.



Initial incident injuries based on ICD-10-CM for 469,973 AD Soldiers (not including NG/Reserve (APHC 2017; Hauschild 2019)

Figure 2. Active Duty Army Incident Injuries by Taxonomy Category, CY 2017

3.2 Defining Costs of Army Injuries

Past Army efforts have primarily focused on establishing the magnitude of the Army's injury problem in terms of incidence rates and numbers of medical encounters (APHC 2018a, 2019; Jones et al. 2018; Marshall et al. 2014; Hauret et al. 2010). Other metrics have included estimates of non-effective or non-availability for service days, lost productivity due to restricted duty days and non-deployable Soldiers (APHC 2018a; Ruscio et al. 2010; Zambraski and Yancosek 2012; Molloy et al. 2012; Smith et al. 2000). Through these investigations, injuries have been cited as a leading cause of medical encounters and lost productivity among military personnel, accounting for more than half of all medically non-deployable Army Soldiers (APHC 2018a). While some studies have previously estimated the monetary costs of injuries (Molloy et al. 2012; Hauschild et al. 2018; National Safety Council 2001), a consistent methodology for determining both direct medical and indirect costs has been lacking. This analysis was initiated to formulate a standardized method for estimating the direct and indirect monetary costs of military injuries. Characterizing the impact of injuries using both direct and indirect monetary costs provides valuable information concerning the economic burden of injury.

As an initial proof-of-concept effort (Phase 1), this cost of an injury (COI) analysis focused on a subset of acute injuries: acute fractures of the lower extremities. Although acute MSK injuries of the lower extremity represent a comparatively small portion of the Army's MSK injury problem (7% in CY 2016-2017), this group of injuries is of particular concern due to their sudden

occurrence, severity, and need for immediate medical treatment (Ruscio et al. 2010; Hauschild et al. 2016). For example, 3,093 acute injuries required hospitalization among non-deployed AD Army Soldiers in 2012. By body region, the lower extremity accounted for 30% of these injuries. In that same year, Soldiers incurred 240,299 acute injuries requiring outpatient care. By body region, 38% of these injuries were associated with lower extremities.

Fractures account for some of the most severe acute injuries (Ruscio et al. 2010; Hauschild et al. 2016). U.S. Army surveillance data from 2015 attributed 45% of hospitalizations to fractures (APHC 2018c). Fractures also accounted for 45% of hospitalizations in 2012 (Marshall et al. 2014) and 40% of hospitalizations in 2006 (Jones et al. 2010). Falls have been a leading cause of serious injuries for Service Members (Smith et al. 2000; Shuping et al. 2009). A study of fall-related incidents captured in Army Safety reports for AD Soldiers identified fractures as the acute injury type most frequently attributed to lost or restricted duty time (33%). That study estimated 8,175 fractures due to falls in a single year, equating to approximately 800,000 lost duty days (Hauschild et al. 2016). While fractures have historically been among the leading causes of hospitalization for the Army and U.S. military (Jones BH & Canham M, Atlas of Injuries, Milit Med 1999; Smith G, AJPM 2000; Jones BH, AJPM, 2010), no papers address the costs of fractures to the Army or other military Services.

While the proof-of-concept COI (Phase 1) specifically focuses on lower extremity fractures, the resulting methodology will provide a foundation from which to build cost estimates of direct and indirect medical costs for other types of Army injuries. This first phase develops the base cost methodology and applies it to acute lower extremity fractures among AD Soldiers in CY 2017. These fractures are the most common cause of injury hospitalizations (Jones BH, AJPM 2010) and medical evacuations from OIF and OEF (Hauret K, AJPM 2010). The next phase will leverage lessons learned and will be used to estimate medical-related costs of the much broader acute and cumulative, lower extremity, and back and spine categories of MSK injuries among AD Soldiers, CY 2017. The third planned phase will also capitalize on lessons learned and will determine the costs of all MSK injuries among AD Army Soldiers, CY 2018. Characterizing injuries using both direct and indirect costs provides more complete information about the total economic burden of injury. Framing the Army injury problem in terms of direct and indirect monetary costs brings a new perspective on the impacts of injury to Soldier health and readiness, aiding decision making concerning future public health interventions and strategies, as well as preventive prioritization and evaluations.

4 METHODS

Similar to other cost of injury studies (Institute of Medicine 1999; Currie et al. 2000; Rice et al. 1985; Changik 2014), this effort uses a cost of illness approach to combine information on the number of injuries and the impact of their associated healthcare utilization into single estimates of cost. Costs estimates are reported using the two cost of illness metrics: direct and indirect costs. Direct costs typically include medical care expenditures for diagnosis, treatment, and rehabilitation. Indirect costs generally refer to productivity losses, including lost income/earnings associated with disability and premature death and losses to performance when working while sick (Rice et al. 1985; Johns 2010). Results from cost of illness estimates are typically reported in a dollar amount. For example, a cost of illness outcome can focus on the total cost to the Army based on Soldiers' documented injuries.

4.1 Study Design

This COI analysis used a cross sectional, prevalence-based study design. Therefore, all acute lower extremity fractures requiring medical care, both new and ongoing for CY 2017 were included. The resulting injury estimates provide an annual cost estimate for lower extremity fractures, rather than costs of these injuries over the course of a Soldier's career.

4.2 Population

This study included injuries identified in the medical records from the AC of the U.S. Army. Army Reserve and National Guard on AD status at any time during CY 2017 are included. The data represent injury-related care received in or paid for by the Military Health System (MHS).

4.3 Injury Identification

Lower extremity fractures were identified using International Classification of Disease 10th Revision, Clinical Modification (ICD-10-CM) medical diagnostic codes. The listing of codes was identified using an ICD-10 Injury Mortality Diagnosis (IMD) Matrix (https://www.cdc.gov /nchs/injury/ice/injury_matrix10.htm; also see Appendix B). The inclusion criterion for a case was any medical encounter with the following diagnosis codes in the first or second diagnosis code position (DX1 or DX2):

- S72 (fracture of bones in the hip or upper leg).
- S82 (fracture of bones in the knee, lower leg, or ankle).
- S92 (fracture of bones in the feet or toes).

Inclusion of the first two diagnosis code positions varies from the methodology used in previous incidence and prevalence studies of Army injuries, which limited inclusion criteria to the first diagnosis code position only. A review of several case examples found that many fractures were not identified by a primary diagnosis because a diagnosis of "pain" in a lower extremity often preceded the fracture diagnosis. For this reason, investigators deemed it necessary to include the secondary diagnosis to capture all fracture incidents and associated direct costs for treatments and indirect costs for estimated days of lost duty more accurately. In this analysis, a Soldier could have an injury to more than one LE specific anatomical site (e.g., foot and toes; hip; knee, etc.) in CY17, and would be included in summaries of each anatomical site. A 365-day incidence rule was applied by person and fracture type (i.e., S82, S92, and S72) to ensure each injury of interest was included only one time for each Soldier.

4.4 Cost Definitions

Direct medical costs represent the cost of care paid for by the MHS. For inpatient visits to facilities owned and operated by the military (military treatment facilities (MTFs)), full cost includes—

- Ancillary laboratory and radiology;
- Clinician salary and other salaries (ancillary and support); and
- Intensive and surgical care units.

For outpatient visits associated with these facilities, full cost includes clinician salary, professional salary, laboratory, radiology, pharmacy, ancillary, support, and other costs. For contracted care provided in civilian or network facilities (NETWORK), the total cost of both inpatient and outpatient care represents the amount paid by TRICARE.

Two types of indirect medical costs were determined (1) lost duty time in which a Soldier is not able to perform his duties due to healthcare reasons (e.g., injury-related hospitalizations), and (2) limited duty time in which a Soldier performs his duty following a fracture, but at diminished capacity (e.g., working while injured). In this study, lost duty time is based on length of a hospital stay associated with a lower extremity fracture. Limited duty days (LDDs) for lower extremity fractures are based on estimates from existing literature (Ruscio et al, 2010). Both costs take into consideration the Soldier's compensation by his/her rank at the time of the injury.

4.5 Data Sources

Population (e.g., date of birth, military rank, gender), injury (based on diagnoses codes), direct medical cost data (e.g., full costs), and indirect medical data (hospital length of stay) were obtained from the following Military Health System Data Repository (MDR) files using the MHS Mart (M2) interface:

- SIDR: MTF Inpatient.
- CAPER: MTF Outpatient.
- TED-I: NETWORK; Inpatient.
- TED-NI: NETWORK; Outpatient.

In 2018, the population was identified in these databases using the—

- Beneficiary category (BENCAT) variable set to Active Duty and Guard/Reserve;
- Sponsor set to A (Army); and
- Family Member Prefix (FMP) variable set to 20 to signify Service members.

Indirect medical costs, as measured by LDDs for lower extremity fractures, are based on published estimates provided by Ruscio et al. (2010). The reported LDD estimate for lower extremity fractures was 120 days.

Soldier salary data were obtained from the Defense Finance and Accounting Service (DFAS) CY 2017 (DFAS 2017) pay charts to calculate indirect costs associated with LDDs.

4.6 Analysis

Data were extracted, downloaded, and analyzed using SAS® V9. Analysis of lower extremity fractures resulting in inpatient and outpatient treatment were stratified by specific anatomical site and encounter type. The number of Soldiers treated for at least one lower extremity fracture (along with age, gender and rank group characteristics), frequency of encounters, and estimated LDDs were reported. While injuries to specific anatomical sites (e.g., foot and toes, hip, knee) are counted only one time in CY2017 for each Soldier, Soldiers may be counted more

than once if they experience injuries in multiple anatomical sites. Total cost was calculated as the sum of direct medical cost and indirect medical cost. Cost calculations are described below:

Direct Medical Cost: For this investigation, the full cost and/or total amount paid for an injury encounter was summed respectively for the three identified injuries (based on ICD-10 codes S72, S82, and S92). Data were reported in 2017 dollars by location of care (outpatient and inpatient) and by injury diagnosis using available ICD-10-CM extension digits (CMS, 2014; AAPC 2014):

- Initial encounters or encounters for active treatment; not necessarily the first time a provider sees a patient; ICD-10 7th character A, B, or C.
- Follow-up encounters for routine care after active treatment has ended, subsequent encounters for recovery; ICD-10 7th character D - R.
- Sequela encounters for late effects, complications, or conditions that are due to, in this case, an injury; ICD-10 7th character S.

Indirect Medical Cost: Indirect medical costs associated with estimated lost duty time and limited duty time were calculated by linking Soldiers' rank from the initial encounter to military pay charts (DFAS 2017). Indirect medical cost associated with lost duty time is calculated as the sum of the days in the hospital multiplied by the salary associated with the Soldiers' rank at the time of the injury. Daily hospitalizations assume an eight hour duty day. Clinician visit duration or appointment time was not captured at all outpatient settings. As a result, no lost duty time was estimated for time away from duties associated with these appointments.

Indirect medical cost associated with limited duty time, based on Ruscio's estimate, was calculated for the initial occurrence of each injury of interest. The first occurrence of a fracture with an initial encounter indicator (i.e., an A) in the 7th position of the ICD code (i.e., S82.xxx with a suffix of A, B, or C) was first assumed to result in 120 days of limited duty (Ruscio et al. 2010). Upon further consideration by injury subject matter experts, and to provide conservative estimates for this analysis, it was assumed that all 120 days were limited duty at 50% productivity. Therefore, the cost of one limited duty day is equal to half of a Service member's daily pay: 120 days X 50% patient salary. The cost for subsequent encounters for the same person and injury type (i.e., S82.xxxA-C) occurring during the study period were included in this analysis, but these encounters were assumed to include only the associated direct medical costs and hospitalization-related lost duty time, not additional limited duty time.

5 RESULTS

5.1 Characteristics of Lower Extremity Fractures

Table 1 shows there were 5,287 Soldiers who experienced at least one LE fracture in CY2017 (83.3% men, 16.7% women). Forty-four percent of those with fractures were over the age of 30 years old and were less than E-5 in rank. Fifty-four percent (54%) of Soldiers experienced fractures to the foot and toes (n=2,880) and another 37% experienced fractures to the lower leg and ankle (n=1,962); all other anatomical sites for the lower extremity accounted for the balance of the fractures.

5.2 Cost of Inpatient Care for Lower Extremity Fractures

Table 2 shows 433 Soldiers received inpatient care for lower extremity fractures. The number of Soldiers hospitalized for lower leg and ankle fractures were five times higher than the number hospitalized for upper leg and thigh fractures which resulted in the second highest number of hospitalized Soldiers (278 vs 55). These fractures also accounted for the highest number of limited duty days associated with inpatient treatment (n=33,744; 64%). Lower leg and ankle fractures also accounted for the highest direct medical costs, just over $6.4M (60% of total direct medical inpatient costs); the highest lost duty cost, a little over $550K (60% of the cost associated with bed days); and the highest limited duty cost, about $4.2M (66% of the cost associated with lost productivity). Of the estimated $18M in inpatient cost reported in Table 2, 62% ($11.2M) were associate with lower leg and ankle fractures.

5.3 Cost of Outpatient Care for Lower Extremity Fractures

Table 3 shows 5,247 Soldier received care for lower extremity fractures. Most Soldiers made initial visits for foot and toe fractures (n= 2,875; 55%); there were more than 900 additional Soldiers seeking care for these fractures than for lower leg and ankle fractures (n=1,944; 37%). All other LE fractures were noted among the remaining 8% of Soldiers (n=428).

The highest direct medical costs, $7.2M (55%) resulted from lower leg and ankle fractures, followed by foot and toe fractures costing $4.9M (37% of direct med costs). The highest indirect cost of fracture, the costs of limited duty, were for foot and toe fractures totaling $47.6M. Likewise the highest total costs associated with outpatient encounters were for foot and toe fractures (more than $52M; 54%) followed by lower leg and ankle at almost $38M (39%).

5.4 Cost of Inpatient and Outpatient Care for Lower Extremity Fractures

Table 4 shows 5,287 Soldiers received care in inpatient and/or outpatient sites in CY 2017; forty soldiers received care in an outpatient setting only. More Soldiers made initial visits for fractures of the foot and toe (n=2,880) than for fractures of the lower leg (n=1,962). Every other region had fewer than 157 Soldiers with initial fracture visits.

Fractures to the foot and toes resulted in more days of limited duty than any other anatomical site of the LE, 359,280 days (51% of the total days). The second greatest number of limited duty days was for lower leg and ankle fractures 275,664 or 39% of the total days of limited duty.

The highest total costs for lower extremity fractures were associated with foot and toe fractures ($54M), followed by the cost of lower leg and ankle fractures (just over $49M). These two anatomical sites accounted for 89% of total costs.

Table 1. FY2017 Demographic and Characteristics for Active Duty Army Soldiers with at least one Lower Extremity Fracture Related Medical Encounters (Initial Encounters Only, Inpatient and Outpatient

Lower extremity specific anatomical sites	Soldiers with at least one encounter*		Sex Subgroup n, %				Age Group Subgroup n, %								Rank Subgroup n, %									
			F		M		17-19		20-24		25-29		30+		E1-E4		E5-E9		O1-O9		W01-WO6		Other	
	N	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Foot and toes	2880	54%	496	56%	2384	54%	188	45%	735	52%	586	53%	1371	59%	1165	50%	1147	56%	458	64%	89	54%	21	51 %
Hip	157	3%	67	8%	90	2%	37	9%	49	3%	24	2%	47	2%	100	4%	34	2%	16	2%	5	3%	2	5%
Knee	136	3%	17	2%	119	3%	6	1%	43	3%	33	3%	54	2%	66	3%	55	3%	13	2%	2	1%	0	0%
Lower leg and ankle	1962	37%	285	32%	1677	38%	174	41%	551	39%	432	39%	805	35%	917	39%	739	36%	222	31%	66	40%	18	44 %
Upper leg and thigh	152	3%	20	2%	132	3%	17	4%	48	3%	31	3%	56	2%	77	3%	62	3%	11	2%	2	1%	0	0%
Total N, % of total	5287	100	**885**	**17%**	**4402**	**83%**	**422**	**8%**	**1426**	**27%**	**1106**	**21%**	**2333**	**44%**	**2325**	**44%**	**2037**	**39%**	**720**	**14%**	**164**	**3%**	**41**	**1%**

* Soldiers experienced at least one initial outpatient and/or inpatient lower extremity fracture encounter

Table 2. CY 2017 Cost of Active Duty Army Soldiers with at least one Lower Extremity Fractures Treated in Inpatient Settings (DX1 and DX2) by Lower Extremity Specific Anatomical Sites and Visit Type

Lower extremity fractures		Soldiers with one or more encounters*		Estimated Limited Duty Days**		Medical Cost							
						Direct Medical Cost#		Indirect Medical Cost				Total Cost	
								Indirect Medical Cost-Lost Duty	Indirect Medical Cost-Limited Duty	Total Indirect Medical Cost			
Specific anatomical sites	Encounter Type	N	%	N	%	Cost	%	Cost	Cost	Cost	%	Cost	%
Foot and toes	Initial	48	11%	5,760	100%	$660,113	71%	$29,616	$612,384	$642,000	93%	$1,302,113	
	Follow-up	10	NA	4	0%	$257,239	28%	$45,350	$0	$45,350	7%	$302,589	
	Sequela	1	NA	0	0%	$7,204	1%	$627	$0	$627	0%	$7,831	
	Total	NA	NA	5764	11%	$924,556	9%	$75,593	$612,384	$687,977	9%	$1,612,533	9%
Hip	Initial	39	9%	4,680	100%	$1,011,490	83%	$55,093	$613,882	$668,975	88%	$1,680,465	
	Follow-up	15	NA	1	0%	$194,821	16%	$85,583	$0	$85,583	11%	$280,404	
	Sequela	1	NA	0	0%	$12,307	1%	$4,640	$0	$4,640	1%	$16,947	
	Total	NA	NA	4681	9%	$1,218,618	11%	$145,316	$613,882	$759,198	10%	$1,977,816	11%
Knee	Initial	13	3%	1,560	100%	$200,609	85%	$8,473	$163,262	$171,735	97%	$372,344	
	Follow-up	4	NA	0	0%	$34,872	15%	$5,409	$0	$5,409	3%	$40,281	
	Sequela	0	NA	0	0%	$0	0%	$0	$0	$0	0%	$0	
	Total	NA	NA	1560	3%	$235,481	2%	$13,882	$163,262	$177,144	2%	$412,625	2%
Lower leg and ankle	Initial	278	64%	33,720	100%	$4,811,993	75%	$251,886	$4,237,327	$4,489,213	94%	$9,301,206	
	Follow-up	70	NA	24	0%	$1,601,269	25%	$286,251	$0	$286,251	6%	$1,887,520	
	Sequela	3	NA	0	0%	$28,723	0%	$12,726	$0	$12,726	0%	$41,449	
	Total	NA	NA	33744	64%	$6,441,985	60%	$550,863	$4,237,327	$4,788,190	66%	$11,230,175	62%
Upper leg and thigh	Initial	55	13%	6,600	100%	$1,257,765	64%	$62,566	$746,978	$809,544	91%	$2,067,309	
	Follow-up	25	NA	5	0%	$694,865	36%	$75,357	$0	$75,357	9%	$770,222	
	Sequela	0	NA	0	0%	$0	0%	$0	$0	$0	0%	$0	
	Total	NA	NA	6605	13%	$1,952,630	18%	$137,923	$746,978	$884,901	12%	$2,837,531	16%
Overall		**433**	**100%**	**52,354**	**100%**	**$10,773,270**	**100%**	**$923,577**	**$6,373,833**	**$7,297,410**	**100%**	**$18,070,680**	**100%**

Note: Reported in 2017 Dollars; Data includes MTF and Purchased Care Information; * Soldiers with at least one initial outpatient and/or inpatient lower extremity fracture encounter

**For each unique fracture, 30 days of lost duty and 90 days of duty at 50% productivity were assumed. Soldiers with only subsequent or sequela encounters were not assigned limited duty days

Hospital bed days multiplied by the individuals pay rate

Table 3. CY 2017 Cost of Active Duty Army Soldiers with at least one Lower Extremity Fractures Treated in Outpatient Settings (DX1 and DX2) by Lower Extremity Specific Anatomical Sites and Visit Type

Lower extremity fractures		Soldiers with one or more encounters*		Estimated Limited Duty Days**		Medical Cost							
						Direct Medical Cost#		Indirect Medical Cost				Total Cost	
								Indirect Medical Cost-Lost Duty	Indirect Medical Cost-Limited Duty	Total Indirect Medical Cost			
Specific anatomical sites	Encounter Type	N	%	N	%	Cost	%	Cost	Cost	Cost	%	Cost	%
Foot and toes	Initial	2,875	55%	353,520	100%	$1,236,961	25%	$0	$47,561,396	$47,561,396	100%	$48,798,357	
	Follow-up	2,786	NA	0	0%	$3,537,952	73%	$0	$0	$0	0%	$3,537,952	
	Sequela	274	NA	0	0%	$104,842	2%	$0	$0	$0	0%	$104,842	
	Total	NA	NA	353520	55%	$4,879,755	37%	$0	$47,561,396	$47,561,396	56%	$52,441,151	54%
Hip	Initial	150	3%	18,240	100%	$42,200	23%	$0	$2,175,903	$2,175,903	100%	$2,218,103	
	Follow-up	194	NA	0	0%	$129,919	72%	$0	$0	$0	0%	$129,919	
	Sequela	32	NA	0	0%	$7,639	4%	$0	$0	$0	0%	$7,639	
	Total	NA	NA	18240	3%	$179,758	1%	$0	$2,175,903	$2,175,903	3%	$2,355,661	2%
Knee	Initial	134	3%	16,560	100%	$105,553	29%	$0	$2,117,602	$2,117,602	100%	$2,223,155	
	Follow-up	141	NA	0	0%	$255,535	69%	$0	$0	$0	0%	$255,535	
	Sequela	24	NA	0	0%	$7,418	2%	$0	$0	$0	0%	$7,418	
	Total	NA	NA	16560	3%	$368,506	3%	$0	$2,117,602	$2,117,602	2%	$2,486,108	3%
Lower leg and ankle	Initial	1,944	37%	241,920	100%	$1,024,152	14%	$0	$30,642,565	$30,642,565	100%	$31,666,717	
	Follow-up	2,118	NA	0	0%	$6,014,572	83%	$0	$0	$0	0%	$6,014,572	
	Sequela	375	NA	0	0%	$169,556	2%	$0	$0	$0	0%	$169,556	
	Total	NA	NA	241920	37%	$7,208,280	55%	$0	$30,642,565	$30,642,565	36%	$37,850,845	39%
Upper leg and thigh	Initial	144	3%	17,880	100%	$66,027	14%	$0	$2,207,845	$2,207,845	100%	$2,273,872	
	Follow-up	212	NA	0	0%	$345,991	75%	$0	$0	$0	0%	$345,991	
	Sequela	52	NA	0	0%	$47,010	10%	$0	$0	$0	0%	$47,010	
	Total	NA	NA	17880	3%	$459,028	4%	$0	$2,207,845	$2,207,845	3%	$2,666,873	3%
Overall		5,247	100%	648,120	100%	$13,095,327	100%	$0	$84,705,311	$84,705,311	100%	$97,800,638	100%

Note: Reported in 2017 Dollars; Data includes MTF and Purchased Care Information

* Soldiers with at least one initial outpatient and/or inpatient lower extremity fracture encounter

**For each unique fracture, 30 days of lost duty and 90 days of duty at 50% productivity were assumed. Soldiers with only subsequent or sequela encounters were not assigned limited duty days

Hospital bed days multiplied by the individuals pay rate

Table 4. CY 2017 Cost of Active Duty Army Soldiers' Encounters for Lower Extremity Fractures Treated in both Inpatient and Outpatient Settings (DX1 and DX2) by Lower Extremity Specific Anatomical Sites and Visit Type

Lower extremity fractures		Soldiers with one or more encounters*		Estimated Limited Duty Days**		Medical Cost							
						Direct Medical Cost#		Indirect Medical Cost				Total Cost	
								Indirect Medical Cost-Lost Duty	Indirect Medical Cost-Limited Duty	Total Indirect Medical Cost			
Specific anatomical sites	Encounter Type	N	%	N	%	Cost	%	Cost	Cost	Cost	%	Cost	%
Foot and toes	Initial	2,880	54%	359,280	100%	$1,897,074	33%	$29,616	$48,173,780	$48,203,396	100%	$50,100,470	
	Follow-up	2,787	NA	4	0%	$3,795,191	65%	$45,350	$0	$45,350	0.1%	$3,840,541	
	Sequela	275	NA	0	0%	$112,045	2%	$627	$0	$627	0.001%	$112,672	
	Total	NA	NA	359284	51%	$5,804,310	24%	$75,593	$48,173,780	$48,249,373	52%	$54,053,683	47%
Hip	Initial	157	3%	22,920	100%	$1,053,690	75%	$55,093	$2,789,785	2,844,878	97%	$3,898,568	
	Follow-up	197	NA	1	0%	$324,740	23%	$85,583	$0	85,583	3%	$410,323	
	Sequela	33	NA	0	0%	$19,946	1%	$4,640	$0	4,640	0%	$24,586	
	Total	NA	NA	22921	3%	$1,398,376	6%	$145,316	$2,789,785	$2,935,101	3%	$4,333,477	4%
Knee	Initial	136	3%	18,120	100%	$306,162	51%	$8,473	$2,280,865	2,289,338	100%	$2,595,500	
	Follow-up	142	NA	0	0%	$290,406	48%	$5,409	$0	5,409	0%	$295,815	
	Sequela	24	NA	0	0%	$7,418	1%	$0	$0	0	0%	$7,418	
	Total	NA	NA	18120	3%	$603,986	3%	$13,882	$2,280,865	$2,294,747	2%	$2,898,733	3%
Lower leg and ankle	Initial	1,962	0	275,640	100%	$5,836,146	43%	$251,886	$34,879,891	35,131,777	99%	$40,967,923	
	Follow-up	2,124	NA	24	0%	$7,615,842	56%	$286,251	$0	286,251	1%	$7,902,093	
	Sequela	376	NA	0	0%	$198,279	1%	$12,726	$0	12,726	0%	$211,005	
	Total	NA	NA	275664	39%	$13,650,267	57%	$550,863	$34,879,891	$35,430,754	39%	$49,081,021	42%
Upper leg and thigh	Initial	152	3%	24,480	100%	$1,323,792	55%	$62,566	$2,954,824	3,017,390	98%	$4,341,182	
	Follow-up	214	NA	5	0%	$1,040,856	43%	$75,357	$0	75,357	2%	$1,116,213	
	Sequela	52	NA	0	0%	$47,010	2%	$0	$0	0	0%	$47,010	
	Total	NA	NA	24485	3%	$2,411,658	10%	$137,923	$2,954,824	$3,092,747	3%	$5,504,405	5%
Overall		**5,287**	**100%**	**700,474**	**100%**	**23,868,597**	**100%**	**923,577**	**91,079,145**	**92,002,722**	**100%**	**$115,871,319**	**100%**

Note: Reported in 2017 Dollars; Data includes MTF and Purchased Care Information

* Soldiers with at least one initial outpatient and/or inpatient lower extremity fracture encounter

**For each unique fracture, 30 days of lost duty and 90 days of duty at 50% productivity were assumed. Soldiers with only subsequent or sequela encounters were not assigned limited duty days

Hospital bed days multiplied by the individuals pay rate.

6 DISCUSSION

The cost to the Army of the most common cause of hospitalization for the military services, lower extremity fractures, was $116 million dollars. This study noted more than 5,000 Active Duty Soldiers experienced one or more lower extremity fractures in 2017.

Even though they are considered serious injuries, the largest percentage of those costs, 84% or $98 million, was for lower extremity fractures treated in outpatient clinics. Overall, 5,247 Soldiers had an outpatient encounter for a LE fracture. The majority of Soldiers treated in this setting (55%) had encounters for fractures to foot and toes, followed by fractures to lower leg and ankle LE anatomical sites (37%).

Although more serious, the costs of LE fractures requiring hospitalization were only $18 million, or 16% of the total costs. However, the costs per case for such fractures treated in inpatient settings was substantially higher, seven times higher than the cost of those treated on an outpatient basis ($30,628 per case versus $4.344). Among the 433 Soldiers hospitalized for a LE fracture, 64% were hospitalized for fractures to lower legs and ankles, followed by upper leg and thigh fractures (13%).

Overall the indirect costs of fractures ($92 million) were considerably higher than the direct costs ($24 million). These indirect costs were clearly driven by the cost associated with limited duty days ($91 million of the $92 million). This study estimates more than 700,000 limited duty days were associated with LE fractures in 2017; 648,000 days related to Soldiers treated in outpatient settings, and 52,000 days related to Soldiers who were hospitalized. The estimated total cost to the Army for this one-year time period was $91M.

While the cost of fractures have not been previously reported, the diagnosis, distribution and anatomical location of these acute injuries for outpatient cases were similar to the locations seen for the military services in Jones B, et al AJPM 2010; and the distribution of LE fractures treated in hospitals in this study are similar to those reported in Jones et al AJPM 2010 and among the medical evacuated cases from OIF/OEF reported by Hauret, et al AJPM 2010.

As previously noted, injuries caused by mechanical energy transfer, and especially those to the MSK system, far outweigh the injuries caused by other energies (such and heat- and cold-weather related injuries) (Hauschild et al. 2019). Many previous U.S. and international studies have described the magnitude of the MSK injury problem in military populations as the leading cause of medical visits, number of medical discharges in basic training, and medical evacuations from deployment settings (Ruscio et al. 2010; Jones et al. 2018; Hauret et al. 2010). By some estimates, millions of dollars are lost annually due to the impact of direct medical costs, with even greater indirect costs incurred from lost training and restricted duty days, disrupted physical performance, and non-deployability, medical discharges, and risks for subsequent injury (Zambraski and Yancosek 2012; Molloy et al. 2012; Nindl et al. 2013).

While acute MSK injuries represent only a small portion of the overall MSK injuries experienced by Soldiers each year, they are a highly visible concern and are highly prioritized by Army safety as well as health communities (Smith et al. 2000; Hauret et al. 2010b; Hauschild et al. 2016). The specific subset of acute fractures is considered a “severe” injury due to the need for hospitalization. Fractures commonly result from falls (e.g., during sports such as basketball and

cold weather sports), vehicular accidents, and from certain military tasks such as parachuting or patrolling. Prior studies have estimated days of lost duty attributable to fractures as ranging from 73 to 120 days, compared to 35 days for dislocations; 18 to 30 days for sprains and strains; and 3 to 11 for heat- and cold-weather related injuries (Ruscio et al. 2010; Hauschild et al. 2019; APHC 2017b).

The selection of ICD codes defining lower extremity fractures align with the APHC's taxonomic injury category of acute fractures (MSK) and the taxonomic grouping of lower body region sites (APHC 2017, 2018b). A study innovation involved inclusion of the secondary diagnosis in the case definition after study investigators noted a diagnosis of "pain" in a lower extremity often precedes the fracture diagnosis for these injuries. As a result, an additional 531 injuries of interest were appropriately identified. See Appendix C for additional details. This study estimated both direct and indirect medical costs attributed to a specific type of injury more precisely than any prior study. While days of lost duty and restricted duty were estimated to determine the indirect costs, these costs were segregated by complete loss of duty time (such as due to hospital or bed restriction) and the cost of restricted abilities (represented as productivity loss).

These findings support the methodological value of estimating Army injury costs. Specifically, the results demonstrate that the majority of costs of lower extremity fractures result from the indirect costs associated with limited duty time, which are approximately four times greater than costs associated with direct medical expenses. This finding and the methods used to calculate the associated indirect and direct costs address a gap, which has previously existed in the study and surveillance of military injuries.

As an initial study, the following limitations are acknowledged:

- Appointment time is also lost duty time but could not be determined from these data.
- Limited duty days are based on survey estimates and not actual profile days assigned by providers.
- Fractures captured in diagnoses categories 3-10 are not included.
- These estimates may underestimate costs if comorbid conditions exist (i.e., other injuries or conditions contribute to the injury type of interest).
- Costs for care payed by insurers outside the MHS are not included; therefore, this is an underestimate.

7 CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

The findings of this cost analysis show that the majority of costs related to fractures are due to the estimated days lost or restricted duty and associated loss of productivity. This finding validates the need to include indirect cost estimates as a part of overall injury costs. This COI methodology provides the foundation for future cost estimates, and it is intended to be applied to other types of Army injuries to provide an additional measure of the overall magnitude of the injury problem. Estimated overall costs of Army injuries, as well as costs of specific injury types and anatomical sites, can inform future injury prevention planning and prioritization efforts.

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7.2 Recommendations

Expand future cost injury estimates to address other mechanical injuries, particularly overuse injuries occurring from cumulative microtrauma, the primary type of injury experienced by Army Soldiers. Future estimates should use ICD alignments to the injury categories, body regions, anatomical sites, and injury types as described in the Army injury taxonomy. Additional assessments to investigate other types of injury (such as MSK overuse or environmental injuries) and ultimately all Active Duty Army injuries are advised. Further evaluation for standardized population selection, presentation of demographic categories, and inclusion of secondary or additional diagnoses is also recommended.

8 POINT OF CONTACT

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APPENDIX A

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APPENDIX B

THE INJURY MORTALITY DIAGNOSIS MATRIX

The figure in this appendix is the ICD-10 Injury Mortality Diagnosis (IMD) matrix developed by the Centers for Disease Control and Prevention. It organizes injury diagnosis data into groups by body region and nature of injury.

Body region of injury		Nature of injury															
		Fracture	Dislocation	Internal organ injury	Open wound	Amputation	Blood vessel	Superficial & contusion	Crushing	Burn	Effect of foreign bodies entering orifice	Other effects of external causes	Poisoning	Toxic effects	Multiple injuries	Other specified injury	Unspecified injury
Head&Neck	Traumatic brain injury (TBI)	S02[.0-.1, .3, .7-.9], T90.2	...	S06, T90.5	S01, T90.1	...	...	...	S07	...	...	...	...	...	S09.7	S04.0, S09.8, T90[.4, .8]	S09.9, T90.9
	Other head	S02[.2, .4-.6]	S03[.0-.3]		S05[.2-.7], S08.0, S09.2	S08[.1-.9]	S09.0	S00, S05[.0-.1], T90.0	...	T26	T15-T16, T17[.0-.1], T18.0	T33.0, T34.0	...	...	...	S03[.4-.5], S04[.1 .9], S05.8, S09.1, T90.3	S05.9
	Neck	S12[.8-.9]	S13[.2-.3]	...	S11	S18	S15[.0, .2-.9]	S10	S17	T27.0, . T27.4	T17[.2-.4]	T33.1, T34.1	...	...	S19.7	S13[.5-.6], S14[.3 .6], S16, S19.8	S19.9
	Head and neck, other	...	...	...	...	...	...	...	...	T20, T28.0, T28.5, T95.0	...	T35.2	...	...	...	...	...
Spine and upper back	Spinal cord	...	...	S14[.0-.1], S24[.0-.1], S34[.0-.1, .3], T09.3, T91.3	...	...	...	...	...	...	...	...	...	...	...	...	...
	Vertebral column	S12[.0-.7], S22[.0-.1], S32[.0-.2], T08, T91.1	S13[.0-.1], S23[.0-.1], S33[.0-.2]	S14.2	...	...	S15.1	...	...	...	...	...	...	...	...	S13.4, S23.3, S24.2, S33[.5-.7], S34[.2, .4], T09.4	...
Torso	Thorax	S22[.2-.9]	S23.2	S26.0, S27[.0-.6, .8-.9], T91.4	S21	S28.1	S25	S20	S28.0	T28[.1, .6]	T17.5	T33.2, T34.2	...	...	S27.7, S29.7	S23[.4-.5], S24[.3 .6], S26.8, S29[.0, .8]	S26.9, S29.9
	Abdomen	...	...	S36	S31[.1, .8]	...	S35[.0-.4]	S30.1	...	...	T18[.2-.4]	...	...	...	...	...	...
	Pelvis and lower back	S32[.3-.8]	S33[.3-.4]	S37	S31[.0, .2-.5]	S38.2	S35.5	S30[.0, .2]	S38.0	T28[.3, .8]	T18.5, T19	...	...	...	...	S34.5	...
	Abdomen, lower back & pelvis	T02.1	...	S39[.6-.7], T06.5, T91.5	S31.7	S38.3	S35[.7-.9]	S30[.7-.9]	S38.1	...	...	T33.3, T34.3, T35.3	...	...	T03.1	S34[.6, .8], S39[.0, .8]	S39.9
	Other trunk	T91.2	...	...	T09.1	T09.6	...	T09.0	T04.1	T21, T27[.2-.3, .6-.7], T28[.2, .7], T95.1	T17[.8-.9], T18[.1, .8-.9]	...	...	...	T09.2	T09[.5, .8]	T09.9
Extremities	Upper extremity	S42, S52, S62, T02[.2, .4], T10, T92[.1-.2]	S43[.0-.3], S53[.0-.1], S63[.0-.2]	...	S41, S51, S61, T01.2, T11.1, T92.0	S48, S58, S68 T05[.0, .2], T11.6	S45, S55, S65, T13.4	S40, S50, S60, T00.2, T11.0	S47, S57, S67, T04.2	T22-T23, T95.2	...	T33[.4-.5], T34[.4-.5], T35.4	...	...	S49.7, S59.7, S69.7, T03.2, T11.2, T92[.3, .6]	S43[.4-.7], S44, S46, S49.8, S53[.2-.4], S54, S56, S59.8, S63[.3-.7], S64, S66, S69.8, T11[.3, .5, .8], T92[.4-.5, .8]	S49.9, S59.9, S69.9, T11.9, T92.9
	Hip	S72[.0-.2]	S73.0	...	S71.0	S78.0	...	S70.0	S77.0	...	...	...	...	...	...	S73.1, S76.0	...
	Other lower extremity	S72[.3-.9], S82, S92, T02[.3, .5], T12, T93[.1-.2]	S83[.0-.1], S93[.0-.1, .3]	...	S71[.1-.8], S81, S91, T01.3, T13.1, T93.0	S78[.1-.9], S88, S98, T05[.3, .5], T13.6	S75, S85, S95, T13.4	S70[.1-.9], S80, S90, T00.3, T13.0	S77[.1-.2], S87, S97, T04.3	T24-T25, T95.3	...	T33[.6-.8], T34[.6-.6], T35.5	...	...	S79.7, S89.7, S99.7, T03.3, T13.2, T93[.3, .6]	S74, S76[.1-.7], S79.8, S83[.2-.6], S84, S86, S89.8, S93[.2, .4-.6], S94, S96, S99.8, T13[.3, .5, .8], T93[.4-.5, .8]	S79.9, S83.7, S89.9, S99.9, T13.9, T93.9
Unclassifiable by body region	Multiple body regions	T02[.8-.9]	...	...	T01.9	T05[.8-.9]	T06.3	T00[.8-.9]	T04[.8-.9]	T27.1, T27.5, T28.9	...	T35[.0-.1, .6]	...	...	T03[.8-.9], T91.0	T06[.2, .4], T91.8	T07, T91.9, T94.0
	System wide	...	...	...	...	...	...	...	...	...	...	T66-T75	T36-T50, T96	T51-T65, T97	...	T79[.0-.9], T98.2	...
Unspecified		T14.2	...	...	T14.1	...	T14.5	T14.0	...	T28.4, T30-T32, T95[.4, .8-.9]	T98.0	T33.9, T34.9, T35.7	...	...	T14.3, T14.7	T14[.4, .6]	T14[.8-.9], T94.1, T98.1

The matrix excludes the following codes that are not valid in the U.S.: T00[.0-.1, .6], T01[.0-.1, .6, .8], T02[.0, .6-.7], T03[.0, .4], T04[.0, .4, .7], T05[.1, .4, .6], T06[.0, .1, .8], T29
Also excluded are codes T78,T80-T88, T98.3 for adverse effects, not elsewhere classified and complications of surgical and medical not elsewhere classified, and their sequelae.
... no applicable code

Source: https://www.cdc.gov/nchs/injury/ice/injury_matrix10.htm

Figure B-1. The Injury Mortality Diagnosis (IMD) Matrix

APPENDIX C

COST OF LOWER EXTREMITY FRACTURES, DX1

The tables in this appendix provide comparison data, based on the use of DX1 only in the calculations of the costs of an injury.

Table C-1. CY 2017 Cost of Lower Extremity Fractures Treated in the Outpatient Setting, DX1 Only

LE specific anatomical sites	Encounter Type	Soldiers	Encounters	Estimated Limited Duty Days	Direct Medical Cost	Indirect Medical Cost (Appointment Time)	Estimated Limited Duty Cost	Total Cost	Average Cost per Encounter
Foot and toes	Initial	2,723	2,796	335,520	$1,202,255	$0	$44,980,426	$46,182,465	$16,517
	Follow-up	2,602	8,390	-	$3,198,597	-	-	$3,198,597	$381
	Sequela	188	382	-	$62,515	-	-	$62,515	$164
Hip	Initial	132	136	6,320	$37,004	$0	$1,828,296	$1,865,300	$13,715
	Follow-up	173	727	-	$119,678	-	-	$119,678	$165
	Sequela	21	36	-	$5,950	-	-	$5,950	$165
Knee	Initial	126	130	15,600	$111,389	$0	$1,997,527	$2,108,916	$16,222
	Follow-up	132	610	-	$239,288	-	-	$239,288	$392
	Sequela	18	36	-	$8,349	-	-	$8,349	$232
Lower leg and ankle	Initial	1,843	1,906	228,720	$1,071,791	$0	$28,860,462	$29,932,253	$15,704
	Follow-up	2,013	10,991	-	$5,689,633	-	-	$5,689,633	$518
	Sequela	261	799	-	$127,541	-	-	$127,541	$160
Upper leg and thigh	Initial	130	153	18,360	$60,358	$0	$2,269,841	$2,330,200	$15,230
	Follow-up	197	1,299	-	$301,584	-	-	$301,584	$232
	Sequela	44	163	-	$30,397	-	-	$30,397	$186

Note:
*Reported in 2017 Dollars.

Table C-2. CY 2017 Cost of Lower Extremity Fractures Treated in the Inpatient Setting, DX1 Only

LE specific anatomical sites	Encounter Type	Soldiers	Encounters	Estimated Limited Duty Days	Direct Medical Cost	Indirect Medical Cost (Bed Days)	Estimated Limited Duty Cost	Total Cost	Average Cost per Encounter
Foot and toes	Initial	43	43	5,160	$582,248	$25,600	$534,026	$1,141,873	$26,555
	Follow-up	9	10	3	$224,094	$44,724	$0	$268,818	$26,882
	Sequela	1	1	0	$7,204	$627	$0	$7,830	$7,830
Hip	Initial	37	37	4,440	$950,705	$50,840	$587,679	$1,589,223	$42,952
	Follow-up	13	14	1	$183,209	$82,250	$0	$265,458	$18,961
	Sequela	1	1	0	$12,307	$4,640	$0	$16,947	$16,947
Knee	Initial	12	12	1,440	$185,661	$8,017	$149,593	$343,272	$28,606
	Follow-up	4	4	0	$34,872	$5,409	$0	$40,280	$10,070
	Sequela	-	-	-	-	-	-	-	-
Lower leg and ankle	Initial	265	267	32,040	$4,393,698	$233,772	$4,010,555	$8,638,026	$32,352
	Follow-up	55	68	18	$1,247,922	$211,431	$0	$1,459,353	$21,461
	Sequela	-	-	-	-	-	-	-	-
Upper leg and thigh	Initial	50	50	6,000	$1,128,890	$58,118	$686,081	$1,873,090	$37,462
	Follow-up	18	22	3	$581,397	$55,882	$0	$637,279	$28,967
	Sequela	-	-	-	-	-	-	-	-

Note:
*Reported in 2017 Dollars.

Table C-3. CY 2017 Cost of Lower Extremity Fractures Treated in Both Inpatient and Outpatient Settings, DX1 Only

LE specific anatomical sites	Encounter Type	Soldiers	Encounters	Estimated Limited Duty Days	Direct Medical Cost	Indirect Medical Cost	Estimated Limited Duty Cost	Total Cost	Average Cost per Encounter
Foot and toes	Initial	2,728	2,839	340,680	$1,784,503	$25,600	$45,514,452	$47,324,338	$16,669
	Follow-up	2,602	8,400	3	$3,422,691	$44,724	$0	$3,467,415	$413
	Sequela	189	383	-	$69,719	$627	$0	$70,345	$184
Hip	Initial	139	173	20,760	$987,709	$50,840	$2,415,975	$3,454,524	$19,968
	Follow-up	76	741	1	$302,886	$82,250	$0	$385,136	$520
	Sequela	22	37	-	$18,257	$4,640	$0	$22,897	$619
Knee	Initial	127	142	17,040	$297,050	$8,017	$2,147,120	$2,452,188	$17,269
	Follow-up	133	614	-	$274,159	$5,409	$0	$279,568	$455
	Sequela	18	36	-	$8,349	$0	$0	$8,349	$232
Lower leg and ankle	Initial	1,855	2,173	260,760	$5,465,489	$233,772	$32,871,017	$38,570,279	$17,750
	Follow-up	2,017	11,059	18	$6,937,555	$211,431	$0	$7,148,986	$646
	Sequela	261	799	-	$127,541	$0	$0	$127,541	$160
Upper leg and thigh	Initial	139	203	24,360	$1,189,249	$58,118	$2,955,923	$4,203,289	$20,706
	Follow-up	200	1,321	3	$882,981	$55,882	$0	$938,863	$711
	Sequela	44	163	-	$30,397	$0	$0	$30,397	$186
Totals					$21,798,535	$781,310	$85,904,487	$108,484,115	

Note:
*Reported in 2017 Dollars.