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This report summarizes findings from the program evaluation conducted by the Injury Prevention Division (IPD), U.S. Army Public Health Center (APHC) of the Infantry (INF) One Station Unit Training (OSUT) extension from 14 weeks to 22 weeks at the Maneuver Center of Excellence (MCoE), Fort Benning, GA. Findings are presented for three primary outcomes: (1) changes in physical fitness, (2) graduation and attrition, and (3) injuries for which trainees sought medical care. These outcomes were compared between INF OSUT trainees in two 14-week training cycles (i.e., control cycles) and trainees in two 22-week training cycles (i.e., pilot cycles) that trained during the same timeframe and graduated on 7 December 2018.

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EXECUTIVE SUMMARY
COMPARISON OF PHYSICAL FITNESS, GRADUATION, AND INJURIES BETWEEN 14-WEEK AND 22-WEEK INFANTRY ONE STATION UNIT TRAINING CYCLES: 13 JULY 2018 TO 7 DECEMBER 2018

1. PURPOSE

This report summarizes findings from the program evaluation conducted by the Injury Prevention Division (IPD), U.S. Army Public Health Center (APHC) of the Infantry (INF) One Station Unit Training (OSUT) extension from 14 weeks to 22 weeks at the Maneuver Center of Excellence (MCoE), Fort (Ft.) Benning, Georgia (GA). Findings are presented for three primary outcomes: (1) changes in physical fitness, (2) graduation and attrition, and (3) injuries for which trainees sought medical care. These outcomes were compared between INF OSUT trainees in two 14-week training cycles (i.e., control cycles) and trainees in two 22-week training cycles (i.e., pilot cycles) that trained during the same timeframe and graduated on 7 December 2018.

2. BACKGROUND

In 2017, the Department of Defense (DOD) conducted the “Close Combat Strategic Portfolio Review” to identify the most promising investment opportunities to improve the military’s close-combat effectiveness and survivability (Roper 2018). A finding from this review was the need to “enhance the lethality and resiliency of Soldiers graduating from initial training” (Department of Training and Doctrine (DOTD) 2018). Following this review, the MCoE and Infantry School at Ft. Benning began a combined effort with the 198th Infantry Brigade and U.S. Army Training and Doctrine Command (TRADOC) to revise and improve INF OSUT by increasing the training cycle from 14 weeks to 22 weeks. The proposed extension would serve to expand the INF-specific training in order to bolster readiness, lethality, and proficiency before Soldiers arrive at their first unit of assignment (Suits 2018, Gatchell 2018).

All INF OSUT training cycles are conducted at Ft. Benning. The Chief, Training and Education Development Directorate and the Chief, Program Evaluation Office, DOTD at the MCoE requested support from U.S. Army Medical Command (MEDCOM) and APHC (13 July 2018) to conduct a program evaluation of the proposed extended 22-week INF OSUT cycle. Specifically, MCoE requested a comparison of training outcomes between two cycles of INF OSUT that would conduct the current 14-week training program (E, 2-58 and E, 2-19; start date: 31 August 2018) and two cycles that would conduct the proposed 22-week program of instruction (B, 2-58 and E, 2-19; start date: 13 July 2018). Since the MCoE referred to the 14-week cycles as the “control” cycles and the 22-weeks cycles as the “pilot” cycles, this same terminology is used throughout this report. All four OSUT cycles (i.e., two control and two pilot cycles) graduated on 7 December 2018.

3. FINDINGS

- There were significant differences in demographics between trainees in the control and pilot cycles. Larger proportions of pilot trainees enlisted with the 18X Military Occupational Specialty (MOS), were E-2 or higher and were college graduates; a smaller proportion of pilot trainees were in the National Guard. These differences may have influenced some training outcomes.

- At the beginning of OSUT, trainees in the pilot cycles had significantly higher physical fitness compared to trainees in the control cycles, as assessed by the Occupational Physical Assessment Test (OPAT), the 1-1-1 assessment, and first trial of the Army Physical Fitness Test (APFT1). This evaluation did not examine if/how these differences in initial physical fitness impacted training outcomes or performance on physically demanding tasks during OSUT.

- At the end of OSUT, trainees in the pilot cycles had significantly higher mean performance on all three events of the final APFT (APFT5) and higher average total APFT5 score (age-adjusted) compared to trainees in the control cycles. But in spite of pilot trainees having approximately 6 additional weeks of training before APFT5, the mean differences in event performance between the control and pilot trainees were smaller on APFT5 than on APFT1. In other words, control trainees improved more than pilot trainees between APFT1 and APFT5.

- Overall, graduation success was higher in the pilot cycles (92%) compared to control cycles (85%; $p<0.01$). Differences in demographics may have benefited trainees in the pilot cycles, partially explaining why a significantly higher proportion of pilot trainees graduated. The longer length of training may have allowed injured trainees additional time to recover from injuries and meet graduation requirements; trainees with lower levels of physical fitness may have benefited from the additional weeks of training to meet APFT standards. Further evaluation is required to identify factors that contributed to higher graduation success in the pilot cycles.

- The “All” musculoskeletal injury (MSKI) rates after 14 weeks of training were similar for the control and pilot cycles (13 injuries per 100 trainees per month; $p=0.91$). Acute (traumatic) MSKI rates (1.0 injuries per 100 trainees per month; $p=0.71$) were similar for the control and pilot cycles, as were the overuse MSKI rates (12 injuries per 100 trainees per month; p-0.82) at 14 weeks.

- After 22 weeks, trainees in the pilot cycles sustained 34% more MSKIs, and 21% more trainees had a MSKI compared to the first 14 weeks of training. These increases were somewhat expected since the longer length of training exposed pilot trainees to additional injury risks and exposures beyond those of the first 14 weeks of training. In spite of these increases, the “All”, acute and overuse MSKI rates were not significantly different after completion of 22 weeks compared to the pilot cycles’ rates after the first 14 weeks of training ($p>0.05$ for each rate comparison).

- Overuse MSKIs accounted for more than 90% of “All” MSKIs after 14 weeks for the control cycles and after 22 weeks for the pilot cycles. Three-quarters of these overuse MSKIs were in the lower extremity.

- Equal proportions of trainees (5%; $p=0.79$) in the control and pilot cycles had a radiologically confirmed bone stress injury (BSI) (e.g., stress reactions and stress fractures); however, the differences in anatomic distribution of bone stress injuries (BSIs) (higher incidence of femoral head and pelvic BSI in the pilot cycles) require further study to understand the relationship between training and anatomic site of BSIs.

- Overall, the athletic trainers accounted for 47% of the injury-related medical encounters (clinic visits) for MSKIs and non-MSKIs that were reported in the electronic health record (EHR) and physical therapists accounted for 34% of encounters. We could not determine from available data whether medical encounters by athletic trainers resulted in trainees missing less training during the day or if there were fewer days of limited duty overall as a result of care rendered by the athletic trainers.

4. CONCLUSIONS

- Differences in trainee demographics between the control and pilot cycles may have influenced differences in training outcomes, such as graduation.

- Trainees in the control cycles had lower physical fitness at the beginning of OSUT compared to trainees in the pilot cycles, as assessed by the OPAT, the 1-1-1 assessment, and APFT1 (initial APFT).

- Mean differences in APFT event performance between control and pilot trainees on the final APFT (APFT5) were smaller than differences in APFT1 event performance, even though pilot trainees had approximately 6 additional weeks of training. In other words, control trainees improved more than pilot trainees between APFT1 and APFT5.

- Higher proportions of trainees in the pilot cycles graduated OSUT compared to trainees in control cycles (92% versus (vs.) 85%; $p<0.01$).

- MSKI injury rates at 14 weeks of training were similar for the control and pilot cycles.

- After 22 weeks, there was a 34% increase in MSKIs in the pilot cycles compared to 14 weeks in the pilot cycles, and an additional 21% of trainees had an "All" MSKI in these final weeks. These increases were not unexpected since the longer length of training exposed pilot trainees to additional injury risks and exposures beyond those of the 14-week control cycles and the first 14 weeks of the pilot cycles.

- In spite of these increases in injury occurrences, the injury rates for "All", acute and overuse MSKIs which consider the actual training time (in the denominator for rate calculations) were not significantly different after 22 weeks compared to the pilot cycles' rates after the first 14 weeks of training ($p>0.05$ for each rate comparison).

- Overall, incidence of BSIs (i.e., stress reactions and stress fractures) was similar in the control and pilot cycles (5% of trainees). But the differences in anatomic distribution of BSIs (higher incidence of femoral head and pelvic BSI in the pilot cycles) requires further study to understand the relationship between training and BSIs.

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1 REFERENCES

Appendix A provides the references cited within this document.

2 AUTHORITY

The Injury Prevention Division (IPD), U.S. Army Public Health Center (APHC), is responsible under Army Regulation (AR) 40-5, Section 2-19, to provide support to the U.S. Army Medical Command (MEDCOM) for comprehensive medical surveillance to identify, prevent, and control evolving health problems (Department of the Army (DA) 2007).

3 INTRODUCTION

3.1 Purpose

This report summarizes findings from the program evaluation conducted by the IPD, APHC of the Infantry (INF) One Station Unit Training (OSUT) extension from 14 to 22 weeks at the Maneuver Center of Excellence (MCoE), Fort (Ft.) Benning, Georgia (GA). Findings are presented for three primary outcomes during the training cycles: (1) changes in physical fitness, (2) graduation and attrition, and 3) injuries for which trainees sought medical care. These outcomes were compared between trainees in two 14-week training cycles (i.e., control cycles) and trainees in two 22-week training cycles (i.e., pilot cycles) that trained during the same timeframe.

3.2 Background

In 2017, the Department of Defense (DOD) conducted the “Close Combat Strategic Portfolio Review” to identify the most promising investment opportunities to improve the military’s close-combat effectiveness and survivability (Roper 2018). Close-combat forces, comprised of front-line INF Soldiers, Marines and Special Forces, have historically accounted for almost 90% of casualties. The DOD-level review sought to identify the close-combat capabilities needed for future conflicts. A finding from that review was the need to “enhance the lethality and resiliency of Soldiers graduating from initial training” (Directorate of Training and Doctrine (DOTD) 2018).

In response to this finding, the MCoE and Infantry School at Ft. Benning began a combined effort with the 198th Infantry Brigade and U.S. Army Training and Doctrine Command (TRADOC) to develop a longer, more rigorous and comprehensive training program for INF Soldiers (Suits 2018). The revised training program is 8 weeks longer in duration and expands INF-specific training to bolster readiness, lethality, and proficiency before Soldiers arrive at their first unit of assignment. Specifically, the extended training program expanded weapons training, increased vehicle platform familiarization and combatives training, added a 40-hour combat-lifesaver course, increased land navigation, and added a combat water survivability test (Suits 2018, Gatchell 2018). The first training cycles to implement this extended INF OSUT cycle began training in July 2018.

On 13 July 2018, the Chief, Training and Education Development Directorate and the Chief, Program Evaluation Office, DOTD at the MCoE, requested support from MEDCOM and APHC to conduct a program evaluation of the proposed extended 22-week INF OSUT training cycle. Specifically, MCoE requested a comparison of training outcomes (e.g., physical fitness, graduation, and injuries) between two cycles of INF OSUT that would conduct the current 14-week training cycle (E, 2-58 and E, 2-19; start date: 31 August 2018) and two cycles that would conduct the proposed 22-week program of instruction (B, 2-58 and E, 2-19; start date: 13 July 2018). Since the MCoE referred to the 14-week cycles as the "control" cycles and the 22-weeks cycles as the "pilot" cycles, this same terminology is used throughout this report. All four OSUT cycles (i.e., two control and two pilot cycles) graduated on 7 December 2018.

4 METHODS

4.1 Data Sources

- Chief, Program Evaluation Office, MCoE provided rosters of trainees with demographics for the control and pilot cycles. The IPD, APHC also downloaded rosters and demographics from the Army Training Requirements and Resource System (ATRRS).

- U.S. Army Human Resource Command provided performance data from the Occupational Physical Assessment Test (OPAT) for trainees that filled the control and pilot cycles. Trainees took the OPAT during their recruitment before shipping to Ft. Benning for INF OSUT.

- Chief, Program Evaluation Office, MCoE provided training dates and trainees' performance on the Army Physical Fitness Tests (APFT) administered during INF OSUT (i.e., 1-1-1 assessment and five iterations of the APFT (APFT1-APFT5).

- For trainees enrolled in the control and pilot cycles of INF OSUT, the IPD, APHC downloaded graduation status (i.e., graduated, discharged, or other non-successful completion) from ATRRS. The IPD confirmed trainee graduation status with the Program Evaluation Office, MCoE.

- Armed Forces Health Surveillance Branch (AFHSB), Defense Health Agency provided the injury-related medical encounters with standardized diagnosis codes for trainees.

- The Navy-Marine Public Health Center provided radiographic results/reports for all suspected bone stress injuries (BSIs).

4.2 Injury Definitions

In 2017, the IPD, APHC developed a comprehensive taxonomy of injuries to uniformly describe and categorize injuries for future injury surveillance, program evaluations, and field investigations (APHC 2017, APHC 2018a). The IPD used this taxonomy, based on standardized injury diagnosis codes (i.e., International Classification of Diseases, 10th Revision, Clinical Module), to categorize injuries for the INF OSUT program evaluation. Definitions of injury, injury categories, and injury types used in this evaluation follow:

- Injury: Any physical damage to the body that resulted from the transfer of mechanical energy to the body. Injuries from transfers of mechanical energy are categorized by the body system that is damaged (e.g., musculoskeletal system versus (vs.) other body systems) and by injury type (i.e., “acute” or “overuse”).

- Acute (Traumatic) Injury: Physical damage to the body that results from a single large transfer of energy such as occurs when falling from heights, being struck by objects, or “twisting” an ankle while running. Examples include joint sprains, tendon ruptures, and traumatic fractures.

- Overuse Injury: Physical damage to the body from the cumulative effects of repeated exposures to small amplitude energy transfers that gradually cause physical damage (i.e., cumulative effects of microtrauma). This occurs in activities such as running, road marching, and repeated lifting, throwing, pushing or pulling. Examples of overuse injuries are tendonitis, muscular strains, “runner’s knee,” “shin splints,” and BSI (e.g., stress reactions and stress fractures).

- Musculoskeletal Injury (MSKI): Physical damage to any of the tissues that comprise the body’s musculoskeletal (MSK) system (e.g., bones, ligaments, muscles, and tendons).

- Non-Musculoskeletal Injury (Non-MSKI): Physical damage to tissues that comprise any system of the body (e.g., neurologic, integumentary (skin), and circulatory), excluding the MSK system. Examples of non-MSKI are injuries to the neurological system such as “rucksack” nerve palsy and sciatica, as well as injuries to the integumentary system such as skin abrasions, lacerations, blisters, and contusions.

4.3 Data Analysis

- The IPD, APHC linked and merged all data and conducted the statistical analyses using IBM® SPSS® Statistics for Window®, Version 25.

- The IPD, APHC identified injuries based on the standardized diagnosis codes assigned by medical providers in the electronic health record (EHR) and then categorized injuries by injury type and anatomic location according to the injury taxonomy (APHC 2017, APHC 2018a).

- IPD reviewed the radiographic results x-rays, bone scans, and magnetic resonance imaging (MRI) for all suspected BSIs. Only BSIs with radiographic confirmation were reported in this evaluation.

- IPD used descriptive statistics (i.e., central tendency metrics, percentages, and frequencies) to describe trainee characteristics, performance on physical assessments (i.e., OPAT and APFT), graduation status, and injury occurrences. IPD used Chi-square test of proportions to compare equality of proportions (nominal data) and independent sample t-tests to evaluate differences between two means of continuous data.

5 RESULTS

5.1 Trainee Physical Attributes and Demographics

Table 1 compares the mean (± standard deviation (SD)) for age, height, weight, and body mass index (BMI ($kg*m^{-2}$)) between trainees in the control (14 weeks; n=474) and pilot training cycles (22 weeks; n=400). There were no differences at baseline between the groups for these physical attributes.

Table 1. Physical Attributes of Trainees in Control and Pilot Cycles

	Control (14 weeks) (n=474)		Pilot (22 weeks) (n=400)		
Physical Attributes	**Mean**	**SD**	**Mean**	**SD**	p-value[a]
Age (yr)	20.3	2.9	20.0	2.8	0.11
Height (in.)	69.2	2.7	69.5	2.7	0.07
Weight (lb.)	168.0	29.3	169.8	26.7	0.37
BMI ($kg*m^{-2}$)	24.7	3.6	24.8	3.5	0.91

Note: [a] p-value: independent sample t-test comparing means between control and pilot cycles (statistically significant if $p \leq 0.05$)
Abbreviations: SD=standard deviation; yr=years; in=inches; lb=pounds; BMI=Body Mass Index; kg=kilograms; m=meters

Table 2 compares the distributions for trainee demographics between the control and pilot training cycles. The distributions for military occupational specialty (MOS), rank, component, and education level were significantly different for pilot trainees compared to control trainees ($p<0.001$, for each of these demographics). These differences in trainee demographics between the control and pilot cycles resulted from the selection criteria and process used by MCoE to assign trainees to the control and pilot cycles. For example, 18% of trainees in the pilot cycles enlisted with the 18X MOS; 50% of pilot trainees were E-2 or higher (vs. 35% of control trainees); 9% of pilot trainees were in the National Guard (NG) (vs. 32% of control trainees); and 12% of pilot trainees were college graduates (vs. 3% of control trainees).

Table 2. Demographic Characteristics of Trainees in Control and Pilot Cycles

Demographics		Control (14 weeks) (n=474)		Pilot (22 weeks) (n=400)		p-value[a]
		n	(%)	n	%	
MOS	11B	153	32.3	36	9.0	
	11X	321	67.7	291	72.8	
	18X (special force)	0	0.0	73	18.3	<0.001
Rank	E-1	308	65.0	202	50.5	
	E-2	121	25.5	117	29.3	
	E-3	25	5.3	29	7.3	
	E-4	17	3.6	50	12.5	
	E-4 CPL	0	0.0	2	0.5	
	E5	3	0.6		0.0	<0.001
Component	Active	322	67.9	364	91.0	
	National Guard	152	32.1	36	9.0	<0.001
Commitment	Ranger	7	1.5	94	23.5	
	Ranger Drop	0	0.0	4	1.0	
	Special Forces	4	0.8	73	18.3	
	Airborne	0	0.0	68	17.0	
	None	463	97.7	161	40.3	
Prior Service	Yes	9	1.9	12	3.0	
	No	462	97.5	388	97.0	0.30
	Unknown	3	0.6	0	0.0	
Education	11th Grade	29	6.1	3	0.8	
	12th Grade	409	86.3	341	85.3	
	College (1-3 yr)	17	3.6	7	1.8	
	College (4 yr)	16	3.4	49	12.3	<0.001
	Unknown	3	0.6	0	0	
Marital Status	Single	432	91.1	380	95.0	
	Married	36	7.6	19	4.8	
	Divorced	3	0.6	1	0.3	0.15
	Unknown	3	0.6	0	0.0	

Note: [a] p-value Chi-square test of proportions (statistically significant if $p \leq 0.05$)
CPL=corporal; yr=years

5.2 Occupational Physical Assessment Test Performance

Table 3 compares the OPAT event performance between trainees in the control and pilot cycles. Recruiters administered the 4-event OPAT before trainees shipped to Ft. Benning for INF OSUT; trainees were required to meet the Black (Heavy) standard on each OPAT event, given the INF OSUT requirements. The mean performance on the OPAT events is presented in **Table 3**. On each of the four OPAT events, the mean performance of trainees in the pilot cycles was significantly higher than the performance of trainees in the control cycles. On average, trainees in the pilot cycles threw the medicine ball 23 cm farther on the Seated Power Throw

(SPT), jumped 13 centimeters (cm) farther on the Standing Long Jump (SLJ), lifted 10 lb. more weight on the Strength Deadlift (SDL), and completed 5 more shuttles on the Interval Aerobic Run (IAR). If we assume trainees in both groups gave their "best effort" on the OPAT events, these results indicate that trainees in the pilot cycles had significantly higher levels of muscular power (SPT and SLJ), muscular strength (SDL) and aerobic fitness (IAR) at the start of OSUT compared to trainees in the control cycles (p<0.01 for each event). Whether or not these differences are meaningful in the context of INF Soldiers' regular duties remain to be determined.

Table 3. Occupational Physical Assessment Test Event Performance of Trainees in Control and Pilot Cycles

	Control (14 weeks) (n=474)		Pilot (22 weeks) (n=400)		Mean Difference (Pilot – Control)		
OPAT Event	Mean	SD	Mean	SD	Mean Difference	95% CI	p-value[a]
SPT (cm)	583.0	88.4	606.2	90.4	23.3	11.4 - 35.2	<0.01
SLJ (cm)	201.2	28.5	214.2	29.7	13.1	9.2 - 16.9	<0.01
SDL (lb.)	184.2	26.2	193.9	26.4	9.7	6.2 - 13.2	<0.01
IAR (shuttles)	50.6	10.1	55.6	15.9	5.0	3.2 - 6.9	<0.01

Note: [a] p-value: independent sample t-test comparing means between control and pilot cycles (statistically significant if p≤0.05)
OPAT=Occupational Physical Assessment Test; SPT=Seated Power Throw;
SLJ=Standing Long Jump; SDL=Strength Dead Lift; IAR=Interval Aerobic Run; cm=centimeters;
lb=pounds; SD=standard deviation; 95% CI=95% confidence interval.

5.3 Army Physical Fitness Test Event Performance

Table 4 compares the APFT event performance (push-ups, sit-ups, timed run) between trainees in the control and pilot cycles on initial 1-1-1 assessment and 2 iterations of the APFT. An initial 1-1-1 assessment (push-ups and sit-ups in 1 minute and 1-mile run) was administered at the beginning of OSUT. Results from the 1-mile run event were used to assign trainees to ability groups for group runs during OSUT. On this 1-1-1 assessment, trainees in the pilot cycles completed, on average, significantly more repetitions (reps) of push-ups (5 more push-up reps) and sit-ups (4 more sit-up reps), and ran faster (0.3 minutes or ~18 seconds faster) on the 1-mile run (p<0.01 for each event).

The control cycles administered the first 3-event APFT (APFT1) (push-ups and sit-ups in 2 minutes and 2-mile run) during the second training week, while the pilot cycles administered APFT1 at the end of the second week or beginning of the third week. The mean trainee performance on APFT1 for the control and pilot cycles is presented in **Table 4**. Trainees in the pilot cycles completed, on average, significantly more repetitions of push-ups (9 more push-up reps) and sit-ups (9 more sit-up reps), and ran faster (1.3 minutes (~1 minute 18 seconds)) on the 2-mile run ($p<0.01$ for each event). Their average total score on APFT1 was 38 points higher (adjusted for age) compared to trainees in the control cycles ($p<0.01$).

The final APFT (APFT5) was administered at the end of the training cycles. The control cycles administered APFT5 during week 10 in one cycle and week 12 in the other cycle. The pilot cycles administered APFT5 during week 17 in one cycle and week 18 in the other cycle. Therefore, trainees in the pilot cycles had approximately 6 additional training weeks before they took APFT5. Trainees in the pilot cycles once again had significantly higher mean performance on all three events (**Table 4**) (+8 push-up repetitions, +5 sit-up repetitions, and ran 2 miles 0.6 minutes (~36 seconds) faster) and had a higher total APFT score (+21 points, adjusted for age) compared to trainees in the control cycles ($p<0.01$ for each event and total score). However, in spite of the trainees in the pilot cycles having higher performance on APFT1 and having more weeks to prepare for the final APFT, the mean performance differences between the pilot and control trainees were smaller on each APFT5 event compared to APFT1 events. This is most likely due to a lower starting fitness in the control trainees, which allows greater improvement initially. Whether or not these differences are meaningful in the context of other performance measures during INF OSUT or for INF Soldiers in their first unit of assignment remains to be determined.

Table 4. Army Physical Fitness Test Event Performance in Control and Pilot Cycles

Test	APFT Event	Control (14 weeks) (N=474)			Pilot (22 weeks) (n=400)			Mean Difference (Pilot – Control)		
		n	Mean	SD	n	Mean	SD	Mean Difference	95% CI	p-value[a]
1-1-1	Push-up (reps)	470	23.4	11.7	400	27.9	13.1	4.5 reps	2.9 - 6.2	<0.001
	Sit-up (reps)	470	28.7	7.2	400	32.3	7.2	3.6 reps	2.7 - 4.6	<0.001
	1-mile Run (min)	470	7.9	1.2	397	7.5	1.2	-0.3 min	0.17 - 0.48	<0.001
APFT1	Push-up (reps)	437	37.9	14.6	359	47.2	15.1	9.3 reps	7.2 - 11.4	<0.001
	Sit-up (reps)	436	47.0	11.9	359	56.3	13.1	9.3 reps	7.6 - 11.1	<0.001
	2-mile Run (min)	435	15.8	2.1	359	14.5	1.6	-1.3 min	1.1 - 1.6	<0.001
	Total Score (pts)[b]	452	173.4	57.7	359	210.9	46.1	37.5 pts	30.3 - 44.7	<0.001
APFT5	Push-up (reps)	402	54.0	11.4	372	62.0	13.1	8.1 reps	6.4 - 9.8	<0.001
	Sit-up (reps)	402	64.6	8.5	372	69.6	9.9	5.0 reps	3.6 - 6.3	<0.001
	2-mile Run (min)	402	13.9	1.0	372	13.3	1.0	-0.6 min	0.5 - 0.8	<0.001
	Total Score (pts)[b]	402	240.6	28.0	372	261.5	28.4	20.9 pts	16.9 - 24.8	<0.001

Notes:
[a] p-value: independent sample t-test comparing means between control and pilot cycles (statistically significant if $p \leq 0.05$)
[b] Total score: summed value of age-adjusted points calculated from the raw performance of each APFT event according to Field Manual 7-22 (DA, 2012).
APFT=Army Physical Fitness Test; reps=repetitions; min=minutes; pts=points
Negative mean difference on 1- and 2-mile run events indicates that pilot trainees ran 1 mile or 2 miles in less time (0.3 minutes or 1.3 minutes faster, respectively) than control trainees.

5.4 Graduation Status

Table 5 summarizes the overall graduation status for trainees in the control cycles after 14 weeks and pilot cycles after 22 weeks. “Non-Graduates” included all trainees that did not graduate as of 21 January 2019. Reasons for not graduating included the following: retraining, holdover, convalescent leave, unit recall, Warrior Training and Rehabilitation Program (WTRP), desertion, and discharge.

Overall, the proportion of trainees that graduated was significantly higher (7% higher; $p<0.01$) in the pilot cycles (92.3%) compared to the control cycles (85.4%). It was beyond the scope of this evaluation to identify reasons for higher graduation success in the pilot cycles, but possible contributing factors include:

- Demographic differences between the groups (Table 2) may have resulted in higher levels of motivation or commitment among trainees in the pilot cycles,
- Longer training cycle may have allowed injured trainees to recover from injury and continue training, and
- Longer training cycle may have provided additional training needed for lower performing trainees to meet training requirements.

Table 5. Graduation Status of Trainees in Control and Pilot Cycles

	Control (14 weeks) (n=474)		Pilot (22 weeks) (n=400)		
Graduation Status	n	Percent (%)	n	Percent (%)	p-value[a]
Graduates	405	85.4	369	92.3	<0.01
Non-Graduates	69	14.6	31	7.8	

Note: [a] p-value Chi-square test of proportions ($p\leq0.05$ denotes a statically significant difference)

Table 6 provides additional detail about the number of non-graduates by category. Overall, there were 69 non-graduates in the control cycles and 31 non-graduates in the pilot cycles. The largest category of non-graduates in both groups was “discharge” from the Army, accounting for 78% and 58% of non-graduates in the control and pilot cycles, respectively ($p=0.04$). Chapter 11 Entry-Level Separations (ELS) was the largest sub-category of discharges and accounted for 61% and 42% of all non-graduates in the control and pilot cycles, respectively.

Table 6. Reasons for Non-Graduation in Control and Pilot Infantry One Station Unit Training Cycles

Categories of Non-Graduation	Control (14 weeks)		Pilot (22 weeks)	
	Non-Graduates (n=69) n	Percent (%)	Non-Graduates (n=31) n	Percent (%)
Unit Recall	0	0.0	1	3.2
Retraining	10	14.5	7	22.6
Holdover (grenades)	1	1.4	0	0.0
Holdover (APFT)	1	1.4	1	3.2
Convalescent Leave (injury)	0	0.0	3	9.7
WTRP (injury)	1	1.4	1	3.2
Desertion	2	2.9	0	0.0
Discharge (all)	54	78.3	18	58.1
Chapter 11 (ELS)	42	60.9	13	41.9
Chapter 5-11 (EPTS)	12	17.4	4	12.9
Chapter 5-13 (Behavioral Health)	0	0.0	1	3.2

Notes:
APFT=Army Physical Fitness Test; WTRP=Warrior Training and Rehabilitation Program;
Chapter 11 (ELS)=Entry-level Separations; Chapter 5-11 (EPTS)=Existed Prior to Service medical conditions.

5.5 Injury Rates after 14 Weeks of Training in Control and Pilot Cycles

Table 7 compares rates of MSKIs and non-MSKIs between the control cycles (14 weeks) and after the first 14 weeks of training in the pilot cycles. In other words, all trainees in this comparison had trained for 14 weeks.

The definition of terms used in Tables 7 and 8 follows:

- **Injuries (columns 3 and 8 from the left margin):** Number of different injuries among trainees within the injury category (column 1) and injury type (column 2). Some trainees had more than one injury within an injury category (MSKI or non-MSKI) or within an injury type (acute or overuse). For example, a trainee could have a fractured finger (injury category: MSKI; injury type: acute) and a BSI in the hip (injury category: MSKI; injury type: overuse).

- **Percent of Injury Category (columns 4 and 9):** Number of injuries (column 3) divided by the number of "All" injuries in the category (MSKI or non-MSKI).

- **Injury Rate (columns 5 and 10):** Number of injuries per 100 trainees per month (e.g., 100 trainee-months).

- **Injured Trainees (column 6 and 11):** Number of trainees with one or more injuries within the injury category and type (row). For example, a trainee with two acute MSKIs would only be counted once as "one injured trainee" with an acute MSKI.

- **Percent Injured (column 7 and 12):** Number of injured trainees divided by the total number of trainees in the control cycles (n=474) or pilot cycles (n=400) times 100.

- **Rate Ratio (RR) (column 13)**: Ratio of the injury rate in control cycles and injury rate in pilot cycles (RR=rate in control cycles/rate in pilot cycles). Rate ratio values greater than "1" indicate that the injury rate was higher for control cycles compared to the pilot cycles. Values less than "1" indicate that the injury rate was lower in the control cycles compared to the pilot cycles.

- **p-value RR (column 14):** Indicator for the statistical significance of the Rate Ratio. (p≤0.05 indicates that the injury rate for the control cycles is statistically different from the injury rate in the pilot cycles).

- **p-value (percent injured) (column 15):** Indicator for the statistical significance of the Chi-square test of proportions comparing the percent injured in control and pilot cycles (p≤0.05 denotes a statically significant difference).

After the entire 14-week training cycle for the control cycles and the first 14 weeks of training for the pilot cycles (**Table 7**), there were 191 "All" MSKIs in the control cycles that affected 148 trainees (31% of all trainees) and 163 "All" MSKIs in the pilot cycles that affected 126 trainees (32% of all trainees). The percentages of trainees with "All" MSKIs in control and pilot cycles were not statistically different (p=0.89). The "All" MSKI rate was the same for both groups (13 injuries per 100 trainees per month; RR=1.01; p=0.91).

The acute MSKIs accounted for only 7% and 8% of MSKIs in the control and pilot cycles, respectively. The acute MSKI rate was the same for both groups (1 injury per 100 trainees per month; RR=0.87; p=0.71). The proportion of trainees that had an acute MSKI was also the same in both groups (3%; p=0.55).

The overuse MSKIs accounted for 93% and 92% of MSKIs in the control cycles and pilot cycles, respectively (p=0.98). The overuse MSKI rate was the same in both groups (12 injuries per 100 trainees per month) (p=0.82) (RR=1.03; p=0.82). Thirty-one percent of trainees in both the control and pilot cycles had an overuse MSKI (p=0.99).

For the non-MSKIs, the lower half of **Table 7** compares the injury rates and percentages of injured trainees between the control and pilot cycles. There were 81 "All" non-MSKIs in the control cycles and 29 in the pilot cycles. The "All" non-MSKI rate and percentage trainees that were injured in the control cycles were significantly higher than in the pilot cycles (<0.01 for both metrics). Overuse non-MSKIs accounted for two-thirds (68%) of "All" non-MSKIs in the control cycles but only one-quarter (28%) of non-MSKIs in the pilot cycles. The overuse non-MSKI rate and percentage injured were significantly higher in the control cycles compared to the pilot cycles (p<0.01 for both metrics).

Table 7. Injury Rates in Control and Pilot Cycles after 14 Weeks of Training

Injury Category	Injury Type	Control (14 Weeks) (n=474) Injuries (n)	Percent of All Injuries (%)	Injury Rate[a]	Injured Trainees[b] (n)	Percent Injured (%)	Pilot (1st 14 Weeks) (n=400) Injuries (n)	Percent of All Injuries (%)	Injury Rate[a]	Injured Trainees (n)[b]	Percent Injured (%)	Rate Ratio[c] (RR) RR	p-value[d]	p-value[e] (% Injured)
MSKI	All	191	-	12.9	148	31.2	163	-	12.7	126	31.5	1.01	0.91	0.89
	Acute	13	6.8	0.9	13	2.7	13	8.0	1.0	10	2.5	0.86	0.71	0.55
	Overuse	178	93.2	12.0	145	30.6	150	92.0	11.7	122	30.5	1.03	0.82	0.99
Non-MSKI	All	81	-	5.5	75	15.8	29	-	2.3	28	7.0	2.41	<0.01	<0.01
	Acute	26	32.1	1.8	23	4.9	21	72.4	1.6	20	5.0	1.07	0.82	0.88
	Overuse	55	67.9	3.7	54	11.4	8	27.6	0.6	8	2.0	5.94	<0.01	<0.01

Notes:
[a] Injury Rate: injuries per 100 trainees per month
[b] Some trainees had an acute MSKI and an overuse MSKI. For this reason, the total number of trainees with one or more "All" MSKIs does not equal the sum of acute and overuse MSKIs. The same applies to non-MSKIs.
[c] Rate Ratio (RR): Compares injury rates between control and pilot cycles (RR=rate for control cycles / rate for pilot cycles)
[d] p-value for Rate Ratio (p≤0.05 denotes a statically significant difference)
[e] p-value for Chi-square test comparing number of trainees with and without an injury between the two groups (p≤0.05 denotes a statically significant difference)
MSKI=musculoskeletal injury; Non-MSKI=non-musculoskeletal injury

5.6 Injury Rate after 22 Weeks of Training in Pilot Cycles

Table 8 presents the injury rate after the entire 22 weeks of training for the pilot cycles. This represents 8 additional weeks of training and exposure to injury risks compared to the first 14 weeks for the pilot cycles presented in **Table 7**. By the end of the 22 weeks, there were 218 "All" MSKIs, a 34% increase in injuries compared to 14 weeks, and 21% more trainees were injured in these final weeks (e.g., 38% vs. 31.5%). Similar to the finding for the first 14 weeks of the pilot cycles, 91% of "All" MSKIs were overuse injuries compared to 9% for acute MSKIs.

During the entire 22 weeks of training, there were only 44 "All' non-MSKIs that affected 42 trainees (11% of pilot trainees). Sixty-eight percent of the non-MSKIs were acute non-MSKIs.

Table 8. Injury Rate in Pilot Cycles after 22 Weeks of Training

		Pilot (22 weeks) (n=400)				
Injury Category	Injury Type	Injuries (n)	Percent of Injuries (%)	Injury Rate[a]	Injured Trainees (n)	Percent Injured[b] (%)
MSKI	All	218	-	11.4	152	38.0
	Acute	19	8.7	1.0	16	4.0
	Overuse	199	91.3	10.4	150	37.5
Non-MSKI	All	44	-	2.4	42	10.5
	Acute	30	68.2	1.6	29	7.3
	Overuse	14	31.8	0.7	14	3.5

Notes:
[a] Injury Rate: injuries per 100 trainees per month
[b] Some trainees had an acute MSKI and an overuse MSKI. For this reason, the total number of trainees with one or more "All" MSKIs does not equal the sum of acute and overuse injuries.
The same applies to non-MSKIs
MSK=musculoskeletal injury; Non-MSKI=non-musculoskeletal injury

5.7 Injury Types and Anatomic Location

Table 9 shows the distribution of injury types within the MSKI and non-MSKI categories. These data are presented separately for the control (14 weeks; **Table 7**) and pilot cycles (22 weeks; **Table 8**). Acute and overuse MSKIs are of greatest concern during Initial Entry Training (IET), being the most common injuries and the injuries with the greatest effect on training outcomes. Acute MSKIs comprised 7% of MSKIs in the control cycles (**Table 7**) and 9% of MSKIs in the pilot cycles (**Table 8**). Traumatic fractures and joint sprains were the two leading acute MSKIs in the control and pilot cycles (**Table 9**).

The overuse MSKI category accounted for 93% and 92% of MSKIs in the control and pilot cycles, respectively. Unfortunately, medical providers tend to use broad injury diagnoses in the

EHR for most overuse MSKIs, such as “pain in leg” and “pain in knee”. As a result, a more specific diagnosis for overuse injuries cannot be determined from the EHR for most of these overuse injuries. To gain further insight into these overuse MSKIs, a specific analysis of BSIs are included in **Section 5.8** below.

There were 55 overuse non-MSKIs among trainees in the control cycles compared to only 14 in the pilot cycles. This was a significant difference ($p<0.01$) between the groups. Of note, the overwhelming majority of these injuries (52 of 55) in the control cycles were foot blisters; there were only 14 blisters in the pilot cycles during the entire 22 weeks of training. In the case of the latter, there were no overuse non-MSKIs outside of blisters in the pilot cycles.

Table 9. Distribution of Injuries by Injury Category and Type in Control and Pilot Cycles

Injury Category and Type	Injury	Control (14 weeks) (n=474)		Pilot (22 weeks) (n=400)	
		Injuries (n)	Percent of Injury Type (%)	Injuries (n)	Percent of Injury Type (%)
MSK: Acute	Crush	0	0.0	1	5.3
	Dislocation	0	0.0	1	5.3
	Fracture (traumatic)	5	38.5	8	42.1
	Sprain	5	38.5	5	26.3
	Strain	3	23.1	4	21.1
	Total	13	100.0	19	100.0
MSK: Overuse	Neck-Back	23	12.9	16	8.0
	Upper Extremity	25	14.0	23	11.6
	Lower Extremity	99	55.6	127	63.8
	Bone Stress Injury	31	17.4	33	16.6
	Total	178	100.0	199	100.0
Non-MSK: Acute	Abrasion	9	34.6	8	26.7
	Concussion	1	3.8	0	0.0
	Contusion	6	23.1	3	10.0
	Insect Bite	3	11.5	5	16.7
	Laceration	7	26.9	14	46.7
	Total	26	100.0	30	100.0
Non-MSK: Overuse	Blister	52	94.5	14	100.0
	Hearing (tinnitus)	1	1.8	0	0.0
	Nerve	2	3.6	0	0.0
	Total	55	100.0	14	100.0

Notes:
MSKI=musculoskeletal injury; Non-MSKI=non-musculoskeletal injury

Table 10 presents the distribution of anatomic location of injury by injury category and type. The overuse MSKIs accounted for 93% and 92% of all injuries in the control (14 weeks) and pilot cycles (22 weeks), respectively (**Tables 7 and 8**). Of the overuse MSKIs, a similar proportion (72% and 79%; p=0.12) of injuries involved the lower extremity in the control and pilot cycles, respectively. The upper extremity was the second leading location of overuse MSKIs in the control and pilot cycles, accounting for 14% and 12% of injuries, respectively, which was also not different between the control and pilot training cycles (p=0.47).

Table 10. Distribution of Injuries by Anatomic Location in Control and Pilot Cycles

Injury Category and Type	Anatomic Location	Control (14 weeks) (n=474)		Pilot (22 weeks) (n=400)	
		Injuries (n)	Percent of Injury Type (%)	Injuries (n)	Percent of Injury Type (%)
MSK: Acute	Head/Neck	1	7.7	0	0.0
	Back	1	7.7	0	0.0
	Torso	1	7.7	4	21.1
	Upper Extremity	3	23.1	9	47.4
	Lower Extremity	7	53.8	6	31.6
	Other	0	0.0	0	0.0
	Total	13	100.0	19	100.0
MSK: Overuse	Head/Neck	0	0.0	0	0.0
	Back	23	12.9	18	9.0
	Torso	1	0.6	1	0.5
	Upper Extremity	25	14.0	23	11.6
	Lower Extremity	128	71.9	157	78.9
	Other	1	0.6	0	0.0
	Total	178	100.0	199	100.0
Non-MSK: Acute	Head/Neck	9	34.6	11	36.7
	Back	0	0.0	0	0.0
	Torso	0	0.0	4	13.3
	Upper Extremity	9	34.6	10	33.3
	Lower Extremity	8	30.8	5	16.7
	Other	0	0.0	0	0.0
	Total	26	100.0	30	100.0
Non-MSK: Overuse	Head/Neck	1	1.8	0	0.0
	Back	1	1.8	0	0.0
	Torso	1	1.8	0	0.0
	Upper Extremity	1	0.0	0	0.0
	Lower Extremity	52	94.6	14	100.0
	Other	0	0.0	0	0.0
	Total	55	100.0	14	100.0

Notes:
MSKI=musculoskeletal injury; Non-MSKI=non-musculoskeletal injury

5.8 Bone Stress Injuries

For this evaluation, IPD staff reviewed the radiographic reports for all suspected bone stress injuries (BSIs). These injuries, often referred to as stress reactions and stress fractures, are overuse MSKIs that result from the cumulative effects of microtraumatic energy exchanges. BSIs are important injuries because they often require prolonged rest and recovery, may require surgery, and can result in long-term disability. By comparison, traumatic fractures are acute musculoskeletal injuries that result from a sudden exchange of mechanical energy that causes a bone to fracture.

Table 11 summarizes and compares the incidence of BSIs and traumatic fractures between the control and pilot cycles. In the control cycles, 23 trainees had a total of 31 BSIs; in the pilot cycles, 21 trainees had a total of 33 BSIs. The percentage of trainees with BSIs was similar in both groups (5%; p=0.79). BSIs accounted for 17% of all overuse MSKIs in both groups. The longer pilot training cycles did not result in more of BSIs. By comparison, five trainees in the control cycles and eight trainees in the pilot cycles had a traumatic fracture. The percentage of trainees with a traumatic fracture was similar in both groups (p=0.30).

Table 11. Bone Stress Injuries and Traumatic Fractures in Control and Pilot Cycles

	Control (14 weeks) (n=474)			Pilot (22 weeks) (n=400)			
Injury Type	Injuries (n)	Injured Trainees (n) [a]	Percent Trainees (%)	Injuries (n)	Injured Trainees (n) [a]	Percent Trainees (%)	p-value[b]
BSI	31	23	4.9	33	21	5.3	0.79
Traumatic Fracture	5	5	1.1	8	8	2.0	0.30

Notes:
[a] Some trainees had more than one BSI
[b] p-value Chi-square test of proportions (p≤0.05 denotes a statically significant difference)
BSI=bone stress injury

The distribution of the BSIs by specific anatomic location is presented in **Table 12** for the control and pilot cycles. Differences are noted in the distributions in the two groups. The femoral neck was the most common stress fracture in both groups, but there were also five BSIs in the femoral head among trainees in the pilot cycles, compared to none among the control cycles. Also noteworthy was the higher proportion of BSIs in the pelvis (18%) among trainees in the pilot cycles compared to the control cycles (10%). Further in-depth investigation is required to understand if/how these differences in the anatomic distribution of BSIs relate to differences in the training, physical fitness, or other factors.

Table 12. Anatomic Location of Bone Stress Injuries in Control and Pilot Cycles

Anatomic Location of Bone Stress Injury	Control (14 weeks) (n=31)[a]		Pilot (22 weeks) (n=33)[a]		Overall (n=66)[a]	
	n	Percent (%)	n	Percent (%)	n	Percent (%)
Sacrum	0	0.0	2	6.1	2	3.1
Pelvis	3	9.7	6	18.2	9	14.1
Femoral Head	0	0.0	5	15.2	5	7.8
Femoral Neck	13	41.9	7	21.2	20	31.3
Femur	4	12.9	2	6.1	6	9.4
Tibia	4	12.9	5	15.2	9	14.1
Calcaneus (heel)	1	3.2	0	0.0	1	1.6
Metatarsals (foot)	6	19.4	6	18.2	12	18.8
Total	31	100.0	33	100.0	64	100.0

Note: [a] Includes all bone stress injuries confirmed by radiographic review

5.9 Graduation Status of Trainees with Bone Stress Injury

Table 13 compares the graduation status of trainees with and without BSIs in the control and pilot cycles. In the control cycles, 44% of trainees with a BSI graduated from OSUT compared to 88% of trainees without a BSI (p<0.001). Similarly, in the pilot cycles, a smaller proportion of trainees with BSI graduated (62%) compared to trainees without a BSI (94%; p<0.01). But the proportion of trainees with BSIs that graduated was not statistically different between the control and pilot cycles (p=0.22).

Table 13. Graduation Status of Trainees with Bone Stress Injuries in Control and Pilot Cycles

Graduation Status	Control (14 weeks) (n=474)					Pilot (22 weeks) (n=400)				
	Bone Stress Injury (n=23)		No Bone Stress Injury (n=451)			Bone Stress Injury (n=21)		No Bone Stress Injury (n=379)		
	n	Percent (%)	n	Percent (%)	p-value[a]	n	Percent (%)	n	Percent (%)	p-value[a]
Graduates	10	43.5	395	87.6	<0.01	13	61.9	356	93.9	<0.01
Non-Graduates	13	56.5	56	12.4		8	38.1	23	6.1	

Note: [a] p-value for Chi-square test of proportions comparing graduation status between trainees with and without bone stress injuries (p≤0.05 denotes a statically significant difference)

Table 14 provides additional detail for the reasons why trainees with BSIs did not graduate. In the control cycles, eight trainees with a BSI (62%) were discharged, and five trainees (38%) were still in the training pipeline (retraining and WTRP, combined) when data collection ended in mid-January 2019. In the pilot cycles, only two trainees with a BSI (25%) were discharged, but six trainees (75%) were still in the training pipeline. In both groups, Chapter 11 (Entry-level Separation) was the most common discharge type for trainees with a BSI.

Table 14. Reasons for Non-Graduation among Trainees with Bone Stress Injuries in Control and Pilot Cycles

	Control (14 weeks)		Pilot (22 weeks)	
	Bone Stress Injuries (n=13)		Bone Stress Injuries (n=8)	
Reasons for Non-Graduation	n	Percent (%)	n	Percent (%)
Unit Recall	0	0.0	0	0.0
Retraining	4	30.8	2	25.0
Holdover (grenades)	0	0.0	0	0.0
Holdover (APFT)	0	0.0	0	0.0
Convalescent Leave)	0	0.0	3	37.5
WTRP (injury)	1	7.7	1	12.5
Desertion	0	0.0	0	0.0
Discharge (all)	8	61.5	2	25.0
Chapter 11 (ELS)	6	46.2	2	25.0
Chapter 5-11 (EPTS)	2	15.4	0	0.0
Chapter 5-13 (Behavioral Health)	0	0.0	0	0.0

Notes:
APFT=Army Physical Fitness Test; WTRP=Warrior Training and Rehabilitation Program; Chapter 11 (ELS)=Entry-level Separations; Chapter 5-11 (EPTS)=Existed Prior to Service medical conditions

5.10 Medical Encounters by Type of Medical Provider

Since medical providers at Ft. Benning are required to document medical care in the EHR, documented medical encounters (i.e., visits) provide information about the total number of clinic visits for injuries and the types of medical provider that rendered care. Athletic trainers are assigned to the INF OSUT training companies as a means of providing forward and timely medical evaluation and treatment of injured trainees. TRADOC leaders expect that injured trainees seen by athletic trainers receive more timely medical care for injuries and return to the unit earlier in the day to attend training events compared to trainees evaluated at the medical treatment facility.

Overall, there were 409 MSKIs and 125 non-MSKIs in the control (14 weeks) and pilot cycles (22 weeks), combined (**Tables 7 and 8**). For MSKIs, medical providers recorded 1,390 medical encounters (**Table 15**), accounting for, on average, 3.4 encounters per MSKI. By comparison, medical providers documented 156 medical encounters for non-MSKIs, accounting for, on average, 1.2 encounters per non-MSKI.

The two leading medical provider categories for injured trainees in the control and pilot cycles were the athletic trainers and physical therapists. The athletic trainers accounted for 48% of encounters for MSKIs and 37% of encounters for non-MSKIs, while the physical therapist accounted for 38% of the MSKI encounters. Overall, these two provider categories accounted for 86% of MSKI encounters and 37% of non-MSKI encounters.

Unfortunately, we cannot determine from the EHR if encounters by athletic trainers and/or physical therapists resulted in trainees missing less training during the day or being able to return to duty quicker. We also cannot determine if trainees were given profiles by any of the providers or if there were fewer days of limited duty overall as a result of care rendered by the athletic trainers.

Table 15. Injury Medical Encounters by Medical Provider Type

Injury Type	Injury Medical Encounters (Visits) (n=1,546)								Total Encounters (n)
	Internal Medicine	Orthopedics	Podiatry	Primary Care	Emergency Room	Physical Therapy	Occupational Therapy	Athletic Trainer	
MSKI									
All	0	18	16	126	13	532	21	664	1390
Acute	0	11	16	21	9	7	0	7	71
Overuse	0	7	0	105	4	525	21	657	1319
Percent of Row (%)	0.0	1.3	1.2	9.1	0.9	38.3	1.5	47.8	100.0
Non-MSKI									
All	4	1	0	72	21	0	0	58	156
Acute	4	1	0	35	18	0	0	5	63
Overuse	0	0	0	37	3	0	0	53	93
Percent of Row (%)	2.6	0.6	0.0	46.2	13.5	0.0	0.0	37.2	100.0
All Injuries									
Total Encounters	4	19	16	198	34	532	21	722	1546
Percent of Row (%)	0.3	1.2	1.0	12.8	2.2	34.4	1.4	46.7	100.0

Notes:
MSKI=musculoskeletal injury; Non-MSKI=non-musculoskeletal injury

6 SUMMARY OF FINDINGS

6.1 Trainee Physical Attributes and Demographics

- There were no significant differences in physical characteristics (i.e., the mean age, height, weight, or BMI) between trainees in the control and pilot cycles at baseline.

- There were significant differences in demographics between trainees in the control and pilot cycles. Larger proportions of pilot trainees enlisted with the 18X MOS, were E-2 or higher, and were college graduates; a smaller proportion of pilot trainees were in the NG. These positive differences for trainees in pilot cycles may have contributed to the higher proportion of trainees in the pilot cycles that successfully graduated from INF OSUT; however, these differences and their effect on training outcomes require further analysis that is beyond the scope of this evaluation.

6.2 Occupational Physical Assessment Test Performance

- Trainees in the pilot cycles had significantly higher mean performance on each of the four OPAT events during the recruitment process. This indicates that trainees in the pilot cycles had higher levels of: (1) upper and lower body muscular power (SPT and SLJ, respectively), (2) lower body muscular strength (SDL), and (3) aerobic capacity (IAR) at the start of OSUT compared to trainees in the control cycles. Whether or not these differences are meaningful in the context of INF OSUT or INF Soldiers remains to be determined.

6.3 Army Physical Fitness Test Event Performance

- On APFT1 at the beginning of OSUT, pilot trainees had higher levels of muscular endurance (push-ups and sit-ups) and aerobic fitness (2-mile run) compared to control ltrainees. Pilot trainees, on average, did significantly more repetitions of push-ups (9 more push-up reps) and sit-ups (9 more sit-up reps), and ran 1.3 minutes faster (~1 minute 18 seconds) on the 2-mile run. They also had a significantly higher total score on APFT1 (38 points higher, adjusted for age) compared to trainees in the control cycles.

- On the final APFT during OSUT (APFT5), trainees in the pilot cycles had significantly higher mean performance on all three APFT5 events and a higher total score (age-adjusted) compared to trainees in the control cycles. On average, pilot trainees did 8 more push-up reps, 5 more sit-up reps, and ran 2-miles faster (0.6 minutes (36 seconds) faster); their APFT5 total score was 21 points higher).

- Even though trainees in pilot cycles had higher mean performance on APFT1 and had 6–8 additional weeks of training compared to control cycle trainees, the mean performance differences between the pilot and control trainees on all three events were smaller on APFT5 compared to APFT1. In other words, on average, trainees in the control cycles improved more on each of the events compared to trainees in pilot cycles, in spite of the shorter training cycle for controls. This was most likely an effect of the lower baseline fitness of trainees in the control cycles and is a well-documented phenomenon in the training literature. In fact, we recently observed this same effect in another study of IET trainees (APHC 2018b).

- Whether or not the above mentioned differences in physical fitness between trainees in the control and pilot cycles (as assessed by the OPAT and APFT) were meaningful in context of training and performance of physically demanding tasks during INF OSUT is beyond the scope of this evaluation.

6.4 Graduation Status

- Overall, graduation success was higher in the pilot cycles (92%) compared to the control cycles (85%; p<0.01). The positive differences in demographics for the pilot trainees may partially explain why a significantly higher proportion of pilot trainees graduated. The longer length of training may have also allowed injured trainees additional time to recover from injuries and meet graduation requirements; trainees with lower levels of physical fitness may have benefited from the additional weeks of training to meet the APFT standards. Further evaluation is required to identify factors that contributed to higher graduation success in the pilot cycles.

6.5 Injury Rates after 14 Weeks of Training in Control and Pilot Cycles

- At the end of 14 weeks of training in the control and pilot cycles, the “All” MSKI rates (13 injuries per 100 trainees per month) and proportion of trainees with an “All” MSKI (~32%) were similar in the control and pilot cycles (MSKI rate: p=0.91; proportion of trainees: p=0.89). Acute MSKI rates (1.0 injuries per 100 trainees per month; p=0.71) were similar for both groups, as were the overuse MSKI rates (12 injuries per 100 trainees per month; p-0.82) at 14 weeks. The proportion of “All” MSKIs that were overuse MSKIs was similar in the control and pilot cycles (93% and 92%, respectively; p<0.001).

- At the end of 14 weeks of training in the control and pilot cycles, the control cycles had a significantly higher overuse non-MSKI rate (3.7 injuries per 100 trainees per month; p<0.01) compared to the pilot cycles (0.6 injuries per 100 trainees per month, respectively). This 6-fold higher rate for the control cycles was primarily due to higher incidence of foot blisters among control trainees (n=52) compared to pilot trainees (n=8).

6.6 Injury Rate after 22 Weeks of Training in Pilot Cycles

- After 22 weeks, there were 218 MSKIs in the pilot cycles, a 34% increase compared to 14 weeks, and an additional 21% of trainees had an MSKI in these final weeks. Ninety-one percent of MSKIs were overuse MSKIs. These increases were partially expected since the longer length of training exposed pilot trainees to additional injury risks and exposures beyond those of the 14-week control cycles or first 14 weeks of the pilot cycles.

- After 22 weeks, 11% of pilot trainees had an “All” non-MSKI compared to 7% after the first 14 weeks of training. Unlike the control cycles where overuse non-MSKIs accounted for 68% of non-MSKIs, only 32% of non-MSKIs were overuse injuries in the pilot cycles.

These differences were driven primarily by the higher incidence of foot blisters in the control cycles (n=52) compared to pilot cycles (n=14).

6.7 Injury Types and Anatomic Location

- The lower extremity accounted for 71% and 79% of overuse MSKIs among trainees in control and pilot cycles, respectively.

6.8 Bone Stress Injuries

- The incidence of radiologically confirmed BSIs (i.e., stress reactions and stress fractures) was 5% in the control and pilot cycles (p=0.79). The 8-week longer training cycle did not result in more BSIs in the pilot cycles. But pilot trainees had five femoral head BSIs (none among control trainees) and a higher proportion of their BSIs involved the pelvis. These differences and their relationship to training require further in-depth examination that is beyond the scope of this evaluation.

6.9 Graduation Status of Trainees with Bone Stress Injury

- In the control cycles, 44% of trainees with a BSI graduated from OSUT compared to 88% of trainees without a BSI (p<0.001). In the pilot cycles, 62% of trainees with a BSI graduated and 94% of trainees without a BSI graduated (p<0.01). The proportions of trainees with BSIs that graduated in the control (44%) and pilot cycles (62%) were not significantly different (p=0.22). Previous studies have similarly shown that a significantly higher proportion of IET trainees with BSIs were discharged compared to trainees with no BSI (Hauret 2004). Further evaluation is needed to determine if the smaller proportion of BSI discharges in the pilot cycles resulted from the longer training cycle (allowing additional time to recover and meet training requirements) or resulted from other factors.

6.10 Medical Encounters by Type of Medical Provider

- Overall, the athletic trainers accounted for 47% of the injury-related medical encounters (clinic visits) for MSKIs and non-MSKIs that were reported in the HER; physical therapists accounted for 34% of encounters. We could not determine from available data whether medical encounters by athletic trainers and physical therapists resulted in trainees missing less training during the day or if there were fewer days of limited duty, overall, as a result of care rendered by the athletic trainers.

7 CONCLUSIONS

- Differences in trainee demographics between the control and pilot cycles may have influenced differences in training outcomes, such as graduation.

- Trainees in the control cycles had lower physical fitness at the beginning of OSUT compared to trainees in the pilot cycles, as assessed by the OPAT, the 1-1-1 assessment, and APFT1. This evaluation did not examine if/how these differences in physical fitness impacted training outcomes or performance of physically demanding tasks during OSUT.

- Mean differences in APFT5 event performance between control and pilot trainees (lower performance) were smaller than differences in APFT1 event performance, even though pilot trainees had approximately 6 additional weeks of training. In other words, control trainees improved more than pilot trainees between APFT1 and APFT5.

- Higher proportions of trainees in the pilot cycles graduated OSUT compared to trainees in control cycles (92% vs. 85%; $p<0.01$).

- MSKI injury rates at 14 weeks of training were similar for the control and pilot cycles.

- After 22 weeks, there was a 34% increase in MSKIs in the pilot cycles compared to 14 weeks in the pilot cycles, and an additional 21% of trainees had an “All” MSKI in these final weeks. These increases were not unexpected since the longer length of training exposed pilot trainees to additional injury risks and exposures beyond those of the 14-week control cycles and the first 14 weeks of the pilot cycles.

- The injury rates for “All’, acute, and overuse MSKIs for the 22-week pilot cycles were not significantly different from the respective injury rates after 14 weeks of training for the pilot cycles ($p>0.05$ for each rate comparison). Even though the number of injuries of each type increased (numerator in calculating injury rates [injuries/100 trainees per month]), the denominator in the rate calculation also increased due to the additional length of training from 14 weeks to 22 weeks.

- Approximately 90% of MSKIs were overuse MSKIs in the control and pilot cycles.

- Overall, incidence of BSIs (i.e., stress reactions and stress fractures) was similar in the control and pilot cycles (5% of trainees). However, the differences in anatomic distribution of BSIs (higher incidence of femoral head and pelvic BSI in the pilot cycles) requires further study to understand the relationship between training and BSIs.

8 POINT OF CONTACT

The point of contact for this report is the IPD, APHC. Questions may be directed to the Injury Prevention Division at usarmy.apg.medcom-aphc.mbx.injuryprevention@mail.mil, or commercial phone 410-436-4655, or DSN 584-4655.

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APPENDIX A

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APPENDIX B

Glossary

AFHSB	Armed Forces Health Surveillance Branch
APFT	Army Physical Fitness Test
APFT1	1st Army Physical Fitness Test
APFT5	5th Army Physical Fitness Test
APHC	Army Public Health Center
AR	Army Regulation
ATRRS	Army Training Requirements and Resource System
BMI	body mass index
BSI	bone stress injury
CI	confidence interval
cm	centimeters
CPL	corporal
DA	Department of the Army
DOD	Department of Defense
DOTD	Directorate of Training and Doctrine
EHR	electronic health record
ELS	Entry-level Separations
EPTS	Existed Prior to Service
Ft.	Fort
GA	Georgia
IAR	Interval Aerobic Run
IET	Initial Entry Training
in	inches
INF	Infantry

IPD	Injury Prevention Division, Army Public Health Center
kg	kilogram
m	meter
lb	pounds
MEDCOM	U.S. Army Medical Command
MCoE	Maneuver Center of Excellence
min	minutes
MOS	Military Occupational Specialty
MRI	Magnetic Resonance Imaging
MSK	musculoskeletal
MSKI	Musculoskeletal injury
NG	National Guard
Non-MSKI	Non-musculoskeletal injury
OPAT	Occupational Physical Assessment Test
OSUT	One Station Unit Training
pts	points
reps	repetitions
RR	rate ratio
SD	standard deviation
SDL	Strength Deadlift
SLJ	Standing Long Jump
SPT	Seated Power Throw
TRADOC	U.S. Army Training and Doctrine Command
vs.	versus
WTRP	Warrior Training and Rehabilitation Program
yr	years