Musculoskeletal Injury and Physical Fitness Across U.S. Army Occupational Specialties

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Abstract

Background: Military occupations are widely diverse, requiring specific skill sets and physical demand levels to accomplish their objectives.

Purpose: To describe musculoskeletal injury and physical fitness across US Army military occupational specialties (MOS).

Methods: Demographics, health behaviours and physical training data were obtained by electronic survey. Musculoskeletal injuries and Army Combat Fitness Test (ACFT) data were obtained from Department of Defense medical and training systems. A multivariable logistic regression model was performed to assess the role of injury risk and MOS while controlling for known military injury risk factors.

Results: Participants were 2124 male and 433 female enlisted US Army Soldiers. Injury incidence by MOS ranged from 29% to 62% for males and 49% to 71% for females. MOS contributed to injury risk for males, with the exception of Support and Administration. All other MOSs had between 2.0 to 5.3 times greater injury risk than Field and Air Defense. Military Police had a 3.8 times higher injury risk for females compared to Military Intelligence. Considering physical fitness, ACFT performance by MOS ranged from 425 to 491 points for males and 310 to 364 points for females (maximum score of 600 points). Males in Infantry and females in Military Police MOSs had the highest ACFT scores of 491 and 364 points, respectively. In addition, health behaviours and physical training varied by MOS.

Conclusion: Surveillance of injury incidence and physical fitness, along with health behaviours and physical training by MOS, may be used to focus injury prevention strategies.

Introduction

The US Army consists of a wide array of military occupational specialties (MOS) and is one of the largest providers of training and vocational education in the world.[1] Each MOS has a unique job description, estimated physical demand level and specific skills to successfully accomplish the mission.[2] Overall, there are approximately 203 career management fields grouping related MOSs for enlisted US Army Soldiers.[2]

Physically demanding professions, such as the military, have been shown to have high risks of injury.[3,4] Risk factors for injury can be classified as intrinsic and extrinsic.[5] Some intrinsic risk factors associated with injury are female sex, older age, low aerobic fitness, low and high body mass index (BMI), tobacco use and sleep duration.[5,6] Some extrinsic risk factors associated with injury are running distance, foot marching and job duties.[5] These are all known risk factors for injury and have been established in the literature.[5,7-9] In previous investigations of the US Army, soldiers with high physical demand MOSs were at a higher risk of injury, hospitalisation and disability.[3,4] However, specific MOSs identified as having a higher injury risk or disability are limited in the literature. Amoroso et al. showed that male Infantry Soldiers and female light-wheeled vehicle mechanics had the highest rate of musculoskeletal hospitalisations.[10] Anderson et al. indicated that the MOS groups of chemical, explosives and ammunition, and armour had a higher risk of injury compared to Infantry Soldiers.[11] However, contrary to other investigations, Anderson et al. indicated no significant differences in injury risk between MOS physical demand levels when controlling for age, BMI, cigarette use and physical fitness.[11] Lincoln et al. showed that soldiers in electronic equipment repair and other technical occupations

were at a higher risk for overall disability.[4] Based on the previous literature, no consensus shows any specific MOS as having higher injury risk compared to other MOSs. In addition, physical demand levels of these MOSs did not seem to predict injury risk consistently. Understanding the relationship between MOS and injury risk is essential in reducing US Army healthcare burden costs.[12] Physical fitness assessments for job selection, placement and retention are often requirements of physically demanding occupations.[13] In the military, physical fitness is critical to performing required occupational tasks.[13] To the authors' knowledge, Anderson et al. is the only study that has investigated physical fitness by MOS. In this study, MOS groups with the highest muscular endurance were Infantry, Field and Air Defense Artillery, and Engineer groups.[11] MOS groups with the highest aerobic endurance were Infantry and Armor groups.[11] Specific physical fitness attributes could impact occupational task performance, ultimately providing a protective effect against injuries among US Army Soldiers.[14,15]

Though the relationship between musculoskeletal injury risk and physical fitness in the US Army has been well established,[8] there are limited studies assessing the relationships between US Army MOS, musculoskeletal injury risk and physical fitness.[11] This investigation aimed to describe musculoskeletal injury and physical fitness across MOS groups.

Methods

Participants. Participants were enlisted Active-Duty US Army Soldiers representing multiple MOSs who completed a survey during Army Combat Fitness Test (ACFT) field testing. A report summarising the results of the ACFT field testing can be found elsewhere.[16] The US Army Public Health Center (APHC) Public Health Review Board (PHRB) reviewed and approved this investigation as public health practice (PHRB#18-688). Informed consent was obtained from all respondents prior to participation.

Survey. A survey was electronically sent from January 2020 to April 2020 to 28 452 soldiers in 61 US Army battalions field testing the ACFT. Thirty of these US Army battalions were augmented by medical and fitness teams consisting of a physical therapist, two strength and conditioning coaches, an athletic trainer, a dietitian, an occupational therapist (in 8 of the 30 battalions) and a mental health specialist (in 4 of the 30 battalions). The survey obtained the following information from each Soldier: demographics, MOS, health behaviours, physical training activities and injuries. US Army policy was referenced to categorise individual MOSs into 13 MOS groups (Table 1).[2] Occupational Physical Assessment Test (OPAT) physical demand categories of moderate (frequently or constantly lift up to 40 pounds), significant (frequently or constantly lift 41 to 99 pounds) and heavy (frequent or constantly lift 41 to 100+pounds) were used to identify the workload requirements of each specific MOS (Table 2).[2,17] The OPAT performance standards are described in detail elsewhere.[18] Personal physical training time was limited to soldiers reporting 20–840 minutes per week, respectively. This exclusion criteria was used to omit responses that indicated more or less than credible amounts of exercise.[19] MOS groups with 10 or fewer participants were considered not sufficiently representative and were excluded from demographic and logistic regression analysis (Tables 3–6).

Physical performance. ACFT data were obtained from the Digital Training Management System (DTMS). DTMS is a US Army web-based training management tool that captures and stores training data, such as ACFT performance and body composition data. At the time of this investigation, minimum US Army physical fitness standards, as measured by the ACFT, were established using the OPAT physical demand categories of moderate, significant and heavy.[17] In addition, ACFT standards were age and gender-neutral during the entire data collection period. The ACFT consisted of six events in the following order: a three-repetition maximum deadlift using a hex bar, a standing power throw for distance, the maximum number of hand release push-ups in two minutes, a sprint-drag-carry event for time, maximum number of leg tucks in two minutes and a two-mile run for time. As of October 1, 2019, the ACFT event and scoring standards were re-evaluated and slightly changed from the previous standards, as displayed in Table 2. The preliminary ACFT standards (July 31, 2018, to September 30, 2019) will be referred to as the initial field testing (IFT) minimum event passing standards. ACFT re-evaluated minimum passing standards (October 1, 2019, to June 11, 2020) will be referred to as initial operational capability (IOC) minimum passing standards. ACFT minimum event passing standards were based on MOS. IFT and IOC ACFT event passing standards are listed in Table 2. The scoring scale for each event ranges from 0 (lowest performance) to 100 (highest performance) points. The minimum points needed to pass the moderate, significant, and heavy categories are 60, 65 and 70 points for each event, respectively. Therefore, the total minimum passing score for the moderate, significant, and heavy physical demand categories were 360, 390 and 420 points, respectively. The maximum score was 600 points.

Medically treated injuries. The Armed Forces Health Surveillance Division provided Defense Medical Surveillance System data for all outpatient and hospitalisation medical encounters in the 12 months prior to survey administration. The Taxonomy of Injuries was subsequently used to identify musculoskeletal injury-related International Classification of Diseases, 10th Revision, Clinical Modification (ICD-10-CM) diagnosis codes to create a musculoskeletal injury index consisting of both overuse and traumatic musculoskeletal injuries.[20]

Statistical analysis. The Statistical Package for Social Sciences (SPSS), Version 28.0 (IBM Corp., Armonk, NY, USA) was used for all statistical analyses. Data were stratified by sex due to physiological differences influencing injury risk.[21] Continuous variables were divided into quartiles or specified categories. To allow for comparisons across MOS groups, frequencies, means and standard deviations (SD) by MOS group were presented for demographics, health behaviours, physical training, soldiers augmented with a medical and fitness team, physical demand category, injury characteristics and physical fitness as measured by performance on individual ACFT events and ACFT total score. Medical encounter data was used to report injured body areas and to conduct logistic regression modelling. Injury activity data was incomplete in the medical records, therefore, descriptive statistics on self-reported injury activity data from surveys were reported.

Cumulative injury incidence by MOS group was calculated as the number of soldiers with one or more

Table 1. Self-Reported Military Occupational Specialty Group

Military Occupational Specialty Group	Male % (n)	Female % (n)	Total % (n)	Military Occupational Specialty (MOS)
Engineers	18.9 (402)	10.6 (46)	17.5 (448)	12A, 12B, 12C, 12H, 12K, 12M, 12N, 12R, 12T, 12W, 12X, 12Z
Repairer and Maintenance	18.7 (398)	7.6 (33)	16.9 (431)	15B, 15D, 15F, 15G, 15H, 15K, 15L, 15M, 15N, 15P, 15Q, 15R, 15T, 15U, 15W, 15Y, 15Z, 91A, 91B, 91C, 91D, 91E, 91F, 91H, 91J, 91L, 91M, 91P, 91S, 91X, 91Z, 94D, 94E, 94F, 94H, 94S, 94W, 94Y
Supply and Logistics	11.4 (243)	23.8 (103)	13.5 (346)	77W, 92A, 92F, 92G, 92L, 92M, 92R, 92S, 92W, 92Y, 92Z
Field and Air Defense Artillery	8.0 (169)	2.3 (10)	7.0 (179)	13F, 13J, 13M, 13Z, 14E, 14G, 14H, 14T, 14Z
Medical	5.7 (121)	13.2 (57)	7.0 (178)	68A, 68B, 68C, 68D, 68E, 68F, 68G, 68H, 68J, 68K, 68L, 68M, 68P, 68Q, 68S, 68V, 68W, 68X, 68Y, 68Z
Military Intelligence and Electronic Warfare	5.6 (120)	9.5 (41)	6.3 (161)	17E, 35F, 35G, 35L, 35M, 35N, 35P, 35S, 35T, 35X, 35Y, 35Z
Signals and Communications	6.4 (136)	4.8 (21)	6.1 (157)	25B, 25C, 25L, 25N, 25P, 25Q, 25S, 25T, 25U, 25W
Transportation	5.9 (125)	6.0 (26)	5.9 (151)	88H, 88M, 88N, 88Z
Military Police	4.9 (105)	6.7 (29)	5.2 (134)	31B, 31E, 31K, 31Z
Chemical Warfare, Explosives and Ammunition	4.1 (87)	8.1 (35)	4.8 (122)	74D, 89A, 89B, 89D
Infantry	5.2 (110)	0.2 (1)	4.3 (111)	11B, 11C, 11M, 11Z
Support and Administration	2.0 (43)	6.7 (29)	2.8 (72)	27D, 36B, 38B, 42A, 42R, 56M, 79R, 79S
Armor	3.1 (65)	0.5 (2)	2.6 (67)	19D, 19K, 19Z
Total	100 (2124)	100 (433)	100 (2557)	139 individual MOSs

musculoskeletal injuries in the 12 months prior to survey administration, divided by the total number of soldiers surveyed. Body area and activity injury variables were calculated as the number of injuries divided by the total number of injuries. A one-way ANOVA and a one way ANOVA with Tukey post hoc tests were used to evaluate statistically significant differences for continuous variables. Chi-square and Chi-square pairwise comparisons with a Bonferroni correction were used to evaluate statistically significant frequency differences. Univariable logistic regression was used to identify associations of MOS, demographics, health behaviours, physical training, physical demand level and physical fitness with musculoskeletal injury risk. A Chi-square was used to identify trends. Variables selected for a multivariable model were known risk factors (e.g., BMI and physical fitness) and additional variables of interest from the univariable model. These variables were entered into a multivariable logistic regression model to assess the association of injury risk with MOS. Odds ratios (OR) and 95% confidence intervals (95% CI) were reported. Results were considered statistically significant at $p \leq 0.05$.

Results

A total of 2124 male (27.9±7.2 years and 26.7±3.5 kg/m^2) and 433 female (26.9±6.8 years and 24.8±2.9 kg/m^2) Soldiers completed the electronic survey. The majority of males (52%) and females (52%) were of lower rank (E1-E4). Twelve-month cumulative

Table 2. Army Combat Fitness Test: minimum passing standards by physical demand level

Physical demand level	Male % (n)	Female % (n)	Total % (n)	IFT ACFT Minimum passing standards	IOC ACFT Minimum passing standards	Military Occupational Specialty (MOS)
Moderate	57 (1208)	52 (225)	56 (1433)	DL 140 lbs SPT 4.6 m HRPU 10 rep SDC 3:35 min LTK 1 rep 2MR 21:07 min	DL 140 lbs SPT 4.5 m HRPU 10 rep SDC 3:00 min LTK 1 rep 2MR 21:00 min	11M, 11Z, 12A, 12H, 12K, 12N, 12R, 12T, 12W, 12X, 12Z, 13J, 13M, 13Z, 14E, 14G, 14H, 14T, 14Z, 15G, 15H, 15K, 15L, 15M, 15P, 15Q, 15Z, 17E,19Z, 25B, 25C, 25N,25P, 25Q, 25S, 25T,25U, 25W, 27D, 31E, 31Z, 35F, 35G, 35L, 35M, 35N, 35P, 35S,35T, 35X, 35Y, 35Z,36B, 38B, 56M, 68A, 68B, 68C, 68D, 68E,68F, 68G, 68H, 68J,68K, 68L, 68M, 68P, 68Q, 68S, 68V, 68X, 68Y, 68Z, 74D, 77W, 79R, 79S, 88Z, 89A,89B, 89D, 91A, 91B, 91C, 91D, 91E, 91F,91H, 91J, 91L, 91M,91P, 91S, 91X, 91Z,92L, 92Y, 92Z, 94D,94E, 94F, 94H, 94S, 94W, 94Y
Significant	22 (467)	34 (147)	24 (614)	DL 160 lbs SPT 6.5 m HRPU 20 rep SDC 2:45 min LTK 3 rep 2MR 19:00 min	DL 180 lbs SPT 6.5 m HRPU 20 rep SDC 2:30 min LTK 3 rep 2MR 19:00 min	12M, 15B, 15D, 15F, 15N, 15R, 15T, 15U, 15W, 25L, 31B, 31K, 42A, 42R, 68W, 88N, 92A, 92F, 92G, 92R,92S, 92W
Heavy	21 (449)	14 (61)	20 (510)	DL 180 lbs SPT 8.5 m HRPU 30 rep SDC 2:09 min LTK 5 rep 2MR 18:00 min	DL 200 lbs SPT 8.0 m HRPU 30 rep SDC 2:10 min LTK 5 rep 2MR 18:00 min	11B, 11C, 12B, 12C,13F, 15Y, 19D, 19K, 88H, 88M, 92M
Total	100 (2124)	100 (433)	100 (2557)			139 individual MOSs

Note: IFT (initial field testing) ACFT and IOC (initial operational capability) ACFT standards were age and gender-neutral. IFT ACFT and IOC ACFT minimum score (point range from 0-100) by physical demand category: Moderate = 60 points per event, Significant = 65 points per event, and Heavy = 70 points per event. DL, 3-Repetition Maximum Deadlift; SPT, Standing Power Throw; HRPU, Hand Release Push-Ups; SDC, Sprint, Drag and Carry; LT, Leg Tuck; 2MR, Two-Mile Run; lbs, pounds; m, metres; rep, repetitions; min, minutes.

Table 3. Demographics, health behaviours, physical training, physical demand level, injury and physical fitness data by Military Occupational Specialty for male respondents

	Overall	Field and Air Defense Artillery	Support and Admin	Signals and Comms	Military Intelligence and Electronic Warfare	Armor	Engineers
Age, BMI, Health behaviours, Physical training and per cent of Soldiers augmented with a battalion medical and fitness team							
n range	1333-2124	106-169	24-42	103-136	82-120	39-65	211-402
Age	27.9±7.2	26.5±6.6	30.4±9.5	28.1±6.8	29.3±7.6	25.7±7.7	25.6±5.8
BMI	26.7±3.5	26.3±3.5	27.1±3.6	26.7±3.5	26.8±3.5	25.8±3.5	26.0±3.3
Sleep (hours/wk)	5.9±1.4	5.8±1.5	5.8±1.3	5.9±1.2	6.0±1.0	6.1±1.6	5.9±1.4
% Smoker	18	26	12	18	14	26	18
Weight training (min/wk)c	96±127	116±160	55±67	109±134	127±133	69±86	84±105
Running (miles/wk)c	7.0±6.8	7.2±7.5	6.2±4.6	7.3±7.1	5.7±4.8	8.1±5.8	7.4±8.4
Foot marching (miles/mth)	5.0±7.9	5.3±6.4	3.9±8.7	3.8±6.6	3.2±5.1	2.6±7.3	6.4±10.1
% Soldiers with a medical and fitness team	81	98	44	24	95	95	99
Physical demand level							
% Heavy	21.1	4.7	0	0	0	92.3	39.3
% Significant	22.0	0	55.8	5.1	0	0	4.0
% Moderate	56.9	95.3	44.2	94.9	100	7.7	56.7
Injury (medical record and self-reported)							
% MR Injury	46	29	35	41	43	45	45
Top three medical record injured body areas							
% Knee	20.3	20.4	13.3	14.3	19.6	24.1	20.6
% Lower Back	18.9	10.2	40.0	19.6	13.7	10.3	20.6
% Ankle	10.5	10.2	13.3	7.1	7.8	10.3	11.7
Top three self-reported injury activities							
% Running	31	24	37	41	32	47	29
% Weight training	18	29	21	16	26	13	14
% Occupational	8	0	0	2	13	0	12
Army Combat Fitness Test							
n range	1426-1569	122-140	27-31	105-116	85-101	38-39	304-327
DL (lbs)	241±58	241±58	232±55	237±63	253±62	221±50	246±56
SPT (m)	9.3±1.7	9.3±1.7	8.9±1.6	9.1±1.9	9.2±2.1	8.7±1.6	9.3±1.7
HRPU (rep)	34.8±10.3	34.5±10.2	31.6±8.5	33.6±9.8	33.9±9.6	39.8±9.7	37.1±8.8
SDC (min)	1.90±0.26	1.89±0.28	1.99±0.25	1.91±0.28	1.90±0.29	1.87±0.18	1.91±0.23
LT (rep)	7.7±5.5	8.0±5.7	5.8±5.3	6.5±5.5	8.5±5.7	9.6±5.4	7.7±5.1
2MR (min)	17.1±2.2	17.0±2.0	17.3±2.2	17.2±1.9	16.9±1.7	17.2±2.2	16.8±2.1
Overall Score (pts)	456±70	458±67	425±91	440±87	454±77	468±49	461±65

Note: [a]ANOVA, [b]Chi-square and [c]Time or mileage ran during personal training, i.e., not unit training. Some survey questions were not answered; therefore, a range of soldiers in each MOS is reported. DL, 3-Repetition Maximum Deadlift; SPT, Standing Power Throw; HRPU, Hand Release Push-Ups; SDC, Sprint, Drag and Carry; LT, Leg Tuck; 2MR, Two-Mile Run; lbs, pounds, m, metres, rep, repetitions, min, minutes, wk, week; mth, month; pts, points.

Transportation	Military Police	Repairer and Maintenance	Infantry	Supply and Logistics	Medical	Chemical Warfare and Explosives Ammunition	p-value
85-125	68-105	258-398	69-110	162-243	71-121	55-87	
27.8±7.8	30.4±7.5	27.9±7.4	29.9±6.7	28.6±7.4	30.6±7.5	27.4±6.4	<0.01[a]
26.9±3.8	27.3±3.4	26.7±3.5	27.7±3.0	27.0±3.6	27.5±3.3	26.5±3.4	<0.01[a]
6.1±1.5	5.8±1.2	6.0±1.4	5.9±1.2	5.9±1.4	5.9±1.3	6.0±1.5	0.86[a]
18	17	22	18	9	17	16	<0.01[b]
57±97	117±138	85±126	140±151	72±108	140±142	93±122	<0.01[a]
7.7±8.3	5.7±5.2	6.3±5.8	6.9±7.1	7.3±6.3	8.4±7.3	7.6±7.2	0.16[a]
6.7±8.5	5.7±7.2	4.3±6.8	9.0±11.1	3.8±7.7	3.9±4.8	4.9±6.0	<0.01[a]
91	63	87	67	82	50	85	<0.01[b]
96.8	0	0.3	90	0.8	0	0	<0.01[b]
0.8	97.1	15.6	0	74.9	60.3	0	
2.4	2.9	84.2	10	24.3	39.7	100.0	
46	47	50	50	52	52	62	<0.01[b]
24.1	22.4	18.6	29.1	20.6	20.6	16.7	0.91[b]
19.0	28.6	18.1	12.7	18.3	23.8	20.4	0.25[b]
15.5	8.2	11.1	12.7	12.7	3.2	7.4	0.75[b]
36	23	33	33	44	16	22	0.03[b]
18	17	18	13	13	24	12	0.28[b]
6	14	7	17	3	9	16	0.03[b]
67-83	88-93	261-270	65-68	134-150	83-89	51-62	
244±54	246±53	230±58	277±56	227±57	249±61	239±69	<0.01[a]
9.5±1.7	9.5±1.5	9.2±1.6	9.9±1.5	9.3±1.9	9.8±1.6	9.4±2.0	0.01[a]
36.8±8.0	35.0±9.5	32.3±10.6	40.2±9.9	32.7±11.1	33.8±13.0	33.2±11.4	<0.01[a]
1.85±0.24	1.88±0.25	1.93±0.25	1.82±0.25	1.95±0.28	1.90±0.30	1.92±0.28	0.02[a]
7.8±5.2	7.6±5.3	6.9±5.1	10.3±5.2	7.5±5.7	7.9±6.0	8.2±6.4	<0.01[a]
17.2±1.9	17.0±1.9	17.5±2.4	16.5±2.1	17.2±2.5	17.5±3.0	16.6±2.1	0.02[a]
464±55	457±71	448±65	491±62	446±71	461±67	457±88	<0.01[a]

Table 4. Demographics, health behaviours, physical training, physical demand level, injury and physical fitness data by Military Occupational Specialty for female respondents

	Overall	Military Intelligence and Electronic Warfare	Support and Admin	Engineers	Transportation
Age, BMI, Health behaviours, Physical training and per cent of Soldiers augmented with a battalion medical and fitness team					
n range	231-420	27-41	21-29	23-46	12-26
Age	27.0±6.8	27.6±6.6	30.9±8.6	24.0±5.9	28.6±7.4
BMI	24.8±2.8	24.6±2.8	24.8±3.3	23.9±2.9	24.8±3.2
Sleep (hours/wk)	5.9±1.4	6.3±1.2	5.7±1.0	6.2±2.1	6.2±1.7
% Smoker	8	5	7	9	8
Weight training (min/wk)c	92±109	91±95	121±175	101±127	51±44
Running (miles/wk)c	5.7±7.9	3.7±3.5	6.6±6.2	5.3±4.4	5.4±5.8
Foot marching (miles/mth)	5.5±8.9	4.5±6.3	5.0±6.9	6.6±10.7	12.5±15.3
% Soldiers with a medical and fitness team	75	98	56	98	81
Physical demand level					
% Heavy	13.8	0	0	73.9	88.5
% Significant	35.0	0	65.5	4.3	7.7
% Moderate	51.2	100	34.5	21.7	3.8
Injury (medical record and self-reported)					
% MR Injury	60	49	52	54	58
Top three medical record injured body areas					
% Knee	19.9	10.0	20.0	40.0	20.0
% Lower Back	14.7	20.0	20.0	8.0	20.0
% Hip	14.3	15.0	13.3	4.0	6.7
Top three self-reported injury activities					
% Running	32	30	43	22	25
% Weight training	21	22	0	17	17
%Foot marching (w/load)	9	9	14	11	0
Army Combat Fitness Test					
n range	231-264	26-29	10	31-35	13-17
DL (lbs)	169±35	163±36	162±53	183±29	183±31
SPT (m)	5.8±1.7	5.5±1.3	6.5±1.5	5.8±1.4	6.0±1.3
HRPU (rep)	24.0±9.6	23.6±10.7	21.3±13.2	28.5±8.6	27.8±6.3
SDC (min)	2.50±0.39	2.48±0.45	2.51±0.49	2.45±0.38	2.38±0.40
LT (rep)	2.0±3.6	2.8±4.4	3.0±6.1	2.3±2.4	1.6±2.3
2MR (min)	18.7±2.0	18.1±1.8	18.7±2.4	18.7±1.8	18.2±1.8
Overall Score (pts)	332±81	336±91	353±92	349±76	328±92

Note: [a]ANOVA, [b]Chi-square and [c]Time or mileage ran during personal training, e.g., not unit training. Some survey questions were not answered; therefore, a range of soldiers in each MOS was reported. DL, 3-Repetition Maximum Deadlift; SPT, Standing Power Throw; HRPU, Hand Release Push-Ups; SDC, Sprint, Drag and Carry; LT, Leg Tuck; 2MR, Two-Mile Run; lbs, pounds; m, metres; rep, repetitions; min, minutes; wk, week; mth, month; pts, points.

Chemical Warfare and Explosives Ammunition	Medical	Military Police	Supply and Logistics	Repairer and Maintenance	Signals and Comms	p-value
15-35	32-57	16-29	52-103	20-33	13-21	
24.7±5.9	27.8±6.4	26.7±5.0	26.1±6.9	28.6±6.4	28.3±6.3	<0.01[a]
24.4±3.2	24.3±2.6	25.1±2.6	25.3±2.8	25.1±2.3	25.8±2.4	0.19[a]
5.9±1.5	5.9±1.2	5.7±1.5	5.8±1.3	5.8±1.4	5.7±1.4	0.18[a]
3	7	17	7	9	24	0.07[b]
105±90	109±120	94±101	74±96	67±79	87±99	0.08[a]
5.3±3.6	7.6±17.7	5.0±4.0	5.1±3.9	7.2±5.3	6.7±3.4	0.66[a]
5.6±10.6	6.3±9.4	6.4±8.4	4.2±8.0	3.7±4.3	2.4±2.8	0.02[a]
94	38	52	87	76	38	<0.01[b]
0	0	0	1.0	0	0	
0	45.6	96.6	64.1	9.1	4.8	<0.01[b]
100	54.4	3.4	35.0	90.9	95.2	
60	61	62	63	67	71	0.68[b]
19.0	17.1	22.2	18.5	18.2	13.3	0.50[b]
9.5	17.1	11.1	18.5	4.5	13.3	0.80[b]
23.8	8.6	16.7	13.8	22.7	26.7	0.48[b]
37	20	35	35	30	58	0.62[b]
32	27	18	28	17	8	0.36[b]
5	7	18	7	13	8	0.16[b]
19-25	30-33	18-24	47-55	20-21	14	
164±25	163±26	185±48	163±26	173±34	154±23	0.02[a]
5.6±1.9	5.7±2.3	6.5±1.7	5.7±2.3	5.5±1.4	5.9±1.4	0.60[a]
23.2±8.0	22.3±7.6	27.3±9.9	22.3±7.6	24.7±12.5	18.9±8.5	0.01[a]
2.62±0.27	2.53±0.38	2.46±0.61	2.53±0.38	2.45±0.32	2.49±0.35	0.83[a]
1.8±3.8	1.0±2.2	3.0±5.6	1.0±2.2	3.2±4.9	1.4±1.7	0.22[a]
18.3±1.4	19.1±1.9	17.8±2.2	19.1±1.9	18.5±2.2	20.2±2.3	0.06[a]
322±74	310±82	364±81	310±82	345±82	344±49	0.25[a]

Table 5. Unadjusted and adjusted odds associated with musculoskeletal injury for Military Occupational Specialty for male respondents

Variable	Variable level	n	% Injury	Unadjusted odds ratio (95%CI)	p-value	n	Adjusted odd ratio (95%CI)	p-value
Age (y)[a]	18-21	446	40	1.00				
	22-25	559	47	1.34 (1.04-1.73)	0.02			
	26-32	583	47	1.34 (1.05-1.72)	0.02			
	≥33	536	51	1.62 (1.25-2.09)	<0.01			
BMI (kg/m2)[a]	≤24.99	663	43	1.00		501	1.00	
	25-27.49	643	42	0.97 (0.78-1.21)	0.80	489	0.88 (0.68-1.14)	0.32
	27.5-29.99	447	50	1.31 (1.03-1.67)	0.03	329	1.26 (0.95-1.68)	0.12
	≥30	356	55	1.61 (1.24-2.08)	<0.01	248	1.43 (1.04-1.97)	0.03
Tobacco	Non-Smoker	1742	47	1.00				
	Smoker	382	43	0.84 (0.67-1.04)	0.11			
Sleep (h/ night)a	≤4	283	60	2.22 (1.56-3.15)	<0.01	193	1.81 (1.17-2.80)	<0.01
	5	498	47	1.29 (0.94-1.76)	0.12	363	1.13 (0.77-1.66)	0.54
	6	666	44	1.16 (0.86-1.56)	0.34	510	1.11 (0.77-1.60)	0.58
	7	437	44	1.16 (0.84-1.59)	0.38	337	1.19 (0.80-1.76)	0.39
	≥8	240	40	1.00		164	1.00	
Foot marching (miles/mth)	None	725	46	1.01 (0.78-1.31)	0.94			
	1-4	347	43	0.87 (0.64-1.18)	0.36			
	5-6	416	43	0.89 (0.67-1.19)	0.44			
	≥7	345	46	1.00				
Weight training (min/wk)	0	378	46	0.92 (0.69-1.25)	0.61			
	1-59	347	42	0.78 (0.57-1.06)	0.11			
	60-150	380	47	0.98 (0.73-1.31)	0.87			
	≥ 151	323	48	1.00				
MOS Group	Field & Air Defense	169	29	1.00		140	1.00	
	Support & Administration	43	35	1.31 (0.65-2.67)	0.45	31	1.28 (0.54-3.00)	0.58
	Signals & Comms	136	41	1.71 (1.07-2.76)	0.03	115	2.18 (1.27-3.72)	<0.01
	Military Intelligence	120	43	1.81 (1.11-2.30)	0.02	101	2.00 (1.14-3.48)	0.02
	Armor	65	45	1.97 (1.09-3.56)	0.02	39	2.48 (1.17-5.22)	0.02
	Engineers	402	45	1.99 (1.35-2.92)	<0.01	327	2.69 (1.73-4.19)	<0.01
	Transportation	125	46	2.12 (1.31-3.44)	<0.01	83	2.78 (1.55-4.98)	<0.01
	Military Police	105	47	2.14 (1.29-3.56)	<0.01	93	2.61 (1.48-4.59)	<0.01
	Repairer & Maintenance	398	50	2.45 (1.67-3.60)	<0.01	270	2.59 (1.64-4.08)	<0.01
	Infantry	110	50	2.45 (1.49-4.04)	<0.01	68	2.38 (1.28-4.44)	<0.01
	Supply & Logistics	243	52	2.64 (1.74-4.00)	<0.01	149	2.88 (1.74-4.77)	<0.01
	Medical	121	52	2.66 (1.63-4.33)	<0.01	89	2.78 (1.57-4.94)	<0.01
	Chemical Warfare	87	62	4.01 (2.32-6.92)	<0.01	62	5.28 (2.76-10.10)	<0.01
Physical demand level	Moderate	1208	47	1.08 (0.87-1.34)	0.49			
	Significant	467	50	1.21 (0.98-1.50)	0.08			
	Heavy	449	45	1.00				
Medical and fitness team	No	393	47	1.03 (0.82-1.28)	0.82			
	Yes	1679	46	1.00				
ACFT total scorea (points)	≤431	421	53	1.56 (1.16-2.09)	<0.01	420	1.54 (1.14-2.09)	<0.01
	432-469	431	44	1.09 (0.81-1.46)	0.56	430	1.09 (0.80-1.47)	0.60
	470-506	397	39	0.89 (0.66-1.20)	0.43	397	0.90 (0.66-1.22)	0.50
	≥507	320	42	1.00		320	1.00	

Note: [a] Linear trend. Variables run in adjusted model: BMI, sleep, MOS and ACFT score. kg, kilogram; m, metre; min, minute; h, hours; wk, week; mth, month; y, years; MOS, military occupational specialty.

Table 6. Unadjusted and adjusted odds associated with musculoskeletal injury for Military Occupational Specialty for female respondents

Variable	Variable level	n	% Injury	Unadjusted odds ratio (95%CI)	p-value	n	Adjusted odd ratio (95%CI)	p-value
Age (y)	18-21	102	54	1.00				
	22-25	114	62	1.41 (0.82-2.43)	0.21			
	26-30	91	60	1.31 (0.74-2.32)	0.36			
	≥31	113	62	1.39 (0.81-2.40)	0.23			
BMI (kg/m2)	≤24.99	217	59	1.00		142	1.00	
	25-27.49	126	51	0.70 (0.45-1.10)	0.12	79	0.84 (0.47-1.50)	0.55
	≥27.5	75	75	2.01 (1.12-3.62)	0.02	41	2.42 (1.07-5.46)	0.03
Tobacco	Non-Smoker	385	59	1.00				
	Smoker	35	66	1.32 (0.64-2.73))	0.45			
Sleep (h/ night)	≤4	59	54	0.54 (0.25-1.13)	0.10			
	5	114	62	0.75 (0.39-1.45)	0.39			
	6	120	57	0.59 (0.31-1.14)	0.11			
	7	66	58	0.61 (0.31-1.27)	0.19			
	≥8	61	69	1.00				
Foot marching (miles/mth)	0	138	58	1.54 (0.87-2.71)	0.11			
	1-4	59	63	1.87 (0.93-3.77)	0.07			
	5-6	56	64	2.01 (0.98-4.09)	0.06			
	≥7	74	47	1.00				
MOS Group	Military Intelligence	41	49	1.00		29	1.00	
	Support & Administration	29	52	1.13 (0.43-2.91)	0.81	10	0.88 (0.19-4.03)	0.46
	Engineers	46	54	1.25 (0.54-2.91)	0.60	35	1.79 (0.64-5.06)	0.27
	Transportation	26	58	1.43 (0.53-3.85)	0.48	16	1.71 (0.47-6.19)	0.42
	Chemical Warfare	35	60	1.58 (0.63-3.92)	0.33	25	2.18 (0.71-6.8)	0.18
	Medical	57	61	1.67 (0.74-3.76)	0.22	32	1.94 (0.68-5.59)	0.22
	Military Police	29	62	1.72 (0.65-4.53)	0.27	24	3.83 (1.16-12.64)	0.03
	Supply & Logistics	103	63	1.80 (0.86-3.73)	0.12	56	1.83 (0.71-4.74)	0.21
	Repairer & Maintenance	33	67	2.10 (0.81-5.42)	0.13	21	3.17 (0.94-10.69)	0.06
	Signals & Comms	21	71	2.63 (0.85-8.11)	0.09	14	1.61 (0.42-6.15)	0.49
Physical demand level	Moderate	215	61	1.24 (0.69-2.23)	0.47			
	Significant	147	61	1.24 (0.68-2.30)	0.48			
	Heavy	58	55	1.00				
Medical and fitness team	No	101	64	1.26 (0.79-2.01)	0.34			
	Yes	302	59	1.00				
ACFT total score (points)	≤291	66	62	2.15 (1.07-4.30)	0.03	66	2.16 (1.03-4.50)	0.04
	292-330	65	62	2.10 (1.05-4.20)	0.04	64	2.23 (1.07-4.64)	0.03
	331-391	66	64	2.29 (1.14-4.60)	0.02	65	2.26 (1.08-4.74)	0.03
	≥392	67	43	1.00		67	1.00	

Note: Variables run in adjusted model: BMI, MOS and ACFT score. kg, kilogram; m, metre; min, minute; h, hours; wk, week; mth, month; y, years; MOS, military occupational specialty.

injury incidence was 46.3% for males and 59.6% for females (overall injury incidence was 48.6%). Therefore, females had a 29% higher risk of being injured compared with males (Risk Ratio 1.29, 95% Confidence Interval, 1.18-1.41, p<0.01)

The percentage of males and females by MOS group and the corresponding self-reported MOSs are reported in Table 1. The percentage of males and females by physical demand categories of moderate, significant and heavy, along with corresponding MOS groups, are reported in Table 2. Additionally, the IFT and IOC ACFT event standards for each physical demand category are displayed in Table 2. Most respondents had a physical demand workload of moderate (106/139 individual MOSs). Approximately 45% of soldiers' most recent ACFT was performed under the IFT ACFT standards and 55% was performed under the IOC ACFT standards.

Age, BMI, health behaviour, physical training, injury, soldiers augmented with a medical and fitness team, physical demand level and physical fitness data by MOS group for male respondents are reported in Table 3. Supplementary Table 1 reports MOS group comparisons of continuous and frequency data. The distribution of males taking the IFT ACFT was 44%, with an average ACFT score of 450±69 points. The distribution of males taking the IOC ACFT was 56%, with an average ACFT score of 460±71 points.

Age, BMI, health behaviour, physical training, injury, soldiers augmented with a medical and fitness team, physical demand level and physical fitness data by MOS group for female respondents are reported in Table 4. Supplementary Table 2 reports MOS group comparisons of continuous and frequency data. The distribution of females taking the IFT ACFT was 49%, with an average ACFT score of 331±75 points. The distribution of females taking the IOC ACFT was 51%, with an average ACFT score of 334±86 points.

Univariable and multivariable logistic regression analyses examining musculoskeletal injury risk for male respondents are reported in Table 5. In the univariable analysis, all MOS groups, compared to Field and Air Defense Artillery (except for Support and Administration group), had 1.7 to 4.0 times higher risk of a musculoskeletal injury. There was a linear trend for injury pertaining to these same variables (age, BMI, sleep and ACFT score; $p < 0.05$; Table 5). In the multivariable analysis, when compared to Field and Air Defense Artillery (except for Support and Administration), all MOS groups had 2.0 to 5.3 times higher risk of a musculoskeletal injury when controlling for BMI, sleep and physical fitness. The multivariable model did not include age due to a significant correlation with BMI ($p < 0.05$).

Univariable and multivariable logistic regression analyses examining musculoskeletal injury risk for female respondents are reported in Table 6. In the univariable analysis, females with the highest BMI and those with lower ACFT total scores had a higher risk of musculoskeletal injury. There were no linear trends for injury in relation to demographics, health behaviours, physical training, MOS group, physical demand level and physical fitness. In the multivariable analysis, when controlling for BMI and physical fitness, the Military Police MOS group had a 3.8 times higher risk of musculoskeletal injury when compared to the Military Intelligence MOS group. The multivariable model did not include age due to a significant correlation with BMI ($p < 0.05$).

Discussion

The current investigation describes demographics, health behaviours, physical training, physical demand level, the per cent of soldiers augmented with a medical and fitness team, physical fitness and injury incidence by MOS group. Additionally, the association between MOS group and musculoskeletal injury risk was explored. Among the MOS groups, there were differences in demographics, physical training, health behaviours, the percentage of soldiers augmented with a medical and fitness team, injury incidence and physical fitness as measured by the ACFT. When controlling for known injury risk factors, the MOS groups of Field and Air Defense, and Military Intelligence had the lowest injury rates for men and women, respectively.

BMI has been shown to increase with age and is associated with physical performance.[22,23] The current investigation found similar relationships between age and BMI among the MOS groups. Regarding physical performance, the Infantry group was the most physically fit (based on ACFT performance) among all the MOS groups yet had the highest average BMI. They did, however, perform the most weight training per week (along with the medical group) and the greatest amount of foot marching per month. It may be that the Infantry Soldiers had more muscle mass and greater amounts of fat mass,[24] but low enough levels of fat mass not to impede physical performance. In addition, higher BMIs were also a risk factor for injury. This is similar to other studies investigating BMI and injury risk.[11,23]

US Army Soldiers are susceptible to sleep inadequacies such as short sleep duration and poor sleep quality.[25] Sleep loss can impair cognition, mental wellbeing and recovery.[26] Habitually sleeping less than seven hours per night increases musculoskeletal injury risk.[6] The current investigation revealed no MOS

group differences but found that ≤4 hours of sleep per night increased musculoskeletal injury risk for male soldiers, as observed in another military study.[6]

Smoking has been associated with higher injury risk, smoking-related illnesses, lower aerobic performance, higher healthcare costs, lost productivity and attrition.[27-33] In the current investigation, male Air and Field Defense and Armor Soldiers reported the highest percentage of smokers at 26%. In the 2020 US Army Health of the Force report, 17% of soldiers reported using smoking products (e.g. cigarettes, cigars, pipes, etc.)[12] It is not known why these specific MOS groups had higher proportions of smokers. However, onsite smoking cessation programs offered through medical facilities and military wellness centres can assist with smoking cessation programs. In addition, smoking did not influence the odds of musculoskeletal injury in this investigation. The literature on smoking and injury risk can be diverse, with some studies showing an increased risk of a musculoskeletal injury among smokers while others show no risk of a musculoskeletal injury.[34 35]

Modifiable factors, such as physical training and fitness level, may be influenced by the addition of a medical and fitness team, personnel turnover, change in leadership intent and the current mission set of a unit. The most notable physical training and fitness (as assessed by ACFT performance) differences between MOS groups were among male respondents. Male Infantry and Medical MOS groups reported the most personal weight training per week, while Support and Administration reported the least weight training per week. Higher amounts of weight training, as seen in Infantry, may be due to the higher physical demands of job duties. With a recent transition to physical fitness testing that includes strength-specific measurements, some units have prioritised strength training and dedicated more time per week to improving strength.

Furthermore, the miles foot marched per month differed between MOS groups. Male Infantry Soldiers reported the highest amount of foot marching per month. This is expected since travelling by foot, manoeuvring and carrying heavy loads is a frequent part of the Infantry mission.[2] Interestingly, female Transportation Soldiers reported the most miles foot marched per month and the least time weight training. The higher foot marching mileage per month may have caused more muscle soreness and fatigue, leading to less personal weight training time for the Transportation group. The Transportation group may have been preparing for an upcoming deployment with more foot marching per month. It has been recommended that carried loads and distance marched gradually increase and that recovery periods allow the body to recuperate from the conditioning stimulus to avoid injury.[36] It is also recommended that other military tasks and physical conditioning programs be considered part of any load carriage conditioning program.[37]

Historically, Infantry Soldiers outperform non-Infantry Soldiers on physical fitness tests.[11] These observations were supported in the current investigation. Infantry Soldiers had the highest performance for each of the six ACFT events, along with the highest overall score.[2] Greater physical–occupational demands would compel a more rigorous physical training program to meet mission requirements. Overall, different mission requirements of each MOS group would influence the frequency, intensity and duration of physical training, thereby influencing physical performance.[38]

Compared to other health conditions, injuries cause significant morbidity among US Army Soldiers, with over two million medical encounters a year.[12,39] Previous studies have also shown higher injury rates for females compared to male service members,[5,15] similar to the current investigation. However, no difference in injury rates among males and females has been shown when controlling for age, body fat, physical fitness and occupational demand.[40] In the current investigation, overall injury incidence (48.6%) was comparable to other US Army operational units, with injury incidence ranging from 35% to 69% over a one-year period.[19,41] The range of injury incidence by MOS group was considerably large and varied from 29% to 62% for males and 49% to 71% for females. Similarly, a Light Infantry brigade of male US Army Soldiers reported a large injury incidence range of 36 to 60% among the different MOS groups.[11] Differences in age, demographics, health behaviours, physical training, physical fitness, environment and mission requirements may provide some explanation of the wide range of injury rates between the different MOS groups.

Similar to previously reported data, leading areas of injury included the knee and lower back for both males and females.[42] Male Field and Air Defense, Armor and Infantry Soldiers had the lowest incidence of lower back injuries and higher than average ACFT fitness performance. In a study of firefighters, higher levels of physical fitness had a significant protective effect against back injuries.[43] Additionally, in a systematic review and meta-analysis, patients with lower back pain had less lower limb strength when compared to healthy controls.[44] Higher fitness levels, including muscular strength, may be protective against lower back injuries.

Lower levels of aerobic endurance running, greater than 20 miles per week, prior injury, older age and elevated BMI have been associated with higher running-related injury risk.[45-47] Contrary to having the lowest running-related injury rate, the Medical MOS group had one of the slowest 2-mile run times, indicative of lower aerobic endurance, compared to the other MOS groups. Even though the number of miles run per week during personal physical training was similar among the MOS groups, the intensity most likely varied between the groups, resulting in different levels of aerobic endurance. The differences in running-related injury rates among the MOS groups may have been influenced by multiple risk factors associated with running-related injuries.[47]

Male Field and Air Defense Artillery Soldiers had the lowest risk of a musculoskeletal injury compared to all other MOS groups (except Support and Administration) when controlling for known risk factors. Field and Air Defense Artillery Soldier demographics, physical training and performance metrics were similar to the overall MOS average metrics. It could be that the Field and Air Defense Artillery's overall mission and moderate physical demand level contributed to their lower injury rates. In a previous study of US Army MOS groups, Infantry Soldiers had the lowest risk of injury compared to other MOS groups.[11] Infantry Soldiers in this previous investigation were the youngest group, had the lowest average BMI and were the most fit. Younger age, lower BMIs and higher aerobic endurance have been shown to be protective against musculoskeletal injury.[5]

Female Military Intelligence and Electronic Warfare Soldiers had the lowest risk of musculoskeletal injury compared to the females in the Military Police MOS group when controlling for known risk factors. Both Military Intelligence and Military Police MOS groups have the same physical demand level of moderate, however, their overall missions are different and may have contributed to the dissimilarities in injury rates. In a previous Air Force Security Forces personnel study, injury incidence was 65% over seven years. The most common injured body areas were the knee and lumbar spine.[48] In a study of Military Police recruits, injury during training was 34.2% for males and 66.7% for females.[49] These previous studies also indicated similar injury rates for Military Police personnel compared to the current study. Injury risk factors specific to Military Police recruits were being older, smoking in the past and those who performed less frequent exercise or sports prior to training.[49]

The current investigation did have limitations. The sample size for female soldiers became small when stratified by MOS groups, leading to lower statistical power. Data obtained from the survey was self-reported, which has the potential for biases or inaccuracies. However, moderate to high correlations have been found between actual and self-reported height and weight, physical training and physical performance.[50,51] A complete understanding of respondents' lifestyles was not obtained. Future studies should include metrics about other behaviours, such as alcohol consumption and medication use. Additionally, future investigations examining MOS group differences should ask about the current deployment cycle status to account for periods of increased occupational duties. The percentage of soldiers augmented with medical and fitness teams varied among the MOS groups, making it difficult to determine their influence on health behaviours, physical training and physical fitness. Future studies should examine soldiers with and without medical and fitness teams to determine the influence on soldiers' health behaviours, physical training and physical fitness. Lastly, the ACFT scoring system was slightly modified during the investigation, but the changes in points by performance event were minimal.

Conclusion

Injuries are the leading threat to health and lost work days in the military services.[52,53] Injury incidence among the MOS groups and physical demand levels varied greatly for males and females. For males, there were also notable differences in age, anthropometrics, health behaviours, physical training and physical fitness between the MOS groups. MOS groups with the lowest injury incidence were males in Field and Air Defense Artillery and females in Military Intelligence and Electronic Warfare. Surveillance of injury incidence and physical fitness, along with health behaviours and physical training by MOS groups, may be used to focus injury prevention strategies and reduce lost work time.

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Supplementary Table 1. Group comparison of Military Occupational Specialty Groups by demographics, health behaviours, physical training, physical demand level, injury and physical fitness data for male respondents

	Field and Air Defense Artillery (A)	Support and Admin (B)	Signals and Comms (C)	Military Intelligence and Electronic Warfare (D)	Armor (E)	Engineers (F)	Transportation (G)	Military Police (H)	Repairer and Maintenance (I)	Infantry (J)	Supply and Logistics (K)	Medical (L)	Chemical Warfare and Explosives Ammunition (M)
Age, BMI, Health behaviours, Physical training and per cent augmented with a medical and fitness team													
Age [a]		F	F	F			-	A, E, F	F	A, E, F	F	A, E, F, I	-
BMI [a]	-	-	-	-			-	F	-	E, F	F	F	-
% Smoker [b]	K	-	-	-	K	-	-	-	K	-			-
Weight training (min/wk) [a]	-		-	G	-			-		B, F, G, I, K		B, F, G, I, K	-
Foot marching (miles/mth) [a]		-				D, I, K	-	-		A, C, D, E, I, K, L			-
% Soldiers with a medical and fitness team	B, C, H, I, J, K, L, M	-	-	B, C, H, J, K, L	B, C, H, J, L	B, C, G, H, I, J, K, L, M	B, C, H, J, L	C	B, C, H, J, L	C	B, C, H, L	C	B, C, L
Physical demand level													
% Heavy [b]	I	-	-	-	A, F, I, K	A, I, K	A, F, I, K	-		A, F, I, K		-	-
% Significant [b]	-	C, F, G, I		-	-			B, C, F, G, I, K, L	C, F, G	-	C, F, G, I	C, F, G, I	-
% Moderate [b]	B, E, F, G, H, I, J, K, L	E, G, H, J	B, E, F, G, H, J, K, L	-		E, G, H, J, K			B, E, F, G, H, J, K, L		G, H	E, G, H, J	-
Injury (medical record)													
% Injury [b]		-	-	-	-	A	-	-	A	A	A	A	A
Top three self-reported injury activities													
% Running [b]	-	-	-	-	-	-	-	-	-	-	L		-
% Occupational [b]	-	-	-	-	-	-	-	-	-	-	-	-	-
Army Combat Fitness Test													
DL (lbs) [a]				-				-		A, B, C, E, F, G, I, K, M		-	
SPT (m) [a]	-	-	-	-		-	-	-	-	E	-	-	-
HRPU (rep) [a]					I, K	I, K	I	-		A, B, C, D, I, K, L, M			
SDC (min) [a]	-	-	-	-	-	-	-	-	-		J	-	-
LT (rep) [a]	-			-	-		-	-		B, C, F, I, K		-	-
2MR (min) [a]	-	-	-	-	-		-	-	F	-	-	-	-
Overall Score (pts) [a]	-			-	-	-	-	-		B, C, I, K		-	-

Note: A=Field and Air Defense Artillery, B=Support and Administration, C=Signals and Communications, D=Military Intelligence and Electronic Warfare, E=Armor, F=Engineers, G=Transportation, H=Military Police, I=Repairer and Maintenance, J=Infantry, K=Supply and Logistics, L=Medical, M=Chemical Warfare and Explosives Ammunition. a The mean difference is significant at the 0.05 level (MOS in column header vs corresponding MOS designated letter) using a one-way ANOVA with a Tukey post hoc test. For each significant pair, the letter with the smaller category appears in the category with the larger mean. b Frequencies differences are significant at the 0.05 level (MOS in column header vs corresponding MOS designated letter) using chi-squared pairwise comparisons with a Bonferroni correction. For each significant pair, the letter with the smaller column proportion appears in the category with the larger column proportion. -, represents no significant difference or no comparisons because the column proportion is equal to zero; min, minutes; wk, week; mth, month; lbs, pounds; m, metres; rep, repetitions; pts, points.

Supplementary Table 2. Group comparison of Military Occupational Specialty Groups by demographics, physical demand level and physical fitness data for female respondents

	Military Intelligence and Electronic Warfare (A)	Support and Admin (B)	Engineers (C)	Transportation (D)	Chemical Warfare and Explosives Ammunition (E)	Medical (F)	Military Police (G)	Supply and Logistics (H)	Repairer and Maintenance (I)	Signals and Comms (J)
Age, Physical training and per cent augmented with a medical and fitness team										
Age [a]	-	C, E, H		-		-	-		-	-
Foot marching (miles/mth) [a]	-	-	-	H, I, J	-	-	-			
% Soldiers with a medical and fitness team	B, F, G, J		B, F, G, J	F	B, F, G, J			B, F, G, J	F	
Physical demand level										
% Heavy [b]	-	-	H	H	-	-	-		-	-
% Significant [b]	-	C, D, I, J			-	C, D, I, J	C, D, F, H, I, J	C, D, I, J		
% Moderate [b]	-				-	C, D, G		D, G	B, C, D, F, G, H	B, C, D, F, G, H
Army Combat Fitness Test										
DL (lbs) [a]	-	-	-	-	-	-	-	-	-	-
HRPU (rep) [a]	-	-	-	-	-	-	-	-	-	-

Note: A=Military Intelligence and Electronic Warfare, B=Support and Administration, C=Engineers, D=Transportation, E=Chemical Warfare and Explosives Ammunition, F= Medical, G=Military Police, H=Supply and Logistics, I=Repairer and Maintenance, J=Signals and Communications.. [a] The mean difference is significant at the 0.05 level (MOS in column header vs corresponding MOS designated letter) using a one-way ANOVA with a Tukey post hoc test. For each significant pair, the letter with the smaller category appears in the category with the larger mean. [b] Frequencies differences are significant at the 0.05 level (MOS in column header vs corresponding MOS designated letter) using chi-squared pairwise comparisons with a Bonferroni correction. For each significant pair, the letter with the smaller column proportion appears in the category with the larger column proportion. -, represents no significant difference or no comparisons because the column proportion is equal to zero; min, minutes; wk, week; mth, month; lbs, pounds; m, metres; rep, repetitions; pts, points.

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