

U.S. Army Center for Health Promotion
and Preventive Medicine

**EVALUATION OF A PROGRAM TO IDENTIFY AND
PRE-CONDITION TRAINEES WITH LOW PHYSICAL FITNESS:
ATTRITION AND COST ANALYSIS**

USACHPPM REPORT NO. 12-HF-01Q9C-04



**US Army Center for Health Promotion and Preventive Medicine
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U.S. Army Center for Health Promotion and Preventive Medicine

The lineage of the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) can be traced back over 50 years. This organization began as the U.S. Army Industrial Hygiene Laboratory, established during the industrial buildup for World War II, under the direct supervision of the Army Surgeon General. Its original location was at the Johns Hopkins School of Hygiene and Public Health. Its mission was to conduct occupational health surveys and investigations within the Department of Defense's (DOD's) industrial production base. It was staffed with three personnel and had a limited annual operating budget of three thousand dollars.

Most recently, it became internationally known as the U.S. Army Environmental Hygiene Agency (AEHA). Its mission expanded to support worldwide preventive medicine programs of the Army, DOD, and other Federal agencies as directed by the Army Medical Command or the Office of The Surgeon General, through consultations, support services, investigations, on-site visits, and training.

On 1 August 1994, AEHA was redesignated the U.S. Army Center for Health Promotion and Preventive Medicine with a provisional status and a commanding general officer. On 1 October 1995, the nonprovisional status was approved with a mission of providing preventive medicine and health promotion leadership, direction, and services for America's Army.

The organization's quest has always been one of excellence and the provision of quality service. Today, its goal is to be an established world-class center of excellence for achieving and maintaining a fit, healthy, and ready force. To achieve that end, the CHPPM holds firmly to its values which are steeped in rich military heritage:

- ★ *Integrity is the foundation*
 - ★ *Excellence is the standard*
 - ★ *Customer satisfaction is the focus*
 - ★ *Its people are the most valued resource*
 - ★ *Continuous quality improvement is the pathway*

This organization stands on the threshold of even greater challenges and responsibilities. It has been reorganized and reengineered to support the Army of the future. The CHPPM now has three direct support activities located in Fort Meade, Maryland; Fort McPherson, Georgia; and Fitzsimons Army Medical Center, Aurora, Colorado; to provide responsive regional health promotion and preventive medicine support across the U.S. There are also two CHPPM overseas commands in Landstuhl, Germany and Camp Zama, Japan who contribute to the success of CHPPM's increasing global mission. As CHPPM moves into the 21st Century, new programs relating to fitness, health promotion, wellness, and disease surveillance are being added. As always, CHPPM stands firm in its commitment to Army readiness. It is an organization proud of its fine history, yet equally excited about its challenging future.

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13. ABSTRACT (Maximum 200 words) From October 1999 to July 2004, all new recruits who arrived for Basic Combat Training (BCT) participated in the Fitness Assessment Program (FAP). The FAP involved an entry-level physical fitness test that new recruits took when they arrive at the Reception Station. Those passing the test entered BCT. Those failing the test entered a special physical training unit where they exercised until they could pass the test and then enter BCT. This report examines the FAP in terms of the number of recruits initially screened out by the test, the effects of the screening test on attrition, and cost effectiveness. Historical data on the proportion of trainees who failed the test was obtained from Ft Jackson, South Carolina. Attrition was compared in 2 groups of recruits, one that failed the test and went directly into BCT (No Pre-Conditioning (NPC) group) and another that trained to the test standards before entering BCT (Pre-Conditioning (PC) group). Cost effectiveness estimates were based on a figure of \$27,628 per recruit. From early 1998 through Fiscal Year 2003, the proportion of recruits failing the screening test ranged from 4% to 7% for men and 10% to 24% for women. When BCT attrition was considered, discharges were over 3 times higher in the male NPC group than in the PC group (25% vs. 8%); the trend was similar among the women but the difference was half as large (29% vs. 19%). When attrition in the special physical training unit was included with BCT attrition, the proportion of discharges was more than twice as high in the male NPC group than in the male PC group (25% vs. 12%); the female NPC and PC groups had a similar proportion of discharges (29% vs. 27%, NPC and PC, respectively). If attrition in the special training physical unit was included with BCT attrition, then the requirement to pass the entry-level fitness test was associated with the retention of an estimated 516 recruits per year for an estimated saving of over \$14 million per year. Results suggested that requiring recruits to meet the fitness requirement is associated with a less attrition and considerable estimated resource savings.			
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Executive Summary

EVALUATION OF A PROGRAM TO IDENTIFY AND PRE-CONDITION TRAINEES WITH LOW PHYSICAL FITNESS: ATTRITION AND COST ANALYSIS

USACHPPM REPORT NO. 12-HF-01Q9C-04

1. INTRODUCTION. From October 1999 to May 2004, all new recruits who arrived for Basic Combat Training (BCT) participated in the Fitness Assessment Program (FAP). The FAP began with an entry-level physical fitness test administered on arrival at the Reception Station. Recruits who passed the test could go on to BCT. Recruits who failed the test entered a special physical training unit where they exercised until they could pass the test and then they entered BCT. The United States (US) Army Center for Accessions Research requested that the US Army Center for Health Promotion and Preventive Medicine analyze the effects of using the current entry-level physical fitness test to screen Army applicants prior to enlistment. Because there was no reason to think that a new Army applicant differed from a new recruit just arriving for BCT the best estimate of the effects of a pre-enlistment screening test were the effects of the test at the Reception Station and in BCT. This paper had 3 purposes: 1) describe the proportion of recruits initially screened out by the entry-level fitness test, 2) determine the effects of the entry-level fitness test on attrition before and during Basic Combat Training (BCT), and 3) estimate cost effectiveness of the entry-level physical fitness test.

2. METHODS. To describe the proportion of new recruits screened out by the entry-level physical fitness test, historical data was obtained from the 120th Reception Battalion at Ft Jackson, South Carolina. These data included the total number of trainees who entered the Reception Station from Fiscal Year (FY) 2000 to FY 2003 and the number of new recruits who failed the entry-level physical fitness test each FY. This was supplemented with previously published data.

To determine the effect of the entry-level physical fitness test on attrition during BCT, a secondary analysis was performed of data from a previous investigation. In this secondary analysis, two groups of recruits were compared. One group was called the No-Pre-Conditioning (NPC) group and was comprised of trainees who failed the entry-level physical fitness test but entered BCT

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without physical training in the FAP. The other group was called the Pre-Conditioning (PC) group and was comprised of recruits who failed the entry-level physical fitness test and physically trained in the FAP before entered BCT. This study design allowed a comparison of BCT attrition in low fit recruits receiving pre-conditioning (PC group) and low-fit trainees not receiving pre-conditioning (NPC group). Some recruits attrited while training in the FAP and analyses were performed both with and without these recruits included.

To determine the cost-effectiveness of the entry-level physical fitness test, the cost to acquire and train a recruit (\$27,628 for FY 2002) was multiplied by a yearly estimate of the number of recruits who did not attrite as a result of the entry-level physical fitness test.

3. RESULTS.

a. Proportion of Recruits Initially Screened Out by the Entry-Level Fitness Test. In early 1998, FY 2000, FY 2001, FY 2002 and FY 2003, the proportion of men failing the entry-level physical fitness test was 7%, 4%, 4%, 5% and 4%, respectively. For women these proportions were 24%, 12%, 13%, 15%, and 10%, respectively.

b. Effects of the Entry-Level Fitness Test on Attrition Before and During BCT. Attrition during BCT was 3.2 times higher in the male NPC group compared to the male PC group (25% vs. 8%, $p=0.02$); for the women, attrition during BCT was 1.5 times higher in the NPC group than in the PC group (29% vs. 19%, $p=0.15$). When recruits who were discharged in the FAP were included in the analysis of the PC group, the male NPC group had 2.1 times as much attrition as the male PC group (25% vs. 12% $p=0.10$) but the female NPC group had attrition similar to the PC group (29% vs. 27%, $p=0.78$, NPC and PC groups, respectively).

c. Cost Effectiveness. If only attrition from BCT was considered, the pre-conditioning program for the low fit trainees was estimated to retain 856 recruits per year Army-wide for an annual savings of over \$23 million. If attrition in the FAP was included with BCT attrition, then pre-conditioning was estimated to retain 522 recruits per year Army-wide for an annual savings of over \$14 million.

4. CONCLUSION. This analysis suggested that requiring recruits to meet the fitness requirements of the entry-level physical fitness test was associated with a lower attrition and considerable estimated cost savings. Implicit in the analysis was the assumption that a pre-enlistment physical fitness test would be conducted in exactly the same manner as it was administered during the entry-level physical fitness test at Ft Jackson. Certain aspects of the entry-level physical fitness test appeared to assist in keeping the failure rate low. These include providing a second attempt on the push-up event and pacing and motivation on the 1-mile run. In administering a pre-enlistment test, organization, staffing, and standardized test administration will be critical for the success.



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- 1. REFERENCES.** Appendix A contains the references used in this paper.
- 2. INTRODUCTION.**

From October 1999 to May 2004, all new recruits who arrived for Basic Combat Training (BCT) participated in the Fitness Assessment Program (FAP). The FAP began with an entry-level physical fitness test that all new BCT recruits were administered on arrival at the Reception Station (25). Those who passed the test could go on to BCT. Those who failed the test did not go on to BCT but rather entered a special physical training unit where they exercised until they could pass the test. Once the test was passed, the recruit could enter BCT; if they could not pass the test within about 3 weeks of beginning the special training program, they were discharged from service.

The criteria for passing the entry-level physical fitness test is shown in Table 1. The test events were administered in the order shown. For all 3 test events, the recruit only had to meet, not exceed, the requirement. Recruits were tested in large groups with Reception Station drill sergeants serving as test administrators. A drill sergeant read detailed instructions on how to perform the tests from Army Field Manual (FM) 21-20 (21). Drill sergeants monitored the performance of each trainee on push-ups (PU) and sit-ups (SU) on a one-on-one basis. If a recruit failed the PU on the first attempt, he or she was sent to a station where they were given specific, individualized instruction on how to perform a correct PU and a second attempt was allowed. Only one attempt was allowed for the SU and the 1-mile run. For the 1-mile run, recruits were provided a "pacer" who ran at the exact pace required to pass the test. In addition, "chasers" attempted to motivate recruits who fall behind the pacer and reminded recruits where the pacer was located.

Table 1. Current Fitness Criteria to Enter BCT

Event	Men	Women
Push Ups (repetitions)	13	3
Sit Ups (repetitions)	17	17
One-Mile Run (minutes)	8.5	10.5

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The United States (US) Army Center for Accessions Research (CAR) requested that the US Army Center for Health Promotion and Preventive Medicine (CHPPM) analyze the effects of using the current entry-level physical fitness test prior to applicant enlistment. Because there was no reason to think that the physical fitness of a new Army applicant differs from that of a new recruit just arriving for BCT the best estimate of the effects of a pre-enlistment fitness test were the effects of the current entry-level physical fitness test.

This paper has 3 purposes: 1) to describe the proportion of recruits initially screened out by the entry-level physical fitness test, 2) to determine the effects of the entry-level fitness test on attrition before and during Basic Combat Training (BCT), and 3) to estimate recruit cost savings or loss associated with the entry-level fitness test. A review of the literature on previous studies examining the effects of entry-level fitness tests on various aspects of BCT is at Appendix B.

3. METHODS.

a. Recruits Initially Screened Out by the Entry-Level Fitness Test.

The first purpose of this paper was to describe the proportion of new recruits initially screened out by the entry-level physical fitness test. We contacted the 120th Reception Battalion at Ft Jackson, South Carolina (Company D and Plans, Training and Operations Office (S-3)). Battalion and company personnel provided us with historical information on the number of new recruits who entered the Reception Station and the number who failed the entry-level physical fitness test. Their data were compiled yearly spanning a period from Fiscal Year (FY) 2000 to FY 2003.

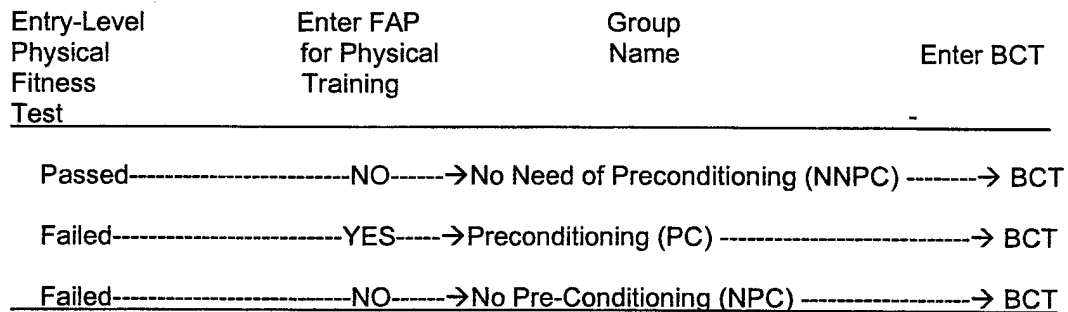
Although the requirement for an initial fitness test was not mandated until October of 1999, a similar 3 event test had been in use at Ft Jackson South Carolina since 1998. Some additional data from 1998 was available in a published article (12).

b. Assessment of the Influence of the Entry-Level Fitness Test and Pre-Conditioning on BCT Attrition.

The second purpose of this paper was to examine the effect of the entry-level physical fitness test on attrition in BCT. To accomplish this, we performed a secondary analysis of data from a previous investigation (10). This previous investigation involved 2 BCT battalions (5 companies each) at Ft Jackson, South Carolina who were involved in training from 28 March 2003 to 19 June 2003. Comparisons were made among 2 groups of recruits. A cohort designated the No Pre-Conditioning (NPC) group was comprised of trainees who failed the entry-level fitness test and entered BCT without training in the FAP. A cohort designated the Pre-conditioning (PC) group was comprised of trainees who failed the entry-level fitness test, trained in the FAP (about 2 weeks on average), and

then entered BCT. A third cohort of trainees was also evaluated but only for descriptive purposes. This third group was called the No Need of Pre-Conditioning (NNPC) group and was comprised of trainees who passed the entry-level fitness test and directly entered BCT. The NNPC group is presented only to show attrition in the larger group of recruits who have sufficient fitness to pass the entry-level physical fitness test. Figure 1 graphically depicts the overall program evaluation design. This design allows a comparison of BCT attrition with the minimal fitness requirements of Table 1 (PC group) and without the minimal fitness requirements (NPC group).

Figure 1. Overall Program Evaluation Design



BCT companies at Ft Jackson maintained the training status of each trainee in a database management system called Warrior Training Room (WTR). Information on attrition was obtained by downloading data from WTR and cross-checking these data with other available BCT information described below. Trainees could attrite due to discharge from service or newstarting.

A trainee was discharged from service if he or she was deemed not suitable for the military and was formally released from their service commitment. There were numerous reasons for discharge but most reasons fell into two major categories: medical conditions that existed prior to service (EPTS discharge) or poor entry-level performance. The latter category was called an entry-level separation (ELS) or Chapter 11 discharge. ELS discharges were most often the result of the trainee's inability to adapt to the military environment because of lack of ability (cannot adequately perform critical military tasks) or for psychosocial reasons (motivation, inability to follow orders, personality problems, etc.). Trainees who were discharged were identified from WTR in each company and cross-checked with rosters in the training battalions S-1 (Personnel Section).

A trainee became a newstart if he or she left the training company he or she began training with and entered another company before the end of the 9-week BCT cycle. Trainees were newstarted (recycled) for three major reasons: 1) failure to meet mandatory training requirements, 2) failure to pass the final Army Physical Fitness Test (APFT), or 3) serious injury.

Trainees were newstarted for failure to meet mandatory training requirements for reasons such as lack of motivation, emergency leave, or lack of ability on critical military tasks (i.e., difficulty developing specific skills like basic rifle marksmanship). Information on newstarted trainees was obtained from WTR and crosschecked with summaries provided by the training battalion S-3 (Plans, Training, and Operations Section).

Trainees could also be newstarted if they could not pass their final APFT prior to their scheduled graduation date. These individuals were sent to the APFT Enhancement Program (APFTEP) at the Reception Station. They physically trained until they could pass the test. If they could not pass the test within about 3 weeks they were discharged from service. Trainees sent to the APFTEP were obtained from WTR and cross-checked with rosters in the APFTEP unit.

Trainees could also be newstarted if they were injured to the extent they could no longer continue training in BCT. These trainees were sent to the Physical Training and Rehabilitation Program (PTRP) for rest and recovery. Physical therapists and other health care providers such as orthopedic surgeons or occupational therapists made the recommendation to either discharge or return the trainee to BCT. Names of individuals sent to the PTRP were obtained from WTR and cross-checked with rosters in the PTRP itself, a list of recommended referrals from the Physical Therapy Clinic, and rosters obtained from the training battalion S-3.

c. Recruit Cost Analysis.

The third purpose of this paper was to determine the recruit cost savings or loss of the FAP. To obtain this measure a necessary figure was the cost of training a recruit, at least through BCT. This cost was estimated at \$27,628 for FY 2002. This approximation was provided by the Army Training and Doctrine Command (TRADOC). The estimate included recruiting costs, costs to process an individual through the Military Entrance Processing Station (MEPS), and the cost of BCT. The recruiting cost per accession was estimated at \$15,265. This included recruiter pay, civilian pay, enlistment bonuses, loan repayments, advertising, and recruiting infrastructure. The MEPS cost per accession was estimated at \$463. This included personnel costs, aptitude and medical testing, and facility/infrastructure costs. The average weighted cost for training at all 5 BCT sites was estimated at \$11,900. This represented personnel costs, training and instruction, base support, appropriations, and infrastructure (not including equipment depreciation) (23).

A further component of the cost analysis would include determining resources allocated to maintaining the training portion of the FAP in BCT. This would include personnel and infrastructure to train recruits who fail the entry-level physical fitness test. However, since the goal of the project was to move the

testing to the pre-enlistment phase these costs would not be relevant and were not considered here. They would not be relevant because enlistees who enter the Army and do not pass the test would be responsible for their own training with possible assistance from the recruiter while they are in the Delayed Entry Program (DEP).

d. Data Analysis.

(1) Recruits Initially Screened Out by the Entry-Level Fitness Test. To determine the proportion of recruits initially screened out by the entry-level physical fitness test we used the following formula: (Number of Recruits Failing Entry-Level Fitness Test/Total Number of Recruits Entering the Reception Station) * 100%

(2) Influence of Entry-Level Fitness Test on BCT Attrition. Attrition rates were compared between the PC and NPC groups using the chi-square test of proportions. Descriptive statistics only are presented on the NNPC group.

Two types of attrition were calculated: peer-group attrition and estimated attrition. Peer-group attrition indicated whether or not the members of a particular group graduated with their peers in BCT. Thus, if a trainee dropped out of one of the companies under study for any reason (discharged or newstarted) during BCT that individual was considered a peer-group attritee.

The second attrition measure was estimated attrition. A certain proportion of trainees who were newstarted eventually graduated from another BCT unit. Unfortunately this was not determined in the study from which we obtained our data (10) because of the difficulty of tracking these individuals. Thus, we had to estimate how many newstarted trainees would likely have ultimately been discharged based on data from the literature. We know how many recruits in each group were *sent* to the PTRP, APFTEP and newstarted for other reasons. To estimate how many of these might have been discharged, we made the following assumptions based on data from the literature: of the trainees who entered the PTRP, 48% of men and 60% of women were discharged (3); of the trainees who entered the APFTEP, 15% of men and 20% of women were discharged (17). Since the fate of other soldiers who newstarted for other reasons was not known, we took a conservative approach and assumed that all these trainees graduated.

For each type of attrition 2 analyses were performed. One analysis included only attrition after a trainee began BCT. The other analysis included not only BCT attrition but also attrition within the PC group while they were physically training in the FAP (i.e., trainees discharged within the FAP). Data from Company D of the 120th Reception Battalion indicated that 3 men and 10 women would have entered the PC group but were instead discharged in the FAP. We

do not know why these individuals were discharged. These 13 individuals added to the PC group attrition without affecting NPC or NNPC group attrition.

(3) Recruit Cost Analysis. To determine the cost effectiveness of a screening test we estimated the yearly BCT attrition with and without the entry-level physical fitness test and pre-conditioning. To do this we multiplied the proportion of recruits who attrited in the PC and NPC groups by the total number of recruits who failed the entry-level physical fitness test in FY 2003. The former data were obtained from the secondary analysis discussed above. The latter data were obtained from the 120th Reception Battalion at Ft Jackson. The difference between the PC and NPC attritees was the number of recruits who would have attrited had there not been entry-level physical fitness test and pre-conditioning. To estimate attrition for the entire Army, the number of recruits training Army-wide was obtained from TRADOC and the proportion training at Ft Jackson and elsewhere was calculated. The estimated number of recruits retained by the FAP Army-wide was calculated. This number was multiplied by \$27,628 (FY 2002 cost for a trainee completing BCT) to determine cost savings (or loss).

4. RESULTS.

a. Recruits Initially Screened Out by the Entry-Level Fitness Test.

One purpose of this paper was to determine the proportion of recruits who did not pass the entry-level physical fitness test the first time they took it. Table 2 shows historical data obtained from a published article (12) and data provided by the 120th Reception Battalion. The proportion of trainees entering the FAP has declined since 1998. The failure rate in FY 2003 was the lowest it has ever been.

Table 2. Proportion (%) of Trainees Failing the Entry-Level Physical Fitness Test, Early 1998 and 2000-2002

Year	Men	Women
Jan to Aug 1998 ^a	6.9	23.9
Fiscal Year 2000 ^b	4.3	12.2
Fiscal Year 2001 ^b	4.4	12.7
Fiscal Year 2002 ^b	5.4	14.8
Fiscal Year 2003 ^b	3.9	10.1

^aFrom Reference Number 12

^bFrom the 120th Reception Battalion

b. Influence of Entry-Level Fitness Test on Attrition.

(1) Peer-Group Attrition in BCT. Table 3 shows the number of trainees in each group and the number who completed and did not complete the 9-week BCT cycle with their peers. The PC group who physically trained up to the standards of the Reception Station Fitness Assessment prior to BCT had less peer-group attrition than the NPC group that did not physically train prior to entering BCT both among the men ($p=0.01$) and women ($p=0.02$). Risk of peer-

group attrition was 2.4 times higher among NPC men and 1.6 times higher among NPC women compared to their respective PC groups.

Table 3. Peer-Group Attrition in BCT

	Group	Total Trainees (n)	BCT Graduates (n)	Did Not Graduate With Peers (n)	Peer-Group Attrition (%)
Men	NPC	32	19	13	40.6
	PC	64	53	11	17.2
	NNPC	1078	939	139	12.9
Women	NPC	73	38	35	47.9
	PC	94	65	29	30.9
	NNPC	731	569	162	22.2

(2) Estimated Attrition in BCT. Table 4 shows estimated attrition during BCT under the assumptions in the Data Analysis section. The PC group tended to have a lower estimated discharge rate than the NPC among the men ($p=0.02$), and the trend was similar among the women ($p=0.15$). Risk of estimated attrition was 3.2 times higher among NPC men and 1.5 times higher among NPC women compared to their respective PC groups.

Table 4. Estimated Attrition in BCT

	Group	Total Trainees (n)	Estimated Total Discharges (n)	Estimated Attrition (%)
Men	NPC	32	8	25.0
	PC	64	5	7.8
	NNPC	1078	83	7.7
Women	NPC	73	21	28.8
	PC	94	18	19.1
	NNPC	731	110	15.0

(3) Peer-Group Attrition with FAP Discharges. Table 5 shows BCT attrition with trainees who were discharged from the FAP included in the PC group. The proportion of discharges was almost twice as high in the male NPC group compared to the male PC group ($p=0.04$). The female NPC group had 1.3 times more attrition than the PC group ($p=0.17$).

Table 5. Peer Group Attrition with FAP Discharges

	Group	Total Trainees (n)	Graduates (n)	Did Not Graduate With Peers (n)	Did Not Graduate With Peers (%)
Men	NPC	32	19	13	40.6
	PC	67	53	14	20.9
	NNPC	1078	939	139	12.9
Women	NPC	73	38	35	47.9
	PC	104	65	39	37.5
	NNPC	731	569	162	22.2

(4) Estimated Attrition with FAP Discharges. Table 6 shows estimated attrition with the trainees who were discharged while training in the FAP included in the PC group. The proportion of discharges was 2.1 times higher in the male NPC group than in the male PC group ($p=0.10$). The female NPC group had 1.1 times more attrition than the PC group ($p=0.78$).

Table 6. Estimated Attrition in BCT with FAP Discharges

	Group	Total Trainees (n)	Estimated Total Discharges (n)	Estimated Total Discharges (%)
Men	NPC	32	8	25.0
	PC	67	8	11.9
	NNPC	1078	83	7.7
Women	NPC	73	21	28.8
	PC	104	28	26.9
	NNPC	731	110	15.0

c. Recruit Cost Analysis.

Table 7 shows the estimated number of recruits retained at Ft Jackson considering estimated attrition. Columns 2 and 3 show, respectively, the total recruit input for FY 2003 and the number of recruits who failed the entry-level physical fitness test in FY 2003. These data were obtained from the 120th Reception Battalion at Ft Jackson. Using the discharge proportions in Table 4 we estimated the number of trainees who would have been discharged *without* the minimum entry-level physical fitness test requirement (Table 7, Column 4) and *with* the entry-level physical fitness test requirement (Table 7, Column 5). Table 7 shows that 301 fewer trainees attrited in the group who met the fitness requirement.

Table 7. Recruit Retained with Entry-Level Physical Fitness Test

	Total Recruit Input for FY2003 ^a (n)	Entry-Level Physical Fitness Test Failures FY2003 ^b n (% of Total Recruit Input)	BCT Discharges for Entry-Level Test Failures Who <i>Did Not</i> Train to Meet Entry-Level Requirement ^b N (% of Total Recruit Input)	BCT Discharges for Entry-Level Test Failures Who <i>Did</i> Train to Meet Entry-Level Requirement ^c N (% of Total Recruit Input)	Recruits Retained ^d N (% of Total Recruit Input)
Men	21,964	858 (3.9%)	215 (1.0%)	67 (0.3%)	148 (0.67%)
Women	15,645	1,580 (10.1%)	455 (2.9%)	302 (1.9%)	153 (0.98%)
Men and Women	37,609	2,438 (6.5%)	669 (1.8%)	368 (1.0%)	301 (0.80%)

^aFrom 120th Reception Battalion

^bEntry-level fitness test failures multiplied by 0.250 for men and 0.288 for women from Table 4

^cEntry-level fitness test failures multiplied by 0.078 for men and 0.191 for women from Table 4

^dEntry-level fitness test failures who *did not* train to meet the fitness requirements minus test failures who *did* train to meet the fitness requirements

Data obtained from the Operations Research Office at TRADOC indicated that there were a total of 93,468 men and 23,504 women who entered the Reception Station at all 5 US Army BCT and OSUT installations in FY 2003. To estimate the total number of recruits that might be salvaged by the FAP we multiplied the total number of recruits by the proportion of recruits retained from Table 7 as follows:

Men: 93,468 X 0.0067 = 626 Men

Women: 23,504 X 0.0098 = 230 Women

Thus, the estimated total number of men and women retained by the FAP was 856.

To estimate the cost savings we multiplied 856 (total recruits retained) by the estimated cost of training a single trainee. The calculation was:

$$856 \text{ trainees} \times \$27,628 = \$23,649,568$$

Similarly, we used the discharge rates shown in Table 6 to estimate the number of trainees who would be discharged with and without the entry-level physical fitness test when those who were discharged while training in the FAP were included in the analysis. Table 8 shows that 143 more trainees were retained with the test requirement.

Table 8. Recruit Loss With and Without the Entry-Level Physical Fitness Test Considering Recruits Lost in the FAP

	Total Recruit Input for FY2003 ^a	Entry-Level Physical Fitness Test Failures FY2003 ^a n (% of Total Recruit Input)	BCT Discharges for Entry-Level Test Failures Who <i>Did Not</i> Train to Meet Entry-Level Requirement ^b n (% of Total Recruit Input)	BCT Discharges for Entry-Level Test Failures Who <i>Did</i> Train to Meet Entry-Level Requirement ^c n (% of Total Recruit Input)	Recruits Retained ^d n (% of Total Recruit Input)
Men	21,964	858 (3.9%)	215 (1.0%)	102 (0.5%)	113 (0.51%)
Women	15,645	1,580 (10.1%)	454 (2.9%)	424 (1.9%)	30 (0.19%)
Men and Women	37,609	2,434 (6.5%)	669 (1.8%)	577 (1.5%)	143 (0.38%)

^aFrom 120th Reception Battalion

^bEntry-level fitness test failures multiplied by 0.250 for men and 0.288 for women from Table 6

^cEntry-level fitness test failures multiplied by 0.119 for men and 0.269 for women from Table 6

^dEntry-level fitness test failures who *did not* train to meet the entry-level fitness requirements minus test failures who *did* train to meet fitness requirements

Again, we multiplied the total number of recruits entering the US Army in FY 2003 by the proportion of recruits retained in Table 8 to estimate the total number of recruits retained Army-wide by the FAP:

$$\text{Men: } 93,468 \times 0.0051 = 477 \text{ Men}$$

$$\text{Women: } 23,504 \times 0.0019 = 45 \text{ Women}$$

Thus, the estimated total number of men and women retained by the FAP if FAP discharges were included in the analysis was 522.

To estimate the cost savings we multiplied 522 by the estimated cost of training a single trainee. The calculation was:

$$522 \text{ trainees} \times \$27,628 = \$14,421,816$$

5. DISCUSSION.

Recruits who enter BCT with low physical fitness have a higher risk of injury (8,19) and discharge (11,24). The analysis in this paper suggested that requiring recruits to meet the requirements of the entry-level physical fitness test plus pre-conditioning was associated with a lower rate of attrition in BCT and considerable estimated cost savings. If only the trainees who actually entered BCT were considered in the analysis, it was estimated that an additional 856

trainees per year would complete BCT Army-wide achieving a cost savings of over \$23 million dollars. If the total discharge rate was considered (including FAP discharges), there were an estimated 522 trainees per year who completed basic training Army-wide for a cost savings of over \$14 million dollars.

Our estimated attrition calculation was conservative because we did not have, nor could we estimate, the number of trainees who might have been lost through means other than direct BCT discharges or discharges from the PTRP or APFTEP. Direct BCT discharges and discharges from the PTRP or APFTEP account for almost all attrition (3,4,14,15,16,17). The unaccounted for discharges would be those who could not meet mandatory training requirements (e.g., basic rifle marksmanship, road marching, obstacle course, etc.) and this is a relatively small portion of recruits (14,15,16,18).


The overall TRADOC BCT attrition rate was 9.1% for FY 2003 (1). This includes all 5 BCT posts, including Ft Benning, Ft Knox and Ft Sill which train exclusively men. Men have less attrition than women (9,11,14,15,16). Our overall estimated attrition was 11.0% with 7.7% attrition for men and 15.5% attrition for women. This does not include the NPC group because the NPC group is not representative of the usual procedures in BCT on which the TRADOC figures are based. The usual procedures is for all recruits to pass the entry-level fitness test, a condition not met by the NPC group. Overall, this analysis suggests our attrition estimates are acceptable approximations.

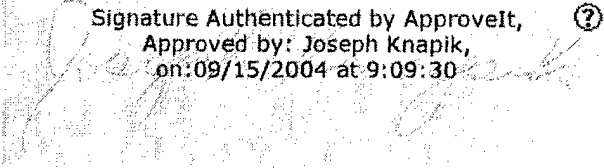
Historical data indicated that 4 to 7% of men and 10 to 24% of women failed entry-level physical fitness tests in the past. The proportion of trainees who fail the test has declined considerably since 1998. The current cadre of the FAP was not aware of this decline over time and could not account for it. Administrative changes (discussed below) in the test over time may be associated with the decline.

Implicit in our analysis is the assumption that a pre-enlistment physical fitness screening would be conducted in exactly the same manner as it is administered during the entry-level physical fitness test at Ft Jackson. We observed the entry-level physical fitness test at the reception station and found it to be highly organized, well staffed, and conducted in a very professional manner. Certain aspects of the test developed by the test cadre over time appeared to assist in keeping the failure rate low. For example, those who failed the push-up test were provided specific instructions on how to perform a correct push-up and provided a second chance to pass this test. "Chasers" and "pacers" on the run helped motivate individuals and provided pacing for less skilled runners who still had the aerobic capacity to pass the test. Men and women ran together. Strong verbal emphasis was provided to the trainees on the consequences of not passing the test.

In administering a pre-enlistment physical fitness test, organization, staffing, and test administration will be critical for success. The results described here can only be generalized to a pre-enlistment fitness test to the degree that it is similar to the entry-level physical fitness test at the reception station. Other limitations to this analysis include the relatively small number of NPC and PC trainees, the estimated attrition rates, extrapolations to installations other than Ft Jackson, and the fact that only 2 battalions at Ft Jackson were included in the attrition estimates.

In conclusion, low physical fitness is a demonstrated risk factor for attrition in BCT (11,24). The requirement for a baseline level of physical fitness and training for low-fit recruit recruits who desire to enter the US Army can reduce attrition and save dollars. We recommend that basic trainees be screened for fitness prior to BCT and that those with low fitness be physically trained before entry to BCT.

Signature Authenticated by ApproveIt, 
Approved by: Joseph Knapik,
on:09/15/2004 at 9:09:30



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APPENDIX A

References

1. Army Training Requirements and Resource System (ATTRS). Training Discharge Report. Ft Monroe VA: Army Training and Doctrine Command, 2004.
2. DiBenedetto M. Experience with a pre-basic fitness program at Ft Jackson, South Carolina. *Mil Med* 154:259-263. 1989.
3. Hauret KG, Knapik JJ, Lange JL, Heckel HA, Coval DL and Duplessis DH. Outcomes of Fort Jackson's Physical Training and Rehabilitation Program in Basic Combat Training - return to training, graduation, and two-year retention. *Mil Med* 169:562-567. 2004.
4. Hauret KG, Shippey DL and Knapik JJ. The Physical Training and Rehabilitation Program: duration of rehabilitation and final outcome of injuries in Basic Combat Training. *Mil Med* 166:820-826. 2001.
5. Heir T and Eide G. Injury proneness in infantry conscripts undergoing a physical training programme: smokeless tobacco use, higher age, and low levels of physical fitness are risk factors. *Scand J Med Sci Sports* 7:304-311. 1997.
6. Jones BH, Bovee MW, Harris JM and Cowan DN. Intrinsic risk factors for exercise-related injuries among male and female Army trainees. *Am J Sports Med* 21:705-710. 1993.
7. Jones BH, Bovee MW and Knapik JJ. Associations among body composition, physical fitness, and injuries in men and women Army trainees. In: Marriott BM and Grumstrup-Scott J. (editors) *Body Composition and Physical Performance*, National Academy Press, Washington, D.C., 1992.
8. Jones BH and Knapik JJ. Physical training and exercise-related injuries. Surveillance, research and injury prevention in military populations. *Sports Med* 27:111-125. 1999.
9. Knapik JJ, Jones BH, Hauret KG, Darakjy S, Piskator G. A review of the literature on attrition from the military services: risk factors and strategies to reduce attrition. Aberdeen Proving Ground: US Army Center for Health Promotion and Preventive Medicine. Technical Report No. 12-HF-01Q9A-04, 2004.
10. Knapik JJ, Bullock SH, Canada S, Toney E, Wells JD, Hoedebecke E and Jones BH. Influence of an injury reduction program on injury and fitness outcomes among soldiers. *Inj Prev* 10:37-42. 2004.
11. Knapik JJ, Canham-Chervak M, Hauret K, Hoedebecke E, Laurin MJ and Cuthie J. Discharges during US Army Basic Combat Training: injury rates and risk factors. *Mil Med* 166:641-647. 2001.
12. Knapik JJ, Canham-Chervak M, Hoedebecke E, Hewitson WC, Hauret K, Held C and Sharp MA. The Fitness Training Unit in Basic Combat Training: physical fitness, training outcomes, and injuries. *Mil Med* 166:356-361. 2001.
13. Knapik JJ, Cuthie J, Canham M, Hewitson W, Laurin MJ, Nee MA, Hoedebecke E, Hauret K, Carroll D and Jones BH. Injury incidence, injury risk factors, and physical fitness of U.S. Army basic trainees at Ft Jackson SC, 1997. Aberdeen Proving Ground, MD: U.S. Army Center for Health Promotion and

Preventive Medicine. Epidemiological Consultation Report No. 29-HE-7513-98, 1998.

14. Knapik JJ, Darakjy S, Scott S, Hauret KG, Canada S, Marin R, Palkoska F, VanCamp S, Piskator E, Rieger W and Jones BH. Evaluation of two Army fitness programs: the TRADOC Standardized Physical Training Program for Basic Combat Training and the Fitness Assessment Program. Aberdeen Proving Ground, MD: US Army Center for Health Promotion and Preventive Medicine. Technical Report No. 12-HF-5772B-04, 2004.

15. Knapik JJ, Hauret K, Bednarek JM, Arnold S, Canham-Chervak M, Mansfield A, Hoedebecke E, Mancuso J, Barker TL, Duplessis D, Heckel H, Peterson J and 2001 Staff of the Army Physical Fitness School. The Victory Fitness Program. Influence of the US Army's emerging physical fitness doctrine on fitness and injuries in Basic Combat Training. Aberdeen Proving Ground, MD: US Army Center for Health Promotion and Preventive Medicine. Epidemiological Consultation Report No. 12-MA-5762-01, 2001.

16. Knapik JJ, Hauret KG, Arnold S, Canham-Chervak M, Mansfield AJ, Hoedebecke EL and McMillian D. Injury and fitness outcomes during implementation of Physical Readiness Training. *Int J Sports Med* 24:372-381. 2003.

17. Knapik JJ, Hauret KG, Lange JL and Jovag B. Retention in service of recruits assigned to the Army Physical Fitness Test Enhancement Program in Basic Combat Training. *Mil Med* 168:490-492. 2003.

18. Knapik JJ, Sharp MA, Canham ML, Hauret K, Cuthie J, Hewitson W, Hoedebecke E, Laurin MJ, Polyak C, Carroll D and Jones B. Injury incidence and injury risk factors among US Army Basic Trainees at Ft Jackson, SC (including fitness training unit personnel, discharges, and newstarts). Aberdeen Proving Ground MD: US Army Center for Health Promotion and Preventive Medicine. Epidemiological Consultation Report No. 29-HE-8370-99, 1999.

19. Knapik JJ, Sharp MA, Canham-Chervak M, Hauret K, Patton JF and Jones BH. Risk factors for training-related injuries among men and women in Basic Combat Training. *Med Sci Sports Exerc* 33:946-954. 2001.

20. Lee L, Kumar S, Kok WL and Lim CL. Effects of a pre-training conditioning programme on basic military training attrition rates. *Ann Acad Med Singapore* 26:3-7. 1997.

21. Physical Fitness Training. U.S. Army Field Manual (FM) 21-20. Washington, D.C.: Headquarters, Department of the Army, 1992.

22. Pope RP, Herbert RD, Kirwan JD and Graham BJ. A randomized trial of preexercise stretching for prevention of lower-limb injury. *Med Sci Sports Exerc* 32:271-277. 2000.

23. Sheppard M. Cost of training a recruit. Ft Monroe VA: Army Training and Doctrine Command, Deputy Chief of Staff for Operations and Training, Program Management Directorate. Information Paper, 2002.

24. Snoddy RO and Henderson JM. Predictors of basic infantry success. *Mil Med* 159:616-622. 1994.

25. Thomas CW. Fitness Training Unit (FTU) entry and exit criteria. Ft Monroe VA: US Army Training and Doctrine Command. Memorandum Dated 10 September 1999.

26. Westphal KA, Friedl KE, Sharp MA, King N, Kramer TR, Reynolds KL and Marchitelli LJ. Health, performance and nutritional status of U.S. Army women during basic combat training. Natick, MA: U.S. Army Research Institute of Environmental Medicine. Technical Report No. T96-2, 1995.

APPENDIX B

Literature Review on the Effectiveness of Physical Training Prior to BCT

A few studies have examined the effectiveness of a pre-conditioning physical training program on injuries in BCT. One study (20) was conducted during Singapore Army basic military training (BMT). Four groups of male recruits were compared. Group A (Control Group) trained under the standard BMT protocol (3 months) and trainees were not segregated by fitness. Group B (Fit Group) was comprised of recruits who passed a physical fitness test. The passing criteria for the test was 4 chin-ups, 28 sit-ups (in 1 minute), an 81 inch standing broad jump, an 11 sec 40 meter shuttle run, and a 13 minute 1.5-mile run. Group C (Unfit-Trained Group) was comprised of recruits who failed one or more items on the fitness test and underwent a 4 to 6 week physical training program consisting of endurance runs, strength training, flexibility exercises, motor skill development and swimming. Group D (Unfit-Untrained/Extended Group) was comprised of recruits who failed the test, had no pre-BMT conditioning, and had their BMT extended by 1 month. Medical attrition in groups A, B, C, and D were 14.2%, 3.7%, 6.9%, and 13.4%, respectively. Attrition due to musculoskeletal injuries was 5.6%, 1.2%, 2.3%, and 4.7%, respectively, in the 4 groups. Compared to Group A (Control), Group C (Unfit-Trained) had both lower overall attrition (RR=2.2 (95% confidence interval (95%CI)= 1.6-2.6)) and lower attrition due to musculoskeletal injuries (RR=2.4 (95%CI=1.6-3.7)). Compared to Group A (Control), Group D (Unfit-Untrained/Extended) had similar overall attrition (RR= 1.1 (95%CI=0.9-1.2)) and similar attrition due to musculoskeletal injuries (RR=1.2 (95%CI=0.9-1.5)). This study indicated that a 4 to 6 week physical conditioning program before BMT was more effective in reducing medically-related attrition than no pre-conditioning program or extending BMT by 1 month.

Another investigation (2) in the U.S. Army found that FAP trainees at Ft Jackson had higher sick call rates, lower end-of-cycle fitness measures, but similar discharge rates compared to Non-FAP trainees. However, this study was conducted in 1989 and at this time the only fitness criterion for entry to BCT for men was 13 push-ups and for women, 1 push-up.

A more recent investigation (11) examined BCT injury, fitness, and training outcomes of recruits who 1) failed the entry-level physical fitness test, completed FAP, and then entered BCT (FAP Group), and 2) those who passed the Reception Station test and entered BCT without the FAP (Non-FAP Group). On entry to BCT, FAP women had similar 2-mile run times compared to Non-FAP women (21.6 vs. 21.5 min, respectively, $p=0.86$). FAP men were considerably slower on the 2-mile run than Non-FAP men (20.3 vs. 17.3 min, $p<0.01$). FAP women and Non-FAP women had similar graduation success (60% vs. 68%),

respectively, $p=0.14$) and time-loss injury rates (1.3 vs. 1.4 people injured/100 person-days, respectively, $p=0.90$). FAP men were less likely to graduate than Non-FAP men (55% vs. 82%, $p<0.01$) and more likely to suffer a time-loss injury (1.2 vs. 0.7 people injured/100 person days, $p<0.01$).

The latter study (11) does not answer the question of whether or not the FAP reduces injury rates and decreases BCT attrition. It does suggest that individuals of similar aerobic fitness levels have similar injury and BCT graduation rates while individuals of lower aerobic fitness have higher injury rates and less success at BCT graduation. This has also been demonstrated in other studies (5,6,7,13,18,19,22,26). To demonstrate the effectiveness of the FAP a more appropriate study design would be to take a group of individuals who fail the entry-level physical fitness test and put $\frac{1}{2}$ into the FAP and send $\frac{1}{2}$ directly to BCT (without FAP training). The two groups could then be compared.

Such a study has been conducted. That study (14) evaluated training outcomes, fitness, and injuries among low-fit trainees who did and did not enter the Fitness Assessment Program (FAP) prior to BCT. Recruits who passed the entry-level physical fitness test were designated the Non-FAP group. Recruits who failed the test, entered the FAP, and later entered BCT were designated the FAP Control group. The trainees who failed the test but entered BCT without going into the FAP were designated the FAP Test group. The proportion of FAP test, FAP Control and Non-FAP who completed the BCT cycle were 54%, 75% and 83%, respectively ($p<0.01$). After all final APFT retakes were completed, the proportion of FAP test, FAP Control and Non-FAP who failed the final test was 11.4%, 8.2% and 2.1%, respectively ($p<0.01$). Injury risk was higher in both the FAP Test and Control groups compared to the Non-FAP for both men and women ($p<0.01$). Injury differences between FAP Test and Control groups were smaller (male RR (FAP Test/FAP Control) =1.1, 95%CI=0.6-2.3; female RR (FAP Test/FAP Control) =1.3, 95%CI=0.9-2.0).

APPENDIX C

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