

A CHARACTERIZATION OF INJURIES AMONG ACTIVE DUTY PERSONNEL AT FORT RILEY, KANSAS

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Capstone Experience

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OUTLINE


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- ▶ Research
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FORT RILEY DEPARTMENT OF PUBLIC HEALTH STUDENT EXTERNSHIP

U.S.ARMY PUBLIC HEALTH COMMAND

- ▶ Mission: “To promote health and prevent disease, injury and disability of Soldiers and military retirees, their Families, and Department of the Army civilian employees; and assure the execution of full spectrum veterinary service for Army and Department of Defense Veterinary missions.”


FORT RILEY DEPARTMENT OF PUBLIC HEALTH

- ▶ Public Health Nursing
 - ▶ Occupational Health
 - ▶ Environmental Health
 - ▶ Industrial Hygiene
 - ▶ Veterinary Services
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PUBLIC HEALTH NURSING

- ▶ Child and Youth Services health inspections
- ▶ Health screening and education
- ▶ Disease surveillance
- ▶ Immunization administration
- ▶ Apple Day


ENVIRONMENTAL HEALTH

- ▶ Food service sanitation and inspections
 - ▶ Child Development Center sanitation and inspections
 - ▶ Water quality surveillance
 - ▶ Vector surveillance
- 

INDUSTRIAL HYGIENE

- ▶ Ventilation assessments
 - ▶ Radiation exposure reduction
 - ▶ Noise exposure assessments
 - ▶ Indoor air quality monitoring
- 

OCCUPATIONAL HEALTH

- ▶ Medical surveillance and screening
 - ▶ Occupational illness and injury
 - ▶ Work-related immunizations
 - ▶ Workplace evaluations
 - ▶ Army Hearing Program
- 

VETERINARY SERVICES

- ▶ Clinical assessments
- ▶ Food item inspections
- ▶ Food facility inspections

CHARACTERIZATION OF INJURIES AMONG ACTIVE DUTY PERSONNEL

BACKGROUND

IMPORTANCE OF PHYSICAL TRAINING

- ▶ Physical training important for health
- ▶ May reduce risk of:
 - ▶ Cardiovascular disease
 - ▶ Type 2 diabetes
 - ▶ Obesity
 - ▶ Anxiety and depression
 - ▶ Injuries

IMPORTANCE OF PHYSICAL TRAINING

- ▶ Physical training is a necessary component of active duty personnel's overall training¹
- ▶ Active duty personnel must maintain a high level of fitness:
 - ▶ To carry out job-related duties^{1,2}
 - ▶ To be ready for combat at any time^{1,2}

RISKS OF PHYSICAL TRAINING

- ▶ Physical training often results in injuries³
- ▶ Injuries: Greatest threat to military readiness and soldier health^{1,4}
- ▶ 50% of active duty personnel develop a musculoskeletal injury
- ▶ 25% of injured personnel develop a second injury
- ▶ In Basic Training, 25% of men and 50% of women are injured
- ▶ For each death due to unintentional injuries:
 - ▶ 33 injury-related hospitalizations
 - ▶ 4,000 outpatient medical encounters

RISKS OF PHYSICAL TRAINING

- ▶ Injuries often result from:
 - ▶ Activities such as long distance running and road marches with heavy ruck sacks¹³
 - ▶ Overtraining caused by repetitive and/or forceful movements associated with strength training, running and other aerobic exercises⁵

FIVE LEADING CAUSES OF INJURY HOSPITALIZATIONS AMONG ACTIVE DUTY PERSONNEL, DOD⁴

Cause of Injury	Number of Hospitalizations	Rate per 100,000 person- years	Percent
Falls and miscellaneous	1,483	129.5	34.3
Land transport accidents	824	71.9	19.1
Athletics and sports	567	49.5	13.1
Medical and surgical complications	348	30.4	8.0
Intentional injuries (non-battle)	222	19.4	5.1

INJURIES DEFINED^{4,5}

- ▶ Injuries are defined as:
 - ▶ Intentional or unintentional damage (trauma) to the body caused by an external force or exposure
 - ▶ Non-traumatic damage to the body, or inability to function properly as a result of continuous or repetitive movements (as commonly seen with training-related injuries)
 - ▶ Excludes casualties resulting from hostile actions in combat

INJURIES DEFINED^{4,5}

- ▶ ICD-9-CM Codes
 - ▶ 710 to 739 (Musculoskeletal disorders)
 - ▶ 800 to 999 (Injuries and poisonings)
- ▶ Injuries and poisonings categorized by Barell Injury Diagnosis Matrix
- ▶ Musculoskeletal conditions categorized using modified Barell Matrix

Special diagnostic codes for trauma: Flail Chest (807.4) Pneumothorax (860)

For purposes of classification, head injuries are labeled as **Type 1 TBI** if there is recorded evidence of an intracranial injury or a moderate or a prolonged loss of consciousness (LOC), Shaken Infant Syndrome (SIS), or injuries to the optic nerve pathways. **Type 2 TBI** includes injuries with no recorded evidence of intracranial injury, and LOC of less than one hour, or LOC of unknown duration, or unspecified level of consciousness. **Type 3 TBI** includes patients with no evidence of intracranial injury and no LOC.

Body Region	Inflammation and pain (overuse)	Joint derangement	Joint derangement with neurological involvement	Stress fracture	Sprain/strain/ rupture	Dislocation
Vertebral column						
Cervical	723.1	722.0	722.71, 723.4	--	--	--
Thoracic/dorsal	--	722.11	722.72, 724.4	--	--	--
Lumbar	724.2	722.10	722.73, 724.3	--	--	--
Sacrum, coccyx	720.2	--	--	--	--	--
Spine, back unspecified	721.7, 724.5	722.2	722.70, 724.9	733.13	--	--
EXTREMITIES						
Upper						
Shoulder	716.11, 719 (.01, .11, .41), 726 (.01, .1, .2)	718 (.01, .11, .81, .91)	--	--	727 (.61, .62)	718.31
Upper arm, elbow	716.12, 719 (.02, .12, .42), 726.3	718 (.02, .12, .82, .92)	--	733.11	--	718.32
Forearm, wrist	716.13, 719 (.03, .13, .43), 726.4	718 (.03, .13, .83, .93)	--	733.12	--	718.33
Hand	716.14, 719 (.04, .14, .44)	718 (.04, .14, .84, .94)	--	--	727 (.63, .64)	718.34
Lower						
Pelvis, hip, thigh	716.15, 719 (.05, .15, .45), 726.5	718 (.05, .15, .85, .95)	--	733 (.14, .15, .96-.98)	727.65	718.35
Knee, lower leg	716.16, 717.7, 719 (.06, .16, .46), 726.6	717 (.06, .9), 718 (.06, .16, .86, .96)	--	733 (.16, .93)	717.8, 727 (.66-67)	718.36
Ankle, foot	716.17, 719 (.07, .17, .47), 726.7, 728.71, 734	718 (.07, .17, .87, .97)	--	733.94	727.68	718.37
UNCLASSIFIED BY SITE						

COST TO THE MILITARY

- ▶ Annually, injuries result in:
 - ▶ >\$340 million in disability costs, approximately 1/3 of all disability costs (1999 estimate)⁷
 - ▶ High medical attrition rates^{1,2,6}
 - ▶ 25 million limited duty days^{1,2,6}
 - ▶ Two million sick call visits^{1,2,6}

MAGNITUDE OF THE INJURY PROBLEM⁴

- ▶ Injuries across DoD in 2006:
 - ▶ Affected nearly 1 million (87%) active duty personnel
 - ▶ Resulted in 1.95 million medical encounters
 - ▶ Caused 11,591 hospitalizations
 - ▶ 68,000 hospital bed days
- ▶ Injury medical encounter rate for DoD (2006)
 - ▶ 1,600 per 1,000 person-years
- ▶ Medical encounter rates highest for Army (2006)
 - ▶ 2,200 per 1,000 person-years

INJURY MEDICAL ENCOUNTER RATES FOR INJURIES ACTIVE DUTY PERSONNEL, DOD AND SERVICES, 2006

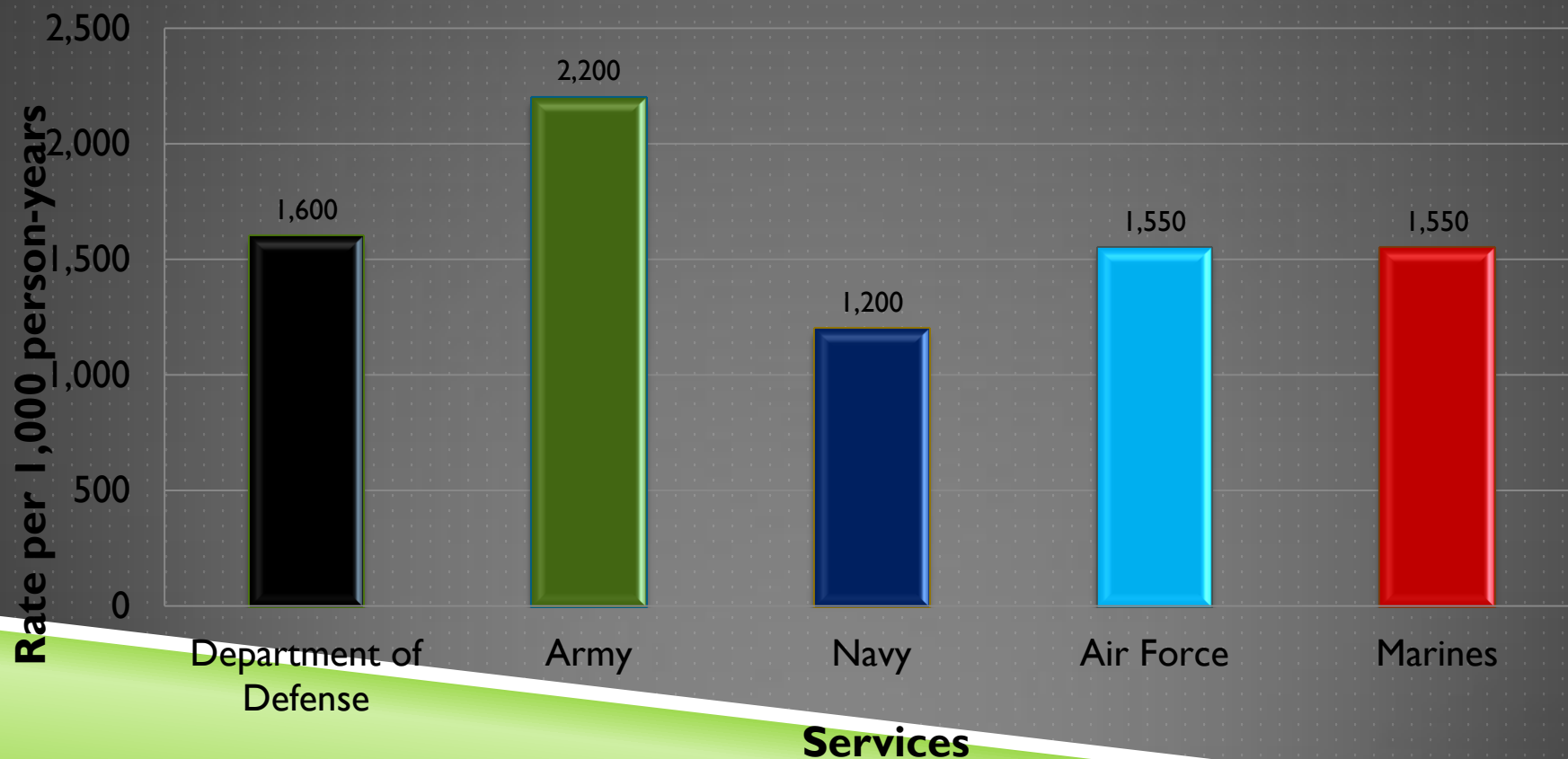


Chart adapted from Jones, et al. (2010). Medical surveillance of injuries in the U.S. Military: Descriptive epidemiology and recommendations for improvement. *American Journal of Preventive Medicine*, 38(1S): S42-S60.

MAGNITUDE OF THE INJURY PROBLEM⁴

- ▶ Most common injury:
 - ▶ Lower-extremity overuse
 - ▶ Medical encounter rate for DoD
 - ▶ 900 per 1,000 person-years
 - ▶ Medical encounter rate for Army
 - ▶ 1,200 per 1,000 person-years

MEDICAL ENCOUNTER RATES FOR LOWER-EXTREMITY OVERUSE INJURY RATES, ACTIVE DUTY PERSONNEL, DOD AND SERVICES, 2006

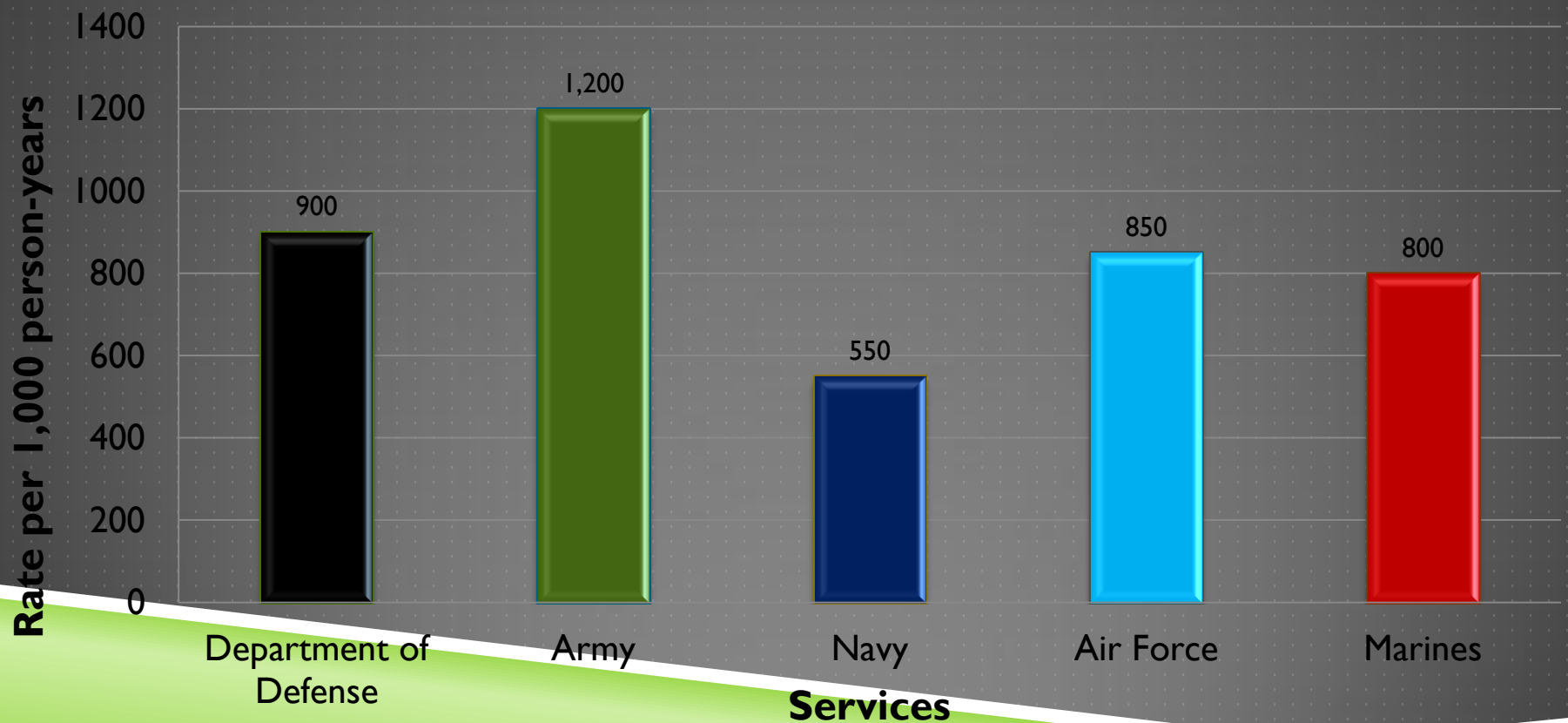


Chart adapted from Jones, et al. (2010). Medical surveillance of injuries in the U.S. Military: Descriptive epidemiology and recommendations for improvement. *American Journal of Preventive Medicine*, 38(1S): S42-S60.

RISK FACTORS FOR TRAINING-RELATED INJURIES

► Intrinsic risk factors

- Age (oldest and youngest personnel)^{1,10}
- Gender (female)¹
- Anatomy (leg and foot structure and stature)¹
- Physical activity level/fitness level (lower level of fitness)^{1,10}
- Weight/body mass index (BMI) (higher weight and BMI)¹⁰
- Smoking status¹

► Extrinsic risk factors

- Time spent in physical training¹
- Type and intensity of training¹
- Shoe type¹
- Training surface¹
- Season^{3,11}

INJURY PREVENTION^{12,15}

- ▶ In 2003, the Secretary of Defense issued a directive to reduce injuries by 50%
- ▶ Defense Safety Oversight Council (DSOC) was formed to oversee injury prevention
- ▶ DoD Military Injury Prevention Priorities Working Group (DMIPPWG) created to evaluate injury prevention efforts already in place and to make recommendations to reduce injuries

INJURY PREVENTION^{12,15}

► DMIPPWG recommendations:

1. Prevent overtraining
2. Perform more exercises that develop body movement skills
3. Wear mouthguards during high-risk activities
4. Wear semi-rigid ankle braces for high-risk activities
5. Consume nutritional supplements to restore energy balance within one hour of high-intensity activities

INJURY PREVENTION¹⁵

- ▶ Further recommendations:
 - ▶ Educate leadership about injury prevention
 - ▶ Enforce policies and programs in place to reduce injuries

CHARACTERIZATION OF INJURIES AMONG ACTIVE DUTY PERSONNEL AT FORT RILEY, KANSAS

PURPOSE

- ▶ To determine the incidence of injuries among active duty personnel at Fort Riley through surveillance of existing medical records.

OBJECTIVES

- ▶ Determine the incidence of injuries among active duty personnel at Fort Riley, KS, over an 18 month period
- ▶ Determine the most common injuries among active duty personnel at Fort Riley, KS, over an 18 month period
- ▶ Make recommendations for interventions based on study results

POPULATION

- ▶ Non-deployed active duty personnel
- ▶ Average monthly population: 12,299 people

METHODS

- ▶ Study reviewed and approved by Kansas State University IRB
- ▶ Medical records requested from Irwin Army Community Hospital (IACH) for injury diagnoses for all non-deployed active duty personnel stationed at Fort Riley between April 2010 and September 2011

METHODS

- ▶ Records included:
 - ▶ Medical diagnosis (ICD-9-CM codes)
 - ▶ 710 to 739 (Musculoskeletal disorders)
 - ▶ 800 to 999 (Injuries and poisonings)
 - ▶ Date of medical encounter
 - ▶ Medical encounter = emergency room visits, outpatient visits, hospitalizations
 - ▶ Demographic data (race, gender, age)
 - ▶ Disposition (released with or without work limitations, hospitalized, etc.)

METHODS

- ▶ Brigade and body mass index information were obtained from the Office of the Assistant Chief of Staff, GI
- ▶ Barell Matrix used to categorize injuries
- ▶ Frequencies, percentages, and rates were calculated to determine the most common injuries

RESULTS

RESULTS

- ▶ Between April 2010 and September 2011:
 - ▶ 12,940 injured active duty personnel
 - ▶ 35,128 injury diagnoses
 - ▶ 62,318 medical encounters

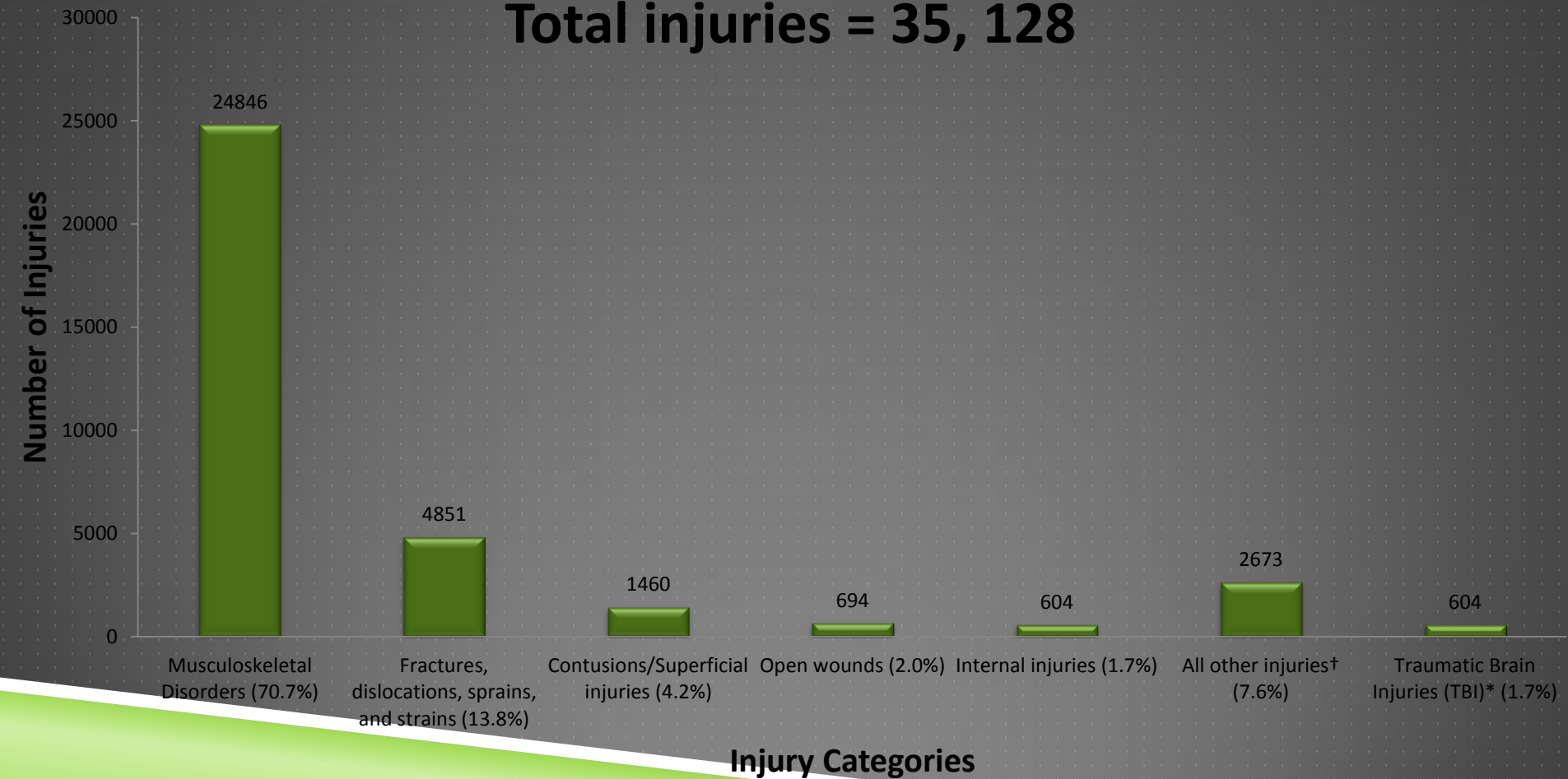
Descriptive characteristics of Army active duty personnel at Fort Riley, Kansas, with an injury diagnosis between 1 April 2010 and 30 September 2011 (N = 12,940).					
Characteristic	Value	SD	Characteristic	# of people	%
Age (years)			Race		
Mean	28.07	7.2	White	2,933	22.7
Mode	21		Black	704	5.4
Range	17-63		Asian/Pacific Islander	55	0.4
			Native American	26	0.2
Age Groups	# of people	%	Other	975	7.5
17 to 22	3,293	25.4	Unknown	1,231	9.5
23 to 25	2,732	21.1	Not available	7,016	54.2
26 to 29	2,483	19.2			
30 to 35	2,201	17.0	Body Mass Index		
36 to 63	2,231	17.2	Below 18.5	548	4.2
			18.5 to 24.9	3,851	29.8
Gender			25.0 to 29.9	3,049	23.6
Male	11,215	86.7	30.0 and higher	1,247	9.6
Female	1,725	13.3	Not available	4,245	32.8

Number of Injuries by Category

Active Duty Personnel, Fort Riley, KS

April 2010 to September 2011

Total injuries = 35, 128



† All other injuries include burns (98); poisonings (69); foreign body injuries (66); toxic effects (51); crushing injuries (39); late effects of injuries, poisonings, toxic effects, and other external causes (22); early complications of trauma (16); nerve injuries (11); amputations (2); blood vessel injuries (1); and unspecified injuries (2,298).

*TBI diagnoses also fall under the fractures and internal injuries categories. These injuries are shown separately due to the importance of TBI prevention in the military.

Top Five General Types of Injury

Active Duty Personnel, Fort Riley, KS

April 2010 to September 2011

Injury Rank	Diagnosis	Number of injuries	Percent of all injury diagnoses^a	Incidence rate per 1,000 person-years^b
1	Overuse (Inflammation and Pain)	15,289	43.5	828
2	Sprains and strains	3,769	10.7	204
3	Joint Derangements	908	2.6	49
4	Fractures	785	2.2	43
5	Open Wounds	694	2.0	38
Total		21,445	61.0	1,162

^a Total injury diagnoses during specified time period = 35,128.

^b Calculated using average population of non-deployed active duty personnel at Fort Riley (12,299) for April 2010 to September 2011.

Top Five Injury Diagnoses

Active Duty Personnel, Fort Riley, KS

April 2010 to September 2011

Injury Rank	Diagnosis	Number of injuries	Percent of all injury diagnoses^a	Incidence rate per 1,000 person-years^b
1	Low back pain	4,082	11.6	221.3
2	Pain in joint, lower leg	3,445	9.8	186.7
3	Pain in joint, shoulder region	1,575	4.5	85.4
4	Pain in limb, not specified	1,486	4.2	80.5
5	Pain in joint, ankle and foot	1,133	3.2	61.4
Total		11,721	33.4	635.3

^a Total injury diagnoses during specified time period = 35,128.

^b Calculated using average population of non-deployed active duty personnel at Fort Riley (12,299) for April 2010 to September 2011.

Top Five Injury Diagnoses by Gender, Active Duty Personnel, Fort Riley, KS

April 2010 to September 2011

Rank	Male			Female		
	Injury	Number of injuries	Rate per 1,000 person-years ^a	Injury	Number of injuries	Rate per 1,000 person-years ^a
1	Low back pain	3,497	213.5	Low back pain	585	283.2
2	Pain in joint, lower leg	2,995	182.8	Pain in joint, lower leg	450	217.9
3	Pain in joint, shoulder region	1,403	85.6	Pain in joint, pelvic region and thigh	244	118.1
4	Pain in limb, not specified	1,255	76.6	Pain in limb, not specified	231	111.8
5	Pain in joint, ankle and foot	956	58.4	Neck pain	206	99.7
Total		10,106	616.9		1,716	830.8
Percent of all injuries by gender ^b		33.8			32.9	

^a Calculated using average male (n = 10,922) and female (n = 1,377) populations for April 2010 to September 2011.

^b Percent of injuries among males and percent of injuries among females. Total male injuries (n = 29,916); total female injuries (n = 5,212).

Injuries among active duty personnel by brigade, Fort Riley, KS

April 2010 to September 2011

Unit	Number of injuries	Percent	Incidence rates* (per 1,000 person-years)
1 st Brigade	4,942	14.1	1,259
2 nd Brigade	3,541	10.1	1,254
4 th Brigade	6,229	17.7	1,595
CAB	3,776	10.7	1,852
Support Units	7,085	20.2	1,231
No Unit Designated	9,555	27.2	--
Fort Riley	35,128	100	1,904

*Incidence rates calculated using average non-deployed population for Fort Riley between April 2010 and September 2011. Average population for Fort Riley = 12,299; 1st Brigade = 2,618; 2nd Brigade = 1,883; 4th Brigade = 2,603; CAB = 1,359; Support Units = 3,836.

Injury-related medical encounters among active duty personnel by brigade, Fort Riley, KS

April 2010 to September 2011

Unit and population	Number of medical encounters	Percent	Incidence rates* (per 1,000 person-years)
1 st Brigade	8,187	13.1	2,085
2 nd Brigade	6,110	9.8	2,163
4 th Brigade	10,965	17.6	2,808
CAB	6,730	10.8	3,301
Support Units	14,160	22.7	2,461
No Unit Designated	16,166	26	--
Fort Riley	62,318	100	3,378

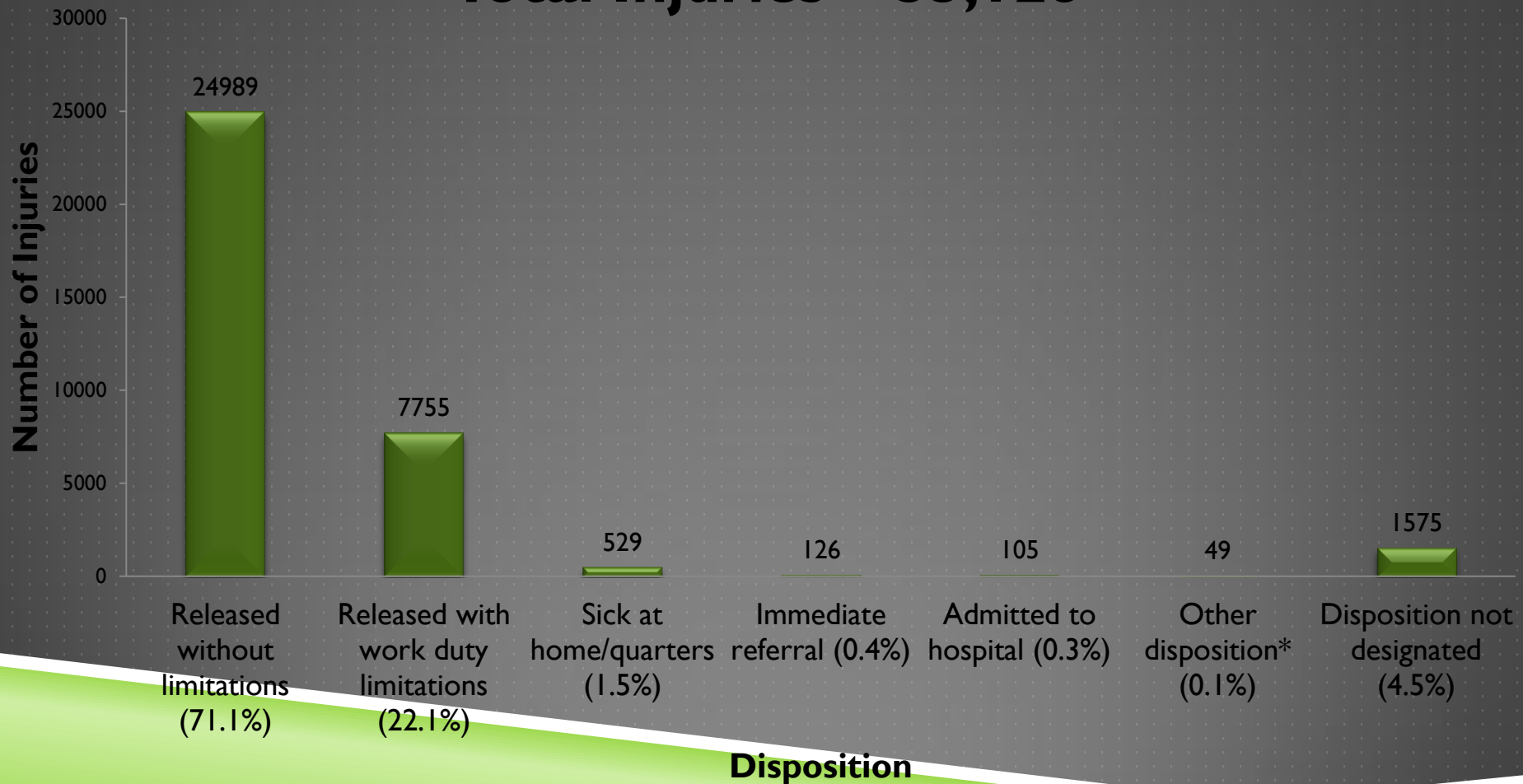
*Incidence rates calculated using average non-deployed population for Fort Riley between April 2010 and September 2011. Average population for Fort Riley = 12,299; 1st Brigade = 2,618; 2nd Brigade = 1,883; 4th Brigade = 2,603; CAB = 1,359; Support Units = 3,836.

Injury Disposition

Active Duty Personnel, Fort Riley, KS

April 2010 to September 2011

Total Injuries = 35,128



*Other disposition included: referred for appointment (n = 16), continued stay (n = 14), discharged home (n = 7), left against medical advice (n = 6), transferred to another hospital (n = 4), transferred to another clinical service (n = 1), and expired (n = 1).

Top Five Injury Diagnoses and Disposition

Active Duty Personnel, Fort Riley, KS

April 2010 to September 2011

Injury Rank	Diagnosis	Number of injuries	Disposition					
			Released without limitations	Released with limitations	Sick at home/ quarters	Admitted to hospital	Other	Disposition not indicated
1	Low back pain	4,082	3,041 (74.5%)	689 (16.9%)	74 (1.8%)	0 (0.0%)	10	268
2	Pain in joint, lower leg	3,445	2,212 (64.2%)	1,076 (31.2%)	22 (0.6%)	0 (0.0%)	4	131
3	Pain in joint, shoulder region	1,575	1,125 (71.4%)	365 (23.2%)	4 (0.3%)	0 (0.0%)	6	75
4	Pain in limb, not specified	1,486	1,018 (68.5%)	393 (26.4%)	11 (0.7%)	1 (0.07%)	6	57
5	Pain in joint, ankle and foot	1,133	752 (66.4%)	313 (27.6%)	9 (0.8%)	0 (0.0%)	4	55
Total		11,721	8,148 (69.5%)	2,836 (24.2%)	120 (1.0%)	1 (0.009%)	30	586

DISCUSSION

- ▶ Types of injuries consistent with Army:
 - ▶ Overuse injury diagnoses most common (43.5% of all injuries)
 - ▶ Most common injuries were low back pain and lower extremity joint pain (24.6% of all injuries)
- ▶ Injury medical encounter rates at Fort Riley higher than Army
 - ▶ 3,378 compared to 2,200 per 1,000 person-years
 - ▶ Reason for higher rates may be that Fort Riley is an infantry post (training involves more weight-bearing activities and long-distance marches)

DISCUSSION

- ▶ Based on observed rates for the top five injuries, females appear to have slightly higher injury incidence rates than males
- ▶ Women in the military more at risk for injuries
 - ▶ Usually less fit when entering Basic Training
 - ▶ Anatomical differences


DISCUSSION

- ▶ 4th Brigade and CAB had highest observed rates of injuries (1,595 and 1,852 injuries per 1,000 person-years, respectively)
 - ▶ Recent 4th Brigade intervention:
 - ▶ Building a Soldier Athlete Program
 - ▶ 4th Brigade physical therapist


DISCUSSION

- ▶ Most injuries resulted in no prescribed limited-duty
- ▶ Pain can still result in limited ability to perform duties

STUDY LIMITATIONS

- ▶ Migration bias
 - ▶ Many unknown variables in data set
 - ▶ Brigade and BMI not readily available for approximately 30% of injured personnel
 - ▶ Age and BMI for entire population during 18 month period not obtained
 - ▶ Smoking status not available
 - ▶ Causes of injuries not provided for nearly all injury diagnoses
- 

CONCLUSION & RECOMMENDATIONS

- ▶ Continued routine surveillance of injuries
 - ▶ Educate leadership on recommendations for preventing injuries
 - ▶ Monitor for adherence to injury prevention guidelines
- 

CONCLUSIONS AND RECOMMENDATIONS

- ▶ Evaluate effectiveness of Building a Soldier Athlete program and presence of physical therapist in 4th Brigade
- ▶ Further analysis of data

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QUESTIONS?