U.S. ARMY PUBLIC HEALTH CENTER

TIP No. 12-119-0121

STRENGTH TESTS IN ARMY FITNESS TRAINING AND ASSESSMENT OF A PILOT PROGRAM

This information paper documents a U.S. Army Public Health Center (APHC) public health investigation involving strength tests used in a physical training (PT) program designed to improve Soldiers' strength and reduce musculoskeletal injury (MSKI) risk. Though the project was terminated prior to completion due to participation restraints, baseline findings in conjunction with other relevant evidence provide useful considerations for the use of strength tests in military settings.

1. STRENGTH TESTING IN THE ARMY

- Since 1980, the U.S. Army's mandatory standard physical fitness assessment test was the Army Physical Fitness Test (APFT). The APFT included a 2-mile run, a 2-minute push-up test, and a 2-minute sit-up test; these tests measured cardiovascular and muscular endurance.[1,2] Strength itself was not tested, though strength training was encouraged as a part of Soldiers' physical readiness training.[3]

- Prior to 2020, only one set of standardized Army test protocols had been established to measure strength: the two Army Wellness Centers' (AWC) static strength tests (SSTs) of the back and handgrip.[4] There was a gap in data regarding the potential value of dynamic strength tests (DSTs) in Army applications.

- In October 2020, revised doctrine[5] established the Army's new physical fitness test (i.e., the Army Combat Fitness Test [ACFT]) which includes six tests (the three-repetition maximum deadlift, the standing power throw, the hand-release push up, the sprint-drag-carry, the leg tuck, and the 2-mile run) to more broadly assess different components of fitness, including strength.

- An APHC systematic review of the literature identified a variety of strength tests that had been used in military and occupational settings to evaluate fitness and physical task performance capabilities.[1,2] These included versions of both static and dynamic strength tests grouped by body areas assessed. The review identified several moderate-to-strong correlations between types of strength tests and military task performance, especially with lower body strength. The review supported further evaluation of test protocols that measure strength among Soldiers.

- Other scientific studies have also provided evidence of a relationship between static and dynamic strength testing.[6,7] One systematic review in particular has highlighted agreements between some isometric testing parameters and dynamic performance parameters.[7]

2. ASSESSMENT OF A UNIT- DEVELOPED PROGRAM

- In the decade prior to implementation of the ACFT, many Army units had implemented their own strength testing and training programs to enhance the APFT training. These programs were intended to improve performance, in part by increasing muscular strength and decreasing injury incidence. Specific quantified evidence of the effectiveness of programs, however, was not available.

- To address this gap in evidence, between 2016 and 2018 the Maneuver Center of Excellence (MCoE), Fort Benning, Georgia had requested that the APHC evaluate its Tactical Athlete Performance (TAP) program and associated TAP Assessment tests (TAP-A).[8,9]

- The TAP-A tests included three DSTs—the Squat, Deadlift, and Pull-ups—and measured height and weight to calculate Body Mass Index (BMI) (Appendix A). It also included several tests administered as part of the standard AWC physical fitness assessment protocol (Appendix B) including a sub-maximal aerobic capacity (VO_2) treadmill test, the two SST assessments (Back strength test and Grip strength test) and the flexibility sit-and-reach test. Though not a routine AWC test, the Leg strength assessment was an additional SST performed by the AWC on those participating in the TAP-A evaluation.

3. APHC TAP-A EVALUATION

The APHC began its evaluation of the MCoE's TAP-A program in November 2018. The primary objective was to assess the program's impact on Soldiers' strength over 8 weeks and their risk for MSKI over 6 and 12 months. The initiative was approved as public health practice (APHC Injury Prevention Division, Office of Human Protections [OHP] #18-630) in support of the AWC Program Evaluation (PHRB #253-13).

Because of low participation in the TAP-A program and very limited follow-up testing, the evaluation was terminated by mutual agreement between APHC and staff at Fort Benning in March of 2019. However, baseline demographics and personal characteristics of TAP-A participants, injury incidence, and correlations between the TAP-A DSTs and the AWC SSTs were obtained and described in the current paper.

a. Self-report survey data

- The project included the development of a survey with input from a National Strength and Conditioning Association (NSCA) certified strength and conditioning specialist (CSCS) at the Fort Benning AWC (Appendix C).
- Data collected from the survey (administered August 2018 to March 2019) included baseline demographics, height and weight, smoking status, fitness training scores, and injury data.
    - Height (in.) and weight (lb.) were first converted to metric units (m and kg, respectively) to calculate BMI. BMI was subsequently calculated by dividing body mass (kg) by height squared (m^2), (BMI = kg/m^2), and then categorized according to the Centers for Disease Control and Prevention (CDC) classifications for "underweight" (<18 kg/m^2), "normal" or "healthy weight" (18-24.9 kg/m^2), "overweight" (25-29.9 kg/m^2), and "obese" (>30 kg/m^2).
    - Underweight and normal weight categories were combined due to low numbers of individuals considered "underweight."
    - Smokers were defined as individuals who smoked cigarettes in the last 30 days and have smoked at least 100 cigarettes in their lifetime.

- Injury was defined for survey participants as “damage or pain to a muscle, joint, bone, or nerve that made it more difficult to work, do PT, or perform other activities” that had occurred in the previous 6 months. More specific questions were then asked about their most serious, duty-limiting injury experienced.

b. Field-collected data

Height, weight, and fitness test results were obtained onsite by the CSCS and AWC staff. The survey was completed at the time of the TAP-A administered by the CSCS. The AWC assessment was administered by the AWC staff approximately 1 week prior to the TAP-A. .

For the TAP-A Assessment (Appendix A) -

- Prior to conducting the DSTs, the CSCS used three selected Functional Movement Screen (FMS-M) tests to determine if the participant would perform either the standard DST protocol, with a barbell, or a modified protocol - consisting of a kettlebell goblet squat and hex bar deadlift. The CSCS scored the DSTs per guidelines put forth by the NSCA.
  - The Squat DST and Deadlift DST were recorded as total volume-load performed during the maximal effort set (pounds lifted x repetitions).
  - The tests were dichotomized as “pass” and “fail.” In order to pass each test, the participant had to successfully squat a load equal to their bodyweight for three repetitions and successfully deadlift a load equal to their bodyweight plus 50 pounds for three repetitions.
  - The Pull-up DST was recorded as the number of pull-up repetitions.
  - For the FMS-M, if pain was present, the individual automatically scored zero points for that particular test;
    - One point was given if the individual could not complete the proper movement and was pain-free;
    - Two points were given if the movement was performed with some difficulty and was pain-free; and
    - Three points were given if the movement was performed as instructed with no difficulty or compensation and was pain-free .[10]

- For the AWC tests, including the additional leg strength test (Appendix B) -
  - The VO_2 Exercise Test was recorded in milliliters of oxygen per kilogram of body mass per minute (mL/kg/min).
  - The SSTs were measured as pounds (lb) for the Back SST and Leg SST, and as kilograms using a handgrip dynamometer for the Grip SST. From all the SST results, a relative strength score (RSS) was computed, following guidelines from Heyward & Gibson (2014): (grip strength * back strength * leg strength) / body mass [lb].
  - The sit-and-reach flexibility test was recorded in inches.

c. Data analyses

Data were de-identified and aggregated as part of the APHC program evaluation deemed public health practice. Only participants who reported ≤ 1,440 minutes/week of total PT were included in analyses to censor responses in excess of plausible amounts of exercise. Participants were stratified by sex before analysis of demographics and outcomes.

- Continuous variables were described by mean ± standard deviation and compared between groups by an independent t-test. Categorical variables were described using frequencies and compared between groups using a chi-square test.

- Injury incidence was calculated by the number of participants who experienced an injury in the 6 months prior to program participation divided by all TAP-A participants. The TAP-A DST (Squat, Deadlift, Pull-ups) results were compared to the SST results (Back, Leg, and Grip strength, and resulting RSS) using a Pearson correlation.

- Findings were deemed statistically significant at an alpha level of 0.05, except in the case of correlation coefficients where a Bonferroni correction was used to adjust for multiple comparisons and therefore statistical significance of correlations were assessed against an alpha level of 0.003 (0.05 initial alpha / 18 comparisons = 0.003), as a conservative way to account for potential Type 1 error.

- The strength of the correlations were interpreted using a previously established correlation scale: $0.70 \leq r < 1.0$ very strong; $0.50 \leq r < 0.7$ strong; $0.40 \leq r < 0.5$ moderate; $0.30 \leq r < 0.4$ fair; $r < 0.3$ weak.[1]

- Statistical Analysis System (SAS®), Version 9.4 was used to conduct all statistical analyses.

d. Findings

- Demographics of participants in the public health investigation are displayed in Appendix D, Table 1. These data show similarities with findings of other recent studies of Soldiers.[11,12]

    - A total of 217 Soldiers (men =199; women=18) were included in the assessment. The majority were male (92%), considered overweight or obese with a BMI ≥25 $kg*m^2$ (82%), and were non-smokers (90%).
    - Both men and women had a mean age of about 30 years old and averaged approximately 6 hours of sleep per night.
    - Most Soldiers had a Military Occupational Specialty requiring “heavy” physical demands (72% overall; 73% of men and 17% of women; $p < 0.0001$).

- Physical training characteristics of participants, stratified by sex and shown in in Appendix D, Table 2, also showed similarities with other Soldier studies.[13,14]

    - The rate of participation in PT was near 100% (this would be unit PT or personal PT or both), with men averaging 564 (± 392) minutes (9.4 hours) per week and women averaging 434 (± 373) minutes (7.2 hours), with no difference between men and women (p=0.19).
    - Among both sexes, the majority of PT time was devoted to running and resistance training, however men averaged around 100 more minutes of resistance training per week than women ($p = 0.01$).
    - Other PT was also significantly different between men and women ($p = 0.01$), which included activities such as swimming and biking.

  - Personal foot marching time was lower than unit foot marching for men, while the opposite was true for women. Both unit and personal foot marching was performed about twice per month among those reporting foot marching. Unit and personal foot marching mileage was the same for men, as were their reported external loads (6.0 vs. 6.1 miles and 40.7 vs. 46.7 lb). Women reported further distances and lighter loads for unit foot marching than for personal (7.2 vs. 4.8 miles and 27.9 vs. 43.1 lb).

- Injury characteristics of participating Soldiers are shown in Appendix D, Table 3. Findings were consistent with that of other relevant Soldier injury studies and reviews.[15-17]

  - 45% of Soldiers experienced an injury in the prior 6 months with no discernable difference between men and women (44.7% of men and 44.4% of women; $p = 0.95$).
  - The most common types of injuries included overuse muscle pain, sprains, and strains. The primary body areas effected were the lower back, knee, and shoulder.
  - Running and resistance training were the most common PT activities associated with injury among both sexes.
  - Overuse was the most commonly reported mechanism of injury in both men and women.
  - A higher percentage of women saw a medical professional for their injury (87.5% vs. 71.9%) and had a higher percentage of injuries that resulted in a profile (57.1% vs. 51.6%), although neither difference was statistically significant.
  - Of those placed on profile because of their injury, women averaged 89 limited duty days while men reported an average of 27 limited duty days per injury ($p = 0.21$).

- Fitness test results are displayed by sex in Appendix D, Table 4. As with other findings, data were in line with results of other pertinent studies .[18,19]

  - For the TAP-A DSTs, men passed the back squat at a rate of 36% and deadlift at 37%, compared to a rate of 5.6% for women on both events ($p = 0.009$).
  - Accordingly, men averaged significantly higher back squat and deadlift volumes and pull-up repetitions compared to women ($p \leq 0.02$).
  - 4.5% of men were required to perform the alternative DST protocol using kettlebells, whereas no women required alternative DSTs.
  - For the SSTs, men exhibited a higher level of muscular strength than women on back, leg, and grip SSTs, as well as the RSS ($p < 0.0001$).
  - With regard to flexibility, women outperformed men by about 3 inches ($p = 0.009$) on the sit-and-reach test. This suggested increased flexibility among women.

- Correlations between TAP-A DSTs and SSTs are shown in Appendix D, Table 5. Given the small sample population, all participants (n=217, men =199 and women =18) were included in Table 5. Though the strength of some correlations were moderate-to-strong among women (i.e., between the computed SST RSS and the Pull-up DST; r=0.58), the significance could not be demonstrated given the small sample. However, several correlations among men were found to be significant:

  - Correlations between Back SST and Leg SSTs and the Squat DST and Deadlift DST, and between the Deadlift DST and Grip SST were considered fair *(r*= 0.34-0.38, $p<0.05$).

- The strongest correlation between DSTs and SSTs was between the computed SST RSS and the Pull-up DST, which was considered moderate (r=0.46). The Pull-up DST otherwise had weak correlations to the individual SSTs.
- Results also showed significant and strong correlations between the Back SST and Leg SST (r = 0.69) and between the Deadlift DST and Squat DST (r=0.54). Significant and moderately strong correlations were shown between Grip SST with the Back SST and Leg SST.

4. FUTURE CONSIDERATIONS

- Evidence from the literature as well as the baseline data from the TAP-A public health investigation suggest that both the DSTs and SSTs evaluated have value as measures of strength among Soldiers. Though limited, baseline findings show consistencies with prior APHC studies, suggesting some data validity.

- Findings suggest not all the tests may needed to represent a metric for Soldier strength. For example, the similarities between the Deadlift and Squat DST correlations, support the inclusion of only one of these tests (the Deadlift) in the current ACFT. Though SSTs may seem more limited, individual strength maybe represented by use of at least two such as the AWCs back and handgrip SSTs.

5. DISCLAIMER

The mention of any non-federal entity and/or its products is not to be construed or interpreted, in any manner, as federal endorsement of that non-federal entity or its products.

6. REFERENCES

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APPENDIX A

Tactical Athlete Performance Program and Assessment Testing

The Maneuver Center of Excellence (MCoE) describes the Tactical Athlete Performance Program and Assessment (TAP-A) testing and exercise prescription session as requiring approximately 90 minutes to complete. TAP-A participants performed TAP-A the week following Army Wellness Center testing (Appendix B). All equipment and testing related to the evaluation were located and completed in the MCoE testing area within the AWC. The TAP-A included three Dynamic Strength Tests (DSTs) as well as measured height and weight used to calculate Body Mass Index. A modified Functional Movement Screen (FMS-M) was also included as a means to select DSTs.

Dynamic Strength Testing (DST)

A linear position transducer (LPT; manufacturer: Gymaware, Kinetic Performance, Winchcombe Ct, Canberra ACT 2602, Australia) was used to conduct these tests. This device was floor-mounted (25x21x10cm) with a tether that originated from the unit and attached to a standard barbell. The LPT was interfaced with commercially available software and a computer tablet from the manufacturer. This software allowed trained AWC personnel to obtain maximal strength during the Back squat and Deadlift DSTs with validated outcomes to include power, force, and velocity components.

During all DST, the certified strength and conditioning specialist (CSCS) followed guidelines put forth by the National Strength and Conditioning Association (NSCA). The proper lifting form and technique, and what criteria constituted a “successful attempt,” were instructed by a trained AWC staff member (that held a CSCS certification from NSCA). The purpose of these tests was to gauge the dynamic strength of the Soldier, not to fatigue them. Safety was enhanced by having each tested Soldier perform movements in a squat rack, where the movement was normalized to the Soldiers’ height, and range of motion limited to the effective tested range. All DST equipment to include weights, barbells, and cages were commercially-available (Sorinex, Inc, Lexington, SC).

Back Squat: The back squat DST measured lower body strength and was estimated to take around 15 minutes to complete. The participant performs a 3-to-5-minute warm-up and then 3 repetitions of half their body weight followed by a 90 second rest period. If successful, they then attempt 3 repetitions lifting their body weight. If determined unable to use the barbell, the participant then performs an alternate squat with kettlebells as follows: 40lb X 3 repetitions (90 second rest), then if successful, 50lb X 3 repetitions (3 minute rest) and then if successful, 60lb X 10 repetitions.

Deadlift: The deadlift DST measured lower body strength and was estimated to require about 15 minutes to complete. The participant first performs a warm-up and then 3 repetitions of half their body weight, followed by a 90-second rest period. If successful, they perform 3 repetitions of their body weight followed by a 3 minute rest period. If successful, they attempt 3 repetitions of lifting their body weight plus 50 lb. If unable to use a barbell, participants perform an alternate suitcase deadlift with kettlebells as follows: 40 lb. X 3 repetitions (90 second rest), then if successful, 50 lb. X 3 repetitions (3 minute rest) and then if successful, 60 lb. X 10 repetitions.

Pull-Ups: With hands facing outward, the Soldier performs as many pull-ups on a bar as they can with no time component. Movement of the legs, particularly in a kicking motion, is not allowed. This assessment requires about 2 minutes to complete.

Modified Functional Movement Screen (FMS-M).
Though not a focus of the U.S. Army Public Health Center's TAP-A assessment, the MCoE selected to use an abbreviated Functional Movement Screen (FMS) test (3 tests instead of 7): overhead squat, lying leg raise, and shoulder mobility test to decide whether the participant should be assessed on the DSTs using a barbell or kettle bells. The FMS was intended to demonstrate movement limitations or asymmetries and is not intended to diagnose any existing injury, orthopedic problem, or specific musculoskeletal limitation. The FMS required about 15 minutes to complete.

Appendix B

AWC Physical Assessment Tests

The standard Army Wellness Center (AWC) physical fitness assessment takes approximately 60-90 minutes to administer. This assessment included the tests described below: sub-maximal aerobic capacity (VO_2) treadmill test, the Standard Static Strength Tests (grip strength and back strength), and a flexibility test (sit-and-reach test). Also described is the leg strength SST conduct by AWC for purposes of the TAP-A public health study. More information about AWC exercise testing and procedures can be found in the AWC Procedure Guide.[5] Additional details on AWC testing are also provided at:

- https://iphc.amedd.army.mil/SiteDirectory/AWCTH/Training/Physical%20Fitness/PFET104%20Physical%20Fitness%20Muscular%20Fitness%20and%20Flexibility.pdf#search=physical%20fitness%20exercise%20testing

- https://iphc.amedd.army.mil/SiteDirectory/AWCTH/Training/Physical%20Fitness/PFET103%20Physical%20Fitness%20VO2%20Submaximal%20Testing.pdf#search=physical%20fitness%20exercise%20testing

Sub-maximal aerobic capacity (VO_2) Exercise Test (Treadmill)

Maximal aerobic capacity (e.g., maximal oxygen consumption (VO_{2max})) was estimated using a treadmill (TMX428CP®, Cosmed, CA. USA) interfaced with a real-time gas analysis system (Fitmate®, Cosmed, CA. USA) to measure O_2 and CO_2 production during a sub-maximal exercise protocol. The Soldiers were outfitted with a heart rate monitor to capture heart rate (HR) and a mask to collect gas exchange. The treadmill had speed or incline adjusted to increase subject workload while HR and VO_2 and other respiratory factors were measured at each sub-maximal exercise stage. Fitmate software estimated VO_{2max} from submaximal data and age-predicted HR. The test was terminated using several criteria: reaching 85% of age-predicted HR or extremely high rating of perceived exertion (RPE), failure to conform to protocol, adverse signs or symptoms, or a request to stop for any other reason.

Static Strength Testing (SST)

***Grip Strength*:** A handgrip dynamometer (GRIP A®, Takai, Japan) was used to assess grip strength. The base of the dynamometer was rested on the heel of the participant's palm, and the handle was adjusted so that the handgrip size was in a comfortable position for the participant (handle should rest on the middle of 4 fingers). Participant was able to conduct test standing or seated, with shoulder abducted, elbow flexed to 90 degrees, forearm in neutral rotation, and wrist 0-30 degrees extension. Participant was asked to squeeze as hard as they could for "one brief maximal contraction" without extraneous body movement. Three trials in each hand are administered, with 1 minute rest in between. The highest score in each of three trials in each hand was added together and recorded in kilograms. Grip strength tests that use dynamometers have been shown to provide valid measurements of grip strength (Hamilton, McDonald, and Chenier, 1992). The outcome measurement for this was maximal handgrip strength.

Back Strength: A dynamometer (T.K.K. 5002®, Takai, Japan) with handlebar & chain in conjunction with the Heyward Protocol[20] were used to assess static back strength. Client stood with trunk erect on dynamometer platform. Participant held handlebar with a pronated grip; knees are flexed to 15-20 degrees and hips are flexed 25-30 degrees so the handlebar rests across the thigh. Client kept back straight and head up. Chain was adjusted to ensure slack was taken out. Client was instructed to lift handlebar straight upward using the back muscles and rolling their shoulders backward during the test. Client was instructed not to lean backward or thrust their hips forward. Client performed two submaximal trials so equipment could be adjusted as needed. Client then performed two maximal trials with 1 minute rest in between. The maximum effort of the two trials was recorded in pounds. Back strength tests that use dynamometers have been shown to provide valid measurements of back strength (Coldwells, Atkinson, and Reilly, 2007). The outcome measurement for this was maximal strength value obtained using the dynamometer.

Leg Strength*: A dynamometer (T.K.K. 5002, Takai, Japan) with handlebar & chain in conjunction with the Heyward Protocol[20] are used to assess AWC clients' leg strength. Client stands on the platform with trunk erect and the knees flexed to an angle of 130 to 140 degrees. The client holds the hand bar using a pronated grip and positions it across the thighs by adjusting the length of the chain. Without using the back, the client slowly exerted as much force as possible while extending their knees. The outcome measurement for this was maximal strength value obtained using the dynamometer across two trials.

* NOTE: This test is not part of the standard AWC test protocol but was an additional SST conducted by participants of the TAP-A study.

Flexibility Testing (FT)

Sit-and-Reach: A bend and reach box (Novel Flex-tester®, Novel Products, Inc., Rockton, IL) was used to assess AWC clients' flexibility. Client removed their shoes and sat on floor with legs together, knees extended, and soles of feet placed against the inside of the Flex Tester box. Client was instructed to reach forward slowly and as far as possible along the top of the box while keeping the two hands parallel, and to hold this position momentarily. Clients' knees were not to flex and clients were not to lead with one hand. Client reached with both hands, one on top of the other, for most distant point possible for a total of three trials. The most distant point reached across three trials was recorded in inches. The sit-and-reach test has been shown to provide a valid measure of hamstring flexibility (Liemohn, Sharpe, and Wasserman, 1994). The outcome measurement for this was the distance measured.

Appendix C

Survey Questionnaire for APHC TAP-A Evaluation

TIP No. 12-119-0121

On behalf of the Maneuver Center of Excellence (MCoE), the U.S. Army Public Health Center (APHC) invites you to participate in the Tactical Athlete Program Assessment for Active Duty Soldiers. Our goal is to help inform future policy decisions by MCoE and other Army leaders interested in combining standard AWC capabilities with command or location-specific augmentation to existing physical training programs. Your participation is requested to help us achieve this goal.

If you agree to participate, we will: 1) collect some basic background/administrative information about you in this survey; 2) obtain your DOD ID number in order to link your survey information with other data; and 3) pull your Army Physical Fitness Test (APFT) scores and injury related medical records from 6 months prior and 6 and 12 months after survey completion. We need this information to compare responses and identify trends in injury data as it relates to the Tactical Athlete Program.

To protect your identity: 1) all paper files will be shredded after scanning; 2) we remove DOD ID numbers and name after data are linked; 3) all electronic data will be password protected; 4) all data transferred by an encrypted e-mail; 5) all data is stored on a secured network;. and 6) only group (aggregate) responses will be reported. Your individual responses will never be reported. We are not assessing or reporting the health and fitness of any single individual.

The survey will take approximately 10 to 15 minutes and must be completed in one sitting. Please reserve sufficient time to complete the survey. You may be asked to complete additional follow up surveys in 8 weeks, 6 months and 1 year. The 6-month and 1 year follow up surveys will be sent electronically. Your participation in the follow-up surveys is also voluntary.

Your participation in this survey is voluntary, and you may withdraw your consent to link your survey data and medical records at any time, without consequences. If you have any questions about the survey, use of your data, or wish to opt out at any time in the future, please e-mail the Injury Prevention Program, APHC at usarmy.apg.medcom- phc.mbx.injuryprevention@mail.mil. You may also contact the APHC Human Protection Administrator at (410) 417.2611.

PRIVACY ACT STATEMENT – HEALTH CARE RECORDS, FITNESS TEST SCORES, AND QUESTIONNAIRE

1. AUTHORITY FOR COLLECTION OF INFORMATION INCLUDING SOCIAL SECURITY NUMBER

Public Law 104-191, Section 1178; Executive Order 9397; Section 8103, Title 5, United States Code; DoD 6025.18, DoD Health Information Privacy Regulation, December 2, 2009; DoD 6025.18R, Privacy of Individually Identifiable Health Information, January 24, 2003; AR 40-5, Preventive Medicine, 26 May 2007

2. PRINCIPLE PURPOSES FOR WHICH INFORMATION IS INTENDED TO BE USED

The primary use of this information is to evaluate the Maneuver Center of Excellence (MCoE) Tactical Athlete Program. We hope to determine if dynamic strength is associated with medical and physical readiness. This survey requests information on current physical fitness activities, sleep, tobacco use and previous or current injuries.

We will need to obtain your DOD ID number in order to link your survey information with other data such as Army Physical Fitness Test (APFT) scores and injuries from your medical records. The information obtained from your medical records will only be on musculoskeletal injuries occurring over an 18 month period. The 18 month period will go back 6 months and forward 12 months from the survey date. No other medical information other than this will be obtained. Using your DOD ID number is the only way we can do this.

To protect your identity, we strictly limit access to your information including your DOD ID number by shredding all paper files after scanning, having all electronic files on a secure network that is password protected, and removing DOD ID numbers and name after data are linked.

3. ROUTINE USES

The data obtained from the questionnaires will be included in a database that contains the same information for all Soldiers participating in this project. You will not be personally identified in any report or any output of any type since the interest is in the health and fitness of the Unit and not the health and fitness of any single individual.

The database that is established will identify current levels of fitness, injury rates, injury trends, and factors that lower Soldiers' risk of injury and enhance fitness. The database will be used to make recommendations to decision makers regarding programs and policies that could improve fitness and reduce the incidence of injury.

4. WHETHER DISCLOSURE IS MANDATORY OR VOLUNTARY AND EFFECT ON INDIVIDUAL OF NOT PROVIDING INFORMATION

Your participation in this survey is voluntary, and you may withdraw your consent to link your survey data and medical records at any time, without consequences. If you have any questions about the survey, use of your data, or wish to opt out at any time in the future, please e-mail the Injury Prevention Program, APHC at usarmy.apg.medcom- phc.mbx.injuryprevention@mail.mil
You may also contact the APHC Human Protection Administrator at (410) 417.2611.

By volunteering to participate in this evaluation, the APHC Injury Prevention Division team will be able to further improve the health and fitness of Soldiers by evaluating injury occurrence and injury reduction strategies.

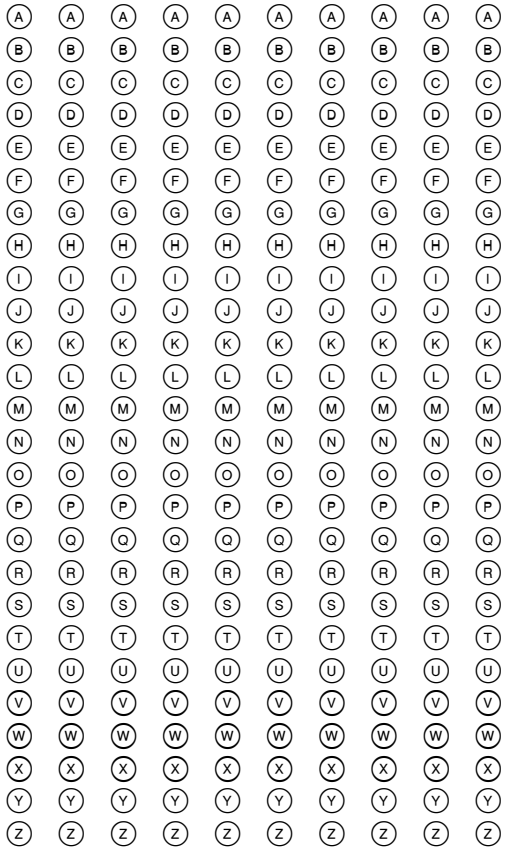
SIGNATURE OF PARTICIPANT	DATE

TACTICAL ATHELE PROGRAM ASSESSMENT (TAP-A) BASELINE SURVEY

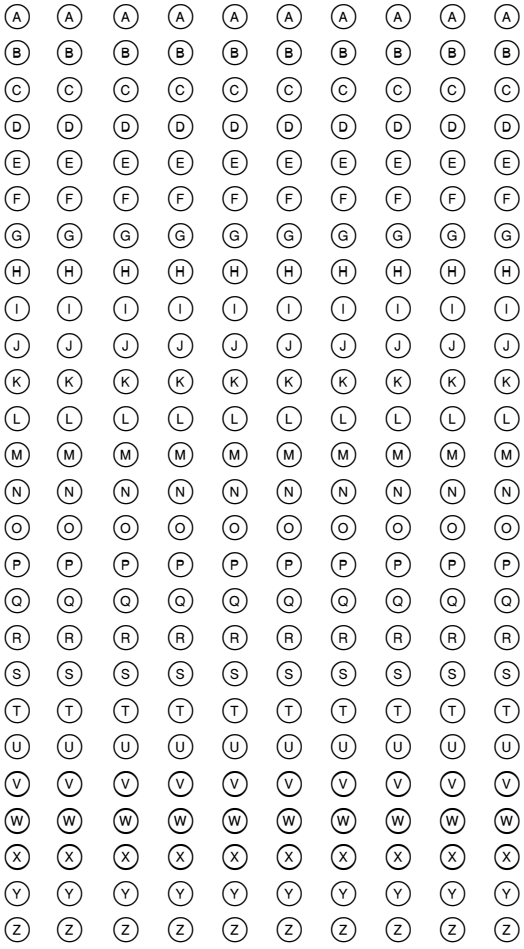
Background Details

Directions: Please carefully read the directions for each section. Be sure to darken bubbles completely. Do not use checks or "x's or special characters" to fill in the bubbles. Please be sure to write legibly where a written answer is required.

Last Name

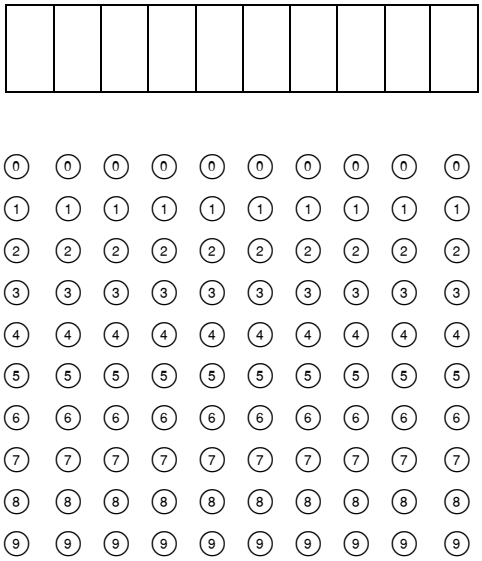


First Name

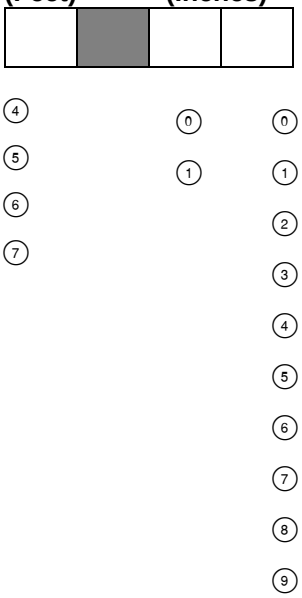


Background Details

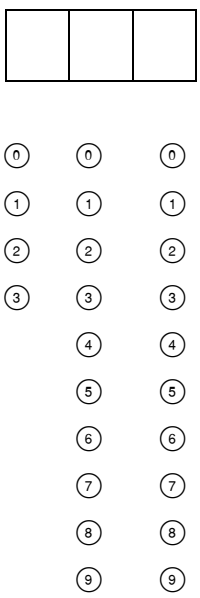
DOD ID Number:



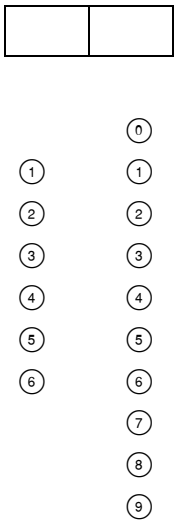
HEIGHT:
(Feet) (Inches)



WEIGHT: (lbs)



AGE



Background Details

1. Today's date: |___|___| / |___|___| / |___|___|___|___|
DAY MONTH YEAR

2. Are you… ⓪ Male ① Female

3. What is your component? ① Regular Army ② Army Reserve ③ National Guard

4. When did you in-process with your current Battalion? |___|___| / |___|___|___|___
MONTH YEAR

5. What is your current Battalion? _____

6. What is your company, troop, battery or FSC? _____

7. What is your Military Occupational Specialty (MOS) (e.g. 11B)? _____

8. What is your rank?

① E1 ② E2 ③ E3 ④ E4 ⑤ E5 ⑥ E6 ⑦ E7 ⑧ E8 ⑨ E9

⑩ O1 ⑪ O2 ⑫ O3 ⑬ O4 ⑭ O5 ⑮ O6

⑯ W1 ⑰ W2 ⑱ W3 ⑲ W4 ⑳ W5

9. During the last 6 months on average (when you were not injured), list the frequency, time spent and total minutes **performing all types of physical training for each activity you participated in? (Exclude time spent warming-up and cooling down)**

	Times per Week	Minutes per Session	Miles per Session	Total Time in Minutes (Times per Week X Minutes per Session)
Running for distance				
Sprinting or Interval Type Training				
Agility Training (i.e., drills requiring lateral movements, typically using cones or ladders, running sideways, backwards, etc.)?				
Resistance Training (i.e., weight lifting using free weights, dumbbells, kettlebells, machines etc.)?				
Calisthenics (i.e., jumping jacks, push-ups, sit-ups)				
Obstacle Course				
Other* (please specify)				
Total number of minutes				

***Do not include Foot Marching in Other Category**

EXAMPLE

	Times per Week	Minutes per Session	Miles per Session	Total Time in Minutes (Times per Week X Minutes per Session)
Running	3	30	3	90
Sprinting or Interval Type Training	2	30		60
Agility Training	2	60		120
Resistance Training	2	45		90
Calisthenics	3	20		60
Obstacle Course	1	30		30
Other* (please specify)				
Total number of minutes				450

10. Is the total number of physical training hours listed above more than 840 minutes or 14 hours per week?

(0) No

(1) Yes (If Yes, please explain)_____

11. During the last 6 months, on average, how often did your unit perform foot marches?

① Our unit does not perform foot marches **(Skip to #16)**
② Less than one time per month
③ 1 time per month
④ 2 times per month
⑤ 3 times per month
⑥ 4 times per month or once a week

12. On average, how far does your unit foot march at a time?

_____Miles

13. On average, how heavy is the load you carry when your unit performs foot marches?

① Estimated weight of load carried (**ruck sack** and/or **body armor** and/or **weapon**) _____pounds
② Our unit does not carry loads during foot marches

14. During the last 6 months on average, did you perform foot marching during personal fitness training?

⓪ No **(Skip to Question #25)**
① Yes

15. On average, in the last 6 months, how often did you foot march for personal fitness training?

① Less than one time per month
② 1 time per month
③ 2 times per month
④ 3 times per month
⑤ 4 times per month or once a week
⑥ More than 4 times per month (#_____times per month)

16. On average, how far do you foot march at a time?

_____Miles

17. On average, how heavy is the load you carry when you perform foot marches during personal fitness training?

① Estimated weight of load carried (**ruck sack** and/or **body armor** and/or **weapon**) _____pounds
② I do not carry any weight

18. What was the date of your **last** Army Physical Fitness Test **(APFT)** (to the best of your recollection)?

|___|___| / |___|___|___|___|
MONTH YEAR

19. What were the **raw scores** on your **last** Army Physical Fitness Test (APFT)?

a. Push-ups number completed |___|___|___| repetitions

① I have a profile and could not perform push-ups

b. Sit-ups number completed |___|___|___| repetitions

② I have a profile and could not perform sit-ups

c. 2 Mile Run Time |___|___| min |___|___| sec

③ I have a profile and could not perform the 2 mile run

If you did not perform the 2 mile run, did you pass the alternate test ⓪ No ① Yes

Tobacco Use

Please answer these questions with regard to your past and current tobacco use.

20. Have you smoked more than 100 cigarettes (not e-cigarettes) in your life? (100 cigarettes=5 packs)

⓪ No **(Skip to #24)**

① Yes

21. Have you smoked cigarettes (not e-cigarettes) in the last 30 days?

⓪ No **(Skip to #24)**

① Yes

22. On average how many cigarettes do you smoke per day? _____

23. How many years or months have you been smoking cigarettes? _____ Years or _____Months

Sleep

24. In the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spend in bed).

① 1 hour	⑤ 5 hours	⑨ 9 hours
② 2 hours	⑥ 6 hours	⑩ 10 hours
③ 3 hours	⑦ 7 hours	⑪ 11 hours
④ 4 hours	⑧ 8 hours	⑫ 12 hours

QUESTONS ABOUT INJURY

Injury History (last 6 months)
This next series of questions will ask you about injures occurring in the last 6 months. Include injuries that are acute (sudden and unexpected) such as twisting an ankle or being in a car crash and those caused by overuse (pain that develops over time from activities such as running multiple times or repeatedly lifting objects). An injury is damage or pain to a muscle, joint, bone or nerve that made it more difficult to work, do physical training or perform other activities.

25. How many injuries have you experienced, that occurred within the **last 6 months**?

⓪ None **(Stop, survey is complete)**
① 1
② 2
③ 3
④ 4
⑤ 5 or more (please list the # of injuries)_____

QUESTIONS ABOUT YOUR INJURY

If you reported one or more injuries, please answer the next questions about the most serious duty limiting injury you have experienced in the last 6 months. Make sure you ONLY answer questions about injuries occurring during the last 6 months

26. Specify month injured as best you can

① **Jan** ② **Feb** ③ **Mar** ④ **Apr** ⑤ **May** ⑥ **Jun** ⑦ **Jul** ⑧ **Aug** ⑨ **Sep** ⑩ **Oct** ⑪ **Nov** ⑫ **Dec**

27. How many days did you have this injury?

① Still have this injury which has affected me for _____ days now
② This injury is now completely healed and lasted for _____ days

28. What was the primary body area injured?

① Head
② Neck
③ Shoulders
④ Upper Arm (bicep/tricep)
⑤ Lower Arm (forearm)
⑥ Elbow
⑦ Wrist
⑧ Hand
⑨ Chest/ribs
⑩ Abdomen
⑪ Back (lower)
⑫ Back (upper)
⑬ Hip
⑭ Upper leg (Thigh/Hamstring)
⑮ Lower leg (Shin/Calf)
⑯ Knee
⑰ Ankle
⑱ Foot
⑲ Other **(Please Specify)**_____

29. What was the type of injury?

Overuse Injury:

(1) Bursitis
(2) Overuse muscle pain
(3) Runner's knee (pain behind the knee cap)
(5) Stress fracture or stress reaction (to include shin splint)
(6) Tendonitis
(7) Other overuse injury (Please Specify) _____

Traumatic Injury:

(8) Dislocation
(9) Fracture (broken bone)
(10) Nerve injury
(11) Pain in a body part (not otherwise specified)_____
(12) Sprained Joint
(13) Strained Muscle
(14) Torn meniscus/cartilage/labrum
(15) Not otherwise specified_____

30. What activity were you doing when this injury occurred?

(1) Physical training (running for physical training)
(2) Physical training (weight lifting for physical training)
(3) Other physical training **(Please Specify)** _____
(4) Lifting or moving heavy objects (not weight training)
(5) Repairing or maintaining equipment
(6) Riding or driving motorized vehicle (car, armored vehicles)
(7) Moving in or around a stationary motor vehicle
(8) Rough-housing or fighting
(9) Combative training / Combative Competition
(10) Obstacle Course
(11) Sports/recreation (such as soccer, basketball)
(12) Stepping up/climbing
(13) Walking or hiking (not foot marching)
(14) Foot Marching
(15) Occupational injuries (job related tasks)
(16) Other **(Please Specify)** _____

31. What was the cause associated with your injury?

(1) Contact (hit by/against) an object/surface (Please list)_____
(2) Direct contact by a person
(3) Falling onto an object or surface or the ground
(4) Impact from a blast
(5) Overuse/repetitive activity
(6) Single overexertion/over-extension/twisting effort
(7) Tripping without falling
(8) Other **(Please Specify)** _____

32. Have you been seen by a medical professional for your injury?

⓪ No **(If No, Skip to #37)**
① Yes

33. Were you placed on a medical profile by a medical professional for your injury?

⓪ No **(Skip to #37)**
① Yes

34. How many total days were you placed on profile for your injury?

Number of Days _____

35. Did you temporarily stop attending regular unit physical training (PT) due to your injury?

① Yes
② Yes, and was placed into a profile PT class with other injured Soldiers
③ No, Continued with regular unit PT
④ No, but modified unit PT exercises to accommodate for my injury
⑤ I don't participate in unit PT

36. How many days was it before you began regular unit physical training again?
Please specify number of days: _____
① I don't participate in unit PT

37. When did your injury occur?

① During duty hours
② Before or after duty hours

QUESTIONS ABOUT ANOTHER INJURY

If you reported one or more injuries, please answer the these questions about the next most serious duty limiting injury you have experienced in the last 6 months. Make sure you ONLY answer questions about injuries occurring during the last 6 months

38. Specify month injured as best you can

① **Jan** ② **Feb** ③ **Mar** ④ **Apr** ⑤ **May** ⑥ **Jun** ⑦ **Jul** ⑧ **Aug** ⑨ **Sep** ⑩ **Oct** ⑪ **Nov** ⑫ **Dec**

39. How many days did you have this injury?

① Still have this injury which has affected me for _____ days now
② This injury is now completely healed and lasted for _____ days

40. What was the primary body area injured?

① Head
② Neck
③ Shoulders
④ Upper Arm (bicep/tricep)
⑤ Lower Arm (forearm)
⑥ Elbow
⑦ Wrist
⑧ Hand
⑨ Chest/ribs
⑩ Abdomen
⑪ Back (lower)
⑫ Back (upper)
⑬ Hip
⑭ Upper leg (Thigh/Hamstring)
⑮ Lower leg (Shin/Calf)
⑯ Knee
⑰ Ankle
⑱ Foot
⑲ Other **(Please Specify)**_____

41. What was the type of injury?

Overuse Injury:

① Bursitis
② Overuse muscle pain
③ Runner's knee (pain behind the knee cap)
⑤ Stress fracture or stress reaction (to include shin splint)
⑥ Tendonitis
⑦ Other overuse injury (Please Specify) _____

Traumatic Injury:

⑧ Dislocation
⑨ Fracture (broken bone)
⑩ Nerve injury
⑪ Pain in a body part (not otherwise specified)_____
⑫ Sprained Joint
⑬ Strained Muscle
⑭ Torn meniscus/cartilage/labrum
⑮ Not otherwise specified_____

42. What activity were you doing when this injury occurred?

(1) Physical training (running for physical training)
(2) Physical training (weight lifting for physical training)
(3) Other physical training **(Please Specify)** _____
(4) Lifting or moving heavy objects (not weight training)
(5) Repairing or maintaining equipment
(6) Riding or driving motorized vehicle (car, armored vehicles)
(7) Moving in or around a stationary motor vehicle
(8) Rough-housing or fighting
(9) Combative training / Combative Competition
(10) Obstacle Course
(11) Sports/recreation (such as soccer, basketball)
(12) Stepping up/climbing
(13) Walking or hiking (not foot marching)
(14) Foot Marching
(15) Occupational injuries (job related tasks)
(16) Other **(Please Specify)** _____

43. What was the cause associated with your injury?

(1) Contact (hit by/against) an object/surface (Please list)_____
(2) Direct contact by a person
(3) Falling onto an object or surface or the ground
(4) Impact from a blast
(5) Overuse/repetitive activity
(6) Single overexertion/over-extension/twisting effort
(7) Tripping without falling
(8) Other **(Please Specify)** _____

44. Have you been seen by a medical professional for your injury?

(0) No **(If No, Skip to #49)**
(1) Yes

45. Were you placed on a medical profile by a medical professional for your injury?

(0) No **(Skip to #49)**
(1) Yes

46. How many total days were you placed on profile for your injury? Number of Days _____

47. Did you temporarily stop attending regular unit physical training (PT) due to your injury?

(1) Yes
(2) Yes, and was placed into a profile PT class with other injured Soldiers
(3) No, Continued with regular unit PT
(4) No, but modified unit PT exercises to accommodate for my injury
(5) I don't participate in unit PT

48. How many days was it before you began regular unit physical training again?

Please specify number of days: _____

(1) I don't participate in unit PT

49. When did your injury occur?

(1) During duty hours
(2) Befor

Appendix D

Results Tables

Table D-1. Characteristics of U.S. Army Soldiers participating in the Tactical Athlete Performance Program and Assessment - Demographics, Tobacco Use, and Physical Training (n = 217)

Variable		Men (n = 199)	Women (n = 18)	p-value
Age, *Mean (± SD)*		30.5 (± 6.5)	28.7 (± 5.7)	0.25
Body Mass Index (BMI)[a] Classification [b] (*%, n*)	Normal/Underweight	15.6% (31)	50.0% (9)	**0.002**
	Overweight	54.8% (109)	33.3% (6)	
	Obese	29.6% (59)	16.7% (3)	
Rank (*%, n*)	E1-E4	11.9% (23)	16.7% (3)	0.26
	E5-E9	53.4% (103)	33.3% (6)	
	O1-O3	34.7% (67)	50.0% (9)	
Physical Demand of MOS (%, *n*)	Heavy	72.9% (145)	16.7% (3)	**<0.0001**
	Medium	14.1% (28)	38.9% (7)	
	Light	13.0% (26)	44.4% (8)	
Rate of Current Smoking (*%, n*)		10.6% (21)	0% (0)	**0.039**
Hours of Sleep per Night, *Mean (± SD)*		6.0 (± 1.1)	6.1 (± 1.0)	0.63
Injury Incidence (*%, n*)		44.7% (89)	44.4% (8)	0.95

LEGEND:
SD = Standard Deviation
MOS = Military Occupational Specialty
n = number of sample participants

NOTES:
Other studies have provided similar results (e.g., References 11 and 12).
[a] BMI – calculated from height and weight
[b] Based on CDC BMI classifications normal and underweight categories were combined due to low number participants in underweight category
[c] Similar to job duty physical demand categories in DA Pam 611-21 and the ACFT categories - heavy (black), significant (gray), and moderate (gold)

Table D-2. Physical Training Habits of U.S. Army Soldiers participating in the Tactical Athlete Performance Program and Assessment (n= 217)

Variable			Men (n = 199)	Women (n = 18)	p-value
Total	PT Participation Rate	% (*n*)	96.5% (198)	100% (18)	0.77
	Total Weekly Minutes	*Mean (±SD)*	563.9 (± 392.3)	434.4 (± 372.8)	0.19
	Weekly Running Time, Minutes		151.8 (±155.9)	132.8 (± 130.0)	0.67
	Weekly Running Distance, Miles		14.3 (± 14.4)	12.5 (± 12.2)	0.90
	Weekly Sprint Time, Minutes		62.5 (± 48.1)	63.3 (± 32.2)	0.95
	Weekly Agility Time, Minutes		67.0 (± 55.9)	85.0 (± 43.3)	0.59
	Weekly Resistance Training Time, Minutes		249.9 (± 200.8)	149.1 (± 121.4)	**0.01**
	Weekly Calisthenics Time, Minutes		118.2 (± 114.8)	100.5 (± 118.6)	0.58
	Weekly Obstacle Course Time, Minutes		83.1 (± 69.9)	126.0 (± 80.5)	0.19
	Weekly Other PT Time, Minutes		69.3 (± 80.8)	15.0 (± 0)	**0.01**
Unit	Unit Foot Marching Participation rate	% (*n*)	55.3% (74)	27.8% (5)	0.06
	Unit Foot March Frequency per month	*Mean (±SD)*	2.1 (± 1.1)	2.0 (± 1.2)	0.94
	Average Miles per Unit Foot March		6.0 (± 2.1)	7.2 (± 2.8)	0.21
	Average Load (lb.) per Unit Foot March		40.7 (± 21.5)	27.9 (± 19.8)	0.12
Personal	Foot Marching Participation Rate	% (*n*)	41.2% (82)	50.0% (8)	0.68
	Foot March Frequency per month	*Mean (±SD)*	1.9 (± 1.2)	1.8 (± 1.1)	0.68
	Average Miles per Foot March		6.1 (± 2.6)	4.8 (± 1.6)	0.15
	Average Load (lb.) per Unit Foot March		46.7 (± 13.2)	43.1 (± 19.5)	0.48

LEGEND:
SD = Standard Deviation
n = number of sample participants

NOTES:
Other studies have shown similar results (e.g., References 13 and 14).

Table 3. Characteristics of Prior Injury Among Tactical Athlete Program and Assessment (TAP-A) Participants, by Sex (n = 97)

Variable			**Men** (*n* = 89)	**Women** (*n* = 8)
Injury Type	Overuse Muscle Pain	%(*n*)	15.7% (13)	25.0% (2)
	Sprain		16.9% (14)	0
	Strain		13.3% (13)	0
	Other Overuse Pain		10.8% (9)	12.5% (1)
	Runner's Knee		9.6% (8)	0
	Unspecified Pain		3.6% (3)	12.5% (1)
	Tendonitis		4.8% (4)	0
	Nerve Injury		2.4% (2)	12.5% (1)
	Torn Cartilage		3.6% (3)	0
	Contusion		2.4% (2)	0
	Concussion		2.4% (2)	0
	Stress Fracture		2.4% (2)	25.0% (2)
	Tendonitis		1.2% (1)	12.5% (1)
	Bursitis		1.2% (1)	0
	Laceration		1.2% (1)	0
	Fracture		1.2% (1)	0
	Shin Splint		1.2% (1)	0
	Other		6.0% (5)	0
Primary Body Area	Lower Back	%(*n*)	19.1% (17)	25% (2)
	Knee		16.9% (15)	12.5% (1)
	Shoulder		15.7% (14)	12.5% (1)
	Ankle		12.4% (11)	12.5% (1)
	Upper Leg/Thigh		9.0% (8)	12.5% (1)
	Hip		5.6% (5)	12.5% (1)
	Foot		3.4% (3)	0
	Head		4.5% (4)	0
	Upper Arm		4.5% (4)	0
	Lower Leg/Calf		3.4% (3)	0
	Elbow		2.2% (2)	12.5% (1)
	Hand		1.1% (1)	0
	Upper Back		1.1% (1)	0
	Wrist		1.1% (1)	12.5% (1)

Table 3, Continued. Characteristics of Prior Injury Among Tactical Athlete Program and Assessment (TAP-A) Participants, by Sex (n = 97)

Variable			**Men** (n = 89)	**Women** (n = 8)
Associated Activity	Physical Training (Running)	% (n)	34.5% (30)	50.0% (4)
	Physical Training (Resistance)		19.5% (17)	12.5% (1)
	Combative Training		9.2% (8)	0
	Sports		6.9% (6)	0
	Job Related Task		5.7% (5)	0
	Marching		4.6% (4)	12.5% (1)
	Lifting an Object		3.4% (3)	12.5% (1)
	Motor Vehicle Accident		3.4% (3)	0
	Walking		3.4% (3)	0
	Obstacle Course		2.3% (2)	0
	Physical Training (Other)		2.3% (2)	0
	Repairing Equipment		1.1% (1)	0
	Other		3.4% (3)	12.5% (1)
Mechanism	Overuse	% (n)	48.8% (40)	62.5% (5)
	Overexertion (single effort)		20.7% (17)	0
	Falling		8.5% (7)	12.5% (1)
	Contact against an object		7.3% (6)	0
	Contact against another person		3.7% (3)	0
	Tripping		3.7% (3)	0
	Other		7.3% (6)	25.0% (2)
Care	Seen by a Medical Professional	% (n)	71.9% (64)	87.5% (7)
	Resulted in a Profile		51.6% (33)	57.1% (4)
	Limited Duty Days per injury	*Mean (±SD)*	26.9 (± 39.7)	89.0 (± 90.6)

LEGEND:
n = number of sample participants

NOTES:
Findings are supported by other studies and reviews (e.g., References 15, 16, 17).

Table 4. Army Physical Fitness Test (APFT), Tactical Athlete Performance Program and Assessment (TAP-A), and Army Wellness Center (AWC) Strength Testing Results, by Sex (n = 217)

Variable			Men (n = 199)	Women (n = 18)	p-value
APFT	2 Mile Run (minutes)	*Mean (±SD)*	15.2 (± 1.9)	16.7 (± 1.9)	**0.006**
	Push Ups (reps)		65.7 (± 12.9)	46.1 (± 18.2)	**0.0007**
	Sit Ups (reps)		69.8 (± 11.9)	72.3 (± 17.2)	0.43
TAP-A	FMS-M Overhead Squat	*Mean (±SD)*	2.3 (± 0.5)	2.3 (± 0.5)	0.93
	FMS-M Single Leg Raise		2.2 (± 0.4)	2.6 (± 0.5)	**0.006**
	FMS-M Shoulder Mobility		1.8 (± 0.6)	2.4 (± 0.5)	**0.002**
	Alternative DST Rate	*% (n)*	4.5% (9)	0% (0)	0.65
	Back Squat Volume (lb)	*Mean (±SD)*	1308 (± 550.1)	682.2 (± 405.2)	**<0.0001**
	Deadlift Volume (lb)		1577 (± 651.6)	1005 (± 388.9)	**0.0003**
	Pull-Ups (repetitions)		3.9 (± 3.4)	0.89 (± 1.5)	**<0.0001**
	Back Squat Pass Rate	*% (n)*	35.7% (71)	5.6% (1)	**0.009**
	Deadlift Pass Rate		36.7% (73)	5.6 % (1)	**0.008**
AWC	Relative Strength Score (RSS)	*Mean (±SD)*	4.1 (± 0.8)	3.1 (± 0.7)	**<0.0001**
	Back Strength (lb)[a]		339.4 (± 68.1)	202.6 (± 46.1)	**<0.0001**
	Leg Strength (lb)[a]		385.4 (± 72.2)	230.7 (± 54.5)	**<0.0001**
	Grip Strength (kg)		48.3 (± 8.1)	33.6 (± 6.1)	**<0.0001**
	Sit and Reach (in)[a]		15.4 (± 4.8)	18.5 (± 4.1)	**0.009**
	VO2max (ml/min/kg)[b]		47.5 (± 8.1)	41.1 (± 10.3)	**0.002**

LEGEND:
APFT = Army Physical Fitness Test
AWC = Army Wellness Center
DST = Dynamic Strength Test
SD = Standard Deviation
in = inches
kg = kilograms
lb = pounds
ml = milliliters
min = minutes
TAP-A = Tactical Athlete Performance Program and Assessment
VO_2max = maximum rate of oxygen consumption measured during incremental exercise (i.e., exercise of increasing intensity)

NOTES:
[a] Static Strength Tests (SSTs)
[b] Estimated from sub-maximal exercise test

- Findings are consistent with those of other pertinent studies (e.g., References 18 and 19).
- FMS-M = Modified (Abbreviated) Functional Movement Screen with 3 assessments

Table 5. Correlation of the Tactical Athlete Performance Program and Assessment (TAP-A) Dynamic Strength Tests (DSTs) and Army Wellness Center (AWC) Standard Static Strength Tests (SSTs) (n= 217)

Variable		*1* Squat	*2* Deadlift	*3* Pull-up	*4* Back SST	*5* Leg SST	*6* Grip SST	*7* RRS
TAP-A	*1.* Squat DST	--	0.54[a]	0.28[a]	0.35[a]	0.38[a]	0.28[a]	0.31[a]
	2. Deadlift DST	0.61	--	0.31[a]	0.35[a]	0.34[a]	0.36*	0.30[a]
	3. Pull-up DST	0.51	0.43	--	0.24[a]	0.22	0.21[a]	0.46[a]
AWC	*4.* Back SST	0.42	0.39	0.40	--	0.69[a]	0.43[a]	--
	5. Leg SST*	0.26	0.21	0.21	0.81[a]	--	0.49[a]	--
	6. Grip SST	0.10	0.36	0.36	0.57	0.68[a]	--	--
	7. Relative Strength Score (RSS)	0.25	0.04	0.58	--	--	--	--

LEGEND:
AWC = Army Wellness Center
DST = Dynamic Strength Test
SST = Standard Static Strength Test (*Leg SST not a standard AWC test)
TAP-A = Tactical Athlete Performance Program and Assessment

NOTES:
[a] Statistically significant ($p < 0.003$) correlation coefficients

- Strength of correlations are evaluated based on scale $0.70 \leq r < 1.0$ very strong; $0.50 \leq r < 0.7$ strong; $0.40 \leq r < 0.5$ moderate; $0.30 \leq r < 0.4$ fair; $r < 0.3$ weak. (Reference 1, APHC Pubic Health Report (PHR 12-02-0614), Correlations between Physical Fitness Tests and Performance of Military Tasks: A Systematic Review and Meta-Analyses; available in DTIC at: http://www.dtic.mil/docs/citations/ADA607688).
- Pearson correlation coefficients listed under the shaded diagonal represent those among women (n = 18), while the correlations above the diagonal represent those among men (n = 199).
- Variable 7 is an amalgamation of variables 4-6 and therefore correlations were not computed.