Estimating Costs of Injury among U.S. Army Soldiers

U.S. ARMY PUBLIC HEALTH CENTER

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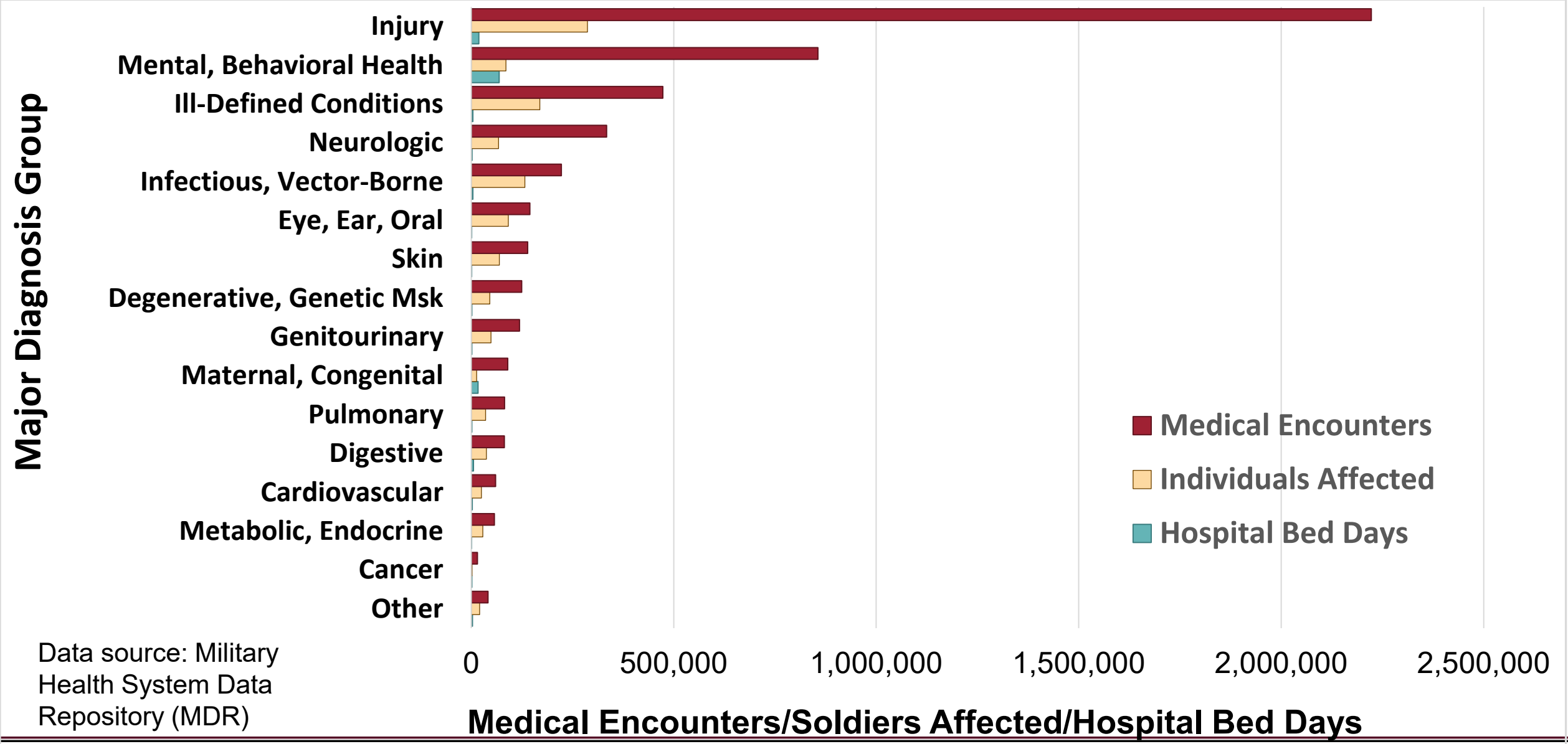
Leading Reasons for Medical Encounters
Active Duty U.S. Army, 2019



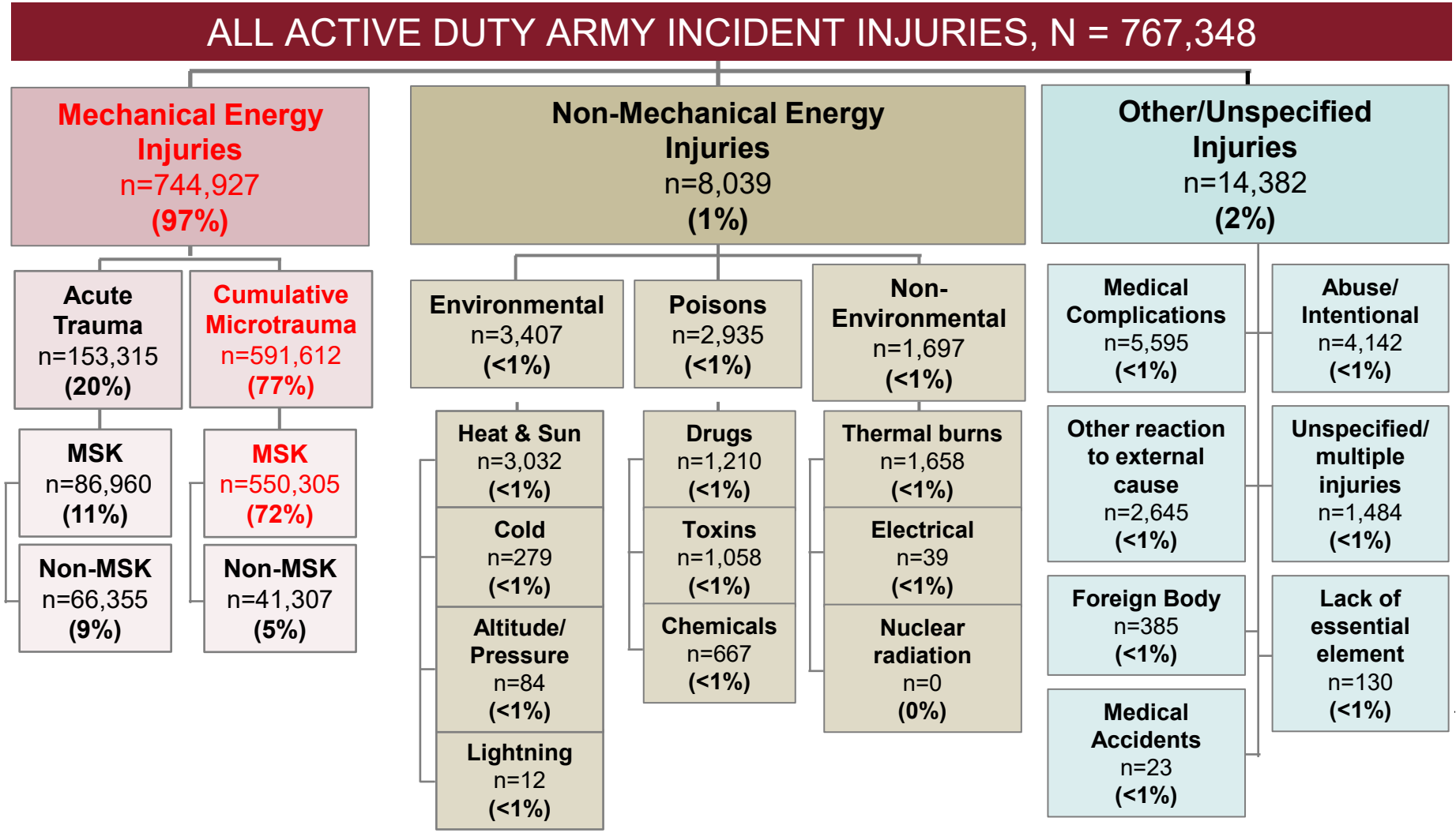
Data source: Military Health System Data Repository (MDR)

Leading Reasons for Temporary Limited Duty
Active Duty U.S. Army, 2019

Condition Types	Men		Women		Total	
	# of days	(%)	# of days	(%)	# of days	(%)
Musculoskeletal Injury	**7,231,437**	**(65.7)**	**1,906,454**	**(42.5)**	**9,137,891**	**(58.9)**
Pregnancy/Post-partum	0	-	1,585,022	(35.3)	1,585,022	(10.2)
Behavioral Health	1,179,830	(10.7)	344,888	(7.7)	1,524,718	(9.8)
Neurology	241,191	(2.2)	67,180	(1.5)	308,371	(2.0)
General Surgery	170,009	(1.5)	50,413	(1.1)	220,422	(1.4)
All Other	2,191,872	(19.9)	535,446	(11.9)	2,727,318	(17.6)
TOTAL	11,014,339	(100)	4,489,403	(100)	15,503,742	(100)

Data source: Army electronic profile (eProfile) system
Soldiers with profiles=188,876; Soldiers can be counted in more than one condition type
Temporary limited duty profiles with start date between 1 Jan and 31 Dec 19

Taxonomy of Injuries (Incident only)
Active Duty U.S. Army, 2019



MSK = damage to tissue(s) of the musculoskeletal system (e.g., bone, cartilage, muscle, tendon, fascia, joint, ligament, bursa).
Data source: Military Health System Data Repository (MDR); injuries defined using the APHC Taxonomy of Injuries.

Prior Military Injury Cost Estimates - Examples

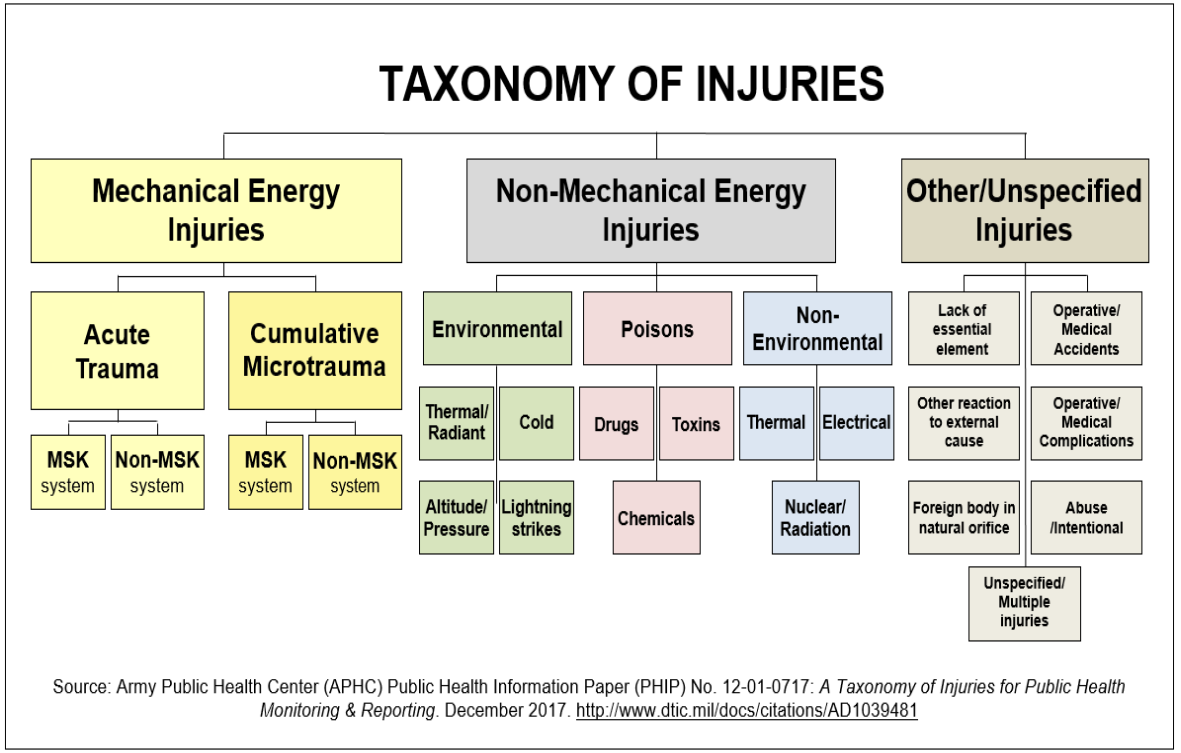
- 2001: National Safety Council - $17 billion per year (all Services)
  - "…much of [the information] is inconsistent and cannot be consolidated into a cohesive and comprehensive picture of injury and illness cost for uniform and civilian personnel…"
  - Included estimated Veterans Administration costs ($2.2 billion)
- 2006: DoD Actuary – "preventable" injuries cost $970 million to $1.8 billion per year (all Services)
  - Considered only 30% of military injuries (i.e., preventable); direct and indirect costs included
- Military safety estimated costs associated with military eye injuries (1988–1998), motor vehicle crashes (1999–2006)
  - Safety direct medical costs not based on actual costs, includes property costs
- 2017: APHC – lower extremity fractures cost $116 million per year (Active Duty Army)
  - ICD-10 codes, 1st or 2nd diagnosis: S72 (fractures of hip, upper leg), S82 (fractures of knee, lower leg, ankle), S92 (fractures of feet, toes)
  - n=5,287 incident injuries, 99% outpatient care
  - 90% fractures to knee, lower leg, ankle, feet, toes
  - 80% costs ($92 million) due to indirect costs (lost and limited duty)

Methods

- **Purpose:** Provide a methodology to estimate costs of injuries sustained by U.S. Army Soldiers
- **Study design:** Cross-sectional, prevalence-based; the cost of illness framework; Army (employer) perspective
- **Population:** All Army Soldiers on active duty status at any time during CY2018, including Guard and Reserve
- **Cost Estimates:**
  - **Direct medical cost:** Cost of a medical encounter to TRICARE for care provided in the military treatment facilities (MTFs) and contracted facilities as noted in the Military Health System Data Repository (MDR)
  - **Indirect costs:** Costs attributable to—
    - ***Lost duty time*:** Time for which a Soldier was not able/available to perform duties due to receipt of healthcare (e.g., hospitalization, clinic visit)
      - Data sources: MDR hospital length of stay, MDR outpatient visit scheduled length, 2018 Defense Finance Accounting Service (DFAS) military pay charts (salary by rank)
    - ***Limited duty time*:** Time for which a Soldier could not perform duties, performed at a diminished capacity, or performed alternate duties due to injury
      - Data sources: Soldier surveys, 2018 DFAS military pay charts (salary by rank)
      - Estimates for 50% and 100% productivity during limited duty time

Methods, continued

- 2018 medical encounter data from MDR via MHS Mart (M2)
- Mechanical energy injuries identified using the APHC Taxonomy of Injuries
  - ICD-10, acute and cumulative microtrauma (overuse), MSK and non-MSK
- Incident injuries identified using 60-day incidence rule based on first diagnosis
- Number of limited duty days (LDD) based on Soldier surveys specific to injury type (e.g., fracture, sprain) and anatomical site (e.g., shoulder, foot)
  - Duplicate visits removed
  - LDDs applied only to the first occurrence and then only every 60 days with reoccurrence



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

Methods: Limited Duty Day (LDD) Estimates for Indirect Costs

Taxonomy Injury Type	Survey Injury Types	Soldier Survey Average Reported LDDs, used for Indirect Cost Estimates
Amputation	--	365
Contusion/Superficial	Abrasion, Bruise; Contusion; Blister	24
Crush	Blunt force trauma	37
Dislocation	Dislocation	56
Fracture	Fracture; Fracture/break	63
Internal organ & blood vessel	--	7
MSK tissue damage, other	Pain; Unspecified pain (Bursitis, Fasciitis, Hernia)	33
Nerve	Nerve injury	24
Open wound	Cut/Laceration/Puncture	34
Sprain/Joint damage	Sprain, Sprain/Strain	26
Strain/Tear	Strain/Tear, Sprain/Strain, Tear	49
Tissue damage, other	--	7

Methods, continued

Study cost calculations:

- Direct medical cost: Costs paid by TRICARE as recorded in MDR
- Indirect cost (lost duty) = Hospital bed days*patient salary/day or scheduled time for the outpatient visit*patient salary/day
- Indirect cost (limited duty) = Soldier reported days*salary/day
- Total cost = Direct medical cost + Indirect cost (lost duty) + indirect cost (limited duty)

Results reported:

For *MSK and Non-MSK*, *acute and overuse*, and by *anatomical site*:

- Injuries, # encounters, lost duty (hospitalization), and limited duty
- Total cost, direct medical cost, indirect cost (lost duty), and indirect cost (limited duty)
- Costs for 50% estimated limited duty time and 100% estimated limited duty time (days)

Summary of Mechanical Energy Injuries, Active Duty Soldiers, CY 2018

All Injuries (N)	
Total Injured Soldiers [a]	348,506
Total Incident Injuries [b]	791,165
Total Encounters	2,586,773
Inpatient Bed Days	14,841
Outpatient Appointment Time (scheduled hours)	1,519,613

[a] Total number of individuals with >1 mechanical energy injury
[b] 60-day incidence rule based on first diagnosis was used to determine the number of incident injuries

Results: Costs by Body System and Injury Category*

Body System	Total cost		Direct Medical		Indirect Cost - Lost Duty		Indirect Cost – Limited Duty	
	$	% All	$	% All	$	% All	$	% All
Overall	**$2,680,304,332**	**100%**	**$570,759,713**	**21.3%**	**$67,145,876**	**2.5%**	**$2,042,398,743**	**76.2%**
All Non-MSK	$259,048,298	9.7%	$72,045,319	12.6%	$8,790,473	13.1%	$178,212,506	8.7%
Acute, Non-MSK	$162,192,792	62.6%	$47,278,037	65.6%	$6,009,351	68.4%	$108,905,404	61.1%
Overuse, Non-MSK	$96,855,506	38.0%	$24,767,282	34.4%	$2,781,122	31.6%	$69,307,102	38.9%
All MSK	**$2,421,256,034**	**90.3%**	**$498,714,394**	**87.4%**	**$58,355,403**	**86.9%**	**$1,864,186,237**	**91.3%**
Acute, MSK	$416,064,062	17.2%	$125,745,893	25.2%	$7,294,718	12.5%	$283,023,451	15.2%
Overuse, MSK	**$2,005,191,972**	**82.8%**	**$372,968,501**	**74.8%**	**$51,060,685**	**87.5%**	**$1,581,162,786**	**84.8%**

*50% limited duty, active duty Army Soldiers, CY 2018

Results: Costs by Body Region and Anatomical Site

- For 50% limited duty limitations, Active Duty Soldiers, CY 2018
- Top 2 body regions:
  - *Total cost:*
    1) Lower extremity ($1.1B, 43%)
    2) Spine & back ($714M, 27%)
  - *Indirect cost (limited duty):*
    1) Lower extremity ($900M, 44%)
    2) Spine & back ($564M, 28%)

Conclusions

For CY 2018 mechanical energy injuries among Active Duty Soldiers:

- **Estimated Total Cost (50–100% duty limitation) = $2.7 to 4.7 billion**
- Direct medical costs = $570,759,713 (12%)
- Estimated indirect costs:
  - Lost duty = $67,145,876 (1%)
  - Limited duty (50% to 100% limitation) = $2.0 to 4.1 billion (87%)
  - At 50% duty limitation ($2.7 billion):
    - $2.4B (90%) due to MSK injuries
    - $2.0B due to MSK overuse

Limitations

- Possible underestimation because:
  - Annual estimates, not over Soldier lifetime
  - Included injuries related to mechanical transfer of energy only; non-mechanical energy injuries and other/unspecified injuries (e.g., poisonings, heat/cold injuries, medical accidents, etc.) not included
  - Lost time estimates used amount of time scheduled for appointment (as assigned in MDR) rather than actual visit time
  - Injuries recorded in diagnostic (DX) positions 2–10 of medical records were not captured
  - Did not use societal perspective; does not include quality of life, familial costs
- Possible overestimation due to the following:
  - Incident injury definition assumes similar diagnosis code used for primary diagnosis (DX1) during follow-up visits
  - Further validation of LDD estimates needed

Strengths

- Currently few military injury cost estimates that quantify the burden and inform injury prevention prioritization
- Injury identification using military-relevant APHC Taxonomy of Injuries
  - Results available by body system (MSK and Non-MSK), acute & cumulative microtraumatic injuries, and by anatomical site
- Inclusion of lost duty time due to outpatient appointments
- LDD estimates based on weighted averages as reported in surveys of over 11,000 U.S. Army Soldiers in operational units (military-relevant injuries)
- LDDs applied to the first visit for an injury at a specific anatomical site (e.g., foot, toe), and applied only once every 60 days
- Preliminary comparison of LDD survey estimates and eProfile data showed similarities for most injury types
- Calculations for 100% and 50% duty limitations

Next Steps

- Lower extremity/low back results (2018) using this methodology
- Expand analyses:
  - Apply new incidence rule
  - Further validate and/or adjust LDD estimates with Army electronic profile (eProfile) data
  - Apply methodology to ALL 2019 Army injuries, including non-mechanical (e.g., environmental, unspecified, multiple)

Questions?

References

- U.S. Army Public Health Center (APHC). 2022. Estimating the Cost of Injuries among U.S. Army Soldiers (PHIP No. 12-06-0322). Prepared by Forrest LJ, A Schuh-Renner, VD Hauschild, SR Barnes, TL Grier, BH Jones, RA Steelman, A McCabe, EO Dada, and M Canham-Chervak. Aberdeen Proving Ground, Maryland.
- Forrest L, B Jones, S Barnes, V Hauschild, A Schuh-Renner, T Grier, R Steelman, E Dada, and M Canham-Chervak. 2021. “The cost of lower extremity fractures among active duty U.S. Army soldiers, 2017.” *MSMR* 28(6):6–12.
- APHC. 2020. The Cost of Army Injuries: Lower Extremity Fractures among Active Duty Soldiers, CY2017 (PHIP No. 12-04-1219). Prepared by Canham-Chervak M, L Forrest, SR Barnes, VD Hauschild, AS Renner, TL Grier, EO Dada, RA Steelman, and BH Jones. Aberdeen Proving Ground, Maryland.

Direct Medical Cost Data Source Details

Source	Field name	Definition (from MDR)	Notes (from MDR)
Comprehensive Ambulatory/Provider Encounter Record (CAPER)	Full Cost	Through FY07: APG-based full cost, based on the MTF-wide average (across all work centers in that MTF) for APG full costs. FY08+ costs based on allocation of MEPRS dollars by RVU and APC weight.	For FY08+: Sum of FCCLNSAL, FCPROFSAL, FCLAB, FCRAD, FCOTHANC, FCOTHER, FCSUP and FCRX. If APPTINFR=Y, based on completion table rules (See MDR CAPER Enhanced specification).
Standard Inpatient Data Record (SIDR)	Full Cost	All MEPRS expenses stepped down into the final "A" (inpatient) accounts. Includes all ancillary, salaries, direct, etc. associated with inpatient care.	FY99-FY15 costs based on their respective FY MEPRS expenses. FY16+ full costs are based on FY15 MEPRS expenses adjusted for inflation. FY98 and backward are not populated. Summation of FCANCLAB, FCANCRAD, FCCLNSAL, FCDIRECT, FCICU, FCOTHANC, FCOTHSAL, FCSUPPRT, FCSURG. For INFFLAG= Y (inferred SIDR), populated with averages based on data already reported.
TRICARE Enhanced Data – Institutional (TEDI)	Paid	Amount paid by TRICARE.	Only includes payments made by TRICARE. Other payors, including the patient, may exist.
TRICARE Enhanced Data – Non-Institutional (TEDNI)	Paid	Amount paid by TRICARE for this line item.	Estimated for HCSRs, actual for TEDs. Under TPharm contract (contractor 70), mail order only (Type of Service 2 = M), amount paid does not include dispensing fee