The Association of Physical Fitness With Psychological Health Outcomes In Soldiers During Army Basic Combat Training

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THE ASSOCIATION OF PHYSICAL FITNESS WITH PSYCHOLOGICAL HEALTH OUTCOMES IN SOLDIERS DURING ARMY BASIC COMBAT TRAINING

by

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DEDICATION

This dissertation is dedicated to my amazing husband, Patrick. I would not have made it without you! Thank you for your enduring support and patience through it all, and for always trying to keep a “lollipops and rainbows” attitude - even during the most stressful times!
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ABSTRACT

Despite the current need for investigation of factors involved with soldiers’ resilience to stressors in the Basic Combat Training (BCT) environment, and evidence in civilian populations that physical training is associated with psychological benefits, little is known about the relationship between physical fitness and psychological adjustment during BCT. Study one of this dissertation involved an extensive literature review of factors related to the relationship between physical fitness and psychological adjustment of soldiers during BCT. Using qualitative focus group methods, study two assessed soldiers’ perceptions about their sleep, and consequences of sleep disruption during BCT at Fort Jackson in Columbia, SC. Soldiers (age ≥ 18 years) were assessed in 45-60 min sessions involving three groups of female soldiers (total n=28) and three groups of male soldiers (total n=38). Soldiers reported reductions in their sleep duration and quality, which were attributed to many factors. These sleep changes had many perceived negative effects on performance, mood, and other components of BCT, and were more evident in low-fit soldiers.

Study three prospectively examined the association between physical fitness and depressive symptoms in 300 soldiers during BCT at Fort Jackson. Soldiers completed a baseline Army Physical Fitness Test (APFT) and survey assessment within one week of arriving at BCT, and an end of cycle survey after eight weeks of BCT. Physical fitness level was determined using the Army standard APFT passing score of greater than or equal to 180 points out of 300 points to assign soldiers to the “high” fitness category, and
less than 180 points to assign soldiers to the “low” fitness category. Depressive symptoms were measured using the 20-item Center for Epidemiologic Studies Depression Scale (CES-D). After adjusting for baseline demographics, BCT confidence score, Army identification score, self-reported sleep prior to BCT, and CES-D score in multivariate analyses, the odds of reporting depressive symptoms were 60% lower for soldiers in the high fitness category (odds ratio, OR 0.40; 95% confidence interval, CI 0.19–0.84), compared to soldiers in the low fitness category. Findings from these studies show evidence of relationships among physical fitness and factors related to the psychological health of soldiers during BCT.
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LIST OF ABBREVIATIONS

AIT ................................................................. Advanced Individual Training
APFT ................................................................. Army Physical Fitness Test
APFTEP ................................................... Army Physical Fitness Test Enhancement Program
BCT ................................................................. Basic Combat Training
BCTI ................................................................. Basic Combat Training
BMT ................................................................. Basic Military Training Inventory
BRM ................................................................. Basic Rifle Marksmanship
CES-D ............................................................ Center for Epidemiological Studies Depression Scale
CMHA ............................................................... Comprehensive Soldier Fitness
CSF ................................................................. Community Mental Health Activity
DBP ................................................................. Diastolic Blood Pressure
EAE ................................................................. Experimentation and Analysis Element
EOC IPT ........................................................ End of Cycle Individual Proficiency Test
EPTS ................................................................. Existing Prior to Service
FTU ................................................................. Fitness Training Unit
FAP ................................................................. Fitness Assessment Program
FY ................................................................. Fiscal Year
GAT ................................................................. Global Assessment Tool
HR ................................................................. Heart Rate
HPA ................................................................. Hypothalamic-Pituitary-Adrenal
ID ........................................................................................................... Identification
IPEHD ................................................ Institute for Partnerships to Eliminate Health Disparities
IRB ........................................................................................................ Institutional Review Board
OIF ......................................................................................................... Operation Iraqi Freedom
OEF ....................................................................................................... Operation Enduring Freedom
OTS ........................................................ Overtraining Syndrome
PSQI .............................................................. Pittsburgh Sleep Quality Index
PT .......................................................................................................... Physical Training
PTSD .......................................................... Post-Traumatic Stress Disorder
RCT .......................................................... Randomized Controlled Trial
SBP ................................................................................................. Systolic Blood Pressure
SERE ........................................................... Survival, Evasion, Resistance, and Escape
SHPERHD .................... Soldier Health Promotion to Examine and Reduce Health Disparities
SNS .............................................................. Sympathetic Nervous System
URI ........................................................ Upper Respiratory Infection
US .................................................................................................... United States
USA .............................................................. United States of America
USAAC ...................................................... United States Army Accessions Command
USARMC ...................... United States Army Medical Research and Materiel Command
USATC ........................................................ United States Army Medical Training Center
VA ............................................................... Veterans Administration
CHAPTER ONE

REVIEW OF THE LITERATURE

The Association Between Stress and Psychological Health

Generally defined, stress is a response by an organism attempting to regain homeostasis following a stimulus which threatens that homeostasis (Chrousos, 2009). Psychological stress, in particular, has been defined as a process in which an individual’s environmental demands exceed the adaptive capacity of that individual, resulting in psychological and biological consequences that may place the individual at risk for disease or disorder (S. Cohen, Kessler, & Gordon, 1997). “Environmental demands” can be conceptualized as external or internal stressors that may be physical (e.g., physically demanding work), or psychological (e.g., an argument with a family member).

Studies indicate that stress can be both causative, and an outcome of psychological distress (Andrews & Wilding, 2004; Banerjee, 2012; Grillon, Duncko, Covington, Kopperman, & Kling, 2007; Hammen, Kim, Eberhart, & Brennan, 2009; Rawson, Bloomer, & Kendall, 1994; Saveanu & Nemeroff, 2012). Though extensive research has investigated the relationship between stress and psychological illness, a clear causational pathway has yet to be elucidated. This may be due, in part, to the complex interplay of psychological, biological, social, and environmental factors which comprise this relationship.
Using the basic definition of stress, the development and/or perpetuation of affective episodes in response to stress represents a failure to maintain homeostasis (Contrada & Baum, 2010). The relationship between stress and psychological distress therefore represents an event in which the demands placed on the individual have outweighed that individual’s adaptive capacity to meet those demands (S. Cohen, Janicki-Deverts, & Miller, 2007; S. Cohen et al. 1997). While this definition has a core structure that all individuals likely share, there remain large differences between individuals in the magnitude of their psychological and physiological reactions to perceived stressors. Indeed, some individuals endure profoundly negative stress reactions in response to stressful events, while others may remain relatively unaffected by the same stressor.

What causes some individuals to be more resilient, while others exhibit vulnerability, has been widely studied in the literature, and may be a product of coping and appraisal processes; environment and circumstances; self-efficacious beliefs; personality and characteristics of the individual; lifetime experiences; prior psychological health history; and many other factors.

**Adaptation to Stress and the Theory of Cognitive Appraisal**

In the stress literature, appraisal and coping have been shown to be critical cognitive mechanisms underlying the association between environmental stressors and psychological health outcomes (Folkman, Lazarus, Dunkel-Schetter, DeLongis, & Gruen, 1986a; Folkman, Lazarus, Gruen, & DeLongis, 1986b; Lazarus & Folkman, 1984; McCuaig Edge & Ivey, 2012). One of the prevailing theoretical models which describes this process is the theory of cognitive appraisal described by Lazarus and Folkman (Lazarus & Folkman, 1984).
Built on a three process model of stress, appraisal, and coping, the theory of cognitive appraisal was designed as a framework for understanding differences in stress and coping between individuals. According to this theory, the psychological stress response is a product of an individual’s appraisal and coping process (Lazarus & Folkman, 1984), which is highly influenced by the individual’s circumstances (e.g., socioeconomic status, military rank, etc.) and their personal characteristics (e.g., gender, personality characteristics, etc.).

Cognitive appraisal of a stressor has been divided into primary and secondary appraisal processes (Lazarus & Folkman, 1984). Primary appraisal involves evaluation of the relevance of a stressor to the well-being of the individual (Lazarus & Folkman, 1984). Secondary appraisal involves evaluation of whether anything can be done to overcome the stressor, or to prevent harm from occurring because of the stressor (Lazarus & Folkman, 1984).

Central to the primary appraisal process is the concept of locus of control, a construct derived from social learning theory (Rotter, 1966). How an individual appraises a stressor may be highly dependent on whether he/she exhibits an internal or external locus of control (Folkman, 1984). Individuals with an internal locus of control view the attainment of outcomes as within their control, and these individuals tend to exhibit higher levels of ambition, persistence, and perseverance in the face of challenges (Folkman, 1984; Rotter, 1966). Conversely, individuals with an external locus of control believe that events are out of their control and dependent upon chance, fate, or the power of others (Rotter, 1966). These individuals tend to exhibit higher levels of hopelessness (Brackney & Westman, 1992; Prociuk, Breen, & Lussier, 1976) and appear to have a
higher risk for development of adverse psychological outcomes in response to stress than
individuals with an internal locus of control (Benassi, Sweeney, & Dufour, 1988; Burger,

Coping is the second key component of the theory of cognitive appraisal, and it
refers to the person’s cognitive and behavioral efforts to manage (reduce, minimize,
master, or tolerate) stress (Lazarus & Folkman, 1984). Two forms of coping are used to
describe the strategies employed by individuals to manage stressful events: (1) problem-
focused coping, and (2) emotion-focused coping. Problem-focused coping involves an
effort to reduce or eliminate the stressful event, while emotion-focused coping strategies
are directed towards decreasing one’s emotional reactions to a stressful event (Lazarus &
Folkman, 1984). Several studies have shown that the effectiveness of a specific coping
behavior depends on the nature of the situation (M. Cohen, Ben-Zur, & Rosenfeld, 2008;
Terry & Hynes, 1998). Task-focused coping behavior appears to be more effective in
controllable situations, whereas emotion-focused coping behavior appears to be more
effective in uncontrollable situations (Folkman & Moskowitz, 2000a; Folkman &
Moskowitz, 2000b).

According to the theory of cognitive appraisal, the psychological stress response
can therefore be described as a product of the stressor (which may be influenced by
environment/circumstances), appraisal of the stressor (which may be influenced by locus
of control characteristics of the individual), and the coping processes of the individual
(which may be problem-focused or emotion-focused). Psychological distress occurs when
the stressor has overtaxed one or more of these components of the stress response system
in the individual, which can lead to feelings of loss of control, or hopelessness. Multiple
studies have shown that it is this perceived loss of control/hopelessness in stressful situations that may increase risk for development of psychological distress (Endler, Macrodimitris, & Kocovski, 2000a; Endler, Speer, Johnson, & Flett, 2000b; S. M. Miller, 1979; Suls & Mullen, 1981).

**The Basic Combat Training Environment**

One environment in which individual coping, appraisal, and stress adaptive processes may be particularly taxed, is that of Army Basic Combat Training (BCT). BCT is an intense orientation program for indoctrination of new soldiers to Army military service. The physical and psychological demands of BCT including separation from support systems, depersonlization, sleep deprivation, intense physical training, lack of privacy, frequent verbal discipline, and lack of personal control, place immense stress on the training soldier. Unlike any civilian institution, the military training process during BCT maintains the goal of transforming very large numbers of civilian individuals, with very different backgrounds and cultures, into cohesive units in a very short period of time (about 10 weeks) (Broadhurst, 2004; Knapik et al., 2002). During the fiscal year (FY) 2011, 64,019 new soldiers entered the Army (Kapp, 2012). Indeed, the military represents one of the largest, and most demanding, training institutions in the nation.

Upon arrival at a US Army training installation, soldiers are initially in-processed at a reception battalion where they undergo various administrative requirements including completion of finance and medical records, receipt of immunizations, receipt of a standard uniform, and a standard haircut (Bornmann, 2009; Westphal et al., 1995). Following reception, soldiers are assigned and transported to a training company where they are randomly assigned to platoons. Each platoon of soldiers is supervised by at least
two drill sergeants, who direct training and enforce standards of physical, personal, and professional performance.

BCT is divided into three sequential phases, identified by Red, White, and Blue phase, respectively. During Red phase, soldiers are introduced to Army values, traditions, and ethics, while they develop combat skills and physical fitness (Rieger & Scott, 2006). Red Phase is often the most stressful for new soldiers due to the stressful indoctrination process, and the need for soldiers to process a large amount of new information in a short period of time. Initiation into Red phase often begins with a vigorous hazing known as the “shark attack” in which drill sergeants yell and threaten privates as soon as they arrive at the company area (Bornmann, 2009). Indeed, Red Phase is often identified as “total control,” indicative of the constant supervision by drill sergeants, and harsher punishments associated with even minor infractions (Bornmann, 2009).

During White Phase, the focus shifts to self-discipline, team building, weapons training, basic rifle marksmanship (BRM), and foot marching (McCrary, 2006). Though soldiers report feeling more respected by their drill sergeants during White Phase (Bornmann, 2009), this phase of BCT is still stressful due, in part, to the heavy focus on BRM training and passing the BRM test which is mandatory for every BCT soldier (Bornmann, 2009). During Blue Phase, soldiers have distinctly more autonomy than the earlier BCT phases, they are more physically fit, and more knowledgeable of Army values and expectations (Bornmann, 2009; Sharp et al., 2002). For this reason, Blue Phase is often reported to be less stressful among soldiers than the previous BCT phases (Bornmann, 2009). Moreover, studies have found a reduction in the amount of stress experienced during Blue phase of BCT, reflected in lower levels of self-reported
psychological distress (Clemons, 1996; Lerew, Schmidt, & Jackson, 1999), and fewer mental health referrals (Cigrang, Carbone, Todd, & Fiedler, 1998).

**Basic Combat Training and the Transition to Adulthood**

While the transition to adulthood, including economic independence from parents, is more stable and orderly for military enlistees than for their civilian peers, there are many other stressors in the basic combat training (BCT) environment which make BCT uniquely challenging. Indeed, the transition from civilian to military life involves moving from a social structure of relative independence to one of tight interdependence and strict hierarchy. The military socialization process itself is built around the breakdown of individualism and indoctrination into group membership (Snyder, 2003). Because autonomy and individuality are important values for many young adults during the transition to adulthood (T. G. O'Connor, Allen, Bell, & Hauser, 1996), some soldiers may have difficulty adjusting to the strict and controlled BCT environment.

Studies have shown that the transition period from adolescence to adulthood is a time when vulnerable individuals appear to be at a higher risk for the development of mental disorders (Aseltine & Gore, 1993; Reinherz, Paradis, Giaconia, Stashwick, & Fitzmaurice, 2003; Thurber & Walton, 2012). Indeed, studies indicate that it is during this period when most of the potentially serious mental disorders have the highest prevalence of onset (Blazer, Kessler, McGonagle, & Swartz, 1994; Kessler et al., 2005; McGorry, Killackey, & Yung, 2007). Depression and anxiety appear to be particularly prevalent during this period (Mahmoud, Staten, Hall, & Lennie, 2012; Moffitt et al., 2007; Rao, Hammen, & Daley, 1999; Reinherz et al., 2003), with one-month prevalence rates for depression higher in individuals between 15-24 years of age than for any other
age group (Blazer et al., 1994; de Girolamo, Dagani, Purcell, Cocchi, & McGorry, 2012; McGorry et al., 2007).

The challenging and stressful BCT environment might be especially problematic for those individuals who are already at heightened vulnerability for the development of psychological distress, particularly when they are separated from home environments, social support systems, and coping resources to which they were previously accustomed.

**Stressors in the BCT Environment**

Some of the more noted stressors of the BCT environment include communal living, regimented eating and sleeping schedules, sleep deprivation, and intense and frequent mandatory physical training (S. Jackson, Agius, R., Bridger, R., Richards, P., 2011; N. L. Miller, Tvaryanas, & Shattuck, 2012). New soldiers participate in physical training (PT) up to 6 days per week (Rieger & Scott, 2006), in addition to physically demanding occupational-related training, such as road marches; confidence, obstacle, and assault courses; team-building, field, live-fire exercises; land navigation; rappelling and night infiltration courses; and marksmanship training (Knapik et al., 2007). Graduation from BCT requires proficiency in BRM, the Army Physical Fitness Test (APFT), the End of Cycle Individual Proficiency Test (EOC IPT), and demonstration of appropriate military values and interpersonal behavior (Westphal et al., 1995).

**Physical Fitness Requirements During BCT**

Beginning in 1985, the Fitness Assessment Program (FAP), formerly the Fitness Training Unit (FTU) was initiated for BCT at Fort Jackson Army base to establish physical fitness initial entry requirements for soldiers at BCT Reception (Sharp et al., 2000). In 1997, the criteria was updated to include a minimum number of push-ups (13
for men, 3 for women), sit-ups (17 for both men and women), and a one-mile run time (9.0 minutes or less for men, 11.0 minutes or less for women) required for soldiers to enter BCT (Sharp et al., 2000). According to this program, soldiers who pass the initial physical fitness test at BCT Reception continue on to BCT, while those who fail the initial entry physical fitness test enter the FAP, where they are provided up to three weeks of physical training to increase their fitness levels before they enter BCT (Knapik et al., 2006).

During BCT, soldiers’ physical fitness levels are assessed at the beginning of BCT, and near the end of the BCT cycle via the APFT. The APFT involves three timed events performed in sequential order beginning with a push-up event (assessed by the number of repetitions completed in two minutes), a sit-ups event (assessed by the number of repetitions completed in two minutes), and finally a two-mile run event (assessed by time for completion of the two-mile run). Soldiers are allowed 10-20 minutes of rest between each of the events. Raw scores on each of the three components of the APFT are converted to point values based on Army normative data for age and gender to yield a maximum total score of 100 on each component test (U.S. Department of the Army, 2012). The three component scores are then sum-totaled to yield a maximum total score of 300 for the total APFT score. The APFT standard passing score is a minimum of 60 points per component event, and no less than 180 points for the overall APFT score (U.S. Department of the Army, 2012).

Soldiers are required to pass the APFT at the end of the BCT cycle in order to graduate from BCT and continue to Advanced Individual Training (AIT) (Knapik, et al., 2003a). In addition to BCT graduation implications, the APFT represents an event that
will remain important throughout soldiers’ military careers. Army service members are required to pass the APFT twice annually throughout their military careers (Kahue, 1995). Failure to pass the APFT during a soldier’s Army career has the potential to result in adverse administrative actions, or even discharge from the Army (Kahue, 1995).

Failure to meet physical fitness standards during BCT is reportedly a primary reason soldiers are recycled (i.e., repeating part, or all, of BCT in another company) (Knapik, Jones, Hauret, Darakjy, & Piskator, 2004b), and soldiers commonly report the fear of being recycled as a significant stressor during BCT (Faris, 1975). The severity of this stressor may be particularly pronounced for new soldiers who are not physically fit at BCT entry, which may increase their risk for the development of psychological distress during BCT.

Difficulty with the APFT during BCT has been associated with higher attrition during BCT and also during later Army service (Knapik et al., 2004b). For soldiers who do not pass the end of cycle APFT for graduation from BCT, the APFT Enhancement Program (APFTEP) was designed to increase soldier fitness at the end of the BCT cycle to allow soldiers to successfully pass the graduation APFT (Knapik, Hauret, Lange, & Jovag, 2003b; Knapik et al., 2004b). In a study of BCT soldiers who failed the BCT graduation APFT and entered the APFTEP, one-year attrition rates from Army service were 18% higher for men and 21% higher for women who had entered the APFTEP program, compared to soldiers who had passed the graduation APFT (Knapik, et al., 2003b).

**Impact of Stress on BCT Occupational Functioning**
While some stressors during BCT are instrumental to preparing soldiers for the rigors of combat, stress that is beyond the adaptive capacity of soldiers may have an adverse effect on their adjustment to BCT. Indeed there are numerous studies linking similar stressors such as disturbed sleep (Baglioni et al., 2011; Baglioni & Riemann, 2012; Buysse et al., 2008; Minkel et al., 2012), abrupt changes in environment (Aseltine & Gore, 1993; Reinherz et al., 2003; Thurber & Walton, 2012), changes in social and family support (Greenberg, Tesfazion, & Robinson, 2012; Kessler, Price, & Wortman, 1985; Saveanu & Nemeroff, 2012; Verdeli et al., 2011), and stress (Contrada & Baum, 2010; Hammen et al., 2009; S. Lee, Jeong, Kwak, & Park, 2010; Myin-Germeys & van Os, 2007; Saveanu & Nemeroff, 2012) to the development of adverse psychological distress in civilian populations.

In civilian populations, psychological distress has been associated with loss of productivity, increased accidents, and higher employer financial burden (Kessler et al., 2006; Kim, 2008). Likewise, among active duty military personnel, high levels of stress have been associated with psychological distress, as well as loss of productivity (Hourani, Williams & Kress, 2006; Pflanz & Ogle, 2006). Consequently, the Army must balance training goals, including the need for long, intensive training days to prepare thousands of soldiers physically and mentally, with the goal of reducing these mental health consequences associated with chronic stress.

Some soldiers are resilient to the intense stressors they endure during the initial phases of BCT, while others experience profound negative stress reactivity during BCT. Poor psychological adjustment during BCT could also have implications for adverse psychological outcomes during Advanced Individual Training (AIT), the next stage of
training for most soldiers. AIT includes advanced academic and skills training related to soldiers’ assigned job specialties prior to enlistment or during BCT (McCrary, 2006).

Studies have extensively illustrated the impact of physical training-related issues on the rate of soldier attrition from BCT (Hauret, Shippey, & Knapik, 2001; Kaufman, Brodine, & Shaffer, 2000; Knapik et al., 2001a; L. Lee, Kumar, Kok, & Lim, 1997; Molloy, Feltwell, Scott, & Niebuhr, 2012). However, there has been little to no investigation of factors surrounding the association between psychological stress and BCT soldier attrition rate. With attrition rates during BCT estimated between 5-10% (Gubata et al., 2012), a significant portion of which are attributed to mental disorders (Niebuhr, Powers, Krauss, Cuda, & Johnson, 2006), the burden of stress-related psychological distress during BCT is apparent. Indeed, psychiatric discharges were the most common cause of Army discharges for conditions Existing Prior to Service (EPTS), which includes discharges that occur during the first 180 days of Army service for pre-existing medical conditions (Niebuhr et al., 2011). During 2006-2010, an average of 29.5% of all Army EPTS discharges were attributed to psychiatric causes (Niebuhr et al., 2011). Although precise estimates of the prevalence and impact of mental health problems during BCT are lacking due in part to limitations associated with privacy protection and attrition coding, mood disturbances in BCT soldiers are commonly reported (Niebuhr et al., 2006).

Besides national security implications associated with soldier attrition during BCT, total monetary losses from BCT attrition, for all causes, in the fiscal year 2007 were estimated to be up to $57 million (Swedler, Knapik, Williams, Grier, & Jones, 2011). Identifying factors which could explain psychological adjustment to BCT may
lead to effective and implementable interventions aimed at increasing resiliency of soldiers during BCT, which could have the potential to impact BCT attrition, as well as the psychological health of soldiers during BCT and beyond.

**The Impact of Psychological Illness on Soldier Occupational Functioning**

Individual coping to the stressors of BCT may be influenced by underlying psychological illness. Among discharges related to psychological illness during BCT, depression and anxiety are most highly associated with attrition during initial military training across all U.S. military services (Lerew et al., 1999). However, identifiable psychological health factors which are associated with attrition rates during BCT are only one manifestation of soldiers’ inability to adapt to the stressors of BCT.

Both depression and anxiety, for example, carry a multitude of cognitive, physical, and behavioral symptoms which can impair soldiers’ functional abilities during BCT, which may limit soldier performance and productivity without necessarily leading to discharge. Studies conducted in civilian occupational settings, for example, have shown that individuals with depressive symptoms show significantly greater deficits in managing mental tasks, interpersonal relations, physical tasks, and time management (Adler et al., 2004; Adler et al., 2006; Lerner et al., 2004a; Lerner, Adler, Chang, Lapitsky, et al., 2004b), and an increased prevalence of work-related injury, absence, and loss of productivity than individuals without depressive symptoms (Lepine & Briley, 2011; Simon et al., 2001; W. F. Stewart, Ricci, Chee, Hahn, & Morganstein, 2003).

The impact of depressive symptoms on the occupational functioning of BCT soldiers may be particularly significant due to the occupational demands placed upon them. For example, the cognitive impairments associated with depression have direct
implications for the BCT environment, where individuals are often required to perform tasks which require a high degree of precision, vigilance, memory, and information processing (Broadhurst, 2004). Likewise, anhedonia, fatigue, and depressed mood may impair soldiers’ motivation to continue with training, particularly in the physically and psychologically demanding BCT environment.

Some research indicates that stressful events can be predisposing factors in depressive episodes (Kendler, Karkowski, & Prescott, 1999; Tennant, 2002). The stress of BCT has the potential, therefore, to expose vulnerabilities and weaken adaptive strategies in individuals who previously were not experiencing active symptoms of depression. Although psychiatric screening is conducted prior to military enlistment and BCT, this screening typically involves a brief self-reported psychiatric history conducted as a part of the pre-enlistment medical screening (Ritchie & Cardona, 2007). Given that the age of onset of some psychiatric disorders coincides with the age of most military soldiers (Kessler et al., 2007), this brief psychiatric history may not accurately reflect the psychological status and psychiatric vulnerability of soldiers when they begin BCT.

More in depth psychological assessments are conducted during BCT Reception. One goal of these assessments is to identify individuals who exhibit characteristics which might impact their ability to adjust to BCT or military life (Kubisiak et al., 2009). However, the percentage of Army EPTS discharges attributed to psychiatric conditions is significant (29.5%) (Niebuhr et al., 2011), and studies report that many soldiers recommended for EPTS discharges most likely represent screening failures, or soldiers failing to disclose medical or psychiatric history (Cigrang, Todd, & Carbone, 2000).
Reports indicate that potential soldiers both purposely and inadvertently omit psychological health history during the BCT pre-accession screening process due to privacy concerns, impact on Army career, clarity of screening instruments, and the perceived stigma surrounding mental health-related issues in the military (Britt, Greene-Shortridge, & Castro, 2007). Indeed, there remains a stigma of perceived “weakness” associated with mental illness in the military, as well as a fear of jeopardizing one’s military career advancement by reporting mental health-related issues (Britt et al., 2007).

Considering the impact of psychological health conditions on soldier occupational functioning, it is possible that some soldiers entering BCT with lower levels of physical fitness may also have psychological conditions that have been previously undiagnosed or unreported. Evidence from epidemiological studies involving civilian populations show that individuals with mental illness may be less physically active than those without mental illness (Jerstad, Boutelle, Ness, & Stice, 2010; Roshanaei-Moghaddam, Katon, & Russo, 2009).

Mental health symptomatology may impede the initiation and motivation to engage in physical activity in affected individuals (Leventhal, 2012; Morgan, 1970). Therefore, it is possible that some soldiers entering BCT with lower levels of physical fitness may also have psychological conditions that have been previously undiagnosed or unreported, which may increase their vulnerability to the deleterious effects of stress during BCT. On the other hand, abundant prospective and experimental studies which indicate mental health benefits of exercise training, provide a rationale for expecting that higher levels of physical fitness may reduce the risk of developing mental health problems during BCT.
Psychological Health during BCT and Development of Psychological Illness during Military Service

Poor psychological adjustment during BCT could also have implications for adverse psychological outcomes during Advanced Individual Training (AIT), the next stage of training for most soldiers, and beyond. Soldiers’ psychological health during BCT may have important implications for psychological functioning of soldiers during their military careers. Emerging evidence suggests that pre-military psychological health history may be indicative of adverse psychological health outcomes during and following military deployment (Chapin, 2004; Seifert, Polusny, & Murdoch, 2011).

Since 1997, the U.S. Army has conducted routine medical evaluations prior to deployment to ensure that soldiers do not have acute or chronic medical conditions that might have an impact on performance during deployment (Warner, Appenzeller, Parker, Warner, & Hoge, 2011). However, mental health screening prior to deployment is wrought with limitations (E. Jones, Hyams, & Wessely, 2003), and limited research exists on the effectiveness of the current pre-deployment screening practices (Warner et al., 2011). A study of soldiers returning from combat in Iraq and Afghanistan showed that 11.4% of the active duty soldiers and marines had depression before deployment (Hoge et al., 2004). Research indicates that psychiatric morbidity before a traumatic event may increase the likelihood of developing serious psychiatric disorder during or after stress exposure (McFarlane, 1989; Shalev et al., 1998).

Pre-deployment mental health screening failures allow the potential for a significant number of psychologically vulnerable military personnel to be exposed to very high levels of combat stress in the current military system. This may be evidenced
by the alarmingly high rates of mental health diagnoses observed in veterans returning from the recent conflicts in Iraq and Afghanistan. In a recent study of 289,328 Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF) veterans receiving care through the Veterans Administration (VA) system, it was found that 36.9% received a mental health diagnosis (Seal et al., 2009). Of the 36.9% receiving a mental health diagnosis, 21.8% were diagnosed with posttraumatic stress disorder (PTSD) and 17.4% were diagnosed with depression (Seal et al., 2009). It seems imperative, therefore, that larger efforts are needed which focus on prevention strategies to assist military personnel in mitigating the deleterious effects of military-related stressors.

**Resilience Programs During BCT**

In recognition of the importance of shifting from primarily treatment-based approaches, Army research and initiatives now include stress management and resiliency-enhancing programs for soldiers pre-deployment, including during BCT (Meredith, Gaillot, Hansell, Ritschard, Parker, & Wrenn, 2011). Such programs may also be beneficial for soldiers as they adjust to the stressors of military life and military occupations.

These resilience programs have included one-on-one counseling, realistic job previews for incoming soldiers, and programs for managing stress throughout a soldier’s career such as the Comprehensive Soldier Fitness program (Cornum, Matthews, & Seligman, 2011). These will be briefly reviewed below.

**One-on One Counseling**

A randomized controlled trial (RCT) of 269 BCT soldiers who were identified as “vulnerable to attrition” based on their responses on a Basic Combat Training Inventory
(BCTI) during Reception at Fort Knox, KY, was conducted to investigate the efficacy of a proactive one-on-one counseling intervention on soldier attrition during BCT (Georgoulakis, Bank, & Jenkins, 1981). The authors randomly assigned those vulnerable soldiers to two groups: (1) a vulnerable experimental group (n=119), and (2) a vulnerable control group (n=150). The experimental group was assigned to the Community Mental Health Activity (CMHA) early intervention program, where they were required to report to CMHA for one-on-one counseling sessions. The control group was not assigned to this program, but did have the option to receive counseling from the CMHA through normal command procedures if necessary.

Results of this study indicated that there was no significant difference in BCT attrition rates between the two groups, which the authors attributed to the large percentage of the control group (n=38%) receiving counseling through normal command procedures. Post hoc analyses conducted on the vulnerable experimental group found a positive relationship between counseling of vulnerable soldiers and completion of BCT. Although the evaluation of this program was examined with a small group of Army BCT soldiers, the results highlight the positive impact one-on-one counseling can have on reducing attrition among vulnerable soldiers during BCT. Referral of soldiers to mental health professionals is an ongoing counseling strategy in the Army, though rigorous testing of counseling interventions during BCT has yet to be conducted (Kubisiak et al., 2009).

**Realistic Job Previews**

Research conducted in civilian occupational settings shows that when employees’ expectations are not met, they have a greater propensity to withdraw from the job or
organization (Phillips, 1998; Porter & Steers, 1973; Premack & Wanous, 1985; Wanous, Poland, Premack, & Davis, 1992). As used in the Army, realistic job previews typically consist of a film or video that provides a portrayal of what new soldiers might expect to experience during BCT (Kubisiak et al., 2009). The Army also provides realistic job previews to potential soldiers through its informational website: http://www.goarmy.com/. The website offers a realistic preview of what to expect from BCT and an Army career, which may ease the adjustment into Army life. Having realistic job previews available for potential enlistees prior to entering military service, attempts to establish realistic expectations for interested individuals, as well as to reduce attrition during BCT for those individuals that choose to enlist (Kubisiak et al., 2009).

The Comprehensive Soldier Fitness Program

The Comprehensive Soldier Fitness (CSF) program is a large-scale, proactive, integrated approach to developing psychological resilience in soldiers, family members of soldiers, and civilian employees of the Army (Casey Jr, 2011). The program includes four components: (1) emotional, social, family, and spiritual assessment, (2) individualized learning modules, (3) general resilience training, and (4) developing Master Resilience Trainers (Casey Jr, 2011). The goal of the program is to increase the number of soldiers who derive meaning and personal growth from their combat experience, to decrease the number of soldiers who return from deployment with mental health-related illnesses, and to decrease the number of soldiers who develop stress pathologies throughout their Army careers (Casey Jr, 2011). The CSF program identifies five key areas that are critical to the overall physical and psychological fitness of soldiers:
(1) physical; (2) emotional; (3) social; (4) family; and (5) spiritual (Casey Jr, 2011; Cornum et al., 2011).

The CSF program is designed to meet the individual needs of soldiers, recognizing that the developmental needs of soldiers may vary by age, rank, Army career experience, and other factors. To better tailor CSF programming to meet the individual needs of soldiers, an online self-assessment to identify resiliency strengths, the Global Assessment Tool (GAT), was developed (Casey Jr, 2011; C. Peterson, Park, & Castro, 2011). This self-report questionnaire was designed to measure four of the five key domains important for psychological fitness (with the exception of physical fitness), as established by the CSF program (C. Peterson et al., 2011). While the CSF program includes a quality control component, intended to longitudinally assess the program’s effectiveness, results are still forthcoming (Meredith et al., 2011; A. H. Taylor, Schatz, Marino-Carper, Carrizales, & Vogel-Walcutt, 2011). To our knowledge, to date, BCT resilience programs have not been demonstrated in the literature (Meredith et al., 2011; A. H. Taylor et al., 2011), nor have they been widely implemented during BCT (Kubisiak et al., 2009; Meredith et al., 2011).

**Barriers to Resilience Program Implementation During BCT**

Several common barriers to resilience program implementation during BCT have been reported and include (1) lack of leadership support, (2) logistical issues, (3) funding, and (4) mental health stigma (Meredith et al., 2011). Of these, the most commonly cited barrier to resilience program implementation involves gaining or maintaining support from military leaders (Meredith et al., 2011). There remains debate amongst some in Army leadership whether resilience programs during BCT are an effective utilization of
valuable BCT time and resources. Logistical barriers to implementation of resilience programs during BCT have been reported to include training and maintenance of adequate staff, acquisition and scheduling of physical space, and establishment of methods for quality assurance (Meredith et al., 2011).

Funding barriers have been reported to be associated with the lack of alignment of resilience programs with existing traditional mental health care or general training funding sources (Meredith et al., 2011). It may be important, therefore, to distinguish resilience programs from traditional mental health programs. This may also help to reduce stigma, another commonly reported barrier to implementation of resilience programs during BCT. A recent review of resilience programs in the military found that resilience programs are often embedded within traditional mental health treatment programs, and that the negative stigma associated with mental illness often diminished soldiers’ participation in resilience programs (Meredith et al., 2011).

Thus, there remains a need to further assess factors which could enhance resilience, and therefore psychological adjustment in BCT soldiers. There is a wealth of data suggesting that physical fitness might be an important factor.

**Rationale for Investigation of the Association Between Physical Fitness and Psychological Health Outcomes in Soldiers During BCT**

There is a large body of research showing that a higher level of physical fitness is important for protection from injury and illness during BCT (Knapik, et al., 2001a; Knapik, et al., 2003b; Knapik et al., 2004a; Knapik, et al., 2001b; Swedler et al., 2011), and also important for the occupational tasks that soldiers perform throughout their military careers (T. C. Roy, Springer, McNulty, & Butler, 2010). Considering the
extensive role of physical fitness in the BCT environment (Knapik, 1989; T. C. Roy et al., 2010), and compelling evidence from a large body of research conducted in civilian populations suggesting that physical fitness may have a protective role in reducing the adverse psychological effects of stress (Brown & Siegel, 1988; Rejeski, Thompson, Brubaker, & Miller, 1992; Roth & Holmes, 1985), the association between physical fitness and psychological adjustment of soldiers during BCT is an important, yet, unexplored area of inquiry.

**The Association Between Physical Fitness and Psychological Health:**

**Evidence from Studies of Civilian Populations**

Evidence from a large body of research in civilian populations suggests that physical fitness may have a protective role in reducing the adverse psychological effects of stress (Brown, 1991; Brown & Siegel, 1988; Dunn, Trivedi, & O'Neal, 2001; Rejeski et al., 1992; Roth & Holmes, 1985). For example, results of a recent cross-sectional study indicated that individuals with high stress and moderate to high levels of physical fitness reported lower levels of depressive symptoms than individuals with high stress and low levels of physical fitness (Gerber, Brand, Holsboer-Trachsler, & Puhse, 2010).

Additionally, in civilian populations, cross-sectional studies have shown that individuals with high levels of physical activity or fitness are less likely to exhibit psychological distress (Dunn et al., 2001; Goodwin, 2003; McKercher et al., 2009), and prospective studies have shown that high fitness/activity is associated with less risk of development of psychological distress (Dishman et al., 2012; Farmer et al., 1988; Sui et al., 2009), compared to individuals who are sedentary or have lower fitness levels.
However, in comparison to most civilian environments, the BCT environment is uniquely stressful. Indeed, there are few comparisons in the civilian world in which men and women, most of whom are just beginning the transition to adulthood, are so challenged. Despite the need for investigation of factors related to the psychological adjustment of soldiers during BCT, and accumulating evidence from studies of civilian populations suggesting that physical fitness may be associated with psychological health, to our knowledge, there has been no research of the association between physical fitness and psychological health outcomes of soldiers during BCT.

**The Association Between Physical Fitness and BCT Outcomes**

Many of the health consequences of exercise training show a U-shaped association, in which moderate amounts of exercise are beneficial (e.g., for reducing illness), whereas excessive amounts are harmful (B. H. Jones et al., 1993b; Moreira, et al., 2009; Walsh et al., 2011). What is moderate or excessive varies according to the fitness and activity history of the individual. Physical training (PT) begins shortly after BCT entry. As with other components of BCT, PT is conducted as a group training exercise. Due to the wide variability in fitness levels of incoming soldiers, PT may present a sudden and significant increase in training for some individuals, while presenting a minimal challenge, or even a decrease in training for others.

A recent study was conducted which attempted to quantify the amount of physical activity performed by BCT soldiers via electronic pedometers and training logs. This study found that soldiers, on average, traveled an estimated 11.7 ± 4.4 kilometers/day during BCT (Knapik et al., 2007). For an elite athlete, this amount of physical training
may not induce high levels of stress, but in an individual who was previously sedentary, this daily requirement may be intensely stressful.

In recognition of the impact of physical fitness at BCT entry and BCT attrition and injury rates, the Army’s Fitness Assessment Program (FAP) was developed as an effort to increase pre-accession BCT fitness of soldiers who fall below initial Army physical fitness standards. Soldiers who pass an initial physical fitness test prior to BCT entry continue on to BCT, while those who fail the initial entry physical fitness test enter the FAP, where they are provided up to three weeks of physical training to increase their fitness levels before they enter BCT (Knapik et al., 2006). Research conducted on soldiers participating in the FAP has shown that low-fit soldiers who trained in the FAP prior to BCT entry had lower attrition rates, injury risk, and higher graduation rates compared to low-fit soldiers who entered BCT without pre-training in the FAP (Knapik et al., 2006).

Indeed, extensive research has shown that individuals entering BCT with low levels of physical fitness are more susceptible to physical injury, illness, and early discharge from BCT (Knapik, et al., 2001b; Knapik et al., 2006; Niebuhr et al., 2008; Swedler et al., 2011). However, evidence of a relationship between physical fitness and mental health-related outcomes during BCT is lacking.

Physical Fitness and Psychological Adaptation to Physical Training during BCT

It is apparent from studies conducted in civilian populations that participation in physical training regimens more challenging than an individual’s habitual regimen may be less likely to reduce stress reactivity, and may even increase adverse stress reactions (Keller & Seraganian, 1984; Meeusen et al., 2013; Petruzzello, Jones, & Tate, 1997;
Performance decrements, psychological disturbances (decreased vigor, depressive symptoms, increased fatigue), disturbed sleep, and hormonal disturbances, which are hallmark symptoms of overtraining syndrome (OTS), have been observed as a result of sudden and significant increases in physical training (Fry et al., 1994; P. J. O'Connor, Morgan, & Raglin, 1991; P. J. O'Connor, Morgan, Raglin, Barksdale, & Kalin, 1989; Slivka, Hailes, Cuddy, & Ruby, 2010). Indeed, research on athletes shows that even a few days of intense physical training can result in decrements in mood, as well as negative changes in biomarkers of stress regulation (Fry et al., 1994; P. J. O'Connor et al., 1991; P. J. O'Connor et al., 1989; P. J. O’Connor, 1997; Slivka et al., 2010). Therefore, soldiers entering BCT with low levels of physical fitness may be at a higher risk for OTS due to the abrupt entry into a demanding physical training regimen to which they are not physically accustomed.

Psychological distress could also contribute to the high prevalence of upper respiratory tract infections in BCT soldiers (S. E. Lee, Eick, & Ciminera, 2008), as extensive evidence in both civilian and military populations suggests an association between psychological stress and risk of infectious disease, including upper respiratory infections (URI’s) (S. Cohen, 1995; Gomez-Merino et al., 2005; Pedersen, Zachariae, & Bovbjerg, 2010). The interplay of physical fitness, psychological adaptation to stress during BCT, and physical illness during BCT is complex, and may be influenced by many factors including season of the year, living quarters, and intra-individual immune characteristics of soldiers (Kolavic et al., 2000). It is noteworthy, however, that prolonged and intensive physical training has been associated with numerous changes in
immunity, including immune suppression, which may reflect a physiological stress response (Moreira et al., 2009).

It is also noteworthy that low levels of physical activity prior to BCT, as well as low performance on BCT physical fitness tests have been associated with an increased risk of having an upper respiratory infection (URI) during BCT (B.H. Jones, Manikowski, Harris, Dziados, & Norton, 1988). Whether physical fitness at BCT entry might play a protective role in psychological and physiological adaptation to the BCT environment through modulation of stress-induced immune responses, will require further investigation.

**Physical Fitness and Psychological Adaptation to Injury during BCT**

Because many components of BCT are reliant on completion of physically-demanding tasks, suffering an injury during BCT can place additional psychological stress on soldiers, including risk of discharge from BCT, extended duration of BCT (which may include additional time spent away from family), and ostracism from fellow soldiers or drill sergeants (Hauret et al., 2001). Those soldiers with serious injuries in need of rehabilitation attend the Physical Training and Rehabilitation Program (PTRP) before they are recycled back in to BCT (Hauret et al., 2001). The average (+/- SD) length of stay in PTRP for soldiers before returning to BCT was 62 +/- 42 days (Hauret et al., 2001). These stressors may be particularly difficult for soldiers who are more vulnerable to the psychological impact of stress, which may in turn, further delay injury rehabilitation (Hauret et al., 2004).

**Physical Fitness and Psychological Adaptation to Sleep Loss during BCT**
Sleep deprivation has been associated with many adverse effects including decreased vigilance, mood disturbances, perceptual and cognitive decrements, impaired judgment, fatigue, and increased vulnerability to stress (Banks & Dinges, 2007; Lim & Dinges, 2008; Pilcher & Huffcutt, 1996). These effects may be particularly problematic for individuals in military environments, where sleep deprivation can have profound negative consequences on individual and unit performance (A. L. Peterson, Goodie, Satterfield, & Brim, 2008; Young-McCaughan et al., 2010). In a recent study conducted during military training, sleep deprivation was associated with decreased marksmanship (Tharion, Shukitt-Hale, & Lieberman, 2003).

A recent actigraphy-based study of BCT soldiers investigated the effect of a phase-delayed sleep schedule on mood, sleep, and performance measures in 392 BCT soldiers at Fort Leonard Wood, Missouri (N. L. Miller et al., 2012). The authors found that soldiers on the delayed schedule obtained 31 minutes more sleep per night, had better sleep quality, and reported less fatigue, than soldiers on the traditional BCT sleep schedule. Soldiers in the delayed sleep schedule group also reported less total mood disturbance relative to baseline than soldiers in the traditional BCT sleep schedule group. Improvements in marksmanship also correlated positively with average nightly sleep in all soldiers (N. L. Miller et al., 2012).

Sleep disturbance, which can represent a symptom of OTS, may exacerbate mood disturbances during BCT (Meeusen et al., 2013). Improved fitness might reduce the risk of this scenario. Injury and illness during BCT may reflect a downstream consequence of the stress-related symptoms of OTS, sleep disturbances, interplay between fitness level and stress reactivity, or a more direct consequence of physical unpreparedness for the
physically demanding BCT environment. The interrelationships between these factors remain to be elucidated, and will require further investigation.

**Social Cognitive Theory and Psychological Adjustment to BCT**

Because of the unique BCT environment, most traditional forms of stress management may not work in such an intense setting. Traditional stress management techniques such as relaxation or task redesign techniques are ineffective in the BCT setting, where tasks are very intense and, for training soldiers, cannot be restructured (Meredith et al., 2011). Thus, prevention strategies are needed which would develop soldiers’ ability to cope with the stressors of BCT effectively in an environment where task redesign or alteration of the stressor may not be feasible.

Combining concepts from cognitive appraisal and social learning theories, it is apparent that the ability to cope with a stressful situation is a key component of positive psychological outcomes following stress. Thus, coping efficacy, or an individual’s belief in their ability to successfully cope in the face of a stressful event, is an important cognitive mechanism for instilling perceived control in individuals during stressful situations. Targeting interventions which might increase self-efficacy in soldiers as they begin BCT, might improve psychological adjustment of soldiers during BCT.

The concept of self-efficacy is key construct of Albert Bandura’s social cognitive theory (Bandura, 1977). Generally defined, self-efficacy is an individual's belief in his/her ability to succeed in specific situations (Bandura, 1977). Efficacy beliefs influence task persistence, motivation and effort, expectations of success, and individual affective responses to challenges (Bandura, 1977). The basic premise is that individuals
with higher levels of self-efficacy might also have higher coping self-efficacy beliefs, or beliefs about their ability to cope with external stressors (Bandura, 2001).

Coping self-efficacy can be conceptualized as a cognitive mechanism for gaining control in stressful situations. A unifying concept of self-efficacy beliefs and appraisal theory involves the idea that it is the perceived inefficacy to cope with potentially stressful events that makes them stressful (Bandura, Cioffi, Taylor, & Brouillard, 1988; Folkman, et al., 1986a). For example, people who believe they are able to cope with stressful situations (i.e., high in coping self-efficacy) appear to appraise stressful situations as challenging rather than threatening. A strong sense of coping self-efficacy, therefore, reduces vulnerability to stress in challenging situations and strengthens resiliency to adversity (Bandura, 2001).

Indeed, a large amount of research has demonstrated that possessing high levels of self-efficacy acts to decrease people's potential for experiencing negative stress effects by increasing their sense of control in stressful situations (Bandura, 1982; Bandura et al., 1988; Chemers, Hu, & Garcia, 2001; Jex, Bliese, Buzzell, & Primeau, 2001). This perception of being in control during stressful situations may serve as an important buffer against the development of psychological distress. It is noteworthy to consider that higher self-efficacy during BCT has been associated with reduced levels of perceived stress (Davis, 2006), as well as reduced attrition, injury, and illness during BCT (Hadid, Evans, Yanovich, Luria, & Moran, 2008).

The psychological mechanisms underlying the impact of physical fitness on the resilience of soldiers to stressors in the BCT environment are unknown, however, Bandura’s concept of self-efficacy holds promise as a potential link between the stress-
adaptive cognitive behaviors associated with physical fitness and psychological adjustment during BCT. The positive relationship between physical training and enhanced self-efficacy in civilian populations has been widely reported in the literature (Fox, 1999; Mason & Holt, 2012; Mikkelsen et al., 2010), and self-efficacy has been shown to mediate the association between physical activity and mental health (Bodin & Martinsen, 2004; Dishman et al., 2006; White, Kendrick, & Yardley, 2009). Furthermore, there is also support for the role of coping self-efficacy in the association between physical training and reduction of adverse psychological health outcomes in response to environmental stressors (Brown & Siegel, 1988).

While several different factors play a role in the development of efficacy beliefs, mastery experiences are perhaps the most influential sources of efficacy information (Bandura, 1982). This concept may provide one theoretical basis for the stress-buffering effect of physical fitness during BCT, as many components of the BCT environment require completion of physically demanding tasks. Individuals with higher levels of physical fitness at BCT entry might therefore have higher self-efficacious beliefs regarding completion of physically demanding BCT challenges, perhaps due in part, to congruent mastery experiences associated with prior physical training.

While self-efficacy is generally thought of as situation specific, rather than domain-specific, there is evidence that physical activity behavior may induce self-efficacious beliefs in other domains outside of physical training (Gauvin & Spence, 1996). Self-efficacy is not a static characteristic, but one that can be altered by cognitive, affective, biological, and environmental events (Maciejewski, Prigerson, & Mazure, 2000). One proposed mechanism underlying the association between physical fitness and
enhanced general self-efficacy beliefs lies in the hypothesis that exercise poses a challenging task for physically inactive individuals. Therefore, the successful adoption of regular physical activity by previously inactive individuals may produce improved mood, increased self-confidence, and enhanced ability to handle other events that may be psychologically challenging or stressful (Gauvin & Spence, 1996; North, McCullagh, & Tran, 1990).

Considering the positive relationship between physical fitness and self-efficacy beliefs, soldiers who begin BCT with higher fitness levels may begin BCT with higher levels of self-efficacy beliefs, and therefore might be less likely to appraise the challenges of BCT as stressful compared with unfit soldiers. This hardier appraisal could in turn lead to less stress reactivity and a reduced risk of development of psychological illness. Indeed, psychological hardiness, defined as three interrelated personality characteristics of commitment (versus alienation), control (versus hopelessness), and challenge (versus threat), has been shown to be protective against the negative effects of stress (Kobasa, 1979; Kobasa, Salvatore, & Puccetti, 1982; Maddi, 2002; Sandvik et al., 2013).

**Potential Physiological Mechanisms Underlying the Association between Physical Fitness and Psychological Adjustment during BCT**

There is a large body of research on the association between physical fitness and psychophysiological reactivity to stress. However, differences in methodological approaches, definitions of stress, and study populations have resulted in heterogeneity in findings (Crews & Landers, 1987; Forcier et al., 2006; E. M. Jackson & Dishman, 2006). Crews and Landers (1987) statistically pooled 34 studies having 92 effect size estimates from 1,449 subjects, which compared the effects of aerobic fitness on resistance
to psychosocial stressor tasks. Stressor tasks utilized in the studies reviewed included cognitive performance tasks such as mental arithmetic tasks, passive coping tasks such as film viewing or presentation of frightening object or picture, and physical performance tasks such as acute exercise. They found that aerobically fit subjects showed reduced psychosocial stress responses in all measures assessed, including changes in heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), skin response, and psychological self-report, compared to either control group (sedentary participants) or baseline (pre-stressor) values (Crews & Landers, 1987).

In contrast to the meta-analytic review by Crews and Landers (1987), the meta-analytic review by Jackson and Dishman (2006) found that fit adults had a slightly increased stress response, but a faster recovery after stress, compared to less fit adults, but the effects were small and heterogeneous. Reactivity and recovery effects in randomized exercise training studies were not significantly different from zero. The authors note that small and heterogeneous effect sizes were likely a result of the variety of laboratory stressors used in the research studies reviewed, differences in physiological response patterns elicited by different stressors, and the variability in methods, variables, and target populations of the studies (E. M. Jackson & Dishman, 2006).

Forcier and colleagues (2006) conducted a meta-analyses of the effect of cardiorespiratory fitness on cardiovascular stress reactivity. Specifically, the authors found that fit individuals showed significantly reduced HR and SBP reactivity to stressors, as well as a trend toward attenuated diastolic blood pressure DBP reactivity. Fit individuals also showed significantly faster HR recovery, but not SBP or DBP recovery, compared to unfit individuals (Forcier et al., 2006).
Although the precise physiological mechanisms underlying the stress-buffering properties of physical fitness are still emerging, animal and human studies suggest that exercise training may lead to adaptations in the hypothalamic-pituitary-adrenal (HPA) axis and the sympathetic nervous system (SNS) in response to stress (Tsatsoulis & Fountoulakis, 2006; Wittert, Livesey, Espiner, & Donald, 1996). Multiple studies have observed improvements in cortisol, catecholamine levels, cardiovascular reactivity, and other stress-related physiological responses to stressful stimuli in individuals who habitually exercise or are physically fit (for a review, see Salmon, 2001).

Indeed, the notable central and peripheral physiological stress responses to exercise have led to the theory of “cross-stressor adaptation,” which posits that physiological adaptations resulting from physical training may also result in physiological adaptations to psychological stressors (Sothmann et al., 1996). Indeed, some studies have shown physical training has resulted in decreased heart rate (Anshel, 1996; Spalding, Lyon, Steel, & Hatfield, 2004; Throne, Bartholomew, Craig, & Farrar, 2000), attenuated blood pressure (Anshel, 1996; Spalding et al., 2004; Throne et al., 2000), and decreased SNS activity (Rimmele et al., 2009) in response to psychological stressors. Trained individuals have also shown attenuated neuroendocrine responses to stress (Brooke & Long, 1987; Light, Obrist, James, & Strogatz, 1987; McCubbin, Cheung, Montgomery, Bulbulian, & Wilson, 1992; M. Roy & Steptoe, 1991).

More investigation is needed to improve understanding of the physiological mechanisms underlying the stress-buffering benefits of physical training. However, cumulative research from population-based human studies continue to suggest a
protective effect of physical fitness against adverse psychological outcomes associated with chronic stress (Dunn et al., 2001).

To our knowledge, there have been no published studies of the association between physical fitness and psychological health outcomes among BCT soldiers. However, such an association was observed in a recent study of U.S. military personnel (n=31) completing a simulated Survival, Evasion, Resistance, and Escape (SERE) training. In that study, aerobic fitness level was inversely associated with self-reported impact of stressful events during SERE (M. K. Taylor et al., 2008). Physically fit soldiers typically have greater levels of self-confidence, mental toughness, and motivation. It seems intuitive, therefore, that the psychologically beneficial benefits of being physically fit may be protective against adverse psychological reactions to the stressors of BCT, perhaps particularly during the Red phase of BCT, when stressors may be at their highest for many soldiers.

**Summary**

While mental health and behavioral causes remain a significant portion of early career attrition in the Army (Niebuhr et al., 2011), psychological health factors related to BCT attrition and soldiers’ adjustment to the stressors of BCT are still under investigation. Studies in civilian populations suggest that physical fitness might help buffer against the adverse impact of psychological stressors, but the association of physical fitness with soldiers’ psychological adjustment to BCT has not been explored. Extensive review of this association is warranted.

Important avenues of inquiry surrounding the association between physical fitness and psychological adjustment of soldiers during BCT should also explore interactions
with factors such as sleep, injury, and physical illness. Other factors to control would be those associated with psychological adjustment during BCT, such as race, gender, education, family income, marital status, family history/environment (Carbone, Cigrang, Todd, & Fiedler, 1999; Knapik et al., 2004b; McGraw & Bearden, 1988); as well as measures of soldiers’ BCT self-efficacy and identification with the Army. Indeed, individuals with high self-efficacy to succeed in BCT and high identity with the Army are more likely to adjust well to military life because their abilities and interests fit with the occupational demands of the Army (Ford, Gibson, DeCesare, Marsh, & Griepentrog, 2013; Mael & Ashforth, 1995).

Physical fitness is one of the five key components of the Army’s CSF program, which is designed to increase resiliency in soldiers throughout their Army careers (Casey Jr, 2011). However, unlike the other four “psychological fitness” components of the CSF program, the psychological benefits of physical fitness have been largely ignored with respect to assessment and interventions in the CSF program (Meredith et al., 2011). In the general population, higher physical fitness levels have been positively associated with factors which are also conceptually important for the psychological adjustment of soldiers during BCT. The association between physical fitness and psychological health of soldiers may therefore provide a potential target for interventions aimed at increasing resiliency to stressors, improving the psychological adjustment of soldiers, and ultimately reducing attrition during BCT. Additionally, illustrating a relationship between physical fitness and improved mental health may be a way to fuel interest in psychological health programming within a currently accepted and established Army training doctrine.
Indeed, there are large gaps in the existing literature pertaining to factors which may increase psychological resilience during BCT and improve psychological health outcomes in soldiers during BCT. The Department of Defense has recently introduced the importance of “total force fitness,” for the military population, emphasizing the role of physical, emotional, health, nutritional, and spiritual factors as important aspects of resilience (Jonas et al., 2010). The purpose of this dissertation, therefore, is to investigate factors related to the association between physical fitness and psychological health outcomes in soldiers during BCT. This will be accomplished through three studies including: (1) a review of the relationship between physical fitness and psychological adjustment during BCT, (2) a qualitative study of sleep during basic combat training, and (3) a prospective study of the association between physical fitness and depressive symptoms in soldiers during BCT.
CHAPTER TWO

METHODS

Statement of the Problem

Epidemiological and experimental studies in civilian populations have provided evidence that physical fitness may have a protective role in reducing the adverse psychological effects of stress. In comparison to most civilian environments, the BCT environment is uniquely stressful. Indeed, there is little in comparison in the civilian world where men and women, most of whom are just beginning the transition to adulthood, are so physically and mentally challenged. However, research to date has almost exclusively focused on the associations between physical fitness and musculoskeletal injuries or all-cause attrition during BCT.

A key aim of BCT involves preparation and training of very large groups of soldiers, with varying abilities and experiences, for the physical and mental rigors of combat. Indeed, new soldiers are exposed to intense physical and psychological stressors for which some new soldiers may not be physically or mentally prepared. Due to the physically intensive BCT training environment, soldiers’ physical fitness level at BCT entry may have a large impact on the ability of soldiers to adjust to BCT. Considering this important role of physical fitness in the BCT environment, and studies conducted in civilian populations suggesting that higher physical fitness may be protective against the
deleterious psychological effects of chronic stress, the association between physical fitness and psychological health outcomes of soldiers during BCT is an important question that has been scarcely investigated.

**Significance of the Study**

This study will add a vital component to the existing literature by investigating the association between physical fitness and psychological health outcomes in soldiers during BCT. Because the BCT environment exposes soldiers to considerable physical and psychological stressors including communal living, regimented eating and sleeping schedules, sleep deprivation, and intense and frequent mandatory physical training (S. Jackson, 2011; Lieberman, Kellogg, & Bathalon, 2008; N. L. Miller et al., 2012), many new soldiers may struggle with the abrupt entry into this physically and psychologically stressful environment, which may put them at risk for the development of adverse psychological health outcomes during BCT. Consequently, mental health-related problems are consistently listed as a significant cause of attrition during Basic Military Training (BMT) in all US armed services (Cigrang, et al., 1998; Clemons, 1996; Gold & Friedman, 2000; Larson, Booth-Kewley, & Ryan, 2002).

Evidence from a large body of research in civilian populations suggests that physical fitness may have a protective role in reducing the adverse psychological effects of stress (Brown, 1991; Brown & Siegel, 1988; Dunn et al., 2001; Rejeski et al., 1992; Roth & Holmes, 1985), but the association between physical fitness and psychological health outcomes of soldiers during BCT has yet to be elucidated. Investigation of this relationship has the potential to provide valuable information to better inform future interventions aimed at improving the ability of soldiers to cope with stress,
psychologically adjust, and succeed during BCT. Moreover, information gained from this study would fill a significant gap in the existing literature, and provide important information for current Army pre-accession programs and practices.

**Rationale for Dissertation Studies**

In order to investigate the relationship between physical fitness and psychological health outcomes during Army Basic Combat Training, the proposed dissertation includes the following three studies: (1) a literature review of the association between physical fitness and psychological adjustment of Army soldiers during BCT, (2) a qualitative study of sleep and mental health during BCT, and (3) a prospective analysis of the association between physical fitness and depressive symptoms in soldiers during Army BCT at Fort Jackson in Columbia, SC.

**Study 1: The Relationship Between Physical Fitness and Psychological Adjustment during Basic Combat Training**

The BCT environment exposes soldiers to considerable physical and psychological stressors including communal living, regimented eating and sleeping schedules, sleep deprivation, and intense and frequent mandatory physical training (S. Jackson, 2011; Lieberman et al., 2008; N. L. Miller et al., 2012). New soldiers participate in physical training (PT) up to 6 days per week (Rieger & Scott, 2006), in addition to physically demanding occupational-related training. While some stressors during BCT are instrumental to preparing soldiers for the rigors of combat, stress that is beyond the adaptive capacity of soldiers may have adverse effects on their adjustment to BCT. Consequently, the military must balance training goals, including the need for long, intensive training days to prepare thousands of soldiers physically and mentally, with the goal of reducing these mental health consequences associated with chronic stress.
From both a military and public health perspective, there is increased interest in the association between stress and psychological health, to identify treatment targets for stress management and resiliency-enhancing interventions. The association between stress and psychological adjustment has been widely studied in civilian populations (Bedi, 1999; Billings & Moos, 1984; Kessler, Kendler, Heath, Neale, & Eaves, 1992; Park & Fenster, 2004; Wagner, Compas, & Howell, 1988), but there has been limited investigation of this association in the BCT environment, or of factors involved in the psychological adjustment of soldiers during BCT. Factors which may lead to effective and implementable interventions aimed at increasing resiliency of soldiers during BCT have the potential to impact BCT attrition, as well as the psychological health of soldiers during BCT and beyond.

Reports have linked BCT attrition with low levels of physical fitness or low levels of physical activity (Knapik, et. al, 2004b). It is clear that physical fitness is important for protection from injury and illness during BCT, and also important for the occupational tasks that soldiers perform throughout their military careers (T.C. Roy et al., 2010). Consequently, failure to meet physical fitness standards during BCT is reportedly a primary reason soldiers are recycled (i.e., repeating part, or all, of BCT in another company) (Knapik et al., 2004a), and soldiers commonly report the fear of being recycled as a significant stressor during BCT (Faris, 1975). The severity of this stressor may be particularly pronounced for new soldiers who are not physically fit at BCT entry, which may increase their risk for the development of psychological distress during BCT.

Considering the extensive role of physical fitness in the BCT environment (Kolavic et al., 2000), and compelling evidence from a large body of research conducted
in civilian populations suggesting that physical fitness may have a protective role in reducing the adverse psychological effects of stress (Brown & Siegel, 1988; Dunn et al., 2001; Rejeski et al., 1992; Roth & Holmes, 1985); the association of physical and psychological adjustment of soldiers during BCT is an important, yet, unexplored area of inquiry.

**Study 1 Methods**

The aims of study 1 were to:

1. Describe the rationale for investigation of the relationship between physical fitness and psychological adjustment of soldiers in the BCT environment.
2. Review the current evidence on this association and related factors during BCT.
3. Discuss implications for future research of this association in the BCT environment.

To address these aims, an extensive literature review was performed to identify evidence related to physical fitness and psychological adjustment of soldiers during Army BCT. Given the limited investigation, to date, into factors related to the association between physical fitness and psychological health of soldiers during BCT, studies conducted in civilian populations were included which were conceptually relevant to the investigation of the association between physical fitness and psychological adjustment of soldiers during BCT.

Literature searches included the following databases: PubMed, Google Scholar, DTIC, ProQuest, and PsycNET. Example terms used for the literature search included the
following, or combinations of the following: psychological adjustment, psychological health, psychological health outcomes, depression, depressive symptoms, behavioral health, mental health, attrition, discharges, injury, illness, health, immune, overtraining syndrome, sleep, sleep disturbances, sleep loss, physical fitness, fitness, physical training, exercise, physical activity, soldiers, recruits, basic combat training, military training, initial military training, initial entry training, basic military training, Army, military.

Articles were limited to studies published in English.

**Study 2: Sleep During Basic Combat Training, a Qualitative Study**

Poor or inadequate sleep has been associated with impaired health, and impaired physical and psychological functioning. It has been speculated that impaired sleep might decrease resilience to stress. In the military, sleep deprivation can have profound negative consequences on both individual performance as well as unit functioning (Young-McCaughan et al., 2010). However, beyond anecdotal accounts of sleep curtailment and forced early morning awakenings, there has been limited systematic investigation of the sleep of soldiers during BCT.

It is possible that some aspects of the sleep environment of BCT are designed to challenge soldiers, or prepare them for the unpredictable sleep environment they may encounter during deployment. However, studies suggest that inadequate sleep during BCT could increase incidents of injury and physical and mental stress, and could impair ability to learn complex skills (Curcio, Ferrara, & De Gennaro, 2006; Flanagan, Kotwal, & Forsten, 2012; Franzen, Siegle, & Buysse, 2008; Harvey, 2011; Walker, 2008).

Investigation of sleep during BCT may provide valuable information to inform future
Army policies and practices, in order to promote better health and performance of soldiers during BCT.

**Study 2 Methods**

The aims of study 2 were to identify factors that influence sleep, and perceived consequences of sleep loss during BCT at Fort Jackson US Army Base in Columbia, SC. To accomplish these aims, the following hypotheses were tested using focus group methodology:

1. Soldiers would report that they sleep much less in BCT than they were accustomed to sleeping in their home environments.
2. Soldiers would report that they have difficulty sleeping during BCT, despite high levels of physical fatigue.
3. Soldiers would report that many factors disturb their sleep during BCT.
4. Soldiers would report that they experience difficulty adjusting to the early sleep schedule of BCT, particularly those soldiers who were more accustomed to delayed schedules prior to BCT.
5. Soldiers would report that poor sleep impairs their daytime functioning during BCT.

**Project overview.** The Soldier Health Promotion to Examine and Reduce Health Disparities (SHPERHD) project is a DoD-supported multi-center research initiative between the Institute for Partnerships to Eliminate Health Disparities (IPEHD) at the University of South Carolina and the Fort Jackson United States Army Base, Columbia, South Carolina (Williams et al., 2011). During November/December of 2010, focus group discussions were conducted with soldiers, ages ≥ 18 years, who had completed at
least 4 weeks of BCT at Fort Jackson US Army Base in Columbia, SC. Each focus group discussion lasted 45 to 60 min. Six groups of soldiers participated in the focus group discussions (total n = 66), including three groups of female soldiers (total n = 28) and three groups of male soldiers (total n = 38). Soldiers were grouped into low, medium, and high fitness groups according to physical fitness performance on the Army Physical Fitness Test (APFT). Focus group discussions were designed to investigate sleep, and the impact of the sleep environment on soldier-reported BCT health, mood, and performance outcomes using structured focus group methodology (D. W. Stewart, Shamdasani, & Rook, 2006).

**Participant screening and recruitment.** Soldiers participating in BCT at Fort Jackson, who were age 18 years or older, were considered eligible to participate in the focus group discussions. The study protocol was approved by Institutional Review Boards (IRB’s) of the University of South Carolina and the U.S. Army Accessions Command. Scheduling of soldiers through the Fort Jackson Initial Military Training Center of Excellence Human Dimensions Division (formerly Experimentation and Analysis Element), was conducted by a Fort Jackson liaison. Fort Jackson BCT battalion commanders were contacted about the study by the Fort Jackson liaison, and a commander willing to volunteer his/her unit for participation in the study was identified. As recommended by Fort Jackson personnel, soldiers were grouped by gender and performance (high, medium, low) on the APFT, with the rationale that soldiers might feel more comfortable expressing their views and opinions, pertaining to the sleep environment of BCT, among peers of similar “status” with respect to fitness performance on the APFT.
Battalion drill sergeants selected groups of soldiers (of designated gender and fitness levels) to report to the specified location for the focus group discussions. Participants were informed that they were going to be asked to volunteer for a research study, and these soldiers were notified verbally that participation in the focus groups was voluntary. No identifying information was obtained from the soldiers participating in the focus group discussions. As such, the focus group discussions were deemed exempt from requiring written informed consent. Nevertheless, the research team obtained oral consent from all participants prior to their participation in the focus group discussions.

**Focus group discussions.** In order to protect the identity of the soldiers, upon arrival in the building, they were immediately assigned subject badges to cover their name tags. Following a standardized orientation, a gender-matched research team, consisting of one experienced facilitator and one to two note-takers, introduced themselves to the soldiers. The facilitator explained that he/she would be asking the soldiers about their sleep; that the soldiers should answer the questions as honestly as possible; that there were no correct or incorrect answers to the questions; and that the soldiers were free to participate as much or as little, as they wanted. Soldiers were given notepads and pens, with the option to write comments instead of, or in addition to, orally responding to facilitator questions. Soldiers were instructed to refrain from using names of any other soldiers and also to refrain from sharing any information from the discussions outside of the focus groups.

The discussions were semi-structured, with nine questions pertaining to the sleep environment of BCT and effects of the sleep environment on soldier adaptation and performance during BCT. According to standard focus group methods, questions were
designed to be open-ended in order to promote discussion (Kitzinger, 1995). Questions that are too specific, or that elicit a yes/no response can limit discussion, thereby decreasing the value of a focus group (Kitzinger, 1995). Follow-up probing questions were asked, if needed, to help facilitate or clarify soldier responses. Focus group questions and follow-up questions are listed in table 2.1.

During the focus group discussions, the facilitators and note-takers made a concerted effort to avoid giving any impression that the research team was expecting or desiring certain responses from the soldiers. Participant oral and written responses from the focus group discussions were manually recorded by the note-takers, who later transcribed their notes for qualitative analysis.

**Data analysis.** According to standard focus group assessment procedures (Kitzinger, 1995; D. W. Stewart et al., 2006), responses were grouped using an open-coding process in which themes were assigned to groups of similar responses. This method involved review of the participant responses, organization of responses into similar groupings, and consolidation of these groupings into similar themes. Using this open coding qualitative analysis approach, the data was analyzed and organized into key themes and categories by one member of the research team (Ryan, 2003). Themes required a consensus vote by two other members of the research team, or refinement and clarification if needed, before sending to the rest of the research team for final approval. Six themes emerged from the focus group discussions: (1) Changes in sleep patterns since entering BCT, (2) Barriers to initiating sleep, (3) Soldier adaptation to the sleep environment of BCT, (4) Sleep interruptions, (5) Effects of diminished sleep on
Study 3: Prospective Study of the Association of Physical Fitness with Depressive Symptoms in Soldiers during Army Basic Combat Training

There is a need for investigation of factors associated with better psychological health of soldiers during BCT. One association that has been extensively researched in civilian populations, and shows promise as a potential avenue of exploration for the BCT environment, is that between physical fitness and mental health. Indeed, evidence from a large body of research in civilian populations suggests that physical fitness may have a protective role in reducing the adverse psychological effects of stress (Brown, 1991; Brown & Siegel, 1988; Dunn et al., 2001; Rejeski et al., 1992; Roth & Holmes, 1985).

For example, results of a recent cross-sectional study indicated that individuals with high stress and moderate to high levels of physical fitness reported lower levels of depressive symptoms than individuals with high stress and low levels of physical fitness (Gerber, Lindwall, Lindegård, Börjesson, & Jonsdottir, 2013).

Additionally, in civilian populations, cross-sectional and prospective studies have shown that individuals who are physically active, or have higher fitness levels, are less likely to exhibit depressive symptoms (Azar, Ball, Salmon, & Cleland, 2008; Dunn et al., 2001; Goodwin, 2003; McKercher et al., 2009), and have less risk of development of depressive symptoms (Brunet et al., 2013; Farmer et al., 1988; Dishman et al., 2012; Mikkelsen et al., 2010; Sui et al., 2009), compared to individuals who are sedentary or have lower fitness levels.
In comparison to most civilian environments, the BCT environment is uniquely stressful. Indeed, there is little in comparison in the civilian world where men and women, most of whom are just beginning the transition to adulthood, are so challenged. Despite the need for investigation of factors related to the psychological adjustment of soldiers during BCT, and accumulating evidence from studies of civilian populations suggesting that physical fitness may be associated with psychological health, to our knowledge, there has been no research of the association between physical fitness and psychological health outcomes of soldiers during BCT.

**Study 3 Methods**

The purpose of study 3 was to prospectively examine the association of objectively measured physical fitness levels of Soldiers at the start of BCT with the odds of reporting depressive symptoms near the end of the BCT cycle. Factors which have been associated with depressive symptoms in young adults, psychological adjustment of soldiers during BCT (Knapik, et. al, 2004b; McGraw & Bearden., 1988), or the association between physical fitness and depressive symptoms in young adults were considered as potential confounders, and controlled for in assessing the association. For study 3, the following hypotheses were tested:

1. After controlling for age, sex, race, education level, marital status, family income (yearly), BCT confidence score, and Army ID score; soldiers entering BCT in the “high fitness” group would be less likely to report depressive symptoms near the end of the BCT cycle than soldiers entering BCT in the “low fitness” group.
2. After controlling for age, sex, race, education level, marital status, family income (yearly), BCT confidence score, Army ID score, baseline CES-D score and self-reported average sleep duration prior to BCT; soldiers entering BCT in the “high fitness” group would be less likely to report depressive symptoms near the end of the BCT cycle than soldiers entering BCT in the “low fitness” group.

**Study overview.** As part of the SHPERHD project, soldiers (ages \( \geq 18 \) years) were assessed longitudinally over the course of Army Basic Combat Training (BCT) from May, 2012 through July, 2012 at Fort Jackson United States Army Base.

Soldiers’ physical fitness was assessed objectively at baseline (within a few days of starting BCT) via the standard Army Physical Fitness Test (APFT). Soldier demographics, as well as measures of mood, sleep and behavioral characteristics were assessed at two time points: (1) a baseline survey administered to the soldiers within the first week of soldiers arriving at Fort Jackson, and (2) an end of cycle survey administered to soldiers approximately 8 weeks after BCT began, towards the end of the BCT cycle. Analysis for the current study included soldiers (n=300), who had complete data for the APFT, provided complete responses for all study variables for the baseline and end of cycle surveys, and indicated absence of depressive symptoms at baseline. Figure 2.1 illustrates the flow of participants for the current study.

Survey measurement was conducted from May, 2012 to July, 2012. Baseline survey assessment duration was approximately 90 minutes, which included a detailed explanation of the study by research staff from the University of South Carolina. Soldiers were informed that participation in the study was voluntary. Those soldiers choosing to
participate in the study were invited to sign a written informed consent, approved by the Institutional Review Board (IRB) at the University of South Carolina, and the Directorate for Research at Fort Jackson and the US Army Medical Research and Materiel Command (USARMC).

The informed consent briefing and document emphasized that participation in the study was confidential and voluntary. Soldiers were informed that they could stop participating at any time, that they could refuse to answer questions, and that there would be no penalties or consequences for not participating or refusing to answer questions. Soldiers who chose to participate in the study signed and dated the informed consent document, and all consent documents (completed or not) were collected without soldiers disclosing their participation decision. Company drill sergeants were asked to leave the room during this consent process, but returned to the room during survey administration to maintain soldier order. However, they were asked to remain at a distance from soldiers during the survey process in order to protect soldier confidentiality in filling out survey questions.

**Baseline fitness assessment.** Objectively measured physical fitness data was obtained via the APFT, a three-event physical performance test used to assess physical fitness in three domains: (1) cardiorespiratory fitness, (2) upper body muscular fitness, and (3) abdominal/core muscular fitness (Knapik, 1989). The APFT involves three timed events performed in sequential order beginning with a push-up event (assessed by the number of repetitions completed in two minutes), a sit-ups event (assessed by the number of repetitions completed in two minutes), and finally a two-mile run event (assessed by time for completion of the two-mile run). Soldiers are allowed a minimum of 10 minutes
and a maximum of 20 minutes rest between each of the events. Raw scores on each of the three components of the APFT are converted to point values based on Army normative data for age and gender to yield a maximum total score of 100 on each component test (U.S. Department of the Army, 2012). The three component scores are then sum-totaled to yield a maximum total score of 300 for the total APFT score. Table 2.2 illustrates the raw component scores (timed two-mile run, push-ups, and sit-ups tests) needed for males and females in each age category in order to achieve a maximum APFT score of 100 points on each component event. The APFT standard passing score is a minimum of 60 points per component event, and no less than 180 points for the overall APFT score (U.S. Department of the Army, 2012). Table 2.3 illustrates the raw component scores (timed two-mile run, push-ups, and sit-ups tests) needed for males and females in each age category in order to achieve a minimum APFT passing score of 60 points on each component event.

For the current analysis, “high” fitness was defined by an APFT score of equal to or greater than 180 points and “low” fitness was defined as an APFT score of less than 180 points. The timed two-mile run component of the APFT has been shown to be highly correlated with maximal oxygen uptake (VO$_2$max; 0.91 for men, 0.89 for women) (Mello, 1984), commonly considered the “gold standard” for measurement of cardiorespiratory fitness (Thompson, Gordon, & Pescatello, 2009).

**Survey data cleaning and management.** Paper surveys were scanned using TELEform, Version 10.2, Cardiff Software, San Diego, CA. At the completion of the scanning process, data were exported to Microsoft Excel. Once exported to Excel, data was checked against the paper surveys for any scanning errors. During the final stage of
data management and cleaning, exported data were processed using SAS 9.3 (SAS Institute, Inc., Cary, North Carolina). The APFT database was merged with the survey databases using SAS. As a final data quality control measure, outliers and missing values were checked against the paper surveys to determine whether the values were due to scanning errors. All values were verified by at least two independent research team members.

**Assessment of covariates.** Covariates from the survey questionnaires were chosen to be included in the study analysis due to their potential to have an effect on depressive symptoms or psychological adjustment of soldiers during BCT (Knapik et al., 2004b; McGraw & Bearden, 1988), which could potentially confound the association between physical fitness and depressive symptoms during BCT. Demographic covariates included age, sex, race, education level (last degree completed), marital status (married or not married), and family income (yearly). Other covariates included baseline measures of self-reported sleep duration, identification with the Army, BCT self-efficacy, and depressive symptoms, assessed via questionnaires included in the baseline survey.

**Education level.** In studies conducted in civilian populations, a higher level of education has been associated with higher participation in regular physical activity (Florindo et al., 2009; Marshall et al., 2007), as well as lower odds of reporting depressive symptoms or reporting a history of depressive disorders (Blazer et al., 1994). Lower education level has also been associated with failure to adapt to the military (McGraw & Bearden, 1988). In the BCT environment, lower education level has been shown to increase the risk of attrition from BCT (Knapik, et. al, 2004b; Swedler et al.,
In particular, it has been shown that soldiers with some college have lower attrition rates during BCT than soldiers with a high school diploma only (Buddin, 1990).

Education level may have implications for the potential of new soldiers to adapt to the structured and disciplined environment of the military. Those with lower education levels may have had fewer experiences with a structured schedule, academic requirements, and a competitive setting than those with higher education levels. Additionally, attainment of a higher educational degree may be associated with higher self-efficacy characteristics in an individual. These characteristics have been shown to be associated with the psychological benefits of physical fitness (Kobasa et al., 1982; McAuley et al., 2005; White, Kendrick, & Yardley, 2009).

To assess soldier education level, participants were asked to select their last degree completed or highest level of education attained prior to entering BCT. Based on the clinical relevance to the current study, and the distribution of responses in the study sample, nine possible responses for soldier education level were collapsed into three categories as follows: (1) GED/high school diploma, (2) some college/Associate’s degree, (3) college degree or higher.

**Gender.** Studies have shown that female soldiers entering BCT have lower physical fitness levels than male soldiers (Sharp et al., 2002; Yanovich et al., 2008). Additionally, female gender has been associated with risk of attrition during BCT (Knapik et al., 2001b; Swedler et al., 2011), which may be attributed to physical fitness-related factors or factors related to the masculine culture of the military environment.

Although participation in the military is open to men and women, organizational resistance and interpersonal adjustments are still prevalent in the culture of the military.
This highly masculine military culture may have an impact on both genders, and in multiple contexts, for the psychological adjustment of soldiers during BCT.

Additionally, there remain perceptions of inequality in physical performance requirements by gender, particularly on the APFT application of standards by gender. The test was originally designed to measure the physical fitness of male soldiers (Segal, 1999). Female soldiers may judge themselves by the male standards, which may have a positive or negative impact on motivation to succeed in BCT. This may have implications for gender differences in depressive symptoms during BCT.

**Age.** Studies conducted in civilian populations have shown that age differences may exist in the association between physical training and depressive symptoms (Fukukawa et al., 2004; Stephens, 1988). In the BCT environment, older age has been shown to be a risk factor for injury, and attrition during BCT (Knapik et al., 2001b; Knapik et al., 2004b; Swedler et al., 2011). Injury and attrition risks may be due to age-related changes in the physical capabilities of soldiers entering BCT at an older age, or differences in social and behavioral characteristics which may impact their psychological adjustment to BCT. For example, soldiers who enter BCT at an older age may have failed in other work environments, which may have implications for their ability to succeed in a military environment (Laurence, Naughton, & Harris, 1996). For the current study, age was entered into the statistical models as a continuous variable.

**Race.** Studies conducted in civilian populations have shown that racial differences may exist in physical activity levels (Eyler, Brownson, Bacak, & Housemann, 2003; Heath, Pratt, Warren, & Kann, 1994; Iannotti & Wang, 2013; Marshall et al., 2007), and
in the likelihood of reporting depressive symptoms or exhibiting symptoms of depression (Blazer et al., 1994; Jones-Webb & Snowden, 1993; Riolo, Nguyen, Greden, & King, 2005). In the BCT environment, BCT injury and attrition risk, both of which may be related to the psychological adjustment of soldiers during BCT, have been shown to be influenced by race (B. H. Jones, Bovee, Harris, & Cowan, 1993a; Knapik et al., 2001b; Swedler et al., 2011). Based on the clinical relevance to the current study, and the distribution of responses in the study sample, six possible racial categories were collapsed into three categories as follows: (1) black, (2) white, (3) other.

Marital status. Married individuals may be more accustomed to the social support that a spouse or a family provides, and the lack of this in the basic training environment may impact the psychological adjustment of those soldiers during BCT (Georgoulakis et al., 1981). Consequently, soldiers who are married when they begin BCT have a higher risk of attrition from BCT than those who are not married (Knapik et al., 2004b; McGraw & Bearden, 1988). On the other hand, research conducted in soldiers during BCT has shown that soldiers of “other” marital status (divorced, widowed, separated) have a higher rate of medical discharge (including discharge for physical and psychologically related illness) from BCT than single (never married) soldiers (Swedler et al., 2011). Based on the clinical relevance to the current study, and the distribution of responses in the study sample, five possible marital status categories were collapsed into two categories as follows: (1) married, and (2) not married.

Household income. Studies have shown among those of lower socioeconomic status, physical activity levels tend to be lower (Crespo, 2000; Eyler et al., 2003; Parks, Housemann, & Brownson, 2003), and odds of reporting depressive symptoms or a history
of depression tend to be higher (Blazer et al., 1994; Lorant et al., 2003). Based on the clinical relevance to the current study, and the distribution of responses in the study sample, nine possible yearly household income categories were collapsed into five categories as follows: (1) “I don’t know,” (2) < $25,000, (3) $25,000-$50,000, (4) $50,000-75,000, (5) > $75,000.

**Sleep.** Average sleep duration for the 30 day period prior to BCT was assessed via the Pittsburgh Sleep Quality Index (PSQI), the most widely used measure of subjective sleep quality (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). The PSQI has been used previously for the assessment of sleep in soldiers during BCT (N. L. Miller et al., 2012). For this analysis, we used the sleep duration component score of the PSQI, collapsed from a 4 category response variable into a conceptually meaningful dichotomized variable reflecting average self-reported sleep per night > 7 hours or ≤ 7 hours. Self-reported sleep duration of ≤ 7 hours per night in young adults has been associated with increased psychological distress (Chang, Ford, Mead, Cooper-Patrick, & Klag, 1997; Glozier et al., 2010), and has been implicated as an independent risk factor for the persistence of psychological distress prospectively (Glozier et al., 2010).

**Army ID.** Army identification (Army ID) was measured using a 5-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). Army identification has been associated with psychological attachment to the Army, as well as cognitively ambitious, achievement-oriented pursuits (Mael & Ashforth, 1995), which have implications for psychological adjustment of soldiers during BCT. Example questions from the Army Identification (ID) scale included, “The Army has a great deal of personal meaning to me,” “The Army’s values are my values,” and “I’m very proud to tell people I am in the Army.”
Negative items from the scale were reverse-scored, and the sum-total of the scale was averaged across the number of items to obtain a total score from 1-5. Higher scores indicate a stronger identification with the Army. Internal consistency reliability (Cronbach’s alpha) of the 9 items was 0.84.

**BCT self-efficacy.** BCT self-efficacy was conceptualized using the BCT confidence scale. The BCT confidence scale consisted of a 5-point Likert-type scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The BCT self-efficacy measure was included as a potential confounder, as self-efficacy beliefs have been associated with the impact of physical training on mental health (Bodin & Martinsen, 2004; Dishman et al., 2006; White et al., 2009). Example questions from the BCT confidence scale included, “I have what it takes to succeed in BCT,” “Based on my ability and the amount of work I do, I think I will excel in BCT,” and “I expect to do well in BCT.” Negative items from the scale were reverse-scored, and the sum-total of the questionnaire was averaged across the number of items to obtain a total score from 1-5. Higher scores indicate higher confidence for succeeding in BCT. Cronbach's alpha of the 9 items was 0.84.

**Depressive symptoms.** Baseline depressive symptoms were assessed using the 20-item version of the Center for Epidemiologic Studies Depression Scale (CES-D). This self-report scale is designed to measure depressive symptoms in the general population (Radloff, 1977) and has been validated for use in military populations (Boisvert, McCreary, Wright, & Asmundson, 2003; Vickers, 1992). The CES-D scale includes questions pertaining to depressed mood, feelings of guilt or worthlessness, feelings of helplessness and hopelessness, psychomotor retardation, loss of appetite, and sleep disturbance (Radloff, 1977). The range of possible scores on the CES-D is 0 to 60, with
higher scores indicating a higher degree of depressive symptoms (Radloff, 1977).

Cronbach’s alpha of the 20-item CES-D was 0.81.

**Assessment of outcome.** For this analysis, presence or absence of depressive symptoms at the end of the BCT cycle was determined using soldiers’ reported CES-D scores from the end of cycle survey. A score of $\geq 16$ indicated presence of depressive symptoms. This cut-point has been extensively used in the general population to indicate presence of depressive symptoms (Radloff, 1977).

**Statistical analysis.** Descriptive statistics (means, SDs, proportions) were used to describe demographic and behavioral characteristics of the study population separately for high and low APFT fitness soldiers. We used $t$-tests and chi-square tests to compare the means of continuous variables and the prevalence of categorical variables, respectively, between participants in APFT fitness categories.

Logistic regression analysis was conducted to test whether APFT fitness category at baseline was a predictor of the odds of reporting depressive symptoms at the end of the BCT cycle. Three models were used in the multivariate logistic regression analyses. Model 1 was unadjusted. Model 2 controlled for age, sex, race, education level, marital status, family income (yearly), BCT confidence score, and Army ID score. Model 3 adjusted for all variables in model 1, plus baseline CES-D score and self-reported average sleep duration prior to BCT. All $p$ values reported are 2-sided with an alpha level of 0.05. All statistical analyses were performed using SAS 9.3 (SAS Institute, Inc., Cary, North Carolina).
Table 2.1 Focus group discussion questions with follow-up/probing questions.

<table>
<thead>
<tr>
<th>Questions</th>
<th>Follow-up/probing Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Have your sleep patterns changed since entering BCT?</td>
<td>1a. If so, how was your previous sleep schedule different?</td>
</tr>
<tr>
<td>2. What time are “lights out” in the barracks on a usual day?</td>
<td>2a. Are there any nights in which lights are out a little later?</td>
</tr>
<tr>
<td>3. At lights out, do you try to fall asleep immediately or do you stay awake?</td>
<td>3a. If you stay awake, what time do you end up going to sleep?</td>
</tr>
<tr>
<td></td>
<td>3b. What are your reasons for staying awake (can’t go to sleep at the scheduled time, this is your only “free time”, etc.)?</td>
</tr>
<tr>
<td>4. How many minutes does it take you to fall asleep?</td>
<td>4a. How does this compare to before BCT?</td>
</tr>
<tr>
<td>5. On the average, how often is your sleep interrupted each night?</td>
<td>5a. What are the reasons for these interruptions (work detail, noise, etc.)?</td>
</tr>
<tr>
<td></td>
<td>5b. During an average week, how many nights do these interruptions occur?</td>
</tr>
<tr>
<td>6. Do you feel your daily performance would improve if you were able to sleep more at night?</td>
<td></td>
</tr>
<tr>
<td>7. On an off day, or in your down time, would you prefer to sleep or do something else?</td>
<td></td>
</tr>
<tr>
<td>8. During the last month, how would you rate your overall sleep quality; good, average, or poor?</td>
<td></td>
</tr>
<tr>
<td>9. Have there been situations or circumstances that have been hindered because of stress, lack of sleep, or fatigue?</td>
<td></td>
</tr>
</tbody>
</table>
Soldiers with data for APFT (n = 1149)

Soldiers with data for baseline survey (n = 1065)
Soldiers with data for end of cycle survey (n = 748)

Soldiers with data in APFT, baseline survey, and end of cycle survey (n = 692)

Cases excluded reporting depressive symptoms at baseline (CES-D ≥ 16)

Soldiers with data for APFT, baseline survey, and end of cycle survey (n = 400)

Soldiers with complete data for APFT, baseline survey, and end of cycle survey (n = 300)

**Figure 2.1.** Flow of Participants through study

Abbreviations: APFT = Army Physical Fitness Test

CES-D = Center for Epidemiological Studies Depression Scale
Table 2.2 APFT component test scores, by age and gender, needed to achieve 100 points per component event (Based on data from the U.S. Department of the Army, 2012).

<table>
<thead>
<tr>
<th>Age group</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Push-ups</td>
<td>Sit-ups</td>
</tr>
<tr>
<td>17-21</td>
<td>71</td>
<td>78</td>
</tr>
<tr>
<td>22-26</td>
<td>75</td>
<td>80</td>
</tr>
<tr>
<td>27-31</td>
<td>77</td>
<td>82</td>
</tr>
<tr>
<td>32-36</td>
<td>75</td>
<td>76</td>
</tr>
<tr>
<td>37-41</td>
<td>73</td>
<td>76</td>
</tr>
<tr>
<td>42-46</td>
<td>66</td>
<td>72</td>
</tr>
<tr>
<td>47-51</td>
<td>59</td>
<td>66</td>
</tr>
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<td>52-56</td>
<td>56</td>
<td>66</td>
</tr>
<tr>
<td>57-61</td>
<td>53</td>
<td>64</td>
</tr>
<tr>
<td>62+</td>
<td>50</td>
<td>63</td>
</tr>
</tbody>
</table>
Table 2.3 Minimum APFT component test scores, by age and gender, needed to achieve 60 points per component event (Based on data from the U.S. Department of the Army, 2012).

<table>
<thead>
<tr>
<th>Age group</th>
<th>Male</th>
<th></th>
<th></th>
<th>Female</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Push-ups</td>
<td>Sit-ups</td>
<td>Run time (mm:ss)</td>
<td>Push-ups</td>
<td>Sit-ups</td>
<td>Run time (mm:ss)</td>
</tr>
<tr>
<td>17-21</td>
<td>42</td>
<td>53</td>
<td>15:54</td>
<td>19</td>
<td>53</td>
<td>18:54</td>
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<tr>
<td>22-26</td>
<td>40</td>
<td>50</td>
<td>16:36</td>
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<td>50</td>
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<td>32-36</td>
<td>36</td>
<td>42</td>
<td>17:42</td>
<td>15</td>
<td>42</td>
<td>21:42</td>
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<td>37-41</td>
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<td>38</td>
<td>18:18</td>
<td>13</td>
<td>38</td>
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<td>18:42</td>
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<td>32</td>
<td>23:42</td>
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<td>9</td>
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<tr>
<td>57-61</td>
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<td>27</td>
<td>19:54</td>
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<td>27</td>
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<tr>
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<td>16</td>
<td>26</td>
<td>20:00</td>
<td>7</td>
<td>26</td>
<td>25:00</td>
</tr>
</tbody>
</table>
CHAPTER THREE

THE RELATIONSHIP BETWEEN PHYSICAL FITNESS AND PSYCHOLOGICAL ADJUSTMENT DURING BASIC COMBAT TRAINING

Abstract

There is established evidence that physical fitness may be associated with reduced vulnerability to psychological stress. Epidemiological studies involving civilian populations show that individuals who are physically fit have lower incidence of mood disorders, report fewer stressful life events, and report the impact of stressful life events to be less aversive than individuals who are unfit. The association between physical fitness and psychological adaptation to stress may have particular relevance for soldiers participating in military basic combat training (BCT), where individuals are indoctrinated into an intense, physically demanding, socially restricted, and highly stressful environment. Mental health-related attrition is a significant cause of soldier loss during BCT, and higher levels of physical fitness have consistently been linked to reduced attrition during BCT. Despite the current need for investigation of factors involved with soldiers’ resilience to stressors in the BCT environment, and evidence in civilian populations that physical training is associated with psychological benefits, little is known about the relationship between physical fitness and psychological adjustment during BCT. Therefore, investigation of the potential association of physical fitness and psychological adjustment of soldiers in the BCT environment is needed. The purposes of this manuscript are twofold: (1) to describe the rationale for investigation of this
relationship in the BCT environment, and (2) to review the current evidence of the association between physical fitness and psychological adjustment among soldiers during BCT. This manuscript concludes with implications for future research in the BCT environment.

**Introduction**

Army Basic Combat Training (BCT) is an intense, stressful orientation program involving the indoctrination and socialization of new soldiers to Army service. During each BCT cycle, large numbers of soldiers are trained in a very short period of time (10 weeks for most soldiers) (Knapik et al., 2002). These soldiers vary widely in their physical, cognitive, and emotional preparedness for BCT, which can influence their adaptation to BCT.

Some soldiers are resilient to the stressors of BCT, but many others experience profound mental health problems, which are believed to be one of the main causes of attrition during BCT. Besides national security implications associated with soldier attrition during BCT, total monetary losses from BCT attrition, for all causes, in the fiscal year 2007 were estimated to be up to $57 million (Swedler et al., 2011).

Poor psychological adjustment during BCT could also have implications for adverse psychological outcomes during Advanced Individual Training (AIT), the next stage of training for most soldiers, and beyond. Indeed, psychiatric discharges were the most common cause of Army Existing Prior to Service (EPTS) discharges, which includes discharges that occur during the first 180 days of Army service for pre-existing medical conditions (Niebuhr et al., 2011), comprising an average of 30% of all Army EPTS discharges from 2006-2010 (Niebuhr et al., 2011).
Identifying factors which could explain psychological adjustment to BCT would be of great significance to the military. This manuscript will advance the hypothesis that physical fitness might be an important factor. Using our conceptual model (Figure 3.1), we will discuss what is known about psychological adjustment of BCT soldiers; the association of physical fitness with mental health and other outcomes; potential mechanisms which could explain this association; and implications for future research of this association in the BCT environment.

**Psychological Adjustment to the BCT Environment**

The BCT environment exposes soldiers to considerable physical and psychological stressors including communal living, regimented eating and sleeping schedules, sleep deprivation, and intense and frequent mandatory physical training (S. Jackson, Agius, Bridger, & Richards, 2011; N. L. Miller, Tvaryanas, & Shattuck, 2012). New soldiers participate in physical training (PT) up to 6 days per week (Rieger & Scott, 2006), in addition to physically demanding occupational-related training, such as road marches; confidence, obstacle, and assault courses; team-building, field, live-fire exercises; land navigation; rappelling and night infiltration courses; and marksmanship training (Knapik et al., 2007).

BCT is divided sequentially into Red, White, and Blue phases. During Red phase, soldiers are introduced to Army values, traditions, and ethics, while they develop combat skills and physical fitness (Rieger & Scott, 2006). Red Phase is often the most challenging for new soldiers due to the stressful indoctrination process, and the need to process a large amount of new information in a short period of time. Initiation into Red phase often begins with a vigorous hazing known as the “shark attack” in which drill
sergeants yell and threaten privates as soon as they arrive at the company area (Bornmann, 2009). Red Phase is commonly referred to as “total control,” indicative of the constant supervision by drill sergeants, and harsher punishments associated with even minor infractions (Bornmann, 2009). During White Phase, the focus shifts to self-discipline, team building, weapons training, basic rifle marksmanship (BRM), and foot marching (McCrary, 2006). Though soldiers report feeling more respected by their drill sergeants during White Phase (Bornmann, 2009), this phase of BCT is still stressful due, in part, to the heavy focus on BRM training and passing the BRM test which is mandatory for every BCT soldier (Bornmann, 2009). During Blue Phase, soldiers have distinctly more autonomy than the earlier BCT phases, and they are more physically fit, and more knowledgeable of Army values and expectations (Bornmann, 2009; Sharp et al., 2000).

Studies show that most BCT soldiers show significant improvements in physical fitness from Red Phase to Blue Phase (Cederberg et al., 2011; Lieberman et al., 2008; Sharp et al., 2000), in addition to a reduction in the amount of stress experienced during Blue phase of BCT, reflected in lower levels of self-reported psychological distress (Clemons, 1996; Lerew et al., 1999), and fewer mental health referrals (Cigrang, et al., 1998).

The association between stress and psychological adjustment has been widely studied in civilian populations (Kessler et al., 1992; Park & Fenster, 2004), but there has been limited investigation of this association during BCT. Although precise estimates of the prevalence and impact of mental health problems during BCT are lacking due, in part,
to limitations associated with privacy protection and attrition coding, mood disturbances in BCT soldiers are commonly reported (Niebuhr et al., 2006).

In light of these problems, Army research and initiatives now include stress management and resiliency-enhancing programs for soldiers pre-deployment, including during BCT (Meredith et al., 2011). Such programs could also be beneficial for soldiers as they adjust to the stressors of military life and military occupations. Emerging evidence also suggests that pre-military psychological health history may be indicative of adverse psychological health outcomes during and following military deployment (Chapin, 2004; Seifert, Polusny, & Murdoch, 2011).

These programs have included one-on-one counseling, realistic job previews for incoming soldiers, and programs for managing stress throughout a soldier’s career such as the Comprehensive Soldier Fitness program (Cornum et al., 2011). However, to our knowledge, such programs have not been demonstrated in the literature (Meredith et al., 2011), nor have they been widely implemented (Kubisiak et al., 2009; Meredith et al., 2011). Thus, there remains a need to further assess factors which could enhance psychological adjustment in BCT soldiers. There is a wealth of data suggesting that physical fitness might be an important factor.

**The Association Between Physical Fitness and BCT Outcomes**

Many of the health consequences of physical training show a U-shaped association, in which moderate amounts of exercise are beneficial (e.g., for reducing illness), whereas excessive amounts are harmful (B. H. Jones et al., 1993a; Moreira et al., 2009; Walsh et al., 2011). What is moderate or excessive varies according to the fitness and activity history of the individual. Physical training (PT) begins shortly after BCT
entry. As with other components of BCT, PT is conducted as a group training exercise. Due to wide variability in fitness levels of incoming soldiers, PT may present a sudden and significant increase in training for some individuals, while presenting a minimal challenge, or even a decrease in training for others. Extensive research has shown that individuals entering BCT with low levels of physical fitness are more susceptible to physical injury, upper respiratory tract infections, and have higher rates of attrition during BCT (Knapik, et al., 2001a; Knapik et al., 2006; Knapik et al., 2001b; Niebuhr et al., 2008; Swedler et al., 2011). Conversely, recent evidence has indicated that identifying low-fitness soldiers prior to BCT [with the Army Fitness Assessment Program (FAP)] and providing them with a 3-week training program has led to lower rates of attrition and injuries compared to low-fit soldiers who entered BCT without entering the FAP (Knapik et al., 2006).

**Physical Fitness and Psychological Adaptation to Physical Training during BCT**

It is apparent from studies conducted in civilian populations that participation in physical training regimens more challenging than an individual’s habitual regimen may be less likely to reduce stress reactivity, and may even increase adverse stress reactions (Keller & Seraganian, 1984; Petruzzello et al., 1997; Yeung, 1996; Meeusen et al., 2013). Performance decrements, psychological disturbances (decreased vigor, depressive symptoms, increased fatigue), disturbed sleep, and hormonal disturbances, which are hallmark symptoms of overtraining syndrome (OTS), have been observed as a result of sudden and significant increases in physical training (Fry et al., 1994; P. J. O’Connor et al., 1989; P. J. O’Connor et al., 1991; Slivka et al., 2010). Therefore, during BCT, low fit soldiers may be more likely to experience OTS.
Psychological distress could also contribute to the high prevalence of upper respiratory tract infections in BCT soldiers (S. E. Lee, et al., 2008), as extensive evidence in both civilian and military populations suggests an association between psychological stress and risk of infectious disease, including upper respiratory infections (URI’s) (S. Cohen, 1995; Gomez-Merino et al., 2005; Pedersen et al., 2010). It is noteworthy that low levels of physical activity prior to BCT, as well as low performance on BCT physical fitness tests have been associated with an increased risk of having an upper respiratory infection (URI) during BCT (B. H. Jones, et al., 1988).

Physical fitness also has some unique psychosocial advantages during BCT. Failure to meet physical fitness standards during BCT is reportedly a primary reason soldiers are recycled (i.e., repeating part, or all, of BCT in another company) (Knapik et al., 2004a), and soldiers commonly report the fear of being recycled as one of the most significant stressors of BCT (Faris, 1975). Undoubtedly, this stressor is more pronounced in less fit soldiers. Moreover, less fit soldiers may also face more ostracism from peers and drill sergeants.

**Physical Fitness and Psychological Adaptation to Injury during BCT**

Because many components of BCT are reliant on completion of physically-demanding tasks, suffering an injury during BCT can place additional psychological stress on soldiers, including risk of discharge from BCT, extended duration of BCT (which may include additional time spent away from family), and ostracism from fellow soldiers or drill sergeants (Hauret et al., 2001). These stressors may be particularly difficult for soldiers who are more vulnerable to the psychological impact of stress, which may in turn, further delay injury rehabilitation (Hauret et al., 2004).
Physical Fitness and Psychological Adaptation to Sleep Loss during BCT

Sleep deprivation has been associated with many adverse effects including decreased vigilance, mood disturbances, perceptual and cognitive decrements, impaired judgment, fatigue, and increased vulnerability to stress (Banks & Dinges, 2007; Lim & Dinges, 2008; Pilcher & Huffcutt, 1996). These effects may be particularly problematic for individuals in military environments, where sleep deprivation can have profound negative consequences on individual and unit performance (A. L. Peterson et al., 2008; Young-McCaughan et al., 2010).

Sleep disturbance, which can represent a symptom of OTS, may exacerbate mood disturbances during BCT (Meeusen et al., 2013). Better fitness might reduce the risk of this scenario. In support of this hypothesis, S.K. Crowley et al. (2012) found that “low fit” BCT soldiers reported more sleep disturbances than “high fit” soldiers (S. K. Crowley et al., 2012a). As indicated by our conceptual model (Figure 3.1), injury and illness during BCT may reflect a downstream consequence of the stress-related symptoms of OTS, sleep disturbances, interplay between fitness level and stress reactivity, or a more direct consequence of physical unpreparedness for the physically demanding BCT environment. The interrelationships between these factors remain to be elucidated, and will require further investigation.

The Potential Role of Psychological Illness in the Association Between Physical Fitness and Psychological Adjustment during BCT

Individual-level adaptive coping to the stressors of BCT may be highly influenced by underlying psychological illness. Whereas epidemiological studies involving civilian populations suggest that individuals with mental illness may be less physically active
than those without mental illness (Jerstad et al., 2010; Roshanaei-Moghaddam et al., 2009), this relationship has not been investigated in soldiers entering BCT.

Although psychiatric screening is conducted prior to military enlistment and BCT, this screening typically involves a brief self-reported psychiatric history conducted as a part of the pre-enlistment medical screening (Ritchie & Cardona, 2007). Given that the age of onset of some psychiatric disorders coincides with the age of most military soldiers (Kessler et al., 2007), this brief psychiatric history may not accurately reflect the psychological status and psychiatric vulnerability of soldiers when they begin BCT.

More in depth psychological assessments are conducted during the entry week of BCT, termed “Reception.” One goal of these assessments is to identify individuals who exhibit characteristics which might impact their ability to adjust to BCT or military life (Kubisiak et al., 2009). However, the percentage of Army EPTS discharges attributed to psychiatric conditions is significant (29.5%) (Niebuhr et al., 2011), and studies report that many soldiers recommended for EPTS discharges most likely represent screening failures (Cigrang et al., 2000), or soldiers failing to disclose medical or psychiatric history (Cigrang et al., 2000).

Mental health symptomatology may impede the initiation and motivation to engage in physical activity in affected individuals (Leventhal, 2012; Morgan, 1970). Therefore, it is possible that some soldiers entering BCT with lower levels of physical fitness may also have psychological conditions that have been previously undiagnosed or unreported, which may increase their vulnerability to the deleterious effects of stress during BCT. On the other hand, abundant prospective and experimental studies which indicate mental health benefits of exercise training, provide a rationale for expecting that
higher levels of physical fitness may reduce the risk of developing mental health problems during BCT. These relationships are integrated into our conceptual model depicted in figure 3.1.

**Social Cognitive Theory and Psychological Adjustment to BCT**

Theoretical constructs from the civilian literature might provide insight into potential mechanisms by which fitness might be associated with psychological resilience during BCT. In particular, Bandura’s concept of self-efficacy, (Bandura, 1977) is a potential link between the stress-adaptive cognitive behaviors associated with physical fitness and psychological adjustment during BCT.

Self-efficacy is an individual's belief in his/her ability to succeed in specific situations (Bandura, 1977). Efficacy beliefs influence task persistence, motivation and effort, expectations of success, and individual affective responses to challenges (Bandura, 1977). Thus, individuals with higher levels of self-efficacy are more likely to believe they have an ability to cope with stressors (Bandura, 2001), which results in reduced vulnerability to stress in challenging situations and strengthens resiliency to adversity (Bandura, 2001).

The positive relationship between physical training and enhanced self-efficacy in civilian populations has been widely reported in the literature (Fox, 1999; Mason & Holt, 2012), and self-efficacy has been shown to mediate the association between physical activity and mental health (Bodin & Martinsen, 2004; Dishman et al., 2006; White, Kendrick, & Yardley, 2009). Furthermore, there is also support for the role of coping self-efficacy in the association between physical training and reduction of adverse
psychological health outcomes in response to environmental stressors (Brown & Siegel, 1988).

Studies have shown that higher self-efficacy during BCT may be associated with reduced levels of perceived stress (Davis, 2006), as well as reduced attrition, injury, and illness (Hadid et al., 2008) during BCT. Thus, soldiers who begin BCT with higher fitness levels are likely to have higher levels of self-efficacy, and might be less likely to appraise the challenges of BCT as stressful compared with unfit soldiers. This hardier appraisal could in turn lead to less stress reactivity, improved psychological adjustment during BCT, and a reduced risk of development of psychological illness (as depicted in figure 3.1).

While several different factors play a role in the development of efficacy beliefs, mastery experiences are perhaps the most influential sources of efficacy information (Bandura, 1982). This concept may provide one theoretical basis for the stress-buffering effect of physical fitness during BCT, as many components of the BCT environment require completion of physically demanding tasks. Individuals with higher levels of physical fitness at BCT entry might therefore have higher self-efficacious beliefs regarding completion of physically demanding BCT challenges, perhaps due in part, to congruent mastery experiences associated with prior physical training.

Potential Physiological Mechanisms Underlying the Association Between Physical Fitness and Psychological Adjustment during BCT

There is a large body of research on the association between physical fitness and psychophysiological reactivity to stress. However, differences in methodological
approaches, definitions of stress, and study populations have resulted in heterogeneity in findings (Crews & Landers, 1987; Forcier et al., 2006; E. M. Jackson & Dishman, 2006).

Although the precise mechanisms underlying the stress-buffering properties of physical fitness are still emerging, animal and human studies suggest that exercise training may lead to adaptations in the hypothalamic-pituitary-adrenal (HPA) axis and the sympathetic nervous system (SNS) in response to stress (Tsatsoulis & Fountoulakis, 2006; Wittert et al., 1996). Multiple studies have observed improvements in cortisol, catecholamine levels, cardiovascular reactivity, and other stress-related physiological responses to stressful stimuli in individuals who habitually exercise or are physically fit (for a review, see Salmon, 2001).

Indeed, the notable central and peripheral physiological stress responses to exercise have led to the theory of “cross-stressor adaptation,” which posits that physiological adaptations resulting from physical training may also result in physiological adaptations to psychological stressors (Sothmann et al., 1996). More investigation is needed to improve understanding of the physiological mechanisms underlying the stress-buffering benefits of physical training. However, cumulative research from population-based human studies continue to suggest a protective effect of physical fitness against adverse psychological outcomes associated with chronic stress (Dunn et al., 2001).

To our knowledge, there have been no published studies of the association between physical fitness and psychological health outcomes among BCT soldiers. However, such an association was observed in a recent study of U.S. military personnel (n=31) completing a simulated Survival, Evasion, Resistance, and Escape (SERE)
training. In that study, aerobic fitness was inversely associated with self-reported impact of stressful events during SERE (M. K. Taylor et al., 2008).

Conclusions and Future Directions

Psychological disturbances are a significant portion of early career attrition in the Army (Niebuhr et al., 2011). There is abundant evidence that physical fitness might reduce the risk of psychological problems during BCT. Investigation of the association between physical fitness and psychological adjustment during BCT should also consider interactions with sleep, injury, illness, and other factors which have been associated with psychological adjustment during BCT, such as race, gender, education, family income, marital status, and family history/environment (Carbone et al., 1999; Knapik, et al. 2004b; McGraw & Bearden, 1988); as well as measures of soldiers’ BCT self-efficacy and identification with the Army (Mael & Ashforth, 1995).

Exploration of differences in mental health-related attrition, or comparisons of psychological adjustment of soldiers with high and low levels of physical fitness at BCT entry would fill a significant gap in the existing literature, and provide important information for current Army pre-accession programs and practices. Physical fitness of BCT soldiers may therefore provide a potential target for interventions aimed at increasing resiliency to stressors, improving the psychological adjustment of soldiers, and reducing attrition during BCT.
Figure 3.1. Conceptual framework for the association between physical fitness level at BCT entry and psychological adjustment during BCT.

Abbreviations: OTS = Overtraining Syndrome; BCT = Basic Combat Training
CHAPTER FOUR

SLEEP DURING BASIC COMBAT TRAINING: A QUALITATIVE STUDY

Abstract

Anecdotal accounts indicate that Basic Combat Training (BCT) is associated with significant sleep impairment, which conceivably could impact health, attrition, and training. However, there has been little empirical investigation of sleep during BCT. The aim of this study was to obtain a qualitative assessment of soldiers’ perceptions about their sleep and consequences of sleep disruption during BCT. During November and December of 2010, focus group discussions were conducted with soldiers ages ≥ 18 y, who had completed at least 4 weeks of BCT at Fort Jackson, SC, USA. The soldiers were assessed in 45-60 min sessions involving three groups of female soldiers (total n=28) and three groups of male soldiers (total n=38). Soldiers reported reductions in their sleep duration and quality, which were attributed to many factors, particularly noise, nighttime work detail, stress, and hunger. These sleep changes had many perceived negative effects on performance, mood, and other components of BCT. These effects were more evident in soldiers of lower physical fitness. This study suggests associations between sleep and BCT outcomes. Whether these associations warrant changes in the sleep environment of BCT will require much further investigation.
Introduction

Basic Combat Training (BCT) is an extremely demanding regimen designed to prepare soldiers physically and mentally for combat, and to instill military values such as duty, respect, and selfless service. Military leadership must execute these goals while avoiding illness, injury, and excessive attrition in otherwise capable troops.

One component of BCT that has the potential to either support or undermine these potentially competing interests is the sleep environment. However, beyond anecdotal accounts of sleep curtailment and early morning reveille, there is little understanding of soldiers’ sleep during BCT. It seems apparent that some aspects of sleep scheduling during BCT are designed to challenge soldiers. However, studies suggest that inadequate sleep during BCT could increase incidents of injury and of physical and mental stress, and could impair ability to learn complex skills (Curcio et al., 2006; Edmonds & Vinson, 2007; Flanagan, 2011; Franzen et al., 2008; Harvey, 2011; Walker, 2008).

Addressing some of these problems to promote better health and performance is a reasonable rationale for investigating sleep during BCT. It is also worth considering whether some of the sleep routines of BCT provide optimal preparation for combat. For example, the tradition of early morning training might not be ideal preparation for combat, which may often occur at night. Indeed, the U.S. military takes pride in their ability to perform nighttime combat missions (due in part to technological advancements) (Pleban, 2002), as exemplified by the U.S. Army’s slogan “We own the night.”

In considering an examination of the BCT sleep environment, it might be instructive to consider analogous decisions that have been made regarding other stressors of BCT. For example, soldiers now wear running shoes for much of BCT because
research demonstrated that continuous boot-wear contributed to injuries during BCT (B. H. Jones, Thacker, Gilchrist, Kimsey, & Sosin, 2002). Of note in this case, the goal of reducing injury during BCT apparently superseded that of simulating combat conditions.

As part of a research consortium, Soldier Health Promotion to Examine and Reduce Health Disparities (SHPERHD) (S. K. Crowley et al., 2012b), the Army has requested that our team place a particular emphasis on sleep. Thus, one aim of our research is to explore the association of sleep with other outcomes in BCT soldiers at Fort Jackson in Columbia, SC.

Since this topic has been scarcely addressed, we surmised that an appropriate first step would be to ask soldiers extensive questions about their sleep during the unique environment of BCT. Standardized sleep questionnaires and open-ended questions were deemed inadequate for this purpose. Instead, we used structured focus group methodology (Poston et al., 2008; D. W. Stewart et al., 2006) to identify factors that influence sleep, and perceived consequences of sleep loss during BCT. We hypothesized that soldiers would report: (1) that they sleep much less in BCT than they were accustomed to sleeping in their home environments; (2) that they have difficulty sleeping during BCT, despite high levels of physical fatigue; (3) that many factors disturb their sleep during BCT; (4) that they experience difficulty adjusting to the early sleep schedule of BCT, particularly soldiers who were more accustomed to delayed schedules; and (5) that poor sleep impairs their daytime functioning during BCT.

Methods

The study protocol was approved by Institutional Review Boards (IRB’s) of the University of South Carolina and the United States Army Accessions Command
Our Fort Jackson liaison (SM) coordinated scheduling of soldiers through the Fort Jackson IMT-CoE Human Dimensions Division (formerly Experimentation and Analysis Element (EAE). Fort Jackson BCT battalion commanders were contacted about the study, and a commander willing to volunteer his unit for participation in the study was identified. As recommended by Fort Jackson personnel, soldiers were grouped by gender and according to performance (high, medium, low) on the Army Physical Fitness Test, with the rationale that soldiers might feel more comfortable expressing their views and opinions among peers of similar “status” with respect to fitness. Battalion drill sergeants selected groups of soldiers (of designated gender and fitness levels) to report to the specified location for the focus group discussions. Participants were told they were going to be asked to volunteer for a research study, and these soldiers were notified verbally and in writing, that participation in the focus groups was voluntary. A total of 66 soldiers ages ≥ 18 yr, who had completed at least 4 weeks of BCT, were assessed in three groups of female soldiers (total n=28) and three groups of male soldiers (total n=38).

The focus group discussions occurred over 3 separate 45-60 minute sessions on Saturdays in late-November to early-December 2010. In order to protect the identity of the soldiers, upon arrival in the building, they were immediately assigned subject badges to cover their name tags. Following a standardized orientation, a gender-matched research team, consisting of one experienced facilitator and 1-2 note-takers, introduced themselves to the soldiers. The facilitator then explained that he/she would be asking the soldiers about their sleep; that the soldiers should answer the questions as honestly as possible; that there were no correct or incorrect answers to the questions; and that the soldiers were free to participate as much or as little as they wanted. Soldiers were given
notepads, with the option to write comments instead of, or in addition to, orally responding to the queries. Soldiers were instructed to refrain from using names of any soldier, and also to refrain from sharing anything from the discussions outside of the focus groups.

Since the identity of participants was not revealed and complete confidentiality regarding the results was communicated to the soldiers, the IRB committees deemed that signed consent forms were not necessary, and, indeed, might have been counterproductive for ensuring complete anonymity. Instead, verbal informed consent was obtained from all the participants.

The discussions were semi-structured with nine questions (see Table 4.1) pertaining to (1) changes in sleep patterns since entering BCT; (2) barriers to initiating sleep; (3) sleep interruptions; (4) adaptation to the BCT sleep environment; (5) effects of diminished sleep on performance/duties; and (6) suggestions for improving sleep during BCT. Follow-up probing questions were asked to help facilitate or clarify the responses. The facilitators and note-takers made a concerted effort to avoid giving any impression that the research team was expecting or desiring certain responses.

Soldier oral and written responses from the discussions were manually recorded by the note-takers, who later transcribed their notes for qualitative analysis. According to standard focus group assessment procedures, responses were grouped using an open-coding process in which six themes were assigned to groups of similar responses (see below).
Results

Changes in Sleep Patterns since Entering BCT

The BCT schedule of lights out at 2100h and lights on at 0430h-0445h contrasted with the sleep schedules to which most of the soldiers were accustomed in their homes. The majority of soldiers reported that they had been “night owls” prior to BCT, whereas only 3 of 38 male and 2 of 28 female soldiers classified themselves as “morning people” prior to BCT. Indeed, some soldiers noted that during BCT they were arising at a time at which they often had gone to sleep previously. Thus, the majority of these soldiers experienced an extreme and abrupt advance in their sleep schedule upon entering BCT.

Most soldiers reported a reduction in sleep duration and quality since entering BCT, citing that they were used to sleeping an average of 8-9 hours at home, but averaged 5-6 hours per night in BCT. Interestingly, several soldiers commented that prior to BCT, they had needed 30 min to 2 h to fall asleep, but they were able to fall asleep in less than 10 minutes during BCT. Many soldiers attributed this change to physical exhaustion as well as sleep loss. Only a few soldiers reported that their sleep quality had improved during BCT compared with home.

Barriers to Initiating Sleep

Several barriers to initiating sleep were consistently noted. The most common complaint pertained to excessive noise. This included soldiers talking in the barracks or commons area; soldiers walking to and from the showers and bathrooms; and soldiers snoring. During this late fall period, almost all soldiers commented that the blankets provided were insufficient to combat the cold temperatures of the barracks. Some soldiers slept in extra physical training (PT) gear for warmth, whereas others were forbidden by
their drill sergeants from doing so. Moreover, bedding (pillows, blankets, bed) was described as uncomfortable, with two soldiers reporting an allergy to the wool fabric of the blankets. Several soldiers, whose beds were located near windows, reported that security lights shining into the bay often delayed them from falling asleep.

Anxiety/stress and family concerns were also listed as barriers to initiating sleep, and these factors appeared to have a larger impact in the soldiers with lower fitness scores on the Army Physical Fitness Test compared with the high-fit soldiers. The most commonly reported sources of stress and anxiety pertained to upcoming qualifying tests such as the Army Physical Fitness Test and marksmanship testing.

Hunger was another commonly reported barrier to initiating sleep. During BCT, the evening meal occurs between 1600-1700 h, with lights out at 2100 h. All focus groups reported being hungry at lights out. One soldier commented, “I used to eat dinner just before bed. Now we have dinner, then 2-3 hours of activity before bed.”

**Sleep Interruptions**

An overwhelming majority of soldiers reported an average of 2-4 interruptions of their sleep per night on 3-7 nights per week. Commonly reported interruptions included drill sergeants entering the bay to wake soldiers, uncomfortable temperature, and performing fire guard duty during the night or being awoken when other soldiers started or ended their fire guard duty. For the uninitiated, BCT fireguard duty is an hour-long detail assigned to two-person soldier teams throughout the night. The teams patrol the bay of sleeping soldiers to ensure that all personnel are present, safe, and accounted for. Ability to fall back asleep after these interruptions was easy for some, but difficult for others.
Stress/anxiety about qualifying tests was listed by all focus groups as a major source of awakenings. When probed if the quality of their sleep would be better without external interruptions, many soldiers answered affirmatively, but several soldiers commented that they would still have trouble sleeping due to anxiety/stress. One soldier commented that he had never been able to get adequate sleep during BCT due to being “more jumpy.”

**Soldier Adaptation to the Sleep Environment of BCT**

Most soldiers reported that they had the most difficulty with the sleep schedule during the first 1-2 weeks of BCT, when they were required to attend relatively more lectures, stand in line more, and were given less time for sleep. The majority of soldiers reported that, over time, it had become easier to adapt to the new schedule. However, several soldiers indicated that they had not been able to adapt to the new schedule, and that it was getting more difficult to adjust as they progressed through BCT.

Adaptation to the sleep environment of BCT seemed to differ by fitness group. Soldiers in the lower fitness groups reported having difficulty adapting to the new schedule, with one female soldier noting, “It’s getting harder to wake up. I’m tired and exhausted.” In contrast, soldiers in the high fitness group reported that it had been relatively easy to adapt to the new schedule. Interestingly, a few soldiers in the high fitness group indicated that they had adapted easily because they had been early morning types previous to BCT.

**Effects of Diminished Sleep on Performance and Adjustment**

Soldiers in all of the focus groups reported difficulty staying awake, concentrating, and retaining information in the BCT classrooms. Several soldiers felt that
their academic performance had suffered during BCT due to lack of sleep. In addition, soldiers reported diminished ability to perform their daily physical training (PT), noting a general feeling of being “slow” or “weak” during physical activities. Soldiers also felt that their performance on the Army Physical Fitness Test and marksmanship tests had suffered. One soldier even reported falling asleep while firing a weapon during target practice.

Most soldiers reported feeling sleepy and lethargic, and having trouble “getting going” in the morning. Only a few soldiers did not feel that their performance had been negatively impacted by changes in sleep during BCT, and these soldiers were in the high-fitness group.

Overwhelmingly, soldiers reported being irritable as a result of sleep loss, and many of the soldiers mentioned that their interpersonal skills suffered because of this. Several soldiers noted that they felt that their ability to establish friendships/camaraderie in their unit had suffered due to impaired sleep.

**Soldier Suggestions for Improving Sleep During BCT**

Among all groups, several recurring themes emerged as suggestions for improving sleep during BCT, including having more comfortable bedding and more comfortable temperature in the barracks; having food/snacks in the evening; and having fewer interruptions after lights out. The majority of soldiers suggested that the “toe the line” roll-call routine prior to lights out should be shortened, as it often cut into their one hour of personal time. Soldiers noted that having more personal time would allow them to unwind prior to lights out. A later wake up time was suggested by the female soldiers, but not the male soldiers, as a means to improve sleep during BCT.
Discussion

Consistent with our hypotheses, BCT soldiers reported reductions in sleep duration and quality, which were attributed to many factors, and these sleep changes had many perceived negative effects on performance, mood, and other components of BCT. Whether these effects warrant changes in the sleep environment of BCT will require further investigation.

The soldiers’ sleep duration was abruptly curtailed from an at-home average of 8-9 h to an average of 5-6 h during BCT. Moreover, sleep became much more interrupted during BCT due to anxiety, fireguard duty, and noises associated with group housing in the barracks.

A rapidly accumulating body of literature indicates that such reductions in sleep duration and quality are associated with multiple morbidities, including depression, illness, impaired cognitive function, and increased risk of accidents (Buysse et al., 2008; Curcio et al., 2006; Franzen et al., 2008; Harvey, 2011; Killgore, 2010; Li, Lam, Yu, Zhang, & Wing, 2010; Neylan et al., 2010; Walker, 2008). Sleep loss can be particularly profound in the military (Neylan et al., 2010), and can be exacerbated by unique levels of physical and psychological stress, often with life or death consequences of error. Moreover, sleep problems have been predictive of post-traumatic stress disorder (PTSD), depression, and suicidal ideation and behavior in military populations (Germain, Buysse, & Nofzinger, 2008; Ribeiro et al., 2012).

The results of the present study suggest several adverse consequences of sleep loss during BCT, including impaired ability to concentrate during class, difficulty performing physical challenges, and compromised camaraderie and communication.
between soldiers. Perhaps most alarming was the report of a soldier falling asleep while firing a weapon. Fortunately, this incident had no negative consequences. However, fatalities do occur during BCT (Scoville, Gardner, & Potter, 2004), often due to human error, to which sleep deprived individuals are clearly more susceptible (Killgore, 2010). Moreover, sleep loss during BCT might precipitate or exacerbate depression and anxiety, which have been associated with attrition during military training (Cigrang et al., 1998; Larson et al., 2002; Martin, Williamson, Alfonso, & Ryan, 2006).

These risks must be weighed against the need to prepare soldiers physically and mentally for combat, as well as the need for long, intensive training days to prepare thousands of troops in a short period of time (10 weeks). The findings that average sleep duration is less than 6 hours per day in troops in Iraq and Afghanistan (Luxton et al., 2011), and that sleep loss may be far more severe in many battlefield scenarios (N. L. Miller, Shattuck, & Matsangas, 2011; Rabinowitz, Breitbach, & Warner, 2009), provide some rationale for maintaining the current BCT sleep schedule.

On the other hand, if sleep restriction contributes significantly to injury, illness, attrition, or impaired ability to meet all of the core components of BCT, there might be justification for changing the BCT sleep environment. Far more empirical investigation of the potential risks of sleep loss during BCT is needed, which is the topic of our subsequent investigations.

One potentially modifiable component of the BCT sleep schedule may be the early bed and rise times, which contrasted starkly with most of the soldiers’ customary sleep schedules, and with the biological tendency of young adults to have a relatively delayed circadian system (S. J. Crowley, Acebo, & Carskadon, 2007; Giannotti, Cortesi,
A more delayed BCT sleep schedule might be accomplished without any other modification of BCT. A recent preliminary study at Fort Leonard Wood, MO compared a company on a standard BCT sleep schedule (2030h-0430h) with a company on a delayed sleep regimen (2300h-0700h). Compared with soldiers on the traditional BCT schedule, soldiers on the delayed schedule obtained 33 more minutes of sleep per night; reported significantly better sleep quality; and had significantly lower levels of anger-hostility and total mood disturbance during the initial weeks of BCT (N L. Miller, Tvaryanas, & Matsangas, 2010). Conceivably, a delayed schedule might have other benefits for performance during BCT, including allowing better preparation for nighttime combat missions. A gradual shift to the earlier schedule, analogous to the prescribed gradual increase in physical training might also be considered, as the present study found that soldiers tended to experience the greatest sleep-related difficulties in the first weeks of BCT.

Another factor for which modification might be well justified is the prohibition of eating after 1600 h. While this policy might fit with general BCT themes of discipline and maintaining tradition, the degree to which this policy impacted the soldiers’ sleep was noteworthy. Moreover, the relevance of this practice is dubious for US troops engaged in present deployment missions for which food is generally accessible. In this case, the solution might be as simple as having drill sergeants distribute a healthy food-bar type snack and beverage to each soldier at evening formation.

Besides potential modification of the BCT environment, the focus group results also have implications for improved soldier preparation for BCT. For example, recruiters and pre-accessions reading material can advise prospective soldiers to get up and receive
more bright light exposure in the morning, and conversely less at night, thus shifting
themselves to an earlier sleep schedule. Moreover, the greater sleep-related problems
found in the lower fit soldiers provide another reason to be physically prepared for BCT.
Indeed, compared with the high fit soldiers, the low fit soldiers reported more
stress/anxiety, which, in turn, was associated with more sleep disturbance and greater
difficulty adjusting to BCT. These findings are consistent with other research indicating
that physical fitness is protective against development of psychological distress during
BCT (M. K. Taylor et al., 2008). Undoubtedly, less fit soldiers are also more susceptible
to other physical maladies such as muscle pain, fatigue, and illness, as well as adverse
psychosocial factors, including a greater fear of failing BCT, ostracism from other
soldiers, and lower levels of confidence and self-esteem.

There were several potential limitations of the present study. First, it is possible
that researchers’ a priori hypotheses could have subtly influenced the participants’
responses, though concerted efforts were made to avoid such bias by our trained
facilitators and dispassionate note-takers, and the soldiers’ responses seemed to be
candid. Second, the relatively greater focus on potential problems associated with the
BCT environment potentially could have resulted in exaggerated complaints. The range
of variation in responses suggests that this was not a major confound. However,
inclusion of questions regarding potential improvements in sleep (e.g., due to fatigue or
homeostatic effects of sleep loss) might have been preferable for minimizing this
confound. Third, study data were based on self-report. An important consideration for
future research might be to include objective measures of sleep (such as actigraphy) and
BCT performance (Army Physical Fitness Test, in class, and marksmanship scores).
Information obtained from these focus group discussions is a preliminary step. Further larger scale, quantitative, and prospectively designed research is needed to better ascertain the association of sleep with physical and mental health and performance of BCT soldiers.
**Table 4.1 Focus group discussion questions and selected quotes**

1.) Please describe your sleep patterns since entering Basic Combat Training.
   
   "We have to go to sleep at 9 pm and wake up at 5am. I used to go to bed between midnight and 4am, then get up at 1pm."

2.) Do you find it hard to unwind or relax prior to going to bed?
   
   "I was used to having my own room before BCT. It's hard to fall asleep with people moving around and people snoring."

3.) What makes it difficult to fall asleep?
   
   "I've gone from being late night to early night."
   
   "People talking makes it difficult to fall asleep. If you only get a certain amount of sleep, you don't even feel like sleeping."
   
   "The pillow doesn't help and the blankets are itchy."

4.) Describe what happens at lights out.
   
   "There is noise - laundry, showers, steps."

5.) On an average night, how often is your sleep interrupted?
   
   "Three to four times per night. Fireguard, cleaning, people getting up, snoring…"

6.) Describe any situations or circumstances that have been hindered because of lack of sleep or fatigue.
   
   "I argue with people for no reason."
   
   "…fall asleep while holding live weapon and firing."
   
   "I failed the land navigation test. I was so sleepy that I failed an easy test."

7.) How do you prepare for lights on?
   
   "I stare out the window for 10-15 minutes before lights on. I have to get motivated."

8.) If you could make any changes that would help you get more sleep or achieve a higher quality of sleep during BCT, what would they be?
   
   "Interruptions. I would want fewer interruptions."

9.) How would you describe your ability or inability to adapt to the new time schedule and the amount of sleep you are getting in BCT?
   
   "It was harder in the beginning."
   
   "It was hard to adapt from home to BCT when it comes to sleep."
   
   "It was harder in the first four weeks."
CHAPTER FIVE

PROSPECTIVE STUDY OF THE ASSOCIATION OF PHYSICAL FITNESS WITH
DEPRESSIVE SYMPTOMS IN SOLDIERS DURING ARMY BASIC COMBAT TRAINING

Abstract

Mental-health related problems are a significant cause of attrition during BCT. Evidence in civilian populations suggests that physical fitness is associated with psychological benefits, but little is known about the association between physical fitness and psychological adjustment during BCT. This study prospectively examined the association between physical fitness and depressive symptoms in 300 BCT soldiers from May to July, 2012 at Fort Jackson, Columbia, SC.

Soldiers completed a baseline Army Physical Fitness Test (APFT) and survey within one week of arriving at BCT, and an end of cycle survey after eight weeks of BCT. Soldiers were assigned to a “high” fitness category if they had a passing score on the Army standard APFT of greater than or equal to 180 points out of 300 points. Soldiers scoring less than 180 points on the APFT were assigned to a “low” fitness category. Depressive symptoms were measured using the 20-item Center for Epidemiologic Studies Depression Scale (CES-D). In multivariate analyses, adjusting for baseline demographics, self-reported sleep prior to BCT, BCT confidence, Army identification, and CES-D scores, the odds of reporting depressive symptoms were 60%
lower for soldiers in the high fitness category (odds ratio, OR 0.40; 95% confidence interval, CI 0.19–0.84), compared to soldiers in the low fitness category. Analogous to other positive outcomes of soldier fitness, improvement of soldier physical fitness prior to BCT might improve soldiers’ psychological health outcomes.

**Introduction**

United States (US) Army Basic Combat Training (BCT) is a 10-week military orientation course designed to indoctrinate new soldiers to Army values, lifestyle, and identity (Davis-Martin, Martin, Williamson, Alfonso, & Ryan, 2006; Gold & Friedman, 2000; Knapik et al., 2002). Most new soldiers are young adults, for whom the BCT environment of intense and frequent mandatory physical training, communal living, regimented eating and sleeping schedules, and sleep deprivation (S. Jackson, 2011; Lieberman et al., 2008; N. L. Miller et al., 2012) is in stark contrast to their prior home environments.

In comparison to most civilian environments, the BCT environment is uniquely stressful for soldiers, most of whom are just beginning the transition to adulthood. Many of these new soldiers may struggle with the abrupt entry into this physically and psychologically stressful environment, which may put them at risk for the development of adverse psychological health outcomes during BCT. Indeed mental health-related problems are consistently listed as a significant cause of attrition during Basic Military Training (BMT) in all US armed services (Cigrang et al., 1998; Clemons, 1996; Gold & Friedman, 2000; Larson et al., 2002).

There is a need for investigation of factors associated with better psychological health of soldiers during BCT. One association that shows promise as a potential avenue
of exploration for the BCT environment is that between physical fitness and mental health. Indeed, evidence from a large body of research in civilian populations suggests that physical fitness may have a protective role in reducing the adverse psychological effects of stress (Brown, 1991; Brown & Siegel, 1988; Dunn et al., 2001; Rejeski et al., 1992; Roth & Holmes, 1985). For example, results of a recent cross-sectional study indicated that individuals with high stress and moderate to high levels of physical fitness reported lower levels of depressive symptoms than individuals with high stress and low levels of physical fitness (Gerber et al., 2013).

Additionally, in civilian populations, cross-sectional studies have shown that individuals with high levels of physical activity or fitness are less likely to exhibit depressive symptoms (Azar et al., 2008; Dunn et al., 2001; Goodwin, 2003; McKercher et al., 2009), and prospective studies have shown that more active/fit individuals have less risk of development of depressive symptoms (Brunet et al., 2013; Farmer et al., 1988; Dishman et al., 2012; Mikkelsen et al., 2010; Sui et al., 2009), compared to individuals who are sedentary or unfit.

To our knowledge, there has been no research of the association between physical fitness and psychological health outcomes of soldiers during BCT. However, research has shown that individuals entering BCT with low levels of physical fitness are more susceptible to physical injury, illness, and early attrition from BCT (Knapik, et al., 2001a; Knapik et al., 2006; Knapik et al., 2012; Knapik, et al., 2001b; Molloy et al., 2012; Niebuhr et al., 2008; Swedler et al., 2011).

The current study examined the association of objectively measured physical fitness levels of soldiers at the start of BCT with the odds of reporting depressive
symptoms near the end of the BCT cycle. Factors which have been associated with depressive symptoms in young adults, psychological adjustment of soldiers during BCT (Knapik, et al., 2004b; McGraw & Bearden, 1988), or the association between physical fitness and depressive symptoms in young adults were considered as potential confounders, and controlled for in assessing the association. Based on previous findings in studies conducted in civilian populations (Brunet et al., 2013; Farmer et al., 1988; Dishman et al., 2012; Mikkelsen et al., 2010; Sui et al., 2009), we hypothesized that soldiers entering BCT with a higher physical fitness level would be less likely to report depressive symptoms near the end of the BCT cycle, compared with soldiers with lower physical fitness levels.

**Methods**

**Study Overview**

The Soldier Health Promotion to Examine and Reduce Health Disparities (SHPERHD) project was a multi-center research initiative between the Institute for Partnerships to Eliminate Health Disparities (IPEHD) at the University of South Carolina and the Fort Jackson Army Base, Columbia, South Carolina (Williams et al., 2011). For the current study, soldiers (ages ≥18 years) were assessed longitudinally over the course of BCT at Fort Jackson in Columbia, SC.

Soldier’s physical fitness was assessed objectively at baseline (within a few days of starting BCT) via the standard Army Physical Fitness Test (APFT). Soldier demographics, as well as measures of mood, sleep and behavioral characteristics were assessed at two time points: (1) a baseline survey administered to the soldiers within the first week of soldiers arriving at Fort Jackson, and (2) an end of cycle survey.
administered to soldiers approximately 8 weeks after BCT began. Analysis for the current study included soldiers (n=300), who had complete data for the APFT, provided complete responses for all study variables for the baseline and end of cycle surveys, and indicated absence of depressive symptoms at baseline. Figure 5.1 illustrates the flow of participants for the current study.

Survey measurement was conducted from May to July, 2012. Baseline survey assessment duration was approximately 90 minutes, which included a detailed explanation of the study by research staff from the University of South Carolina. Soldiers were informed that participation in the study was voluntary. Those soldiers choosing to participate in the study were invited to sign a written informed consent, approved by the Institutional Review Board (IRB) at the University of South Carolina and the Directorate for Research at Fort Jackson and the US Army Medical Research and Materiel Command (USARMC).

The informed consent briefing and document emphasized that participation in the study was confidential and voluntary. Soldiers were informed that they could stop participating at any time, that they could refuse to answer questions, and that there would be no penalties or consequences for not participating or refusing to answer questions. Soldiers who chose to participate in the study signed and dated the informed consent document, and all consent documents (completed or not) were collected without soldiers disclosing their participation decision. Company drill sergeants were asked to leave the room during this consent process, but returned to the room during survey administration to maintain command and control. However, they were asked to remain a distance from soldiers during the survey process in order to protect soldier confidentiality in filling out
survey questions. This study was performed in accordance with the ethical standards described in the Declaration of Helsinki.

**Baseline Fitness Assessment**

Objectively measured physical fitness data was obtained via the APFT, a three-event physical performance test used to assess physical fitness in three domains: (1) cardiorespiratory fitness, (2) upper body muscular fitness, and (3) abdominal/core muscular fitness (Knapik, 1989). The APFT involves three timed events performed in sequential order: a push-up event (the number of repetitions completed in two minutes), a sit-ups event (the number of repetitions completed in two minutes), and lastly a timed two-mile run event. Soldiers are allowed a minimum of 10 minutes and a maximum of 20 minutes rest between each of the tests. Raw scores on each of the three components of the APFT are converted to point values based on Army normative data for age and gender to yield a maximum total score of 100 on each component test (U.S. Department of the Army, 2012). The three component scores are then sum-totaled to yield a maximum total score of 300 for the total APFT score. For an 18 year-old male, a score of 100 points per component event (300 for the total APFT score) would be obtained by completing ≥71 push-up in two minutes; ≥78 sit-up in two minutes; and running two miles in ≤ 13.0 minutes.

The APFT standard passing score is a minimum of 60 points per component event, and no less than 180 points for the overall APFT score (U.S. Department of the Army, 2012). For an 18 year-old male, a score of 60 per component event would be obtained by completing 42 push-ups, 53 sit-ups, and running two miles between 15:48 to 15:54.
For the current analysis, “high” fitness was defined by an APFT score of ≥180 points and “low” fitness was defined as an APFT score of < 180 points. The timed two-mile run component of the APFT has been shown to be highly correlated with maximal oxygen uptake (VO$_2$max; 0.91 for men, 0.89 for women) (Mello, 1984), commonly considered the “gold standard” for measurement of cardiorespiratory fitness (Thompson et al., 2009).

**Baseline Survey Assessment**

Covariates were chosen for inclusion in the study analysis due to their potential to have an effect on depressive symptoms or psychological adjustment of soldiers during BCT (Knapik et al., 2004b; McGraw & Bearden, 1988), which could potentially confound the association between physical fitness and depressive symptoms during BCT. Demographic covariates included age, sex, race, education level (last degree completed), marital status (married or not married), and family income (annually).

Other covariates included baseline measures of self-reported sleep duration, identification with the Army, BCT self-efficacy, and depressive symptoms. Average sleep duration for the 30 day period prior to BCT was assessed via the Pittsburgh Sleep Quality Index (PSQI), the most widely used measure of subjective sleep quality (Buysse, et. al, 1989). The PSQI has been used previously for the assessment of sleep in soldiers during BCT (N. L. Miller et al., 2012). For this analysis, the sleep duration component score of the PSQI was collapsed from a 4 category response variable into a conceptually meaningful dichotomized variable reflecting average self-reported sleep per night > 7 hours or ≤ 7 hours. Self-reported sleep duration of ≤ 7 hours per night in young adults has been associated with increased psychological distress (Chang, et al., 1997; Glozier et al.,...
2010), and has been implicated as an independent risk factor for the persistence of psychological distress prospectively (Glozier et al., 2010).

Army identification was measured using a 5-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). Army identification has been associated with psychological attachment to the Army, as well as cognitively ambitious, achievement-oriented pursuits (Mael & Ashforth, 1995), which have implications for psychological adjustment of soldiers during BCT. Sample questions from the Army Identification (ID) scale included, “The Army has a great deal of personal meaning to me,” “The Army’s values are my values,” and “I’m very proud to tell people I am in the Army.” Negative items from the scale were reverse-scored, and the sum-total of the scale was averaged across the number of items to obtain a total score from 1-5. Higher scores indicate a stronger identification with the Army. Internal consistency reliability (Cronbach's alpha) of the 9 items was 0.84.

BCT self-efficacy was conceptualized using the BCT confidence scale. The BCT confidence scale consisted of a 5-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). The BCT self-efficacy measure was included as a potential confounder, as self-efficacy beliefs have been associated with the impact of physical training on mental health (Bodin & Martinsen, 2004; Dishman et al., 2006; White et al., 2009). Example questions from the BCT confidence scale included, “I have what it takes to succeed in BCT,” “Based on my ability and the amount of work I do, I think I will excel in BCT,” and “I expect to do well in BCT.” Negative items from the scale were reverse-scored, and the sum-total of the questionnaire was averaged across the number of items to obtain a total score from 1-5. Higher scores indicate higher confidence for succeeding in BCT. Cronbach's alpha of the 9 items was 0.84.
Baseline depressive symptoms were assessed using the 20-item version of the Center for Epidemiologic Studies Depression Scale (CES-D). This self-report scale is designed to measure depressive symptoms in the general population (Radloff, 1977) and has been validated for use in military populations (Boisvert, et al., 2003; Vickers, 1992). The range of possible scores is 0 to 60, with higher scores indicating a higher degree of depressive symptoms (Radloff, 1977). Cronbach's alpha of the 20-item CES-D was 0.81.

Assessment of Outcome

For this analysis, presence or absence of depressive symptoms at the end of the BCT cycle was determined using soldiers’ reported CES-D scores from the end of cycle survey. A score of ≥ 16 indicated presence of depressive symptoms. This cut-point has been extensively used in the general population to indicate presence of depressive symptoms (Radloff, 1977).

Statistical Analysis

Descriptive statistics (means, SDs, proportions) were used to describe demographic and behavioral characteristics of the study population separately for high and low APFT fitness soldiers. T-tests and chi-square tests were used to compare the means of continuous variables and the prevalence of categorical variables, respectively, between participants in APFT fitness categories.

Logistic regression analysis was conducted to test whether APFT fitness category at baseline was a predictor of the odds of reporting depressive symptoms at the end of the BCT cycle. Three models were used in the multivariate logistic regression analyses. Model 1 was unadjusted. Model 2 controlled for age, sex, race, education level, marital status, family income (annually), BCT confidence score, and Army ID score. Model 3
adjusted for all variables in model 2, plus baseline CES-D score and self-reported average sleep duration prior to BCT. All \( p \) values reported are 2-sided with an alpha level of 0.05. All statistical analyses were performed using SAS 9.3 (SAS Institute, Inc., Cary, North Carolina).

**Results**

Table 5.1 presents demographic and behavioral characteristics of study participants at baseline. Soldiers ranged in age from 18-35 years, with a mean age of 22.0 years \((SD, 3.7)\), 22.3\% were female.

At baseline, 34.7\% (n=104) and 65.3\% (n=196) of soldiers were categorized into the “low” (scoring <180 on the APFT) and “high” fitness categories, respectively. Mean APFT score for soldiers in the high fitness category was 220.1 \((SD, 25.5)\), while mean APFT score for soldiers in the low fitness category was 149.8 \((SD, 25.6)\). Mean APFT for the total study population was 195.7 \((SD, 42.1)\).

There were significant differences in Army ID \((p = 0.0179)\) and BCT confidence \((p <0.0001)\) scores between soldier APFT fitness categories, indicating that participants in the high fit category were more likely to report a higher degree of identification with the Army and higher BCT confidence at baseline. No other baseline differences were detected between APFT fitness categories.

Table 5.2 displays the number of soldiers in each of the APFT fitness categories, the number of cases where soldiers reported depressive symptoms on the end of cycle survey, and the odds ratios (OR’s) for depressive symptoms with associated 95\% confidence intervals (CI’s) for three logistic regression models. The unadjusted results from model 1 indicate that the odds of reporting depressive symptoms near the end of the
BCT cycle were 60% lower for soldiers in the high fitness category (OR 0.40, CI 0.21-0.77, \(p_{value} = 0.0061\)), compared to soldiers in the low fitness category.

Model 2 adjusted for age, sex, race, education level, marital status, family income (annually), BCT confidence score, and Army ID score. Results from model 2 indicate that the odds of reporting depressive symptoms near the end of the BCT cycle were 57% lower for soldiers in the high fitness category (OR 0.43, CI 0.21-0.89, \(p_{value} = 0.0233\)), compared to soldiers in the low fitness category.

The results of model 3 show essentially the same association between APFT physical fitness category and odds of reporting depressive symptoms near the end of the BCT cycle, after adjustment for the variables in model 2, plus self-reported average sleep duration prior to BCT ≤ 7 hours/night (yes or no), and baseline CES-D score. In model 3, the odds of reporting depressive symptoms near the end of the BCT cycle were 60% lower for soldiers in the high fitness category (OR 0.40, CI 0.19-0.84, \(p_{value} = 0.0148\)), compared to participants in the low fitness category.

**Discussion**

**Summary of Findings**

Results from our longitudinal analyses show that compared to soldiers in the low fitness category, soldiers in the high fitness category had significantly lower odds of reporting depressive symptoms at the end of BCT. These findings are consistent with results from recent studies conducted in civilian populations which show an inverse association between cardiorespiratory fitness level and odds of reporting depressive symptoms in healthy individuals (Dishman et al., 2012; Sui et al., 2009), and odds of
reporting depressive symptoms in individuals who have high levels of chronic stress (Gerber et al, 2013).

Physical fitness is recognized by the Army as one of the key components necessary to increase resiliency in soldiers throughout their Army careers (Casey Jr, 2011). However, unlike other factors related to the “psychological fitness” of soldiers during BCT, the psychological benefits of physical fitness have been largely ignored with respect to assessment and interventions prior to, and during, BCT (Meredith et al., 2011). Physical fitness might provide a potential target for preventative interventions aimed at increasing resiliency to stressors, improving the psychological adjustment of soldiers, and ultimately reducing attrition during BCT, as well as later in soldiers’ Army careers. Focusing on physical fitness could also help reduce barriers to mental health programming, by placing emphasis on psychological resilience programming within a currently accepted and established Army physical training doctrine.

**Potential Mechanisms**

Mechanisms underlying the impact of physical fitness on the psychological health of soldiers during BCT are unknown. Animal studies and human studies in the civilian literature suggest that the psychological benefits associated with physical training might be partially attributed to physiological adaptations in stress response systems such as the hypothalamic-pituitary-adrenal (HPA) axis and the sympathetic nervous system (SNS) (Tsatsoulis & Fountoulakis, 2006; Wittert at al., 1996). Multiple studies have reported improvements in cortisol, catecholamine levels, cardiovascular reactivity, and other stress-related physiological responses in physically active or physically fit individuals (for a review, see Salmon, 2001).
Psychological mechanisms that have been hypothesized to underlie the psychological benefits of physical training include increased self-efficacy (Bodin & Martinsen, 2004; Dishman et al., 2006; White et al., 2009). Physical training can also impact related constructs such as increased coping self-efficacy (Brown & Siegel, 1988) and self-esteem (McAuley et al., 2005; Schmalz, Deane, Birch, & Davison, 2007; White et al., 2009).

In the BCT environment, soldiers with high physical fitness may exhibit increased levels of self-efficacy, coping self-efficacy, and/or self-esteem, which may have a positive impact on their ability to cope with the stressors and psychologically adjust to BCT. Indeed, studies have shown that higher self-efficacy during BCT may be associated with reduced levels of perceived stress (Davis, 2006), as well as reduced attrition (Hadid et. al, 2008) during BCT.

**Strengths and Limitations**

This study has several strengths which add to the existing literature on the association between physical fitness and depressive symptoms. First, to our knowledge, this is the first study of the association between physical fitness and depressive symptoms in soldiers during BCT. Second, by conducting the study at Fort Jackson, the largest and most active Initial Entry Training center in the U.S. Army, soldiers in this study were representative of the typical BCT training population. According to the US Army Training Center (USATC), Fort Jackson holds the distinction of training 50% of all soldiers, including 60% of all female soldiers entering the Army each year (US Army Training Center, 2013). Third, this study employed a standardized objective measure of physical fitness, whereas existing population-based studies have primarily relied on self-
reported measures of physical activity (Camacho, Roberts, Lazarus, Kaplan, & Cohen, 1991; Goodwin, 2003; Harvey, Hotopf, Overland, & Mykletun, 2010; Strohle et al., 2007). Fourth, this study controlled for covariates which have been shown to moderate the association between physical fitness and depressive symptoms in our study population.

However, there were also several limitations of this study. First, although the CES-D has been shown to be a valid measure of depressive symptoms in both young adults and in military populations (Boisvert et al., 2003; Radloff, 1991), the CES-D is not a clinical diagnostic tool for depression. The CES-D questionnaire was originally developed for the purpose of identification of individuals who may have clinically significant depressive symptoms that may require more intensive evaluation (Radloff, 1977). Although the CES-D has been used in previous population-based studies to measure depressive symptoms (Davidson, 2000; Dishman et al., 2012; Sui et al., 2009), as well as psychological adjustment (Park & Fenster, 2004), the CES-D data in this study should be interpreted with caution.

Second, although the prospective design of the study has advantages over cross-sectional designs, the measurements were made at only two time points. Survey responses at the end of BCT may not have been representative of the responses of the approximately 4% of soldiers estimated to have attrited prior to the end of the BCT cycle (Swedler et al., 2011). However, we attempted to minimize selection bias by recruiting a large and representative sample at the study onset, anticipating both soldier attrition and potential missing data for survey responses during this study. Moreover, no significant differences were found between baseline demographic and behavioral characteristics
between participants with complete survey and APFT data, and participants with missing
data who were excluded from the analysis.

A third limitation of this study may exist in the survey procedures. Although
efforts were made to assure soldiers that their survey answers would remain anonymous,
completion of the survey at Fort Jackson in the presence of drill sergeants could have had
an influence on survey responses, or the willingness of the BCT soldiers to answer survey
questions. Indeed, there remains a stigma of perceived “weakness” associated with
mental illness in the military, as well as a fear of jeopardizing one’s military career
advancement by reporting mental health-related issues (Britt, et al., 2007). Thus,
measurement of depressive symptoms in this study may have resulted in a conservative
estimate of the prevalence of these symptoms. Taking these limitations into account, we
advise caution when interpreting the results of this study.

Conclusions

Our findings suggest an association between physical fitness levels of soldiers at
BCT entry and depressive symptoms near the end of the BCT cycle. These results are
consistent with previous cross-sectional and longitudinal studies conducted in civilian
populations. Further research is needed to better understand this association and could
inform future military policies and interventions aimed at improving the psychological
health of soldiers during BCT.
Figure 5.1. Flow of Participants through study

Abbreviations: APFT = Army Physical Fitness Test

CES-D = Center for Epidemiological Studies Depression Scale
Table 5.1 *Baseline characteristics of study participants by APFT fitness categories*

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Lowᵃ</th>
<th>Highᵇ</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants, n (%)</td>
<td>104 (34.67%)</td>
<td>196 (65.33%)</td>
<td>—</td>
</tr>
<tr>
<td>Age, years (mean ± SD)</td>
<td>21.61 ± 3.22</td>
<td>22.24 ± 3.90</td>
<td>0.1301</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td>0.6055</td>
</tr>
<tr>
<td>Male, n (%)</td>
<td>79 (75.96%)</td>
<td>154 (78.57%)</td>
<td></td>
</tr>
<tr>
<td>Female, n (%)</td>
<td>25 (24.04%)</td>
<td>42 (21.43%)</td>
<td></td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td>0.8625</td>
</tr>
<tr>
<td>Non-Hispanic, n (%)</td>
<td>90 (86.54%)</td>
<td>171 (87.24%)</td>
<td></td>
</tr>
<tr>
<td>Hispanic, n (%)</td>
<td>14 (13.46%)</td>
<td>25 (12.76%)</td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td>0.4995</td>
</tr>
<tr>
<td>Black, n (%)</td>
<td>28 (26.92%)</td>
<td>41 (20.92%)</td>
<td></td>
</tr>
<tr>
<td>White, n (%)</td>
<td>60 (57.69%)</td>
<td>123 (62.76%)</td>
<td></td>
</tr>
<tr>
<td>Other, n (%)</td>
<td>16 (15.38%)</td>
<td>32 (16.33%)</td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td>0.2645</td>
</tr>
<tr>
<td>High school degree, n (%)</td>
<td>42 (40.38%)</td>
<td>73 (37.24%)</td>
<td></td>
</tr>
<tr>
<td>Associate’s degree or some college, n (%)</td>
<td>53 (50.96%)</td>
<td>93 (47.45%)</td>
<td></td>
</tr>
<tr>
<td>College degree or higher, n (%)</td>
<td>9 (8.65%)</td>
<td>30 (15.31%)</td>
<td></td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
<td>0.3823</td>
</tr>
<tr>
<td>Married, n (%)</td>
<td>14 (13.46%)</td>
<td>34 (17.35%)</td>
<td></td>
</tr>
<tr>
<td>Not married, n (%)</td>
<td>90 (86.54%)</td>
<td>162 (82.65%)</td>
<td></td>
</tr>
<tr>
<td>Family income (annually)</td>
<td></td>
<td></td>
<td>0.4191</td>
</tr>
<tr>
<td>“I don’t know,,” n (%)</td>
<td>8 (7.69%)</td>
<td>23 (11.73%)</td>
<td></td>
</tr>
<tr>
<td>&lt; 25,000, n (%)</td>
<td>28 (26.92%)</td>
<td>57 (29.08%)</td>
<td></td>
</tr>
<tr>
<td>25,000-50,000, n (%)</td>
<td>16 (15.38%)</td>
<td>31 (15.82%)</td>
<td></td>
</tr>
<tr>
<td>50,000-75,000, n (%)</td>
<td>13 (12.5%)</td>
<td>13 (6.63%)</td>
<td></td>
</tr>
<tr>
<td>&gt; 75,000, n (%)</td>
<td>39 (37.50%)</td>
<td>72 (36.73%)</td>
<td></td>
</tr>
<tr>
<td>Sleep duration</td>
<td></td>
<td></td>
<td>0.2606</td>
</tr>
<tr>
<td>&lt; 7 hours, n (%)</td>
<td>21 (20.19%)</td>
<td>51 (26.02%)</td>
<td></td>
</tr>
<tr>
<td>&gt; 7 hours, n (%)</td>
<td>83 (79.81%)</td>
<td>145 (73.98%)</td>
<td></td>
</tr>
<tr>
<td>CES-D (mean ± SD)</td>
<td>9.50 ± 3.84</td>
<td>9.52 ± 3.48</td>
<td>0.9721</td>
</tr>
<tr>
<td>Army ID (mean ± SD)</td>
<td>4.20 ± 0.56</td>
<td>4.36 ± 0.55</td>
<td>0.0179</td>
</tr>
<tr>
<td>BCT confidence (mean ± SD)</td>
<td>4.25 ± 0.52</td>
<td>4.58 ± 0.42</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

APFT=Army Physical Fitness Test; CES-D = Center for Epidemiological Studies Depression Scale; BCT = Basic Combat Training; ID = identification

ᵃ APFT total score < 180
ᵇ APFT total score ≥ 180
<table>
<thead>
<tr>
<th>APFT fitness category</th>
<th>n</th>
<th>Cases</th>
<th>Incidence (%)</th>
<th>OR (95% CI)</th>
<th>OR (95% CI)</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (APFT score &lt; 180)</td>
<td>104</td>
<td>23</td>
<td>22.1</td>
<td>1.0 (Referent)</td>
<td>1.0 (Referent)</td>
<td>1.0 (Referent)</td>
</tr>
<tr>
<td>High (APFT score ≥ 180)</td>
<td>196</td>
<td>20</td>
<td>10.2</td>
<td>0.40 (0.21-0.77)</td>
<td>0.43 (0.21-0.89)</td>
<td>0.40 (0.19-0.84)</td>
</tr>
</tbody>
</table>

**P value**

0.0061  
0.0233  
0.0148

OR=odds ratio; CI=confidence interval; APFT=Army Physical Fitness Test; CES-D=Center for Epidemiological Studies – Depression Scale; 
n=sample size; cases=individuals with CES-D score ≥ 16 on CES-D equivalent survey.

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*a* Model 1: unadjusted model.

*b* Model 2: adjusted for age, sex, race, education level, marital status (married/not married), family income (annually), BCT confidence, and Army ID.

*c* Model 3: adjusted for all variables in model 1 plus baseline CES-D score, self-reported average sleep duration prior to BCT ≤ 7 hours/night (yes or no).
CHAPTER SIX

SUMMARY AND CONCLUSIONS

Psychobiological responses to stress have been widely studied in civilian populations (Kessler et al., 1992; Park & Fenster, 2004). However, there is a need for investigation of factors associated with better psychological health of soldiers during BCT, as these factors may have important implications for soldiers’ psychological adjustment to military life and career. Indeed, mental health-related problems are a significant portion of early career attrition in the Army (Niebuhr et al., 2011). One association that has promise as a potential avenue of exploration for the BCT environment is that between physical fitness and mental health. To our knowledge, there has been no research of the association between physical fitness and psychological health outcomes of soldiers during BCT.

This dissertation was designed to investigate the association between physical fitness and psychological health outcomes during BCT, via three studies: (1) a review of the relationship between physical fitness and psychological adjustment during BCT, (2) a qualitative study of sleep during basic combat training, and (3) a prospective study of the association between physical fitness and depressive symptoms in soldiers during BCT. Study one involved an extensive literature review of evidence related to physical fitness and psychological adjustment of soldiers during Army BCT. Also included were studies conducted in civilian populations which were conceptually relevant to the investigation
of the association between physical fitness and psychological adjustment of soldiers during BCT.

Conclusions of the literature review were that there were significant gaps in in the existing literature pertaining to the association between physical fitness and soldiers’ psychological adjustment during BCT. Exploration of factors in the BCT environment that may impact the psychological adjustment of soldiers during BCT, and comparison studies of the psychological adjustment of soldiers with high and low levels of physical fitness at BCT entry, would help to fill such gaps, and also provide important information for current Army pre-accession programs and practices.

One factor, which might partly mediate an association of physical fitness with psychological adjustment during BCT, is the soldiers’ sleep during BCT. Studies suggest that inadequate sleep during BCT could increase incidents of injury and of physical and mental stress, and could impair ability to learn complex skills (Curcio et al., 2006; Edmonds & Vinson, 2007; Flanagan, 2011; Franzen et al., 2008; Harvey, 2011; Walker, 2008). Moreover, sleep loss during BCT might precipitate or exacerbate depression and anxiety, which have been associated with attrition during military training (Cigrang et al., 1998; Larson et al, 2002; Martin et al., 2006).

Study two was designed to assess soldiers’ perceptions about their sleep, and consequences of sleep disruption during BCT at Fort Jackson in Columbia, SC. Soldiers (age ≥ 18 years) were assessed in 45-60 min focus group sessions involving three groups of female soldiers (total n=28) and three groups of male soldiers (total n=38). Findings from study two indicated that soldiers’ sleep duration was abruptly curtailed from an average of 8-9 hours per night prior to BCT, to an average of 5-6 hours per night during
BCT. This greatly shortened sleep schedule may have implications for soldier psychological health outcomes during BCT. In studies conducted in civilian populations, self-reported sleep duration of \( \leq 7 \) hours per night in young adults has been associated with increased psychological distress (Chang, Ford, Mead, Cooper-Patrick, & Klag, 1997; Glozier et al., 2010), and has been implicated prospectively as an independent risk factor for the persistence of psychological distress (Glozier et al., 2010).

Soldiers also reported that during BCT, sleep became much more interrupted due to many factors including anxiety, fireguard duty, and noises associated with group housing in the barracks. These sleep interruptions may reduce sleep quality in soldiers during BCT, which may have adverse effects on well-being in soldiers during BCT. Indeed, poor sleep quality has been correlated with increased physical health complaints, and increased feelings of anxiety and depression in young adults in civilian populations (Breslau, Roth, Rosenthal, & Andreski, 1996; Gregory et al., 2011; Pilcher, Ginter, & Sadowsky, 1997).

Soldiers also reported more difficulty adapting to the BCT sleep environment in the first few weeks of BCT, noting that it became easier to adapt to the sleep environment as they progressed through the BCT cycle. Interestingly, soldiers in the lower fitness groups reported having more difficulty adapting to the BCT sleep environment than soldiers in the high fitness group. Overwhelmingly, soldiers reported being irritable as a result of sleep loss, and many of the soldiers mentioned that their interpersonal skills had suffered because of this.

Interestingly, compared with the high fit soldiers, the low fit soldiers reported more stress and anxiety, which, in turn, was associated with more sleep disturbance and
greater difficulty adjusting to BCT. The greater sleep-related problems found in the lower fit soldiers might partly mediate higher prevalence of other difficulties with BCT, including stress-related mood disturbances; but much further investigation is needed in this area.

To further investigate the association between physical fitness and psychological adjustment during BCT, study three prospectively examined the association between physical fitness and depressive symptoms in 300 soldiers during BCT at Fort Jackson. Soldiers completed a baseline Army Physical Fitness Test (APFT) and survey assessment within one week of arriving at BCT, and an end of cycle survey after eight weeks of BCT. Physical fitness level was determined using the Army standard APFT passing score of greater than or equal to 180 points out of 300 points to assign soldiers to the “high” fitness category, and less than 180 points to assign soldiers to the “low” fitness category. Depressive symptoms were measured using the 20-item Center for Epidemiologic Studies Depression Scale (CES-D).

Soldiers ranged in age from 18-35 years, with a mean age of 22.0 years ($SD$, 3.7), 22.3% were female. At baseline, 34.7% (n=104) and 65.3% (n=196) of soldiers were categorized into the “low” (scoring <180 on the APFT) and “high” fitness categories, respectively. Mean APFT score for soldiers in the high fitness category was 220.1 ($SD$, 25.5), while mean APFT score for soldiers in the low fitness category was 149.8 ($SD$, 25.6).

One unadjusted model and two multivariate models were used in the analysis for study three. The unadjusted results from model 1 indicate that the odds of reporting depressive symptoms near the end of the BCT cycle were 60% lower for soldiers in the
high fitness category (OR 0.40, CI 0.21-0.77, \( p_{value} = 0.0061 \)), compared to soldiers in the low fitness category.

After adjusting for age, sex, race, education level, marital status, family income (annually), BCT confidence score, and Army ID score, results from model two indicated that the odds of reporting depressive symptoms near the end of the BCT cycle were 57% lower for soldiers in the high fitness category (OR 0.43, CI 0.21-0.89, \( p_{value} = 0.0233 \)), compared to soldiers in the low fitness category. The results of model three showed essentially the same association between APFT physical fitness category and odds of reporting depressive symptoms near the end of the BCT cycle, after adjustment for the variables in model one, plus self-reported average sleep duration prior to BCT < 7 hours/night (yes or no), and baseline CES-D score. In model three, the odds of reporting depressive symptoms near the end of the BCT cycle were 60% lower for soldiers in the high fitness category (OR 0.40, CI 0.19-0.84, \( p_{value} = .0148 \)), compared to soldiers in the low fitness category.

The findings from study three suggest an association between the physical fitness levels of soldiers at BCT entry and depressive symptoms near the end of the BCT cycle. These results are consistent with previous cross-sectional and longitudinal studies conducted in civilian populations, which show an inverse association between physical activity/fitness and depressive symptoms (Brunet et al., 2013; Farmer et al., 1988; Dishman et al., 2012; Mikkelsen et al., 2010; Sui et al., 2009).

Overall, results of these studies suggest an association between physical fitness and better psychological health outcomes in soldiers during BCT. However, considering that this topic has been scarcely investigated in the BCT environment, information
obtained from these studies should be considered a preliminary step in the investigation of this association. Further research is needed in this area, and should include larger scale, quantitative, and randomized controlled trial (RCT) study designs in order to better ascertain the association of physical fitness with mental health outcomes in BCT soldiers. Measurements of perceived stress, coping, and soldier attrition outcomes would also increase our understanding of the relationship between physical fitness and factors related to the psychological adjustment of soldiers during BCT. Further investigation of this association may inform interventions aimed at increasing resiliency to stressors, improving the psychological adjustment of soldiers, and ultimately reducing attrition during BCT.
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