Chapter 7

PHYSICAL FITNESS IN INITIAL ENTRY TRAINING

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INTRODUCTION

The US Army recruits approximately 10,000 new soldiers per month to fill the ranks of the active duty and reserve component forces, which total approximately 1 million soldiers. In 9 weeks, these volunteers must undergo a transformation from civilian to soldier. For many, the physical requirements pose the greatest obstacle to graduation from initial entry training (IET). IET includes basic combat training (BCT), advanced individual training (AIT), and one-station unit training, which is a combination of BCT and AIT for certain military occupations.

In 2002, the commander of the Army Accessions Command tasked the US Army Physical Fitness School (USAPFS) to develop a standardized physical training (PT) program for use throughout the IET programs that would improve performance without causing injuries. The USAPFS intended the new program to bring recruits to an end-state of physical readiness considered necessary to meet the demands of duty in the current operational environment.

The first step in developing such a program is to identify the client, or the new soldier. The fitness levels of the average new soldiers should not be confused with those of the average veteran. While most new soldiers have the advantage of youth, they often lack experience and may, in fact, be performing many tasks for the first time. Several studies[1–5] show that low fitness levels are associated with a higher risk of injuries. Therefore, a new soldier who is not physically fit may be a detriment to the unit mission or an outright loss because of injury.

The second step in developing a physical fitness program is to identify and define the specific components of fitness and principles of exercise that will best support training tasks and fitness outcomes. This step was accomplished through a comprehensive review of research on exercise prescription, matching the exercise methods to both the client and the physical tasks involved in IET.[6] USAPFS focused on the fitness components of strength, endurance, and mobility, which were compared to "warrior core tasks" to determine the relative importance of each one. USAPFS used the exercise principles of precision, progression, and integration to ensure that appropriate exercises were scheduled and performed in the proper sequence, volume, and intensity to facilitate performance without compromising injury control.

The third step in program development is to define the challenges to universal physical fitness in IET, and the fourth step is to develop a product: a PT strategy for IET that meets Army course-of-action requirements—feasible, acceptable, suitable, complete, and distinct from other courses of action. Finally, the last step in program development is to test the strategy in a controlled IET environment to ensure that it provides the desired outcome: maximum fitness achieved with minimum injury. The result is a physical fitness exercise prescription for IET that significantly improves pass rates on the end-of-cycle APFT for BCT soldiers while significantly decreasing injury rates.[7] The Army implemented the IET standardized PT program throughout its training locations in April 2004.

ASSESSMENT OF THE INITIAL ENTRY TRAINING CLIENT: THE NEW SOLDIER

Soldiers are expected to be among the more physically fit demographic groups in the country. They are expected to perform arduous and repetitive physical tasks on demand. Accordingly, their safety, and the safety of their fellow soldiers, often rests on their physical ability to do their jobs.

Studies of American society shows that an increasing segment of the population is less active, less fit, and less concerned with physical fitness.[8–11] Because the Army relies exclusively on volunteers from this pool of applicants, it is not surprising that many volunteers reflect the societal norm. Fitness levels are of growing concern to PT program designers for the IET population. The trends of increasing body weight and slower run times,[8] and an associated higher injury rate,[1,3,4,5] for new soldiers further complicate the physical conditioning process.

COMPONENTS OF FITNESS

The Army's current doctrine containing the operational and doctrinal definitions of physical fitness, Field Manual 21-20, *Physical Fitness Training* (1992),[12] includes body composition, flexibility, muscular strength, muscular endurance, and cardio-respiratory endurance as the components of physical fitness. These components can be summarized by the functional areas of strength, endurance, and mobility.

Strength

Strength is the ability to overcome resistance. The classic definition of strength is the maximal amount of mass that can be moved one time from point *a* to point *b* by a muscle or group of muscles. This is also called a one repetition max. Soldiers need strength to foot march under load, enter and clear a building or

trench-line, repeatedly load heavy artillery rounds, lift equipment, and transport a wounded soldier to the casualty collection point. A well-designed strength-training program *(a)* improves performance and appearance and *(b)* minimizes injuries. USAPFS's approach to strength training is performance-oriented. The aim is to first attain and then to exceed the muscular strength required to perform functional movements against resistance.

Calisthenics are the foundation of Army strength training and body management. They are designed to develop the fundamental movement skills necessary for soldiers to manipulate their own body weight. Once a soldier can manipulate his or her own body weight, additional exercises, sets, repetitions, and resistance may be used to facilitate further strength gains. A provision for developing any physical fitness program for the Army is to minimize the need for equipment. The program must be as deployable as the soldier.

Using body weight for resistance is an acceptable way to build core strength and ensure that all major muscle groups are trained. A calisthenics drill developed as a warm-up includes body management competency through all three planes of motion and provides general conditioning. A specific drill for push-up and sit-up improvement was developed to enhance APFT performance. The push-up and sit-up events are emphasized during IET because of their prominence on the APFT. Although there are specific benefits from doing these exercises, they should not overshadow other strength requirements in training. A climbing drill, using a horizontal pull-up bar, was added to the drill to promote muscular balance and strength needed for climbing and body management above the ground.

The exercise selection process was synchronized with common soldier tasks in appearance and function. A soldier's task matrix was developed to compare physical requirements to these warrior core tasks. Table 7-1 shows an example of a matrix used to align one of the core tasks, "shoot," with components of fitness and PT activities. In most cases, the requirement for strength exceeds the requirement for aerobic endurance (in contrast to the emphasis placed on aerobic conditioning throughout the Army).

TABLE 7-1

WARRIOR CORE TASK ANALYSIS: SHOOT

	Components					PT Activities							
Warrior Core Tasks: Shoot	**Musuclar Strength**	**Muscular Endurance**	**Aerobic Endurance**	**Anaerobic Endurance**	**Mobility**	**Calisthenics**	**Movement Drill**	**Climbing**	**Speed Running**	**Shuttle Run**	**Sustained Running**	**Stretch Drill**	**Obstacle Course**
Qualify with assigned weapon		x		x	x	x						x	
Correct malfunctions with assigned weapon		x		x	x	x						x	
Engage targets with M240B MG or M60 MG		x			x	x						x	
Engage targets with M249 MG		x			x	x						x	
Engage targets with M2 .50 Cal. MG	x	x			x	x						x	
Engage targets with MK-19	x	x			x	x						x	
Correct malfunctions of an MG	x	x			x	x						x	
Engage targets with weapon using night vision sight		x			x	x						x	
Engage targets using an aiming light		x			x	x						x	
Employ mines and hand grenades		x			x	x						x	

MG: machine gun
PT: physical training
Data source: US Army Physical Fitness School, Fort Benning, Ga.

Endurance

Endurance is the ability to sustain activity. It includes both aerobic endurance (the ability to sustain activity for long periods of time) and anaerobic endurance (the ability to perform high-intensity activity for a short period of time). A properly planned and executed endurance training program is balanced between aerobic and anaerobic training.

The gold standard for aerobic fitness is direct measurement of the maximal oxygen uptake per unit time ($\dot{V}O_{2max}$). Many ways to estimate $\dot{V}O_{2max}$ are readily available, including step-testing, bicycle ergometry, and timed distance runs. Examples of aerobic training are distance running, foot marching, cross-country movement, and water survival. Aerobic endurance is enhanced by higher intensity distance running (75%–85% $\dot{V}O_{2max}$). There is often a necessary trade-off between intensity and duration. As intensity is increased, duration should remain the same or be reduced. Likewise, if duration is increased, intensity should be maintained or decreased.

Anaerobic fitness can be estimated through a variety of assessments, including the timed 300-yard shuttle

EXHIBIT 7-1

COMPONENTS OF MOBILITY

Agility:	the ability to stop, start, change direction and efficiently change body position. Performing movement drills, the shuttle run, and specific calisthenics are included in the standardized physical training program in an effort to improve agility. Any single assessment of agility, such as the 300-yard shuttle run, is a way to quantify mobility, but only captures one aspect of this important component of physical fitness.
Balance:	the ability to maintain equilibrium, an essential component of movement. External forces, such as gravity and momentum, act on the body at any given time. Sensing these forces and responding appropriately leads to quality movements. Conditioning drills 1 and 3 in the standardized physical training program are designed to challenge and improve balance.
Coordination:	the ability to synchronize the simultaneous movement of a number of body parts. Driving military vehicles and operating various machines and weaponry requires coordination. Coordination of arm, leg, and trunk movements is essential in climbing, low crawling, dodging, traversing obstacles and many other initial entry training tasks. All conditioning drills and the movement drill in the standardized physical training program require coordination.
Flexibility:	the range of movement at a joint and its surrounding muscles. Flexibility is essential to perform quality movements safely. Regular, progressive, and precise performance of calisthenics and resistance exercises through a full range of motion will promote flexibility. Time spent on long-duration, low-intensity, sustained stretching exercises performed in the recovery drill helps to improve flexibility.
Posture:	any position in which the body resides. Posture is fluid and constantly changing as the body shifts to adapt to the forces of gravity and momentum. Good posture is important to military bearing and optimal body function. Proper carriage of the body during standing, sitting, lifting, marching, and running is essential to movement quality, performance, and injury control. The precision of movement required to perform all the drills in the standardized physical training program assists in developing proper body carriage.
Stability:	depends on structural strength and body management. Movements such as lifting a heavy load from the ground to an overhead position require stability to ensure optimal performance with minimal risk of injury. In the lifting example, the abdominal muscles must act as stabilizers to protect the low back and to maintain optimal posture. The rotator cuff muscle in the shoulder provides stabilization during overhead lifting and throwing motions. The specific exercises for stability and the emphasis on precision and posture in the standardized physical training program promote the development of stabilizing muscles.
Power:	the product of strength and speed. Throwing, jumping, striking, and moving explosively from a starting position require both speed and strength. Power is generated from the core (hips and torso). Developing core strength, stability, and mobility is important to increasing power.

run, obstacle course negotiation, and dummy drags. Examples of anaerobic training are sprinting intervals, low crawling, transporting a casualty, and negotiating obstacles. Several repetitions of high-intensity, short-duration activity are required for optimal anaerobic conditioning (> 85% $\dot{V}O_{2max}$). Decreasing recovery time between repetitions can improve performance.

Analysis of the mission and mission-essential task lists for nearly all units shows a significant need for anaerobic endurance. To enhance effectiveness and survivability, soldiers must train to efficiently perform activities of high intensity and short duration. Endurance programs based solely on slow long-distance running, although likely to improve aerobic endurance, will fail to prepare units for the type of anaerobic endurance or intensity they will need on the battlefield.

Mobility

Mobility is proficiency in movement, or the functional application of strength and endurance. For example, strength with mobility allows a soldier to squat low to achieve a good position to lift a casualty. Without sufficient mobility, a strong soldier may have difficulty executing the same casualty transport technique. Likewise, endurance without mobility may be fine for a distance runner, but for soldiers performing individual movement techniques, both components are essential for success. Performing movements with correct posture and precision improves physical readiness while controlling injuries. Mobility training is incorporated into calisthenics drills, a military movement (agility) drill, the climbing drill, the stretch drill, and the 300-yard shuttle run. Several quantitative performance factors fall under the definition of mobility (Exhibit 7-1).

Mobility is not as easy to measure as strength or endurance. Mobility, which can be measured at one joint, several joints, or the whole body, is a qualitative measure of function or the ability to transfer strength to a specific task. It also relates to subjective ease of motion while performing a specific function. One thing is certain: a mobile Army must have mobile soldiers. Again, calisthenics specifically address mobility for new soldiers. Full ranges of motion in multiple planes are accomplished through slow, precise performance of the calisthenics exercises. This promotes the mobility needed to apply strength in a functional way.

EXERCISE PRINCIPLES

Exercise principles are guidelines used to develop effective physical fitness programs. Field Manual 21-20[12] lists progression, regularity, overload, variety, recovery, balance, and specificity (PROVRBS) as the principles of exercise. Although PROVRBS is an effective mnemonic, a thorough review of these principles and others produced a list of the essential exercise principles specific to IET: (*a*) precision, (*b*) progression, and (*c*) integration.

Precision

Precision requires an exact posture, position, or motion for optimal results and the most beneficial stress on muscles, connective tissue, and joints. Attention to detail must be taught and emphasized during practice. The philosophy that "perfect practice makes perfect" will also affect the way that soldiers approach routine tasks.[13] Although the exercises in the conditioning drills are relatively easy to perform with little practice, there is an intended cross-over from these exercises to functional activities of daily life in the military. This movement strategy and motor learning model is a unique and overdue approach to physical fitness training in the Army. Amateur and professional sports coaches and trainers often use the same model to maximize the effect of PT programs on desired performance outcomes.[14] The windmill exercise is an example of movement proficiency that relates to the task of loading explosive rounds into a mortar tube as part of a team-oriented task (Figure 7-1).

Progression

Progression takes into account current levels of fitness and produces improvement through overload, regularity, recovery, variety, and balance. Progression is not only the key to improving physical performance, but it is also important in injury control and avoidance of overtraining.

Overload and Regularity

Progressive overload is the stimulus that causes physical adaptation. Inducing overload too slowly will waste valuable training time (especially in IET); conversely, progressing too quickly will likely produce injury and overtraining. Overload should be applied systematically and must incorporate progressive increases in regularity, intensity, and duration. It is seldom prudent to increase multiple variables at the

a

Conditioning Drill 1

Exercise 6: The Windmill

Purpose: This exercise develops the ability to safely bend and rotate the trunk. It conditions the muscles of the trunk, legs, and shoulders.
Starting Position: Straddle stance with arms sideward, palms facing down.
Cadence: **SLOW**.

Count:
1. Bend the hips and knees while rotating to the left. Reach down and touch the outside of the left foot with the right hand while looking toward the rear. The left arm is pulled rearward to maintain a straight line with the right arm.
2. Return to the starting position.
3. Repeat count one to the right.
4. Return to the starting position.

Starting Position | Count 1 | Count 2 | Count 3 | Count 4

Check Points:
- From the starting position, feet are straight ahead, arms parallel to the ground, hips set, and abdominals tight.
- On counts one and three, ensure that the knees bend during the rotation. Head and eyes are directed to the left foot on count one and the right foot on count three.

Precautions: This exercise is always performed at a slow cadence.

b

Fig. 7-1. Calisthenics link to military task. For example, (**a**) the windmill exercise (from drill 1, exercise 6, of the TRADOC Physical Training Guide for Basic Combat Training), strengthens the muscles and improves agility and precision for (**b**) loading and firing mortars.
(a) Reproduced from: TRADOC Standardized Physical Training Program Guide for BCT. November 5, 2003. Available at: www.rotc.usaac.army.mil/training/current_ops_div/docs/tradoc pt guide for bct.pdf. Accessed October 19, 2005.
(b) Photographs: Courtesy of US Army Physical Fitness School; reproduced from: the US Army Public Affairs Web site. Available at http://www4.army.mil/ocpa. Accessed November 22, 2005.

same time. For example, increasing running intensity and duration at the same time will result in more soldiers falling out of the run.

Recovery

Recovery must be programmed into the training schedule to prevent injury. A good physical fitness program will prepare soldiers to cope in stressful environments; however, overtraining is counterproductive and potentially dangerous. If overtraining occurs, performance will decrease despite efforts to the contrary.

Overtraining is perhaps the most overlooked syndrome that can occur in an overly aggressive training regimen.[15] Some symptoms of overtraining such as increased fatigue, depression, loss of sleep and appetite, reduced concentration, and lack of motivation may be hard to discern in the IET environment, where part of the objective is to teach individuals to function in stressful environments. It may not be possible to protect all new soldiers from the overtraining syndrome, but it is advisable to follow a consistent recovery pattern and follow prescribed work–rest ratios to improve the odds for the vast majority.

Variety

Providing a wide range of exercises and drills introduces variety to the training schedule and helps prevent boredom or burnout. Besides using different exercises, altering exercise volume or intensity and changing the order of activities add variety and may also produce better results. However, frequent wholesale changes should be avoided, because soldiers and trainers may become frustrated if they do not have enough time to adapt or to see improvements in specific components of physical fitness.

Balance

Balance is provided to an exercise program by assuring that all major components of physical fitness and all major muscle groups are exercised in proportion to how often they will be used. To ensure balance when developing the IET exercise program, strength, endurance, and mobility exercises must be considered. It is important to include exercises that work all the major muscle groups in both the upper and lower body.

Muscles are generally organized into opposing or antagonistic groups. An overemphasis on a single muscle can lead to an imbalance at the joint or joints that the muscle groups act on. To avoid this, an exercise program must provide sufficient volume of training to antagonistic muscles, even muscles with only a stabilizing role. The sequence of exercises also affects the workout and the results. For example, large muscles and multiple joint exercises should precede small muscle and single joint exercises so that the supporting or stabilizing muscles are fatigued last and are better able to contribute during heavy lifting.

Integration

Developing a comprehensive exercise program for the Army is accomplished by integration. The integration of the physical fitness components of strength, endurance, and mobility must be combined with precise application and a rational progression to gain the desired physical performance outcomes with minimal risk of injury.

An off-shoot of the IET standardized exercise program, the Pre-BCT Physical Training Program was developed as a way to introduce civilians to the standardized exercise program for IET before they are recruited. This program incorporates many of the same exercises, drills, and running programs performed during BCT. The program is implemented by the recruiter as part of the accession process. This process is discussed in greater detail later in the chapter.

Two requirements for the exercises in the IET standardized exercise program were (1) they must have a military appearance and (2) they can be conducted with minimal equipment in an austere environment. The exercises, drills, and running programs were field tested with the input of drill sergeants to ensure that they meet the integration goals of the Army trainer. Several exercises that did not have the requisite military appearance were eliminated and replaced by alternative exercises that were at least as effective as the originals.

A final integration occurs when the PT schedule is synchronized with the overall training program of instruction at IET. This integration is an ongoing function of unit leaders as they organize training time around resources and competition for training sites. Standardized PT eliminates the need for exercise leaders to develop their own exercise prescriptions. Table 7-2 is the standardized PT schedule for week 2 of BCT. Each week has a similar schedule for planners and exercise leaders to follow. This is the actual exercise prescription and the coordinating document that aligns training at all Army training centers.

TABLE 7-2

WEEK 2 PHYSICAL TRAINING SCHEDULE FOR BASIC COMBAT TRAINING

Session 2-1	**Warm-up**: Conditioning Drill 1 (5 repetitions) **Activity**: The Military Movement Drill (1 repetition), Ability Group Run (A: 15 min @ 7:15; B: 15 min @ 8:30; C: 12 min @ 10:00; D: 12 min @ 11:00) **Cool-down**: Stretch Drill (20 seconds)
Session 2-2	**Warm-up**: Conditioning Drill 1 (5 repetitions) **Activity**: Conditioning Drill 2 (1 set x 10/10/5/5/5 repetitions and 1 set x 5/5/5/5/5 repetitions) **Cool-down**: Stretch Drill (20 seconds)
Session 2-3	**Warm-up**: Conditioning Drill 1 (5 repetitions) **Activity**: The Military Movement Drill (1 repetition) and 30:60s run (6 repetitions) **Cool-down**: Stretch Drill (20 seconds)
Session 2-4	**Warm-up**: Conditioning Drill 1 (5 repetitions) **Activity**: Conditioning Drill 2 (1 set x 10/10/5/5/5 repetitions and 1 set x 5/5/5/5/5 repetitions) **Cool-down**: Stretch Drill (20 seconds)
Session 2-5	**Warm-up**: Conditioning Drill 1 (5 repetitions) **Activity**: None **Cool-down**: Stretch Drill (20 seconds)
Session 2-6	**Warm-up**: Conditioning Drill (5 repetitions) **Activity**: 1-1-1 Physical Fitness Assessment **Cool-down**: Stretch Drill (20 seconds)

Reproduced from: IET Standardized Physical Training Program Guide. January 4, 2005. Available at: https://www.benning.army.mil/usapfs/doctrine.htm. Accessed October 21, 2005.

CHALLENGES TO UNIVERSAL PHYSICAL FITNESS IN INITIAL ENTRY TRAINING

Army Field Manual 21-20[12] was written to provide the basis for developing exercise programs at the unit level from induction through retirement. Despite the manual's sound guidance, there has been a consistently high rate of attrition due to injury within the initial enlistment period.[1] The need to reduce injury and attrition in IET was the major catalyst for initiating standardization of the IET PT. Injuries were not the only obstacle USAPFS had to overcome, however. The primary challenges to achieving universal physical fitness in IET are

- low initial fitness levels of many new soldiers,
- preexisting medical conditions and overuse injuries,
- a decentralized PT philosophy,
- limited time to accomplish physical fitness objectives, and
- overemphasis on APFT events.

Initial Fitness Levels

As researchers study indicators of success in the initial phases of military training, it has become increasingly apparent that physical fitness is one of the most important predictors of success in IET.[16,17] Although directly measured physical *fitness* has not changed over time, the physical *performance* level of the average new soldier is lower now than it was a generation ago.[8] This change is presumably because a lower physical activity level has led to a reduced ability to apply physical fitness to military situations (see Figure 7-1). This reduced performance level is possibly the most important consideration when developing a physical fitness program for IET. Physical fitness is inversely related to injury risk and directly related to success in IET.[16,17]

Preexisting Conditions and Overuse Injuries

The developers of the PT program assumed that new soldiers were free of injuries or preexisting conditions that could interfere with their ability to train. However, despite physical examinations and signed disclosure statements, there are still those who conceal existing conditions in order to join the Army. Injuries can be divided into those that existed prior to service (EPTS) and those that occur during IET. EPTS injuries are often not discovered until a new soldier is exposed

to the rigors of military training. Preexisting conditions such as knee reconstruction, shoulder instability, and chronic low back pain affect the ability to train and often cause injuries in BCT, in many cases requiring rehabilitation or surgery to correct the problem.

Safety measures such as safety nets, limits for height of obstacles, supervision, spotting, simulators, and special marking for hazards are in place to control traumatic injuries in training are all intended to reduce the incidence of accidents in training. Despite these measures, traumatic injury will always be a risk during the tough, realistic Army training.

Overuse injuries to the lower extremity account for the largest group of preventable injuries sustained during IET. An epidemiological study conducted at Fort Jackson, South Carolina, showed a cumulative incidence of one or more injuries in BCT of 37% for men and 63% for women.[18] Most of these injuries were classified as overuse injuries to the lower extremities.

A look at risk factors for injuries within the same study reveals that soldiers who sustain injury are often predisposed to injuries based on their lifestyle prior to service. For men, older age, low APFT event scores, less walking or hiking in the month preceding accession, and cigarette smoking are all considered risk factors. All except age are modifiable behaviors. For women, low APFT event scores were also considered risk factors. For both genders, the training company was a risk factor as well.[18] In other words, some training companies conducted training programs that increased risk, while others ameliorated risk through better practices.

One mechanism for risk of lower extremity overtraining injuries is related to bone geometry. Increased bone diameter as a result of weight-bearing stress enhances the strength of the bone and increases tolerance for additional load bearing. Therefore, active individuals have a greater capacity to tolerate rigorous training than do inactive individuals.[19] As a consequence of this *mechanism* and identified fitness trends, the cumulative volume of activity in the early weeks of IET outpaces the bone remodeling capacity of many previously sedentary individuals. Consequently, the routine, dogmatic approach to PT that worked a generation ago is no longer effective. In fact, some older PT methods can be hazardous to a growing segment of new soldiers.

Decentralized Physical Training Philosophy

A fundamental challenge for exercise leaders in IET has been the lack of an established system for ensuring that the best possible combination of physical conditioning and injury control was built into the PT schedule. Over the past several years the staff and faculty of USAPFS have worked closely with personnel at the US Army Center for Health Promotion and Preventive Medicine (USACHPPM), Aberdeen Proving Ground, Maryland. USACHPPM observations and analyses of fluctuations in injury rates between similar units over time indicate that injury rates can best be controlled with a proper recovery cycle and a rational progression of volume and intensity. Furthermore, programs that develop overall strength, endurance, and mobility result in a higher success rate on the APFT and lower injury rates.[7,20,21] However, advice on recovery between PT sessions that focus on particular muscle groups or energy systems has often been disregarded. Despite well-established expert opinion that 48 hours is a minimal recovery period between similar exhaustive activities, running on consecutive days has been the norm instead of the exception. Running mileage and running on consecutive days have strong positive correlations with lower extremity overuse injuries.[5,17,18,22]

Limited Time to Accomplish Physical Fitness Objectives

A typical training program for sedentary, otherwise healthy individuals usually includes three to five exercise sessions of 30 to 60 minutes per week, including a warm-up, activity, and a cool-down period. A progression is established based on an initial physical fitness assessment and individual goals. An initial conditioning stage of 4 weeks is often used to allow time for physical adaptation. Aerobic exercise and muscular endurance activities are conducted at a moderate intensity (40%–60% of heart rate reserve).[6] The most dramatic improvement occurs during the initial training period. One reason for this initial surge in fitness is due to neural adaptations that occur between the nerve-to-muscle junction and within the muscle fibers. A good reason to start slowly is that muscle develops at a faster rate than connective tissue and bone because of neural adaptation and better circulation. During this developmental period, the force-producing capability of muscle can overwhelm the slower development of tendons, ligaments, and bone.

The initial conditioning stage is followed by an improvement stage. This stage usually lasts from 4 to 5 months, and intensity is progressed to a target range of 50% to 85% of heart rate reserve.[6] Within this stage and intensity range lie the ideal timeline for PT in BCT. Because of the wide variability in fitness levels of new soldiers, some will simply not adapt enough in 9 weeks to meet fitness standards. Others will become

injured but will stay fit enough to meet the APFT physical standard.

New soldiers conduct PT up to 6 days per week in addition to all the other physical requirements of training. The training is typically and traditionally intense enough to cause exhaustion. The high incidence of overuse injuries is not surprising in light of the overall change in activity level from civilian life to BCT. The only way to get the least fit ready in so little time is through careful manipulation of the exercise variables of frequency, duration, and intensity. The product of frequency and duration is volume. The volume of activity in a 1-hour PT session is relatively small compared to the volume of activity in a typical training day. The challenge is to ensure that the volume and type of activity in PT is not compounded by other training scheduled for that day. For instance, if a 5-mile foot march is scheduled for a given day, then the activity for the PT session *is* that foot march. This approach spares the muscles in the lower extremity and balances training activities. In the past, an exhaustive run would precede the foot march, and the total volume of "foot time" would result in many sick call visits for overuse injuries such as shin-splints and stress reactions to the tibias, metatarsals, and femoral necks. The exploitation of intensity to decrease volume is the most important timesaving element in the IET PT program. Decreasing the volume of running decreases injury rates, while increased intensity results in enhanced physiological adaptation. This win-win solution is not unique to the USAPFS and should have broader application for the Army beyond IET.

Overemphasis on Army Physical Fitness Test Events

Since the 1980s, the APFT has been the driving force behind PT in IET. The 2-minute push-up event, the 2-minute sit-up event, and the 2-mile run became the measure of fitness for the Army in 1980, and since then all soldiers must meet age and gender standards before they can graduate from any IET course. Although the APFT is a good assessment of aerobic fitness and muscular endurance, the tendency toward single-minded training for APFT events, at the expense of a better overall solution, can be a problem. Overtraining for APFT events is most costly in the area of injury to the lower extremity due to excessive running volume. Fortunately, success can be achieved with less volume and more intensity built into the running program.

THE PRODUCT: A PHYSICAL TRAINING STRATEGY FOR INITIAL ENTRY TRAINING

A comprehensive PT strategy results in soldiers who are fit in the short term and ready in the long term. Such a strategy starts with enforced discipline and ends with self-discipline. A systematic approach also covers the time a recruit spends preparing to transition from civilian to soldier.

The solution devised by USAPFS is an exercise prescription tailored to the initial fitness level of all IET soldiers. An initial assessment is used to assign soldiers to ability groups, and a rational progression ensures that an adequate training effect will be obtained without causing overuse injuries to soldiers at high risk. The exercises and exercise drills in this program meet the criteria of feasibility for drill sergeant application, suitability for mass training, and acceptability in appearance to the Army. Field testing was conducted with IET drill sergeants to ensure that their input was included in the final product. The US Army Training and Doctrine Command (TRADOC) Standardized Physical Training Program Guide for BCT was produced on November 5, 2003, and updated as the IET Standardized Physical Training Guide on January 4, 2005.[23]

An exercise prescription that includes a warm-up, activities, and a cool-down is consistent with most existing exercise programs in the Army and is supported by the literature.[6] The 10 calisthenics exercises in the dynamic warm-up, called conditioning drill 1, are sequenced to complement each other and result in total-body conditioning. Events that are prominent in the APFT are included among the activities; also included are activities that balance the strength and mobility requirements of soldiering with the aerobic and anaerobic endurance needed for the APFT. The cool-down period is devoted to improving flexibility through long-duration, low-intensity static stretching of major muscle groups. Placing static stretches in the cool-down period is consistent with the prevailing research on flexibility and injury control.[24] The only equipment requirements are horizontal climbing bars. Each workout is designed to be completed in 60 minutes or less.

It is well known by health promotion experts, the medical community, and commanders that overuse injuries to the lower extremity account for most injuries that occur in IET. It is further understood that running mileage and other high-impact activities have a cumulative effect on the demands of bone remodeling (see Appendix II, Diagnosis of Stress Fractures by Nuclear Medicine). The obvious solution to this problem is to decrease running mileage rather than to curtail other training activities. In developing

the endurance training concept for IET, it was vitally important to convince all those involved—from leadership to drill sergeant to recruit—that a calculated drop in running mileage would still provide an adequate training result.

Following this logic, the cumulative effects of common soldier-task training were offset by specific adjustments in volume and intensity of the daily PT sessions. A running program was developed that significantly reduced the mileage for all ability groups. In addition to the undisputed link between running mileage and lower extremity injury, Pollock et al[22] demonstrated that beyond a certain threshold, increased running mileage was not associated with improved performance. The Army tradition of long, slow runs is not consistent with the literature regarding performance or injury control.

To compensate for the decrease in mileage, a slight increase in intensity is required. It is known that training at higher intensity results in faster adaptations in aerobic capacity. The American College of Sports Medicine guidelines for intensity as a percentage of $\dot{V}O_{2max}$ were used as the upper limits to running paces[6,25]; the guidelines prevented the new PT program from exchanging too much volume for too much intensity. In addition to increased pace on distance runs, a 300-yard shuttle run and interval speed running were added once a week to facilitate anaerobic endurance. These runs require much less volume and near maximal intensity. Table 7-3 shows the progression for ability group runs during a 9-week BCT cycle based on a consideration of initial fitness level, potential for injuries, and practical requirements for BCT.[25] Running ability groups are based on initial 1-mile run times conducted during week 1 of IET (gender and age were not taken into consideration).

Fewer foot strikes over time was the predominant injury control measure of the standardized program. Strict adherence to a 48-hour recovery period between running sessions was also viewed as essential for injury control and performance. The IET program of instruction was changed so that long foot marches (over 3 miles) would now be considered aerobic training events, thus avoiding consecutive days of running and foot marching. This important adjustment allowed for adequate recovery between high-impact force absorption activities for the lower extremities.

TABLE 7-3

PROGRESSIVE ABILITY GROUP RUN SCHEDULE FOR BASIC COMBAT TRAINING

Training Week	Ability Group*	Distance (miles)	Pace (min/mile)	Total Run Time (min)
1	A (fast)	2.0	8.0	16
	B	1.7	9.0	15
	C	1.0	10.5	10
	D (slow)	0.8	12.0	10
2	A	2.0	7.5	15
	B	1.8	8.5	15
	C	1.2	10.0	12
	D	1.1	11.0	12
3	A	2.7	7.5	20
	B	2.4	8.5	20
	C	1.4	9.5	14
	D	1.3	10.5	14
4	A	2.7	7.5	20
	B	2.4	8.5	20
	C	1.7	9.5	16
	D	1.6	10.0	16
5	A	2.8	7.25	20
	B	2.5	8.0	20
	C	2.0	9.0	18
	D	1.9	10.0	18
6	A	3.4	7.25	25
	B	3.1	8.0	25
	C	2.4	8.5	20
	D	2.1	9.5	20
7	A	3.4	7.25	25
	B	3.1	8.0	25
	C	2.4	8.25	20
	D	2.1	9.5	20
8/9	A	4.1	7.25	30
	B	3.8	8.0	30
	C	2.4	8.25	20
	D	2.2	9.0	20

* Soldiers running the 1-mile in **7:15 and faster** are assigned to ability group **A**.
Soldiers running the 1-mile in **7:16 to 8:45** will be assigned to ability group **B**.
Soldiers running the 1-mile in **8:46 to 10:15** will be assigned to ability group **C**.
Soldiers running the 1-mile in **10:16 and slower** will be assigned to ability group **D**.

Data source: IET Standardized Physical Training Program Guide. January 4, 2005. Available at: https://www.benning.army.mil/usapfs/doctrine.htm. Accessed October 21, 2005.

TESTING THE PHYSICAL FITNESS PROGRAM IN INITIAL ENTRY TRAINING

The exercises defined by research and matched to the tasks in IET were methodically tested in a controlled IET environment to assure that the exercise prescription provided the desired outcome: maximum fitness achieved with minimum injury. The testing took place at a gender-integrated, 9-week BCT site.

Performance on the APFT was significantly improved as measured by the percentage of soldiers who passed the end-of-cycle fitness assessment on the first attempt (88% of the standardized PT group vs 84% of the control group; $P < .05$). Lower extremity injury control was also significantly reduced. A reduction of sick call visits by 33% for overuse injuries meant that more soldiers were able to attend more training without interruption.[7] These results matched results of two prior studies and led to the implementation of the IET standardized PF program across all US Army Training and Doctrine Command installations by April 2004.[20,21]

The question of whether a fitness program can achieve performance objectives while limiting injury during a 7-week training cycle was fundamental to successful mission completion of the standardized PT program. To advance a positive change in the PT of new soldiers, a clear and indisputable improvement over the status quo had to be demonstrated.

Care must be taken when defining the term "good physical training." Often the adjective "good" is used interchangeably with "hard" or "rigorous" and is quantified by the number of soldiers who fall out of an event (ie, discontinue performing), fail, or quit IET. When we talk superficially about applying rigor to the PT program, we run the risk of thoughtless attempts to condition soldiers before they are ready. PT that exhausts a soldier to the point of failure is perhaps emotionally rewarding to the leader who conducted it, but does little to advance the cause of physical fitness.

The exercise principles of progression and recovery must be at the forefront of any exercise program plan. "Good physical training" should not be defined by the extremes of performance in the formation but by how many soldiers can meet the established standards, thus elevating the average. Current practices that track averages only for soldiers who take the APFT are misleading. Soldiers who are unable to take the APFT due to an overuse injury should be factored in to give a real measure of successes and failures. Illness and traumatic injury, however, are fairly excluded from this equation.

Exceeding the physical limits of a soldier's body through an unstructured PT program may lead to injury. Failure to take into account the progressive nature of physical adaptation is the exact opposite of physical conditioning. Symptoms of poor volume or intensity control in PT include high overuse injury rates (high sick call rates), inability to function in PT or continue training due to a temporary or permanent medical condition, poor morale, inability to concentrate, a drop-off in performance, and poor sleep. Good PT is a leadership imperative. Improved fitness and injury control go hand in hand to prevent waste of the unit's two most valuable assets: people and time. Once a soldier is injured, it is necessary to manage all his or her subsequent individual training by exception.

TABLE 7-4

RECRUIT PHYSICAL ASSESSMENT STANDARDS

Event	Push-ups	Sit-ups	1-mile run (time in min)
Males	13	17	8:30
Females	3	17	10:30

Data source: IET Standardized Physical Training Program Guide. January 4, 2005. Available at: https://www.benning.army.mil/usapfs/doctrine.htm. Accessed October 21, 2005.

Insights gained while developing the standardized PT program lead to the determination that a preadmission physical fitness screening standard should be established, which would require the successful completion of a fitness assessment prior to induction into the Army. USAPFS developed the TRADOC Standardized Physical Fitness Guide, Pre-BCT[26] to assist prospective soldiers who need PT to meet the minimal standards. The pre-BCT program uses many of the same exercises as are in the TRADOC Standardized Physical Training Program Guide for BCT. Using the same exercises in both programs should help to *(a)* decrease attrition, (*b*) ensure that new soldiers have a minimal level of physical fitness, and (*c*) accustom recruits to the exercises that they will use daily in IET.

Starting in July 2004, all Army recruits are required to pass a three-event physical fitness assessment before they begin training. The assessment consists of 1 minute of push-ups, followed by 1 minute of sit-ups, followed by a 1-mile run (Table 7-4). A rest period of up to 10 minutes is allowed between events. Recruits who fail are given additional time and instruction in the pre-BCT standardized PT program to address specific areas that need improvement. This simple change is estimated to save the Army more than $14 million per year.[27] This cost includes the recruiter pay, civilian pay, enlistment bonuses, loan repayments, advertising, and recruiting infrastructure needed to recruit, transport, house, feed, and train soldiers who failed initial physical fitness standards in 2003.

CONCLUSION

Developing and implementing a comprehensive exercise program for new recruits involves generalizing what is known about performance and injury prevention and applying this knowledge to an entire group of new soldiers. Much effort should be directed toward specific compensations for ability level and risk

of injury. In this way, we can best prepare soldiers for the physical demands of Army life.

Although the new standardized physical fitness program for IET is appropriate in scope, volume, and intensity for new soldiers of all fitness levels, the program may not meet the needs for all occupations or Army units. Further research into developing physical fitness programs specific to units, occupations, and missions is needed to further address the physical fitness of the operational Army.

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