THE ASSOCIATION OF HEALTH RISK BEHAVIORS AND OCCUPATIONAL INJURY AMONG U.S. ARMY BASIC TRAINEES

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ABSTRACT

Knowledge of behavioral risk factors for occupational injury, especially among young workers, is limited. This study investigated the association of health risk behaviors with injuries sustained by young men and women during Army basic training. Self-reported questionnaire data on prior health risk behaviors collected upon entry to training were linked to medical data on injuries occurring during the nine-week training period. Multivariate survival analysis was used to model the association of training-related injury with a combined risk-taking index consisting of five individual health risk behaviors (cigarette use, smokeless tobacco use, alcohol use, weight control practices, and diet/lifestyle choices). Analysis was conducted separately for men and women, and models controlled for demographic, physical fitness, and physiologic characteristics. Among this multi-ethnic sample of 1,156 young men and 746 women (median age: 19), cumulative injury incidence was 4.2 trainees/1,000 trainee-days for men and 9.3 trainees/1,000 trainee-days for women. Males in both the lowest (HR=1.73, 95%CI: 1.47, 2.05) and highest (HR=1.92, 95%CI: 1.57, 2.34) combined risk-taking index categories had greater risk of training-related injury compared to persons within one standard deviation of the mean combined risk index score. Cigarette use was independently associated with training-related injury; males in the medium risk cigarette use index category had 1.8 times the risk of a training-related injury compared to the low risk category (HR=1.77, 95%CI: 1.31, 2.40). An association between the combined risk-taking index and injury was not seen among females. However, females in the high risk cigarette use category (HR: 1.53, 95%CI: 1.10, 2.12) and females in the medium (HR: 1.08, 95%CI: 1.03, 1.14) and high risk (HR: 1.52, 95%CI: 1.21, 1.93) diet/lifestyle

categories had higher risk of training-related injury compared to females in low risk categories. Among females, injury risk was more closely associated with individual health risk behaviors related to cigarette use and diet/lifestyle choices. Among males, risk-taking as measured by prior self-reported health risk behaviors was associated with training-related injury while controlling for known risk factors. These data suggest that occupational injury risk, particularly among young males, is influenced by risk taking-tendency, a behavioral risk factor worthy of further study.

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INTRODUCTION

This dissertation examines the relationship between health risk behaviors and injury among a multi-ethnic population of 1,902 young men and women (median age: 19) who entered U.S. Army basic training between March and June 2003. Self-reported questionnaire data on prior health risk behaviors were collected upon entry to training. These data were linked to medical surveillance data on injuries occurring during the nine-week basic training period. Multivariate survival analysis was used to model the relationship of a combined risk-taking index, developed from information on prior health risk behaviors, and training-related injury. Analysis was conducted separately for men and women, and models controlled for demographic, physical fitness, and physiologic characteristics.

This study contributes to knowledge on the relationship between health risk behaviors and occupational injury, and in particular offers insight into the association of health risk behaviors and injury risk among working-age young adults. Additionally, physiologic risk factors for injury in military training populations have been well-established, and this study addresses a gap in the knowledge of behavioral risk factors for training-related injury in the population from which the study sample is drawn.

In this first chapter, background literature providing the rationale for this study is presented. In the chapter that follows, a more detailed review of supporting literature will be discussed, along with specific research aims and the theoretical models that guided this work.

Health risk behaviors: a measure of risk-taking tendency

Health behaviors have been defined as "the combination of knowledge, practices, and attitudes that together contribute to motivate the actions we take regarding health" (Last 2001). *Risk behaviors* are those behaviors that can compromise one's health or success in life (Jessor 1991); the term *risk-taking behavior* has been used to describe the same concept (Igra and Irwin 1996). Combining these terms, *health risk behaviors* refer specifically to health-related behaviors that can compromise an individual's health and well-being. A familiar example of a health risk behavior is alcohol use, which has been linked to numerous adverse health and life-compromising outcomes such as cirrhosis, hemorrhagic stroke, cancer, and injury (U.S. Preventive Services Task Force 1996).

Health risk behaviors have been recognized as the true "root causes" of disease and injury, with behaviors such as tobacco use, poor diet and low physical activity levels, and alcohol use contributing to more than 800,000 deaths annually (McGinnis and Foege 1993). As the importance of measuring health risk behaviors was recognized, large national datasets containing information on multiple risk behaviors were established (e.g., Behavioral Risk Factor Surveillance System in 1984, Youth Risk Behavior Surveillance System in 1989). These data enabled research on the effects of multiple health risk behaviors and the investigation of a growing number of theoretical discussions suggesting these behaviors co-occurred.

In the injury field, researchers have begun to use available information on multiple health risk behaviors to create measures of risk-taking tendency (Jovic, Vorko et al. 2001; Pickett, Garner et al. 2002; Pickett, Schmid et al. 2002). Risk-taking is a behavioral risk factor of persistent interest to the injury community, but to date has been

investigated in only a few high-quality, published analytic studies (Turner, McClure et al. 2004). A systematic review of the literature from 1966-2002 found only seven analytic epidemiology studies that included risk-taking as a potential independent risk factor for unintentional injury (Turner, McClure et al. 2004). These previous studies were limited by reliance on self-reported injury data, cross-sectional survey design, convenience samples, or by use of only one behavior as an indicator of risk-taking tendency (Turner, McClure et al. 2004).

Even fewer studies of risk-taking and occupational injury risk have been done, despite the concern and suggestion that risk-taking contributes to occupational injury risk as well (Occupational Safety and Health Administration 1998; U.S. Department of Health and Human Services August 1997). A number of occupational injury studies have measured safety behaviors, rather than injury, as an outcome (Farid and Lirtzman 1991; Salminen and Klen 1994; Alavanja, Sprince et al. 2001; Schenker, Orenstein et al. 2002; Reed, Westneat et al. 2003; Garcia, Boix et al. 2004). Of those studies in which injury or accidents were the outcome of interest, several focused on evaluating the role of perceived control (Janicak 1996; Greening 1997; Hechanova-Alampay and Beehr 2001), a contributing psychological factor described in a number of occupational injury conceptual models (Huang, Feuerstein et al. 2002).

Very few studies with an occupational injury outcome have included measures of risk-taking in their analyses. In a study by Kahn et al., analysis of ambulance crash data found a greater proportion of ambulance drivers involved in fatal crashes had prior motor vehicle crashes and prior motor vehicle convictions (measures of risky driving) compared to the general population (Kahn, Pirrallo et al. 2001). A study by Cohen et al. indicated

that persons with a suspended or revoked drivers license were 2.3 times more likely to be involved in a ladder-related fall, although this relationship did not persist when controlling for ladder use behaviors and work environment (Cohen and Lin 1991). Although these studies suggest that risk-taking plays a role in occupational injury risk, conclusions are limited by the exclusion of the risk-taking measure from multivariate analyses (Kahn, Pirrallo et al. 2001) and use of only one surrogate measure of risk-taking (Cohen and Lin 1991).

More convincing evidence on the role of risk-taking with occupational injury risk is offered by Westaby et al. In their longitudinal assessment of injury among youth employed in agriculture, a survey was used to collect information on dangerous risk-taking and other factors, such as gender, prior injury, safety consciousness, safety knowledge, self-esteem, and leadership self-concept (Westaby and Lee 2003). Dangerous risk-taking, as measured by a five-item scale, had the strongest association with injury over time, leading to the authors' conclusion that individuals exhibiting high levels of dangerous risk-taking "are prime candidates for intervention" (Westaby and Lee 2003). A study by Forrester et al. also found an index of non-occupational risk-taking behavior, as measured by alcohol use, non-use of seat belts, exposure to violence, use of a motorcycle, and drinking and driving history, was associated with occupational injury risk (Forrester, Weaver et al. 1996). The authors concluded that personal risk-taking behavior appeared to translate to risk-taking behavior in the occupational environment (Forrester, Weaver et al. 1996).

Risk-taking and occupational injury: the selected study population

After a period of strong emphasis on environmental interventions, the injury field has once again begun to call for additional exploration of behavioral risk factors for injury (Bonnie, Fulco et al. 1998; Gielen and Sleet 2003). The effects of risk perception and risk-taking among subsets of the population at greatest risk of injury are of particular interest (Bonnie, Fulco et al. 1998) and the need for behavioral risk factor information is even greater for a less frequently-studied subset of injuries, those that are work-related (U.S. Department of Health and Human Services 1998; U.S. Department of Health and Human Services 2001; U.S. Department of Health and Human Services August 1997).

With over 1.4 million active duty service members (Defense Medical Surveillance System 2005), the Department of Defense is one of the largest employers and health care providers in the nation. Although medical surveillance data show that injuries have been a leading health problem for the U.S. military for decades (Jones, Amoroso et al. 1999), in recent years, the problem has come to the attention of policymakers at the highest levels of the Department of Defense (Rumsfeld 2003). As a result, the U.S. military is keenly interested in understanding injury risk factors, and ultimately preventing injuries, reducing healthcare costs and attrition due to injury, and ensuring the "readiness" of military service members (i.e., the ability of the service members to perform essential job duties).

As will be discussed in the next chapter, military populations, particularly those in training, experience high rates of injury. Demographic and physiologic risk factors for injury risk associated with military training have been well-documented, but little is known about the role of risk-taking behavior with injury risk in military populations. It

has been suggested that injuries among U.S. Army Soldiers are, in part, due to a large number of "risk-takers" attracted to and enlisting in the U.S. Army (Rothberg, Bartone et al. 1990; Bell, Amoroso et al. 2000; Garvey Wilson, Lange et al. 2003; Knapik, Jones et al. 2005). This dissertation will explore this idea, as well as the relationship between risk-taking and training-related injury.

BACKGROUND and LITERATURE REVIEW

For the nine weeks of basic combat training, trainees spend twenty-four hours a day with their peers and drill sergeants. The training received provides basic military occupational skills such as rifle marksmanship, hand-to-hand combat, and teamwork in negotiating physical obstacles. Improving physical fitness, agility, and confidence are key goals, as is education in Army standards of conduct and introduction to military traditions.

Individuals in Army basic combat training range in age from 17 to 35, although approximately seventy-five percent of trainees are between the ages of 17-20 (U.S. Army Accession Medical Standards and Research Activity 2001); only a select few are allowed to enter basic training after age 35 if they had prior military service. The gender distribution in basic training is typically 60% male and 40% female, the majority of whom are white (49-56%), followed by black (27-34%) and Hispanic (6-24%) (Knapik, Sharp et al. 1999; Canham-Chervak, Knapik et al. 2000; Knapik, Darakjy et al. 2005). Given that multiple studies of basic training populations have shown that the highest education level of approximately 80% of persons entering Army basic combat training is high school (Knapik, Sharp et al. 1999; Knapik, Darakjy et al. 2005) and the mean age of persons entering Army basic training is 20 years (Knapik, Sharp et al. 1999; Canham-Chervak, Knapik et al. 2000; Knapik, Darakjy et al. 2005), the adolescent health literature was reviewed to provide insight into health risk and risk-taking behaviors likely to be seen in the enlisted basic training population.

Risk-taking among adolescents and young adults

A great deal of research on risk-taking, both theoretical and empirical, has been conducted in the area of adolescent health risk behaviors and risk-taking. While the age range of adolescence has been debated (Irwin, Burg et al. 2002), developers of "adolescent" heath risk-taking theory have applied their theories to both high school and college-age individuals (Donovan and Jessor 1985; Donovan, Jessor et al. 1988; Severson, Slovic et al. 1993). National surveys and summaries of adolescent health data have also adopted a wide age range when describing adolescents; from 10-19 (MacKay, Fingerhut et al. 2000) and up to twenty-one years of age (Everett, Kann et al. 1997).

In searching for reasons for adolescent risk-taking, researchers have found biological, psychological, and social explanations for the greater propensity for risk-taking among adolescents. While social explanations for risk-taking (e.g., peer pressure, desire to "fit in") are well known, it has also been suggested that neurologic changes in the prefrontal cortex and limbic regions of the brain during adolescence may also contribute to greater risk-taking behavior (Spear 2000). From a psychological standpoint, Steinberg suggests that adolescents' greater propensity for risk-taking is due to underdeveloped self-regulation skills, skills that do not mature until early adulthood, and a concurrent desire for new and exciting experiences (Steinberg 2004). Kuther asserts that immature moral reasoning and a general egocentricity ("it's my own business") contributes to health risk-taking during adolescence (Kuther 2000).

Regardless of the underlying reasons for adolescent risk-taking behavior, there is recognition that some risk-taking during adolescence is "normal" and of value. Longitudinal studies have indicated that adolescent experimentation "paves the way to

independence and to more mature, successful adult commitments" (Moore and Parsons 2000). Newcomb and Bentler found adolescent alcohol use to be associated with positive outcomes such as higher perceived social support and reduced loneliness (Newcomb and Bentler 1988). Shedler and Block observed that experimental drug (primarily marijuana) users were better adjusted and had better psychological functioning compared to non-users and heavy users (Shedler and Block 1990).

Despite some value to experimentation, numerous studies warn of the negative health effects and adverse life consequences resulting from *chronic* health risk behaviors established during adolescence. Data from the National Household Survey on Drug Abuse have indicated that adolescent smoking and alcohol use is related to poorer subjective measures of health and a greater number of hospitalizations (Johnson and Richter 2002). Cigarette use during adolescence has been related to respiratory symptoms, reduced hardiness, psychosomatic complaints, and increased use of health services (Newcomb and Bentler 1987).

Among the adverse life consequences studied, a study by Hill et al. showed that, by age 13, heavy drinkers were less likely to be involved in clubs and other social activities, and had lower levels of parental bonding (Hill, White et al. 2000). Looking at longer-term effects, Horowitz found that alcohol use at age twenty-one was associated with delayed marriage and parenting, and lower marital success (Horowitz and White 1991). Use of cigarettes and hard drugs in high school has been directly related to dropping out of school prior to completion, lack of college attendance, employment at a younger age, and greater likelihood of being fired (Newcomb and Bentler 1986).

Furthering concern about adolescent health risk behaviors is the significant amount of scientific evidence that these behaviors co-occur. Studies have shown that negative health behaviors tend to cluster within individuals (Huizinga, Loeber et al. 1993; DiClemente, Hansen et al. 1996; Igra and Irwin 1996; Petridou, Zavitsanos et al. 1997; Brener and Collins 1998; Everett, Malarcher et al. 2000), forming a "risk behavior syndrome" (Jessor 1991; Gullone and Moore 2000). For example, in a study by Sabel et al., adolescents who reported drinking and driving and riding with a drinking driver also reported a higher quantity and frequency of drinking, more cigarette smoking and drug use, less seatbelt use, and gun carrying (Sabel, Bensley et al. 2004). In a study by Bachanas, teens reporting conduct problems and substance use also reported risky sexual behaviors (Bachanas, Morris et al. 2002). As might be expected, adolescents and young adults with multiple risk behaviors are more likely to experience negative health outcomes (Irwin, Burg et al. 2002).

Concerns about adolescent and young adult health risk behaviors have increased as links between early health behaviors and adult health have been demonstrated. Behaviors adopted in high school can persist during college (Wiley, James et al. 1997) and can affect one's health status as an adult (Shedler and Block 1990; Centers for Disease Control and Prevention, Council of State and Territorial Epidemiologists et al. 2004). For example, health risk behaviors such as low physical activity or smoking, initiated during adolescence, have been shown to contribute to the development of chronic diseases, such as obesity and heart disease, in adulthood (Public Health Service 1994; Public Health Service 1994).

Health risk behaviors among U.S. adolescents and young adults

The prevalence of selected health risk behaviors in a nationally-representative sample of students in grades 9-12 is presented in Table 1. These data from the 2001 National Youth Risk Behavior Survey (YRBS) indicate that the prevalence of cigarette and alcohol use among U.S. adolescents is 28.5% and 47.1%, respectively (Grunbaum, Kann et al. 2002). One third (33.4%) of students in grades 9-12 were currently sexually active (Grunbaum, Kann et al. 2002). YRBS data from 1991-2001 indicate that health risk behaviors such as the non-use of seat belts, drinking and driving, and sexual activity have declined over the last decade (Grunbaum, Kann et al. 2002). After a rise in cigarette and smokeless tobacco use in the early 1990s, declines in use have occurred since 1997 (Grunbaum, Kann et al. 2002).

Table 1. Prevalence of selected health risk behaviors among students in grades 9-12, National Youth Risk Behavior Survey, 2001 (Grunbaum, Kann et al. 2002)

Behavior	**%**
Cigarette use before age 13	22.1
Ever smoked ≥1 cigarette every day for 30 days	20.0
Smoked ≥1 day in previous 30 days	28.5
First drink before age 13	29.1
≥1 alcoholic drink in past 30 days	47.1
Drove after drinking in past 30 days	13.3
Seat belt use (never or rarely worn)	14.1
Sex before age 13	6.6
Sex in last 3 months	33.4

Some general trends in health risk behaviors include that health risk behaviors are more prevalent among adolescent boys (Grunbaum, Kann et al. 2002), although at specific ages, certain risk behaviors may be more prevalent among girls (Stevens and Griffin 2001). For example, in a sample of 674 middle school students, a higher proportion of 13-year-old girls reported cigarette and alcohol use compared to 13-year-old boys (Stevens and Griffin 2001). Boys are also more likely to exhibit multiple health

risk behaviors (Brener and Collins 1998; Duberstein Lindberg, Boggess et al. 2000; Stevens and Griffin 2001).

The prevalence of multiple risk behaviors increases with age among both boys and girls (Brener and Collins 1998; Duberstein Lindberg, Boggess et al. 2000; Stevens and Griffin 2001). The 1995 National Longitudinal Study of Adolescent Health indicated that 19% of students in grades seven and eight engaged in two or more risk behaviors while 36% of those in grades eleven and twelve engaged in two or more risk behaviors (Duberstein Lindberg, Boggess et al. 2000). In addition, risk behaviors vary according to ethnic group. During the 1990s, the prevalence of risk behaviors among Hispanic students decreased at a slower rate compared to the decrease in risk behaviors seen among white and black students (Duberstein Lindberg, Boggess et al. 2000). The proportion of Hispanic students engaging in multiple risk behaviors (five or more) also increased during this time period (Duberstein Lindberg, Boggess et al. 2000). The 2001 YRBS concluded that white and Hispanic students were significantly more likely than black students to report tobacco and alcohol use, while black students were more likely to have engaged in sexual intercourse (Grunbaum, Kann et al. 2002).

Injury and injury risk factors in adolescents and young adults

Unintentional injury is the leading cause of death for persons aged 1 to 34 in the United States (Bensel and Kish 1983; Anderson 2001; Centers for Disease Control and Prevention, Council of State and Territorial Epidemiologists et al. 2004). More specifically, among adolescents (10-19 years of age), there are 15,000 deaths each year, or one injury death per hour in this country (Runyan and Gerken 1989; Vyrostek, Annest et al. 2004). Injuries are also a leading cause of medical visits (Ziv, Boulet et al. 1998);

for every adolescent death, there are 41 hospitalizations and 1100 emergency room visits (Centers for Disease Control and Prevention 1993). In 2001, emergency department injury visit rates were highest for males and females aged 15-24 compared to all other age groups (Vyrostek, Annest et al. 2004). These injuries result in considerable costs; the Institute of Medicine estimated that, in 1995, 12% of all medical care costs were due to injury, with total direct and indirect costs of injury reaching $260 billion (Bonnie, Fulco et al. 1998).

Risk factors for adolescent injury include non-modifiable characteristics such as age, gender, and race (Paulson 1988; Runyan and Gerken 1989). However, health risk behaviors also play an important role. Behaviors such as the non-use of seat belts and helmets, speeding, alcohol use, tobacco use, and other health risk behaviors have been identified as risk factors for adolescent injury (Alexander, Ensminger et al. 1992; Kann, Kinchen et al. 2000; Mathews, Zollinger et al. 2001). Such risk behaviors are prevalent in adolescent populations (Cornell and Loper 1998; Leigh 1999; Kann, Kinchen et al. 2000) and injury risk is higher among those adolescents who participate in multiple health risk behaviors compared to those who do not engage in multiple health risk behaviors (Alexander, Ensminger et al. 1992; Pickett, Garner et al. 2002).

Occupational injury and injury risk factors in adolescents and young adults

Work-related injury rates are highest for persons 18-24 years of age compared to all other working-age adults (Smith, Wellman et al. 2005). The most current available estimates from national data sources indicate that, on average, sixty-seven young workers die as a result of work-related injury each year (West, de Castro et al. 2005), and over 64,000 adolescent emergency department visits are attributable to work-related injury

(Runyan and Zakocs 2000). Injuries can be severe; a review of studies of state-based workers compensation claim data and industry self-reported data indicated that between 15-45% of adolescents with a work-related injury could not work for one day or more and between 15-44% of injured adolescents sustained a permanent disability (Runyan and Zakocs 2000).

Although a number of national committees have identified a need for research on occupational injury risk factors among adolescents and young adults (National Research Council and the Institute of Medicine 2001; U.S. Department of Health and Human Services 2001; U.S. Department of Health and Human Services August 1997), work in this area remains limited. It is recognized that many of the adolescent tendencies discussed previously (e.g., sensation-seeking, immature reasoning) increase adolescents' susceptibility to workplace injury (Runyan and Gerken 1989; Brezler 1999; Castillo, Davis et al. 1999; Wegman and Davis 1999; West, de Castro et al. 2005; U.S. Department of Health and Human Services August 1997). Other characteristics of adolescence, such as inadequate experience, desire to prove independence and maturity, vulnerability to peer pressure, and pressure to excel may all contribute to an adolescent's inability to appropriately reject, or their willingness to attempt, tasks they are not capable of accomplishing (Hobbs and Williamson 2002; West, de Castro et al. 2005; U.S. Department of Health and Human Services August 1997).

Occupational injuries in the U.S. Army

With more than half its population less than 30 years of age (Defense Medical Surveillance System 2005), given the previously-presented injury statistics, it may be no surprise that the U.S. Army has found non-combat, unintentional injuries to be one of its

greatest health problems (Jones, Amoroso et al. 1999). Surveillance data provide evidence that unintentional injuries, during both peacetime and times of war, have consistently been a leading cause of death, disability, and hospitalization for the Army. From 1980-1994, unintentional injury was the leading cause of active duty Army personnel deaths (Helmkamp, Gardner et al. 1999). Over this same fourteen-year period, injury and musculoskeletal conditions were among the top four causes of Army active duty hospitalizations (Gardner, Amoroso et al. 1999).

As these data suggest, unintentional injuries result in significant costs to the Army. It is estimated that the Army medical department spent $111 million for outpatient visits in the year 2000 (U.S. Army Patient Administration Systems and Biostatistics Activity 2001). Costs do not come in the form of medical expenses only, however. Loss of work time, loss of trained personnel, and disability compensation are also significant (Amoroso, Yore et al. 1999).

Injuries during U.S. Army basic combat training

Beginning in 1980 and continuing through 2000, a series of studies looking at injuries during basic training documented cumulative injury rates (one or more injury visits) over the eight or nine-week basic training period of 19-37% for men and 42-67% for women (Kowal 1980; Bensel and Kish 1983; Jones, Bovee et al. 1993; Jones, Cowan et al. 1993; Westphal, Friedl et al. 1995; Knapik, Hauret et al. 2001; Knapik, Sharp et al. 2001). The most consistently demonstrated risk factor was slow two-mile run time as measured during the diagnostic Army Physical Fitness Test (APFT) administered at the start of basic training (Bensel and Kish 1983; Jones, Bovee et al. 1993; Jones, Cowan et al. 1993; Knapik, Ang et al. 1993; Reynolds, Knapik et al. 1994; Reynolds, Heckel et al.

1994; Canham 1998; Knapik, Sharp et al. 1999; Knapik, Hauret et al. 2001). In the two studies in which the "gold standard" measurement of aerobic fitness, maximal oxygen consumption (VO_{2max}), were measured in Army basic trainees, low VO_{2max} was associated with higher cumulative injury rates during basic training (Jones, Manikowski et al. 1988; Knapik, Sharp et al. 1999). Other fitness variables that have been associated with basic training injuries include poor sit-up performance during the diagnostic APFT (Bensel and Kish 1983; Jones, Bovee et al. 1993; Knapik, Ang et al. 1993; Reynolds, Knapik et al. 1994; Reynolds, Heckel et al. 1994; Canham 1998), poor push-up performance during the diagnostic APFT (Jones, Cowan et al. 1993; Knapik, Ang et al. 1993; Reynolds, Knapik et al. 1994; Reynolds, Heckel et al. 1994; Canham 1998; Knapik, Sharp et al. 1999), low levels of self-reported physical inactivity prior to basic training (Gardner, Dziados et al. 1988; Jones, Bovee et al. 1993; Jones, Cowan et al. 1993; Heir and Eide 1997), self-reported low physical fitness (Heir and Eide 1997; Shaffer, Brodine et al. 1999), extremes of flexibility (Jones, Cowan et al. 1993; Knapik, Sharp et al. 1999; Kaufman, Brodine et al. 2000), and prior injury (Jones, Cowan et al. 1993).

Other physiologic characteristics have also been identified as risk factors for injury during basic training. These include high arches (Giladi, Milgrom et al. 1985; Cowan, Jones et al. 1996; Kaufman, Brodine et al. 2000), bowlegged-ness (Cowan, Jones et al. 1996), and either high or low body mass index (Jones, Bovee et al. 1993; Reynolds, Heckel et al. 1994; Heir and Eide 1997; Knapik, Sharp et al. 1999). In addition, women (Jones, Bovee et al. 1993; Canham 1998; Knapik, Sharp et al. 1999; Canham-Chervak, Knapik et al. 2000; Henderson, Knapik et al. 2000; Hauret, Shippey et al. 2001; Knapik,

Hauret et al. 2001) and persons of older age (Gardner, Dziados et al. 1988; Jones, Cowan et al. 1993; Knapik, Ang et al. 1993; Heir and Eide 1997; Knapik, Sharp et al. 1999; Henderson, Knapik et al. 2000) have been shown to be at higher risk for injury during basic training.

Health risk behaviors associated with injuries among military personnel

Behavioral risk factors associated with basic training injuries have been investigated to a lesser extent. Studies evaluating the effect of smoking on military training-related injury indicated that smokers have a 1.5-2.3 times greater risk of overuse injuries compared to nonsmokers (Jones, Cowan et al. 1993; Reynolds, Heckel et al. 1994; Heir and Eide 1997; Knapik, Sharp et al. 1999; Altarac, Gardner et al. 2000). Investigations of alcohol use and its association with injury have shown that injury risk during basic training increased with an increase in the reported number of days per week that alcohol was consumed prior to basic training (Westphal, Friedl et al. 1995). More recently, research on a broader population of Army personnel showed that younger age, low utilization of seat belts (0-50% of the time), and heavy drinking (>21 drinks/week) were independently associated with motor vehicle accident-related injury hospitalizations (Bell, Amoroso et al. 2000).

Research aims

There are two main purposes of this dissertation: (1) to provide insight into the distribution and relationship between health risk behaviors among enlisted U.S. Army trainees (Research Aim A) and (2) to investigate the association of health risk behaviors with a health- and potentially career-compromising outcome, injury during basic combat training (Research Aim B). Research Aim A consists of descriptive and exploratory

analyses (Research Questions 1 and 2), which are followed by a series of multivariate regression analyses (Research Question 3) to address Research Aim B.

Research Aim A: Understanding health risk behaviors among enlisted U.S. Army basic trainees

Question 1: Describe the prevalence of health risk behaviors among U. S. Army trainees.

Hypothesis: Given that the median age of Army trainees is 19 years, health risk behaviors of incoming trainees will be similar to the prevalence of health risk behaviors reported among the general U.S. adolescent population.

Question 2: Investigate the patterns of health risk behaviors in this population.

Hypothesis 1: Health risk behaviors will be more prevalent among males compared to females.

Hypothesis 2: Health risk behaviors will co-occur in this study sample, as has been seen in other adolescent and young adult populations, i.e., trainees engaging in one health risk behavior will be more likely to engage in additional health risk behaviors.

Research Aim B:

Question 3: Examine the association of multiple health risk behaviors and risk of injury during basic training.

Hypothesis: Multiple health risk behaviors, as measured by a combined risk-taking index, will be associated with injury risk during Army basic combat training.

Theoretical basis

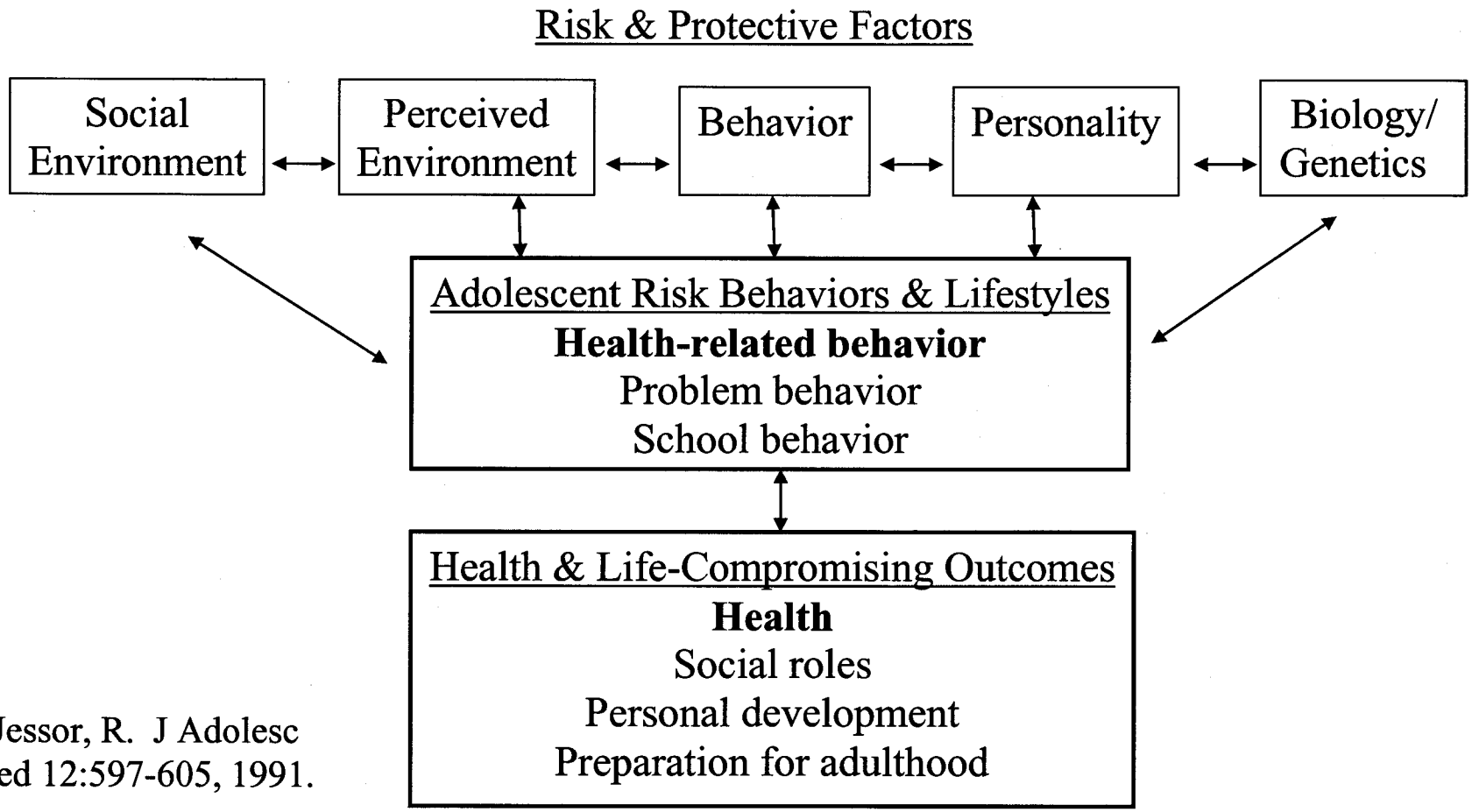
Existing occupational injury conceptual models were considered as potential theoretical guides for this work. However, the occupational injury models had minimal focus on the role of health risk behaviors; rather, these models focused on the association of injury with work factors (e.g., lack of rest, repetition, mechanical load), psychologic and social/organizational factors (e.g., job stress, job control, social support at work), and individual physiologic characteristics (e.g., pre-existing disease or injury, age, gender) (Tanaka and McGlothlin 1993; Burdorf, Rossignol et al. 1997; Hagberg, Christiani et al. 1997; National Research Council and the Institute of Medicine 2001; Huang, Feuerstein et al. 2002). As was seen during the evolution of chronic disease epidemiology (Jessor 1991), it appears that individual human behavior is the last risk factor genre to be thoroughly considered and investigated in the field of occupational injury.

Sports injury conceptual models were also considered. While selected measures of individual risk-taking tendencies, such as motivation, have been incorporated (McIntosh 2005), other models lacked consideration of measures of individual health risk-taking behaviors (Norton, Schwerdt et al. 2001; Eime, Owen et al. 2004).

As a result, the conceptual framework for and much of the theory behind this dissertation draws from the adolescent psychology literature, in which definitions of risk behavior and consequences of such behaviors have been discussed in-depth. Specifically, this dissertation tests the association of health risk behaviors with an adverse health outcome, a link that was proposed by Jessor in his model of adolescent problem behavior (Jessor 1991).

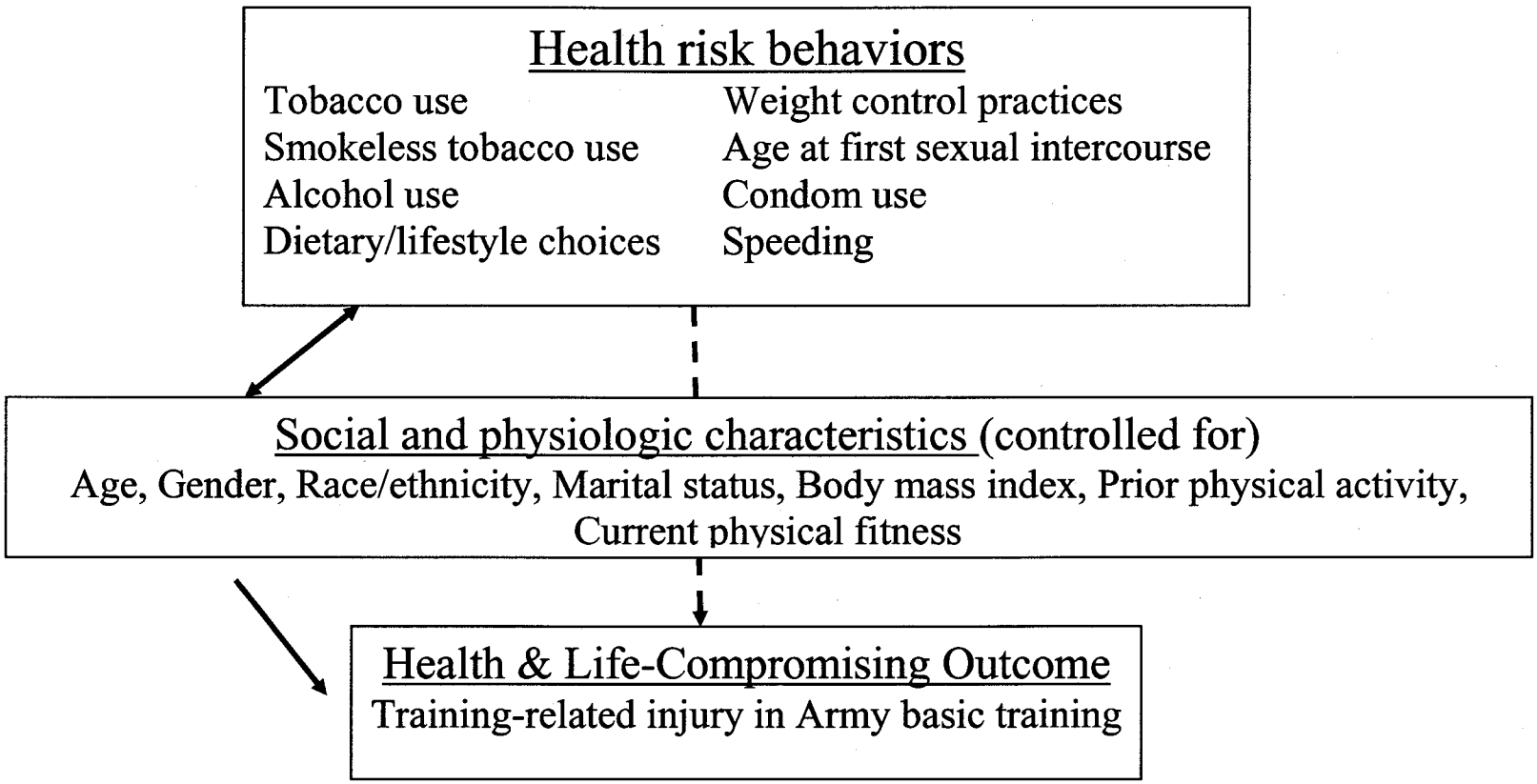
Jessor's model is based on social/developmental psychology. He suggests that personality traits, such as a "risk taking propensity", are linked to risk behaviors and lifestyle choices, to include health risk behaviors. These health risk behaviors are subsequently linked to health and life-compromising outcomes (Figure 1). This study tested a portion of Jessor's model: the link between health risk behaviors and a health and life-compromising outcome, injury during basic training (Figure 2). Injury during basic training can be considered a health *and* life-compromising outcome because of the potential for chronic medical problems that could result in disability, early termination of a military career, and decreased options for employment in the civilian workforce. Alternative models linking adolescent risk-taking with adverse health outcomes were considered (Alexander, Young et al. 1990; Zuckerman and Kuhlman 2000), however these models could not be tested using existing data available from the Army Recruit Assessment Program (RAP) survey.

Figure 1. Factors influencing adolescent risk behavior and subsequent adverse outcomes*
(Pathway of interest highlighted in **bold**)



* Jessor, R. J Adolesc Med 12:597-605, 1991.

Figure 2. An adaptation of Jessor's model: The association of selected health risk behaviors and training-related injury among Army basic trainees



METHODS

Data sources

Health risk behaviors and demographics

Health risk behavior data were obtained from a questionnaire that was administered as part of the U.S. Army Recruit Assessment Program (RAP) Pilot Study at Fort Jackson, South Carolina. Men and women entering enlisted basic training at Fort Jackson between October 2002 and May 2004 received an informed consent briefing on the pilot study within the first four days of their arrival to Fort Jackson Reception Station and prior to the initiation of basic training. The briefing was given by civilian research assistants; superiors were not allowed in the room during this time. Those who volunteered to participate were given 40 minutes to complete the questionnaire. Those who did not volunteer remained seated in the room for this time period. Data collected by the questionnaire included demographic information, work history, medical history, and mental health measures. Health risk behaviors captured by the questionnaire included tobacco and alcohol use, eating habits, sexual history, driving habits, methods of weight control used, and prior physical activity.

The questionnaire used during the Army RAP Pilot Study (Appendix A) was modeled after the questionnaire used by the U.S. Navy Recruit Assessment Program. Development of the Navy's questionnaire began in 1998 in response to a call from the Institute of Medicine (Institute of Medicine 1995) and several other scientific review panels (Department of Defense 1994; NIH Technology Assessment Workshop Panel 1994; Presidential Advisory Committee on Gulf War Veterans' Illnesses 1996) for a more comprehensive collection of health and exposure data on U.S. military personnel; these

recommendations resulted in response to the lack of information on exposures prior to and during the Persian Gulf War. A collaborative effort between the Department of Defense (DoD), Department of Veterans Affairs, and Department of Health and Human Services produced a questionnaire designed to assess baseline health characteristics of incoming recruits (Ostroff and Riddle 2002). In September 2002, the Armed Forces Epidemiology Board reviewed the RAP and issued a recommendation to the Assistant Secretary of Defense for Health Affairs to administer the RAP DoD-wide (Ostroff and Riddle 2002). A revised RAP survey (renamed the Health Assessment Research Tool for Accessions, or HART-A) is currently under DoD review. Plans suggest that the HART-A will be made available to epidemiologists and policy makers to assist in health promotion resource planning as well as to health care providers to assist with individual health counseling.

Comparability to other data sources was a priority (Hyams, Barrett et al. 2002); thus the designers of the original RAP questionnaire incorporated questions from validated survey instruments and a number of standard DoD medical data collection tools. The sources included the DoD Standard Form 93, the DoD Medical Outcomes Short Form (SF-12/36), the DoD Health Enrollment Assessment Review 2.0, the Revised DoD History Opinion Inventory, the Youth Risk Behavior Survey, the Alcohol Use Disorders Identification Test (AUDIT), the CAGE alcohol use survey, the National Comorbidity Study, and the PRIME-MD patient questionnaire (Young 2003).

The RAP questionnaire was piloted by the Naval Health Research Center (NHRC) at the Marine Corps Recruit Depot (MCRD), San Diego, California. The NHRC conducted two separate focus group tests to identify difficulties with individual questions

and the questionnaire in general. Results of the focus group testing led to the addition of two questions, the elimination of twenty-three repetitive or unnecessary questions, and the modification of twenty-one questions that were difficult to understand or did not include appropriate answers (Lane, Young et al. 2000). Reliability was assessed using a test-retest procedure with a sample of 195 Marine recruits (Lane, Young et al. 2000). The Kappa coefficient for the overall questionnaire was 0.93, with a range of 0.84-0.97 among the twelve sections of the questionnaire (Lane, Young et al. 2000).

The RAP questionnaire has been a part of recruit in-processing at the MCRD San Diego since June 2001. Changes since the Navy pilot test included rewording of particular questions with low response rates (Young 2002) and the addition of questions taken from the Adverse Childhood Experiences Study (Felitti, Anda et al. 1998). The questionnaire, with these changes, was adapted for use by the Army RAP Pilot Study in May 2002. A test-retest reliability analysis of the Army questionnaire showed acceptable reliability (Kappa coefficients ≥ 0.6) for all but the last section (Section 9) of the questionnaire (Canada, Canham-Chervak et al. 2005). Questions from this section were not used in this study.

Physical fitness and time-in-training

Physical fitness data are not captured in a surveillance system, so available data were limited to a subset of Fort Jackson trainees on whom Army Physical Fitness Test (APFT) data were previously collected by the U.S. Army Center for Health Promotion and Preventive Medicine Injury Prevention Program as part of a physical training program evaluation (Knapik, Darakjy et al. 2004). The sample consisted of

approximately 3,500 recruits who entered three different basic training battalions at Fort Jackson between March and June 2003.

The APFT consists of three events: (1) a two-mile run for time, (2) push-ups completed in a two-minute time period, and (3) sit-ups completed in a two-minute time period. Run time on the APFT has been shown to be a valid surrogate for the "gold standard" measurement of aerobic fitness, VO_{2max} (Knapik 1989). Performances on the push-up and sit-up events, measures of muscle endurance, are less correlated with "gold standard" measures of muscle endurance (Knapik 1989), but have been routinely included in investigations of fitness and injury in Army populations and have been associated with training-related injury risk in past studies. APFT data used in this study are from the first APFT test, administered within the first week of basic training, which represents physical fitness upon entry to training. As part of the APFT, data on height and weight are also collected; these data were also obtained to allow for calculations of body mass index (BMI).

Attrition data collected from the basic training units as part of the program evaluation were also obtained in order to calculate time-in-training for each trainee. Potential reasons for leaving the basic training unit prior to completion of the nine-week training cycle were (1) discharge from the Army or (2) transfer to another basic training unit. Discharges occurred for medical, motivational, and other reasons. Transfers occurred because of inability to complete mandatory training requirements according to the required unit schedule due to injury, emergency leave, lack of motivation, or a problem mastering a particular skill. Due to the rigidity of the basic training schedule, trainees who could not keep up with the pace of their current unit were required to change

units so that missed or incomplete training could be repeated. Although basic training units typically accept additional trainees throughout the training cycle, during the course of the program evaluation this was not allowed in these units.

Injury

Injury data were obtained from the Army Medical Surveillance Activity (AMSA), a program within the U.S. Army Center for Health Promotion and Preventive Medicine responsible for maintaining the Defense Medical Surveillance System (DMSS). As mandated by DoD Directive 6490.2, AMSA routinely receives, cleans, manages, and maintains electronic medical data for all inpatient and outpatient medical encounters for all active duty Service members. Inpatient and outpatient injury data were obtained on the sample for which APFT data were also available. Variables requested included hospitalization or outpatient visit dates, primary and secondary diagnoses, and disposition upon discharge from the treatment facility (e.g., discharged with or without work limitations). Diagnoses were recorded according to codes available in the International Classification of Disease, Ninth Edition, Clinical Modification (ICD-9-CM). Gender, date of birth, height, weight, and military pay grade were also requested and used to compare to RAP data to validate results of the data linkage and replace missing data when necessary.

Creation of health risk behavior indices

Twenty-three health risk behaviors were selected for consideration for inclusion in the health risk behavior indices (Table 2). These behaviors represented the following key categories of health risk behaviors: tobacco use, alcohol use, sexual behaviors, injury-related behaviors, and diet and general health behaviors. Since prior fitness was

intended to be a covariate in future multivariate analyses due to its association with injury in studies of military training (Gardner, Dziados et al. 1988; Jones, Bovee et al. 1993; Jones, Cowan et al. 1993; Heir and Eide 1997) , it was excluded from consideration for the indices. The selected behaviors were chosen based on their consistent classification in the literature as "risky", or putting an individual at risk for adverse health outcomes (Donovan, Jessor et al. 1988; Jessor 1991; Meschke 1998; Flay, Petraitis et al. 1999; Zuckerman and Kuhlman 2000; Centers for Disease Control and Prevention, Council of State and Territorial Epidemiologists et al. 2004; Flay, Graumlich et al. 2004; Ozer, Adams et al. 2004), including injury (Alexander, Ensminger et al. 1992; Sabel, Bensley et al. 2004; Smith-Khuri, Iachan et al. 2004). Whenever possible, measures of frequency, intensity, and duration were included.

Table 2. RAP questions considered for inclusion in health risk behavior indices

Health risk behavior	**Question(s) on RAP questionnaire**
Tobacco use	
Age at first cigarette use	*Section 6, Question 4:* At what age did you first start smoking regularly (meaning, you smoked most days)?
Cigarette use – frequency	*Section 6, Question 5:* How many years did you smoke more than 3 cigarettes on most days?
Cigarette use – intensity	*Section 6, Question 6:* When you were smoking regularly, how many packs did you smoke each day?
Smokeless tobacco use - frequency	*Section 6, Question 9:* How many years did you use smokeless tobacco (chew, dip, snuff) on most days?
Smokeless tobacco use - intensity	*Section 6, Question 10:* When you were using smokeless tobacco regularly, how many cans did you use each day?

Table 2. RAP questions considered for health risk behavior indices, continued

Health risk behavior	Question(s) on RAP questionnaire
Alcohol use	
Age at first drink	*Section 7, Question 2:* How old were you when you first had a drink containing alcohol?
Alcohol use – lifetime duration	*Section 7, Question 3:* How many years have you been drinking alcoholic beverages on a regular basis?
Sum of first three AUDIT questions*	*Section 7, Questions 4-6:* During the year (12 months) before entering the military, how often did you have a drink containing alcohol? During the past year, how often did you have 6 or more drinks at one sitting? During the past year, how many drinks containing alcohol did you have on a typical day of drinking?
Sum of CAGE questions*	*Section 7, Questions 9-12:* Did you ever feel as though you needed to cut down on your drinking [during the past year]? Did you ever feel annoyed because someone in your life said you needed to cut down on your drinking [during the past year]? Did you ever felt guilty after drinking [during the past year]? Did you ever need a first drink, or eye-opener, in the morning following a day or night of heavy drinking [during the past year]?
Drunk driving	*Section 7, Question 14:* Have you ever driven a car within two hours of drinking two or more alcoholic drinks [during the past year]?
Motor vehicle injury-related risk behaviors	
Speeding	*Section 9, Question 6:* How many traffic tickets for moving violations have you ever received (such as speeding or running a red light)?
Seat belt use	*Section 9, Question 7:* How often do you wear a seat belt when driving or riding in a car?

*Creation of summary AUDIT and CAGE questions described in next section.

Table 2. RAP questions considered for health risk behavior indices, continued

Health risk behavior	Question(s) on RAP questionnaire
Sexual health risk behaviors	
Age at first sexual intercourse	*Section 9, Question 8:* How old were you when you had sexual intercourse for the first time?
Condom use	*Section 9, Question 9:* Did you or your partner use a condom (rubber) the last time you had sex?
STD diagnosis	*Section 9, Question 10:* Have you ever been told by a doctor or nurse that you had a sexually transmitted disease or STD?
Diet and other health risk behaviors	
Sleep	*Section 8, Question 1:* About how many hours did you sleep on most nights [during the past year]?
TV	*Section 8, Question 2:* About how many hours did you watch TV (television) on an average day [during the past year]?
Caffeine use	*Section 8, Question 3:* On an average day [during the past year], about how may cups, bottles, or cans of drink with caffeine did you drink?
Fast food consumption	*Section 8, Question 4:* About how many times each week [during the past year] did you eat from a fast food restaurant?
Breakfast	*Section 8, Question 5:* About how often each week [during the past year] did you eat breakfast?
Diet pill use	*Section 8, Question 9:* Have you ever taken diet pills to lose weight?
Laxative use	*Section 8, Question 10:* Have you ever used laxatives to lose weight?
Vomiting to lose weight	*Section 8, Question 11:* Have you ever caused yourself to vomit to lose weight?
Steroid use	*Section 8, Question 12:* Have you ever used steroids to gain weight or increase muscle strength?

AUDIT and CAGE scoring

Two measures of alcohol use in the RAP questionnaire required the assignment of point values to individual questions and the calculation of a total score. The first of these measures were questions taken from the Alcohol Use Disorders Identification Test

(AUDIT), a ten-item survey designed by the World Health Organization to assess hazardous alcohol use in primary care settings (Conigrave, Hall et al. 1995). The AUDIT has been found to be a reliable and valid measure of risky drinking (Centers for Disease Control and Prevention 2003), even when imbedded in a general health questionnaire (Daeppen, Yersin et al. 2000), and predictive of alcohol-related social problems (Conigrave, Saunders et al. 1995).

Although it would have been preferable to calculate a score based on the full ten-item AUDIT survey, this was not possible since only six of the original AUDIT questions were present in the RAP questionnaire. As a result, a score based on the first three questions was calculated. This three-question version, the AUDIT-C, was previously developed to save time in primary care and emergency room settings (Nordqvist, Johansson et al. 2004; Dawson, Grant et al. 2005) . The AUDIT-C has since been deemed a useful screening tool that performs well across various population subgroups (Nordqvist, Johansson et al. 2004; Dawson, Grant et al. 2005), though it is less effective than other screening tools at identifying alcohol abuse and alcoholism (National Institute on Alcohol Abuse and Alcoholism 2002).

For this analysis, responses to the first three AUDIT questions in the RAP questionnaire were each assigned a score of zero through four (Table 3), as was done in the original AUDIT questionnaire (Babor, de la Fuente et al. 1992), so that the range of the sum of these three questions was zero to twelve. While various cut points have been debated (Nordqvist, Johansson et al. 2004; Dawson, Grant et al. 2005), a cut point of greater than or equal to five was shown to be as sensitive as the full AUDIT questionnaire in detecting "hazardous drinkers" (Gordon, Maisto et al. 2001), i.e., persons displaying a

"repeated pattern of drinking that confers the risk of harm" (Saunders and Lee 2000). A dichotomous variable representing those below and equal to or above the selected cut point was created as a measure of hazardous drinking behavior. This dichotomous variable is used in further analyses.

Table 3. Questions and scores assigned to responses to first three AUDIT questions

AUDIT question from RAP questionnaire	Score
In past year, how often had alcoholic drink	
Never	0
Once/twice*	1
A few times*	1
Monthly	2
Weekly	3
Daily	4
In past year, how often ≥6 drinks at one sitting	
Never	0
Once/twice*	1
A few times*	1
Monthly	2
Weekly	3
Daily	4
In past year, # alcoholic drinks on typical day of drinking	
None	0
1-2	0
3-4	1
5-6	2
7-9	3
10 or more	4

*In other versions of the AUDIT, the comparable response choice is "Less than once a month" (Nordqvist, Johansson et al. 2004) or "Monthly or less" (Babor, de la Fuente et al. 1992; Gordon, Maisto et al. 2001).

All four questions of another commonly-used alcohol use screening tool, the CAGE, were also included in the RAP questionnaire. The CAGE has been deemed superior to the AUDIT for detecting alcohol abuse and dependence (Bradley, Bush et al. 1998; Fiellin, Reid et al. 2000; National Institute on Alcohol Abuse and Alcoholism 2002), though it may not detect "low but risky" levels of drinking (Fiellin, Reid et al. 2000; National Institute on Alcohol Abuse and Alcoholism 2002). Like the AUDIT,

various cut points have been used (Fiellin, Reid et al. 2000; McCusker, Basquille et al. 2002), but clinicians have argued that even one positive response indicates a potential alcohol problem (Ewing 1998). Studies have reported respectable sensitivity (60-70%) and specificity (84-88%) using a cut point of one (Fiellin, Reid et al. 2000). As a result, data were analyzed and presented with this cut point in mind.

Scoring of the CAGE questions followed the standard procedure of assigning one point for every question to which a "yes" response was reported (Ewing 1998; McCusker, Basquille et al. 2002) (Table 4). Total (summed) CAGE scores ranged from zero to four. A dichotomous variable representing those below and equal to or above the selected cut point of one was created as a measure of potential alcohol abuse and dependence. This dichotomous variable is used in further analyses.

Table 4. Questions and scores assigned to responses to CAGE questions

CAGE question in RAP questionnaire	Score
Did you ever feel as though you needed to cut down on your drinking?	
Never	0
Yes, but more than one year ago	1
Yes, during the past year	1
Did you ever feel annoyed because someone in your life said you needed to cut down on your drinking?	
Never	0
Yes, but more than one year ago	1
Yes, during the past year	1
Did you ever felt guilty after drinking?	
Never	0
Yes, but more than one year ago	1
Yes, during the past year	1
Did you ever need a first drink, or eye-opener, in the morning following a day or night of heavy drinking?	
Never	0
Yes, but more than one year ago	1
Yes, during the past year	1

Factor analysis

Factor analysis was used to determine if and how the individual health risk behavior questions could be grouped. Analysis focused on results for men and women combined (n=1,902). Principle components analysis was chosen over other factor analyses techniques since data reduction and exploration of the interdependence among variables was desired (Kim and Mueller 1978). Since the variables entering the factor analysis consisted of varying scales, correlation matrices formed the basis of the analysis (Kim and Mueller 1978). Results of orthogonal rotations are reported, although oblique rotations were also run for comparison purposes. Cases were excluded if missing values existed for one or both of the pair of variables in computing a specific statistic. The number of components was determined by evaluating the eigenvalues (retained if eigenvalue $\geq$1.0) and scree plot. Internal consistency of the final components was assessed using Cronbach's alpha (with ordinal variables) or the Kuder-Richardson 20 (KR20) coefficient (with dichotomous variables). Values were evaluated using cut points suggested by Fleiss (Fleiss 1981) (poor/good/excellent: <0.40/0.40-0.75/>0.75). When statistical significance of the internal consistency measure did not improve with removal of a variable, the variable was maintained in the index.

Index scoring

Following identification of appropriate individual health risk behavior indices, scores were calculated for each index based on item responses within each index (Table 5). Scores were assigned based on health risks; item responses thought to convey the greatest health risks were given a score of two, item responses conveying moderate health risk were given a score of one, and item responses conveying little or no health risk were

given a score of zero. Thus, a higher score represented greater reported participation in behaviors posing threats to health and well-being. As an example, if a trainee reported never smoking regularly, they would receive a score of zero for each of the items in the cigarette use index, and thus a total score of zero for that index. If a trainee started smoking before age twenty-one, but smoked regularly for a year or less and smoked less than a half pack a day, their total score for the cigarette use index would be four. When only one response was missing from the questions used to create the index, a total index score was calculated using available responses.

Once total scores for each index were obtained, the scores were standardized to a sixty point scale so that each health risk behavior index would have equal weight in the combined risk-taking index. To achieve the standardized scores, scores from indices consisting of three items were multiplied by ten, scores from indices consisting of five items were multiplied by six, and scores from the index consisting of two items were multiplied by fifteen. In addition to the continuous summed value, total standardized scores for each index were also divided into low (0-20 points), medium (21-40 points) and high (41-60 points) risk categories. Relationships between risk indices were evaluated by gender using Spearman rank order correlations.

A combined risk-taking index (300 possible points) was then created by summing the standardized scores of the five indices. In addition to the continuous summed value, a gender-specific 4-category variable (lowest/average/higher/highest risk-taking) was created based on the distance from the mean combined risk-taking index score.

Table 5. Characteristics of low/medium/high risk categories for five individual health risk behavior indices

Index	Question/item	Specific item responses associated each risk category		
		Score=0	Score=1	Score=2
Cigarette use[1]	Age at first use	Never smoked regularly	≥21 years old	<21 years old
	Years smoked	Never smoked regularly	1 year or less	2 or more years
	Packs smoked	Never smoked regularly	1/2 pack or less/day	1 pack or more/day
Smokeless tobacco use[2]	Number of cans/packs used	Never used regularly	1/2 can or less/day	1 can or more/day
	Years used	Never used regularly	1 year or less	2 or more years
Alcohol use[3]	Age at first drink	Have never had a drink	21 yrs or older	9-20 yrs old
	Years been drinking	Have never had a drink	Just tried a few times, 1 year or less	2 or more years
	Drinking and driving	Never	--	Yes
	CAGE score	0	--	1-4
	AUDIT-C score	0-4	--	5-12
Diet/lifestyle choices[3]	Hours of TV viewing	None	1 to 3 hrs/day	4+ hrs/day
	Caffeinated beverages	None - 3	4 to 5	6+/day
	Fast food consumption	None-2 to 3 times/wk	4-7 times/week	8+ times/wk
	Breakfast	5-7 mornings	1-4 mornings	Never
	Seat belt use	Always	Usually, Sometimes	Never
Weight control practices[1]	Diet pill use	No	(none)	Yes
	Laxative use	No	(none)	Yes
	Vomiting	No	(none)	Yes

[1] Multiplied by a factor of 10 to standardize to a 60-point scale
[2] Multiplied by a factor of 15 to standardize to a 60-point scale
[3] Multiplied by a factor of 6 to standardize to a 60-point scale

Additional data coding and preparation for analyses

The following section describes the re-coding and grouping of social and physiologic covariates and the injury outcome variables. All data management and descriptive statistical analyses were conducted in SPSS version 13.0.1 (SPSS, Inc., Chicago, IL).

Social and physiologic covariates

Divorced, widowed, married but separated, and trainees living with a significant other (2.5% of the total sample) were grouped with married trainees based on similarities in mean age (mean age = 24.7 years and 26.8 years, married and other, respectively). Selected education levels (split option and no high school; high school and trade/technical school; some college, four-year college, and advanced degrees) were also grouped. The variable capturing component (regular Army, Army Reserves, Army National Guard) was collapsed into two categories: regular Army and Reserves/National Guard. As in national samples of young adults (Grunbaum, Kann et al. 2002), the number of persons identifying themselves as "other" race/ethnicity (7.4%) was too small for meaningful analysis. These individuals were omitted from race-specific bivariate and multivariate analyses.

APFT results (run time minutes, number of push-ups completed, and number of sit-ups completed) were kept as continuous variables, but were also divided into gender-specific quartiles for certain analyses. Body mass index (BMI) was calculated from height and weight using the following equation: weight(kg)/height(m)^2. BMI was kept continuous, but also divided into categories of "underweight" (BMI<18.5), "normal"

(18.5-24.9), "overweight" (25.0-29.9), and "obese" (30.0 or higher) according to established cut points (Centers for Disease Control and Prevention 2005).

Injury outcomes

A training-related injury was defined as any inpatient or outpatient medical encounter captured in the DMSS with a primary diagnosis code matching a pre-defined list of ICD-9-CM codes representing training-related injuries (Appendix B). This set of codes was developed for use in investigations of Army training-related injuries that obtain injury outcome data from DMSS (Knapik, Darakjy et al. 2004). A subset of these codes is currently used to track and report injuries sustained by active duty military personnel (U.S. Army Center for Health Promotion and Preventive Medicine 2004) and yet another subset is used, more specifically, to track and report training-related injuries among training populations (unpublished). Diagnosis codes were grouped into major ICD-9-CM categories (e.g., Injuries and Poisonings, 800-999) for some descriptive analyses.

The ICD-9-CM code list used in this study (Appendix B) included selected chronic musculoskeletal conditions and a few neurologic conditions and dermatologic conditions that, from extensive field investigation evidence and experience of military clinicians and injury researchers, were determined to be primarily training-related when observed in basic training populations. For example, running, marching, and other lower-extremity load-bearing activities associated with military occupational training have been identified as leading causes of Army outpatient injury visits (Jones, Cowan et al. 1994; Knapik, Bullock et al. 2003) and reductions in running mileage, in particular, have resulted in fewer training-related injuries (Almeida, Williams et al. 1999; Knapik, Hauret

et al. 2001; Knapik, Hauret et al. 2003; Knapik, Darakjy et al. 2004; Knapik, Darakjy et al. 2005). For this reason, conditions associated with overuse due to military physical training and classified using ICD-9-CM Musculoskeletal Conditions codes, such as ingrown toenails (ICD-9-CM code 703.0) and joint dislocations (ICD-9-CM code 718), are included in the definition of training-related injury.

The code list used in this study differs from codes lists used in previous Army training-related injury studies in one way: four selected ICD-9-CM injury-related treatment ("V") codes were added after a detailed review of the data suggested that some injury-related medical encounters might never have received an ICD-9-CM diagnosis code, but rather were only assigned a V-code. To enhance the capture of all injury-related diagnoses, the following codes from the ICD-9-CM V-code list were added to the previously-established list of "training-related injury" codes: V54.19 (Aftercare for healing traumatic fracture of other bone), V54.89 (Other orthopedic aftercare), V57.1 (Other PT), and V57.21 (Encounter for occupational therapy). This resulted in the addition of 367 visits coded as injury-related. The total number of persons injured did not change however, suggesting that most of these visits were follow-ups.

Injuries were further classified as overuse or traumatic following previously-established conventions (Knapik, Darakjy et al. 2004) and consistent with definitions of overuse and traumatic injuries used in prior Army training-related injury investigations (Jones, Bovee et al. 1993; Jones, Cowan et al. 1993; Canham 1998; Knapik, Canham-Chervak et al. 1999; Canham-Chervak, Knapik et al. 2000; Knapik, McCollam et al. 2000; Knapik, Canham-Chervak et al. 2001; Knapik, Hauret et al. 2001; Knapik, Sharp et al. 2001; Knapik, Hauret et al. 2003). A fourth injury variable, an indicator of injury

severity, was also created. This variable categorized injuries according to whether the Soldier was discharged from medical care with or without work limitations. Information on the number of days of work limitation was not available.

Since injuries often result in multiple medical encounters, visits were also classified into initial (first) visits for an injury and follow-up visits for an injury in order to obtain an accurate count of "unique (incident) injuries". An exact repeat of an ICD-9-CM diagnosis code was coded as a follow-up visit if it occurred within 30 days of the previous code, a method consistent with definitions of follow-up used when reporting DMSS data (Army Medical Surveillance Activity 2005). Further data review indicated that a large number of visits had slightly different diagnoses codes within the same major code category or between injury-related major cause categories (i.e., Diseases of the Musculoskeletal System and Connective Tissue, 710-739, and Injuries and Poisonings, 800-999), as occurs when different providers are seen at each visit or providers revise previous diagnoses based on new medical information (see Table 6 for examples). As a result, the following visit types were also coded as follow-ups: (1) visits within 30 days of each other and within the same major diagnostic category as a previous visit, and (2) visits within 30 days of each other, within an injury-related major diagnostic category, and within the same body region (e.g., lower, upper). The first coding decision captured visits receiving slightly different codes from providers (e.g., 719.40 and 719.46). The second coding decision captured visits for an injury in the same body region, but with diagnoses across injury-related major diagnostic groups (see examples 4 and 5 in Table 6). The coding algorithm also allowed for the capture of follow-ups that occurred when there were intervening visits for other conditions. Manual review of an approximately

10% random sample (n=536 visits) indicated that only 0.4% of the visits received an inappropriate code using this methodology.

Table 6. Examples of Defense Medical Surveillance System injury visits and follow-up coding

ID#	Visit date	Follow Up 0=No 1=Yes	ICD-9 code & description
1	Example of (1) injury diagnoses variation *within* major code category and (2) use of V-codes for injury follow-up visits		
	21-JUL-2003	0	719.45 Pain In Joint Involving Pelvic Region And Thigh
	29-JUL-2003	1	719.46 Pain In Joint Involving Lower Leg
	29-JUL-2003	1	V57.1 Other PT
	11-AUG-2003	1	V57.1 Other PT
	26-AUG-2003	1	V57.1 Other PT
2	Example of (1) injury diagnoses variation *within* major code category and (2) use of V-codes for injury follow-up visits		
	10-MAY-2003	0	717.7 Chondromalacia Of Patella; Degeneration of articular cartilage of patella
	17-MAY-2003	1	719.46 Pain In Joint Involving Lower Leg
	19-MAY-2003	1	V57.1 Other PT
3	Example of (1) injury diagnoses variation *within* major code category and (2) use of V-codes for injury follow-up visits		
	08-APR-2003	0	815.00 Closed Fracture Of Metacarpal Bone(s), Site Unspecified
	08-APR-2003	1	829.0 Fracture Of Unspecified Bone, Closed
	15-APR-2003	1	V65.43 Counseling on injury prevention
	22-APR-2003	1	V65.43 Counseling on injury prevention
	22-APR-2003	1	V54.19 Aftercare for healing traumatic fracture of other bone
	22-APR-2003	1	V67.4 Following treatment of healed fx
	29-APR-2003	1	V54.89 Other orthopedic aftercare
	29-APR-2003	1	V65.43 Counseling on injury prevention
	06-MAY-2003	1	V54.19 Aftercare for healing traumatic fracture of other bone
	06-MAY-2003	1	V65.43 Counseling on injury prevention
	07-MAY-2003	1	V65.43 Counseling on injury prevention
	08-MAY-2003	1	V65.43 Counseling on injury prevention
	13-MAY-2003	1	V65.43 Counseling on injury prevention
	19-MAY-2003	1	815.00 Closed Fracture Of Metacarpal Bone(s), Site Unspecified
	19-MAY-2003	1	V67.4 Following treatment of healed fx
	20-MAY-2003	1	V65.43 Counseling on injury prevention

Table 6. Examples of Defense Medical Surveillance System injury visits and follow-up coding, continued

ID#	Visit date	Follow Up 0=No 1=Yes	ICD-9 code & description	
4	Example of injury diagnoses variation *across* injury-related major code categories			
	28-APR-2003	0	844.9	Sprain Of Unspecified Site Of Knee And Leg Knee NOS
	29-APR-2003	1	719.46	Pain In Joint Involving Lower Leg
	07-MAY-2003	1	844.9	Sprain Of Unspecified Site Of Knee And Leg Knee NOS
5	Example of injury diagnoses variation *across* injury-related major code categories			
	18-APR-2003	0	719.46	Pain In Joint Involving Lower Leg
	26-APR-2003	1	845.00	Unspecified Site Of Ankle Sprain
	01-MAY-2003	1	719.47	Pain In Joint Involving Ankle And Foot
	05-MAY-2003	1	845.00	Unspecified Site Of Ankle Sprain
6	Example of diagnoses progression from pain to stress fracture			
	07-JUL-2003	0	719.47	Pain In Joint Involving Ankle And Foot
	10-JUL-2003	1	719.47	Pain In Joint Involving Ankle And Foot
	11-JUL-2003	1	719.47	Pain In Joint Involving Ankle And Foot
	22-JUL-2003	1	733.10	Pathologic Fracture, Unspecified Site Spontaneous Fracture
	22-JUL-2003	1	V57.1	Other PT
7	Example of diagnoses progression from pain to chondromalacia			
	18-APR-2003	0	719.46	Pain In Joint Involving Lower Leg
	30-APR-2003	1	717.7	Chondromalacia Of Patella; Degeneration of cartilage of patella
	30-APR-2003	1	V57.1	Other PT

Descriptive analyses (Research Aim A)

The description of the study sample began with a comparison of demographics, physical fitness, and injury data on the study sample with trainees from the same basic training units who did not complete a RAP survey. To assess the generalizability of the sample, demographic data on the study sample were also compared to a larger sample of U.S. Army basic trainees and to the general U.S. 20-24 year old population.

Next, cumulative injury incidence, rates, injury types, and the frequency of multiple injuries in the study sample were tabulated. Total time-in-training was calculated for each trainee using the basic training unit start and end dates, or in the case of discharged persons or persons transferred to another unit, the unit's start date and the individual's discharge/transfer date. Injury rates and injury visit rates were calculated for males and females separately using gender-specific total time-in-training.

Health risk behavior data available from the RAP questionnaire were summarized by gender, with differences between genders assessed using chi-square tests of proportions. When chi-square tests showed statistically significant differences between genders for health risk behaviors with multiple levels (categories), selected chi-square tests were calculated to assist in identifying the specific levels with statistically significant differences, in accordance with the partition chi-square technique (Volicer 1981; Agresti 1990).

To investigate Question 1 of Research Aim A, a qualitative comparison of health risk behaviors in the study sample to nationally-representative samples of U.S. adolescents and young adults was conducted. To investigate Question 2 of Research Aim A, the following analyses were conducted by gender: bivariate analyses of risk-taking by

social, psychological, and physical characteristics, distributions of risk categories (low/medium/high) within risk indices, proportion of trainees with high-risk indices scores by level of combined risk-taking, and correlations between risk indices.

Regression analyses (Research Aim B)

Univariate Cox regression analyses

To assess the unadjusted associations of the combined risk-taking index, individual health risk behavior indices, and social and physiologic covariates with injury during basic training, univariate Cox regression was used, a methodology consistent with other recent Army injury investigations (Knapik, Hauret et al. 2001; Knapik, Bullock et al. 2004; Knapik, Darakjy et al. 2005). Time-to-first-injury was calculated for each trainee for each injury type using their basic training unit's start date and the appropriate first injury (any, overuse, traumatic, or with limitations) visit date. Trainees who were never injured were censored at the end of their basic training cycle (63-65 days), upon transfer from the unit, or upon discharge from the Army. Differences in time to first injury by gender were assessed using Kaplan-Meier cumulative hazard plots and log-rank tests generated in SPSS.

Given that prior research has consistently shown injury risk and risk factors vary by gender, all analyses were conducted separately for males and females. Health risk behavior indices were tested both as continuous and categorical (low/medium/high) variables. The combined risk-taking index was analyzed as a continuous variable and a categorical variable, with categories based on gender-specific standard deviations of combined risk-taking. Unadjusted hazard ratios and associated 95% confidence intervals

were calculated. For categorical variables, the level at lowest risk of injury was used as the referent category.

All regression analyses were conducted using Intercooled STATA 7.0 for Windows 98/95/NT (STATA Corporation, College Station, TX). Since injury rates varied by battalion in this population due to unmeasured characteristics such as the commanders' physical training philosophy and attention to injury prevention, all regression models were adjusted for clustering by battalion and robust estimates of variance were produced using the CLUSTER command available in STATA.

Multivariate Cox Regression analyses

Multivariate Cox regression was used to test the association of the combined risk-taking index with training-related injury, adjusting for social and physiologic factors. As with the univariate analyses, males and females were modeled separately and robust estimates of variance were obtained using the STATA CLUSTER command. When multiple forms of a variable had been tested in univariate analyses (e.g., run time and run time quartiles), the continuous variable or the variable revealing an association with injury in the univariate analysis was selected for inclusion in the multivariate analyses. Results of both backward and forward stepwise regression models were reviewed. Potential variable interactions were determined *a priori* and tested prior to defining the final model. The cut point for removal and entry into the models was set at $p \leq 0.05$, although variables exiting the model at $p<0.10$ are noted in the text.

The final adjusted multivariate models testing the association of the combined risk-taking index with any training-related injury were constructed using the following steps: (1) univariate (unadjusted) Cox regression with the combined risk index only; (2)

multivariate Cox regression with the combined risk-taking index, adjusting for social variables of interest; (3) multivariate Cox regression with the combined risk-taking index, adjusting for social and physiologic variables of interest; (4) multivariate Cox regression with the combined risk-taking index, adjusting for social and physiologic variables that were significantly associated with injury in previous models *and* each of the five individual health risk indices, separately (i.e., five separate models, each one evaluating additional risk explained by cigarette use, smokeless tobacco use, alcohol use, diet/lifestyle choices, and weight control practices); (5) multivariate Cox regression with the combined risk-taking index, adjusting for those factors demonstrating independent association with risk of injury in previous analyses. Other health risk behavior variables (age at first sexual intercourse, condom use, number of moving violations) that had not been previously excluded and were not included in an index were also tested in Step 4. The final models (one for males, one for females) contained variables demonstrating sustained statistical significance (95% confidence interval not containing 1.00) when all levels of the variables were included in a Cox regression analysis. When an interaction term remained statistically significant, the contributing variables plus the interaction term were retained in the final model. Adjusted hazard ratios and 95% confidence intervals are reported. Final multivariate models based on any training-related injury were used to examine the association of the combined risk-taking index with other outcomes of interest: overuse training-related injury, traumatic training-related injury, and training-related injuries resulting in work limitations.

RESULTS

Part I: Understanding health risk behaviors among Army basic trainees

(Research Aim A)

Comparison of RAP participants vs. non-participants

In this sample of 3,561 basic trainees, 1,919 (54%) completed a RAP survey. When compared to non-participants (Table 7), a greater proportion of the RAP survey participants were white, older, married, a higher enlisted pay grade, and in the Regular Army. The proportion of males and females among participants and non-participants was comparable. The RAP participant population had greater representation from the educational extremes; a higher proportion of persons who had not graduated from high school and a higher proportion of persons with some college education or more participated in the RAP survey, as compared to non-participants.

Table 8 shows that both BMI and aerobic fitness upon entry to basic training (run time on initial APFT) did not differ between those who completed the RAP survey and those who did not ($p>0.100$). Statistically significant differences between certain measures of muscle endurance were observed, but absolute differences in the number of sit-ups and pushups completed were small.

Of the 1,919 trainees in this sample who completed a RAP survey, medical surveillance data were obtained for 1,902 (99.1%). Table 9 shows that the proportion of trainees with one or more injury or illness visits did not differ between the two groups ($p=0.799$ and $p=0.354$, respectively).

Table 7. Comparison of demographics, RAP participants and non-participants

Demographic variable	Specific category	Total sample (%)	Number of participants (%)	Number of non-participants (%)	p*
Gender	Male	2185 (61)	1162 (61)	1023 (62)	0.285
	Female	1376 (39)	757 (39)	619 (38)	
Race/Ethnicity	White	2059 (58)	1188 (62)	871 (53)	0.000
	Black	729 (21)	347 (18)	382 (23)	
	Hispanic	489 (14)	243 (13)	246 (15)	
	Other	280 (8)	141 (7)	139 (9)	
Age group	17-20	2368 (67)	1201 (63)	1167 (71)	0.000
	21-37	1193 (34)	718 (37)	475 (29)	
Education	No HS diploma or still in HS	477 (14)	284 (15)	193 (12)	0.000
	HS graduate	2290 (66)	1175 (61)	1115 (71)	
	GED	356 (10)	226 (12)	130 (8)	
	Some college	200 (6)	117 (6)	83 (5)	
	Bachelor's or more	162 (5)	112 (6)	50 (3)	
Marital status	Single	2913 (82)	1582 (83)	1331 (87)	0.003
	Married	450 (13)	280 (15)	170 (11)	
	Other	75 (2)	47 (2)	28 (2)	
Pay grade	Enlisted-1	1916 (54)	1020 (53)	897 (55)	0.002
	Enlisted-2	728 (20)	380 (20)	348 (21)	
	Enlisted-3	747 (21)	342 (21)	342 (21)	
	Enlisted-4	168 (5)	114 (6)	54 (3)	
Component	Regular Army	1933 (54)	1104 (58)	830 (51)	0.000
	Reserve	774 (22)	374 (19)	400 (24)	
	National Guard	851 (24)	441 (23)	410 (25)	

Abbreviations: HS=high school, GED=General Educational Development
*from X^2 statistic

Table 8. Comparison of physical fitness measures, RAP participants and non-participants

Characteristic	Gender	Participants Mean (±SD)	Non-participants Mean (±SD)	p*
BMI	Male	24.7 (±3.8)	24.5 (±3.7)	0.171
	Female	23.1 (±2.8)	23.2 (±2.8)	0.601
Run time on initial APFT	Male	8.1 (±1.3)	8.0 (±1.3)	0.135
	Female	10.3 (±2.0)	10.2 (±1.6)	0.452
Situps on initial APFT	Male	31.5 (±6.9)	32.5 (±6.9)	0.001
	Female	24.7 (±8.0)	25.7 (±8.6)	0.032
Pushups on initial APFT	Male	28.0 (±11.4)	30.0 (±11.4)	0.000
	Female	9.3 (±8.3)	10.0 (±9.0)	0.099

APFT=Army Physical Fitness Test; SD=standard deviation
*from t-test

Table 9. Comparison of medical encounters, RAP participants and non-participants

Variable	Number of trainees (%), total sample	Number of RAP participants (%)	Number of RAP non-participants (%)	p*
Cumulative proportion of (one or more) injury visits	1,317 (37.3)	706 (37.1)	611 (37.6)	0.779
Cumulative proportion of (one or more) illness visits	1,913 (54.2)	1,045 (54.9)	868 (53.4)	0.354
Cumulative proportion of (one or more) environmental exposure-related visits	83 (2.4)	44 (2.3)	39 (2.4)	0.868

Number of trainees with medical information: 99.1% (3,528) of total sample; 99.0% (1,626) of non-participants; 99.1% (1,902) of participants.
*from X^2 statistic

Comparison of study sample (RAP participants) with other populations

Table 10 shows the distribution of other demographic features of the RAP participant population compared to (1) a historical sample of U.S. Army basic trainees and (2) the U.S. 20-24 year old general population. The age, gender, and marital status distributions of this study sample were similar to previous Army basic training populations that have been the subject of injury investigations conducted by the U.S.

Army Center for Health Promotion and Preventive Medicine (Knapik, Sharp et al. 1999; Canham-Chervak, Knapik et al. 2000; Knapik, Hauret et al. 2001). However, the sample used in this study contained fewer blacks and more persons who completed basic training prior to high school graduation. Compared to the 2002 U.S. population aged 20-24, this sample had a greater percentage of males, blacks, and single individuals and fewer persons who had a college education or higher.

Table 10. Comparison of demographics of the study sample, a larger sample of U.S. Army basic trainees, and the 20-24 year old U.S. population

	Study sample (RAP participants with medical data), n=1,902	U.S. Army basic trainees who trained at Ft Jackson (U.S. Army Center for Health Promotion and Preventive Medicine 2001), n=4,274	U.S. population, 20-24 years of age, 2002 (U.S. Census Bureau 2002), n=20,214,000
Age (mean±SD)	20.8±3.9	20.7±3.7	--
Gender (%)			
Male	60.8	57.2	50.9
Female	39.2	42.8	49.1
Race (%)			
Black	17.9	31.1	14.5
White	62.3	52.9	78.0
Other	19.9[1]	16.0	7.5
Ethnicity (%)			
Hispanic	12.5	n/a	17.8
Martial status (%)			
Single	82.8	81.0	79.7
Married	14.7	19.0	19.1
Divorced	n/a	n/a	1.0
Widowed	n/a	n/a	<1.0
Other	2.5[2]	n/a	n/a
Educational level (%)			
Did not complete HS[3]	14.7	0.0	13.1[4]
GED certificate	11.9	14.2	n/a
HS graduate	61.6	65.6	28.4
Some college	6.1	14.2	19.1
College graduate	5.7	6.1	31.9
Advanced degree	n/a	n/a	7.4

[1] includes 12.5% reporting Hispanic ethnicity
[2] includes divorced, separated, and widowed
[3] This category includes trainees who enlisted, but are still in high school and chose to complete basic training prior to high school graduation. Also includes trainees for whom the requirement for a high school diploma was waived.
[4] Data on educational attainment are for 25-34 year olds (n=38,670)
Abbreviations: n/a=data not available, HS=high school, GED=General Educational Development

Descriptive analyses of the study sample

Study sample by unit

The distribution of units included in the study sample is shown in Table 11. All units conducted basic training in the spring or early summer of 2003. Gender distribution differed for Battalion 2, Cycle 2 compared to the other units ($p<0.001$).

Table 11. Distribution of sample by basic training unit and gender

Basic training unit and cycle (n=total trainees)	**Training start date range**[1]	**Males in unit** Frequency (% of battalion)	**Females in unit** Frequency (% of battalion)
Battalion 1, Cycle 1 (n=673)	21-28MAR03	397 (59.0)	276 (41.0)
Battalion 2, Cycle 1 (n=556)	16-18APR03	317 (57.0)	239 (43.0)
Battalion 2, Cycle 2 (n=673)	25-27JUN03	442 (65.7)	231 (34.3)

[1] Start date varied by individual company within each battalion.
Total sample=1,902 (1,156 males, 746 females)

Table 12 shows cumulative training-related injury incidence (i.e., trainees with one or more injuries in the basic training cycle) by unit and gender. Statistically significant differences between cumulative injury incidence by unit were seen for both males and females ($p=0.003$ and $p=0.038$, males and females respectively). Based on these data, a decision was made to control analyses for clustering effects by unit (STATA CLUSTER command). Additional descriptive data on injuries in this sample will be presented shortly.

Table 12. Cumulative training-related injuries during the basic training cycle, by unit and gender

	Cumulative training-related injuries		
Basic training unit and cycle	**Males** Number injured (% of males in battalion)	**Females** Number injured (% of females in battalion)	**Total** Number injured (% of total battalion)
Battalion 1, Cycle 1 (n=397 males, 276 females)	125 (31.5)	163 (59.1)	288 (42.8)
Battalion 2, Cycle 1 (n=317 males, 239 females)	75 (23.7)	135 (56.5)	210 (37.8)
Battalion 2, Cycle 2 (n=442 males, 231 females)	96 (21.7)	111 (48.1)	207 (30.8)

Total sample=1,902 (1,156 males, 746 females)

Attrition from basic training

Trainees in these units could leave the unit prior to the end of the basic training cycle for two reasons: (1) discharge from the Army, or (2) reassignment to another unit. There were a total of 147 discharges and 45 reassignments. Proportions by gender are presented in Table 13. Leading reasons for discharge included failure to adapt to military life and related mental conditions (47.0%), and medical disorders, such as chronic musculoskeletal disorders, that existed prior to service and were exacerbated by training (41.5%). Reassignment to another unit occurred primarily due to "motivational" difficulties (64.4%) and missed training (31.1%).

Table 13. Attrition from basic training by gender

	Males Frequency (% males)	Females Frequency (% females)	Total Frequency (% total)
Discharged from Army	60 (5.2)	87 (11.7)	147 (7.7)
Reassigned to another unit	25 (2.2)	20 (2.7)	45 (2.4)
Totals	85 (7.4)	107 (14.3)	192 (10.1)

Total sample=1,902 (1,156 males, 746 females)

Medical surveillance data on injuries

Table 14 demonstrates the importance of injury in relation to other medical conditions. Primary diagnoses, or the main causes of medical visits as determined by a provider, are listed by gender and major ICD-9-CM code category. Looking specifically at injuries, 24.8% of male visits and 33.7% of female visits received injury-related ICD-9-CM primary diagnosis codes. Of the visits (initial and follow-up) made by females during their basic training cycles, the leading primary diagnoses were Musculoskeletal conditions (25.1%), followed by Respiratory conditions (20.0%) and V-codes (18.6%). Among male basic trainees, the majority of visits received a primary diagnosis of Respiratory (30.8%), followed by Musculoskeletal (17.2%), and V-codes (13.8%).

Table 14. Distribution of primary diagnoses codes for medical visits during Army basic training by gender (n=1156 males, 746 females)

Disease or injury category	Associated ICD-9-CM codes	Males Number of visits (%)	Females Number of visits (%)	Total Number of visits (%)
Injury-related				
Musculoskeletal	710-739	357 (17.2)	696 (25.1)	1053 (21.7)
Injury & poisonings	800-999	158 (7.6)	239 (8.6)	397 (8.2)
Respiratory system	460-519	640 (30.8)	555 (20.0)	1195 (24.6)
V-code	V01-V85	288 (13.8)	515 (18.6)	803 (16.6)
Symptoms, signs, and ill-defined	780-799	144 (6.9)	212 (7.7)	356 (7.3)
Infectious & parasitic	001-139	138(6.6)	134 (4.8)	272 (5.6)
Skin & subcutaneous tissue	680-709	131 (6.3)	60 (2.2)	191 (3.9)
Mental disorders	290-319	63 (3.0)	105 (3.8)	168 (3.5)
Nervous system & sensory organs	320-389	92 (4.4)	63 (2.3)	155 (3.2)
Digestive system	520-579	40 (1.9)	81 (2.9)	121 (2.5)
Genitourinary system	580-629	9 (0.4)	78 (2.8)	87 (1.8)
Endocrine, nutritional, & metabolic	240-279	8 (0.4)	14 (0.5)	22 (0.5)
Circulatory system	390-459	11 (0.5)	6 (0.2)	17 (0.4)
Blood & blood organs	280-289	0 (0.0)	9 (0.3)	9 (0.2)
Pregnancy	630-677	0 (0.0)	3 (0.1)	3 (0.1)
Congenital anomalies	740-759	1 (0.0)	0 (0.0)	1 (0.0)
Neoplasms	140-239	0 (0.0)	1 (0.0)	1 (0.0)
Perinatal period	760-779	0 (0.0)	0 (0.0)	0 (0.0)
E-codes	E800-E999	0 (0.0)	0 (0.0)	0 (0.0)
Total		2,080 (100)	2,771 (100)	4,851 (100)

Secondary diagnoses were recorded for only 577 (27.7%) of male visits and 898 (32.4%) of female visits (data not shown). Leading categories of secondary diagnoses for male trainees included Musculoskeletal (30.8%), Respiratory (16.8%), and V-codes. Leading categories for female trainees included Musculoskeletal (38.8%), V-codes (13.8%), and Injury (11.4%).

Injuries

Table 15 shows the cumulative training-related injury rates (i.e., trainees with one or more injuries during training) per 1,000 trainee-days by gender. Stated differently, these rates suggest that, among a group of 100 females, 60 females would be injured one

or more times over the course of a typical basic training cycle (65 days). Among a group of 100 males, it would be expected that 27 would be injured one or more times over the course of a typical basic training cycle.

Table 15. Cumulative injury incidence† (injured trainees/1,000 trainee-days) during basic training by gender and injury type

	Training-related injury‡	Overuse training-related injury‡	Traumatic training-related injury‡	Training-related injury with limitations‡
Males	4.2	2.9	1.5	3.9
Females	9.3	7.2	3.8	8.8
Total	6.1	4.5	2.4	5.7

n=1,156 males, 746 females

† Defined as "Trainees who experienced one or more injuries during basic training". It was possible for a trainee to be counted in each injury subcategory (overuse, traumatic, and injury with limitations).

‡ Statistically significant difference existed between male and female proportions ($p<0.001$).

While the injury rates were high, the number of multiple injuries was minimal (Table 16). Among injured males, 79.4% had only one injury during training and 70.3% of injured females had only one injury during training.

Table 16. Frequency of unique (incident) injuries among injured trainees by gender and injury type

Number of unique (incident) injuries	Training-related injury[1] Frequency (% within gender)	Overuse training-related injury[2] Frequency (% within gender)	Traumatic training-related injury Frequency (% within gender)	Training-related injury with limitations[2] Frequency (% within gender)
Males				
1	235 (79.4)	16 (87.3)	91 (92.9)	222 (81.0)
2	50 (16.9)	22 (11.6)	6 (6.1)	46 (16.8)
3	7 (2.4)	1 (0.5)	1 (1.0)	5 (1.8)
4	4 (1.4)	1 (0.5)	0 (0)	1 (0.4)
Females				
1	286 (70.3)	225 (79.5)	124 (87.9)	287 (74.2)
2	90 (22.1)	52 (18.4)	16 (11.3)	76 (19.6)
3	28 (6.9)	6 (2.1)	1 (0.7)	22 (5.7)
4	3 (0.7)	0 (0)	0 (0)	2 (0.5)

n=296 males, 409 females with any training-related injury; 189 males, 283 females with overuse injury; 98 males, 141 females with traumatic injury; 274 males, 387 females with injury resulting in limitation.

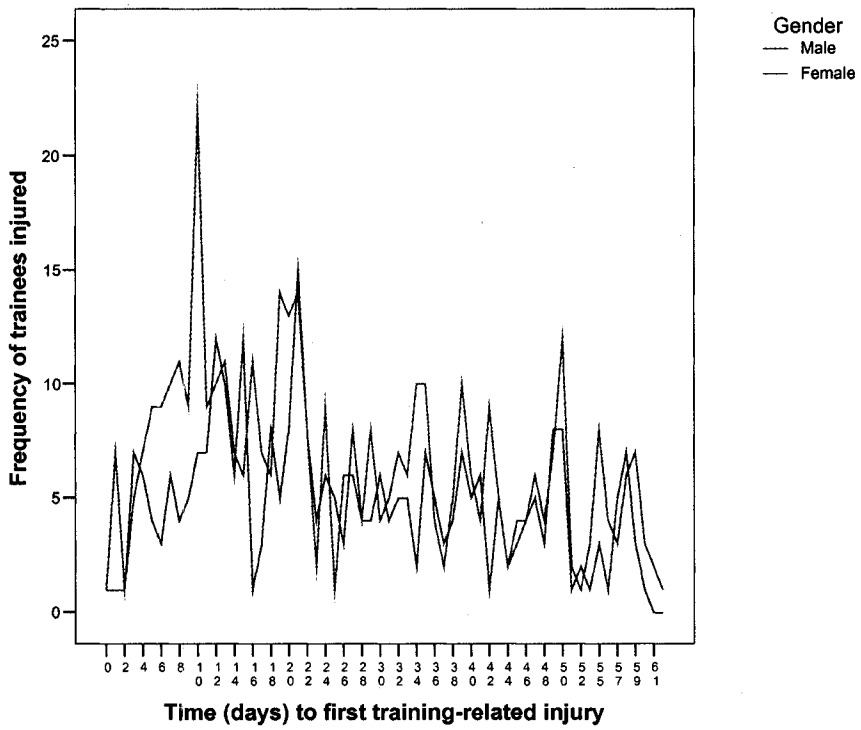
[1] $p<0.05$

[2] $p<0.10$

Looking at specific diagnoses for all visits (incident and follow-up), the leading training-related injury diagnoses for both males and females were 'Pain in joint, lower leg' (18.0% and 11.6%, males and females respectively), 'Pain in joint, ankle or foot' (6.5% and 11.5%), and 'Other physical therapy' (16.8% and 17.8%). Of the unique (incident) training-related injuries among female trainees, the majority (69.2%) were coded as musculoskeletal in nature (ICD-9-CM 710-739), followed by 29.2% acute injuries (ICD-9-CM 800-999), and 1.9% coded in the Skin & Subcutaneous Tissue category (ICD-9-CM 680-709). Among males, the unique (incident) visits for training-related injuries were in the following disease and injury code categories: Musculoskeletal (65.4%), Injury (28.2%), and Skin & Subcutaneous Tissue (6.4%).

Figure 3 shows the distribution of training-related injuries over time. Especially among females, training-related injuries tended to occur at the beginning of the training cycle.

Figure 3. Time to first training-related injury (excluding uninjured trainees)



Health risk behavior and other data from the RAP questionnaire

Tables 17-23 present descriptive information on the study sample, summarized for the total population and by gender. Data are from the RAP questionnaire unless otherwise noted. Sixty-three percent of this sample was between the ages of 17 and 20 years old (Table 17). The majority were white (62.3%), single (82.8%), and had a high school education (61.6%). The proportion of black females (25.5%) was significantly greater than the proportion of black males (13.1%) ($p<0.001$). Most parents of trainees in this sample had a high school diploma or higher degree (84.2% and 88.4%, fathers and mothers, respectively). Most trainees were born in the United States (90.9%) and over a

third were from Southern states (37.5%). Nearly a third (30.5%) were from a small town or rural area, but most (53.5%) were from a large or small city. Over a quarter of the sample came from a one-parent family and 41% came from homes with four or more children.

Table 17. Demographics of sample population for study sample by gender[1]

Demographic characteristics from RAP survey	% Total (n=total non-missing)	% Males (n=total non-missing)	% Females (n=total non-missing)	X^2 p-value
Age group[2]	n=1902	n=1156	n=746	0.375
17-20	62.6	63.4	61.4	
21-37	37.4	36.6	38.6	
Race/ethnicity[2]	n=1902	n=1156	n=746	0.000
White, non-Hispanic	62.3	67.4	54.3	
Black, non-Hispanic	17.9	13.1	25.5	
Hispanic	12.5	11.8	13.5	
Other	7.4	7.8	6.7	
Marital status[3]	n=1892	n=1149	n=743	0.041
Single	82.8	84.2	80.6	
Married, widowed, or divorced	17.2	15.8	19.4	
Educational level[2]	n=1897	n=1154	n=743	0.001
Still in high school (split option) or no high school diploma	14.8	16.7	11.7	
High school	61.6	58.8	65.8	
GED	11.9	13.2	9.8	
Some college or 4 years college or more	11.8	11.3	12.7	
Father's highest education	n=1492	n=919	n=573	0.711
No high school diploma	15.8	16.0	15.4	
High school or GED	33.3	33.4	33.2	
Some college/tech school	27.2	26.2	28.8	
4 years college or more	23.7	24.4	22.7	
Mother's highest education	n=1679	n=1008	n=671	0.059
No high school diploma	11.6	10.4	13.4	
High school GED	34.9	35.9	33.4	
Some college	30.9	29.5	33.1	
4 or more years of college	22.6	24.2	20.1	
Country of birth	n=1888	n=1146	n=742	0.471
US or US territory	90.9	90.0	91.0	
Caribbean	2.1	1.8	2.6	
Europe	1.5	1.5	1.5	
North America	1.2	1.1	1.4	
Central/South America	1.3	1.0	1.6	
Asia	1.3	1.7	0.7	
Other (groups contributing <1%)	1.6	1.9	1.2	
Region of origin (U.S.)	n=1682	n=1023	n=659	0.093
South	37.5	35.3	40.8	
West	21.7	21.3	22.3	
Midwest	20.8	22.4	18.4	
Northeast	18.4	19.4	16.8	
Other (Puerto Rico, Guam)	1.7	1.7	1.7	

[1] n=1,902 (1,156 males, 746 females)

[2] Obtained primarily from program evaluation data. When data were missing, responses was completed with information from other data sources.

[3] Obtained primarily from medical surveillance/personnel data. When data were missing, responses was completed with information from other data sources.

Table 17. Demographics of sample population for study sample by gender[1], continued

Demographic characteristics from RAP survey	% Total (n=total non-missing)	% Males (n=total non-missing)	% Females (n=total non-missing)	X^2 p-value
Where lived most of time as child	n=1872	n=1133	n=739	0.071
Large city or suburb[2]	28.2	28.3	28.0	
Small city	25.3	27.4	22.2	
Small town	19.0	18.5	19.6	
Moved around a lot	14.6	14.0	15.4	
Farm, ranch, or rural area	11.6	10.8	12.9	
Not sure	1.3	1.0	1.9	
Raised by	n=1878	n=1140	n=738	0.204
Two parents	57.9	60.4	54.2	
One parent	26.3	24.9	28.3	
Grandparents	2.2	2.0	2.6	
Foster parent or guardian	1.0	0.8	1.2	
Other relative	0.6	0.5	0.8	
Group home or institution	0.3	0.2	0.4	
Other	1.1	1.2	0.8	
Multiple responses	10.6	10.0	11.7	
Adopted	n=1873	n=1138	n=735	0.606
	4.3	4.1	4.6	
Number of siblings in same home	n=1853	n=1123	n=730	0.161
0	7.9	8.7	6.6	
1	26.4	26.5	26.2	
2	24.6	25.2	23.6	
3	17.4	17.5	17.1	
4	9.1	8.0	10.8	
5 or more	14.7	14.0	15.8	

[1] n=1,902 (1,156 males, 746 females)

[2] A large city or suburb was defined as >100,000 residents; a small city=10,000-100,000 residents; a small town as <10,000 residents.

Table 18 shows that over half (53.1%) of the sample entered the Army at the lowest enlisted pay grade and had enlisted in the Regular Army (57.4%) as opposed to the National Guard or Reserves. A small proportion had prior military service (4.3%) and over a third (38.2%) had a parent who had served in the military. The leading reason for joining the Army was to gain an education and job skills (74.0%).

Table 18. Military service-related information for study sample by gender[1]

Information related to military service	**% Total** (n=total non-missing)	**% Males** (n=total non-missing)	**% Females** (n=total non-missing)	X^2 **p-value**
Rank/Pay grade	n=1902	n=1156	n=746	0.049
E1	53.1	54.8	50.5	
E2	19.8	20.0	19.4	
E3	21.3	19.2	24.5	
E4	5.8	6.1	5.5	
Component	n=1902	n=1156	n=746	0.001
Regular Army	57.4	54.2	62.2	
Army Reserves or National Guard	42.6	45.8	37.8	
Prior military service	n=1890	n=1149	n=741	0.860
	4.3	4.4	4.2	
Father or mother served in military	n=1902	n=1156	n=746	0.866
	38.2	38.3	37.9	
Reason joined Army[2]	n=1902	n= 1156	n=746	
Education & new job skills	74.0	71.2	78.4	0.007
Travel & adventure	4.8	4.8	5.0	
Earn money	4.0	5.1	2.4	
Leave problems at home	0.8	0.7	0.9	
Family member in military	1.2	1.3	1.1	
Want 20 year career	2.5	2.7	2.1	
Serve my country	6.2	7.2	4.6	
Other reasons	6.5	7.1	5.5	

[1] n=1,902 (1,156 males, 746 females)
[2] Multiple responses allowed

Table 19 indicates that males, on average, were taller, heavier, and had a higher BMI compared to females ($p<0.001$). The average BMI for both males and females were within the "healthy" weight range for adults (BMI=18.5 to 25.0) (Centers for Disease Control and Prevention 2005). Males had faster run times, with an average of 8.12 minutes/mile compared to 10.20 minutes/mile for females ($p<0.001$). Males also performed more push-ups (28 vs. 9 push-ups in two minutes, males vs. females respectively) and sit-ups (32 vs. 25 sit-ups in two minutes, males vs. females respectively) on the initial Army Physical Fitness Test ($p<0.001$). The same was true for the final APFT test ($p<0.001$).

Table 19. Physiologic characteristics and physical fitness for study sample by gender[1]

Physiologic and physical fitness measures obtained during BCT	Mean(±SD) Males	Mean(±SD) Females	t-test p-value
Height (inches)	n=1156 69.3 (±2.8)	n=746 64.4(±2.6)	0.000
Weight (pounds)	n=1156 169.2(±29.2)	n=746 136.5(±20.7)	0.000
Body mass index (weight/height^2)	n=1156 24.7(±3.8)	n=746 23.1(±2.8)	0.000
Initial APFT[2] 1-mile run time (minutes)	n=1115 8.12(±1.30)	n=717 10.20(±1.57)	0.000
Initial APFT sit-ups completed in 2 minutes	n=1121 31.5(±6.9)	n=722 24.7(±9.0)	0.000
Initial APFT push-ups completed in 2 minutes	n=1121 28.0(±11.4)	n=721 9.2(±8.3)	0.000
Final APFT[2] 2-mile run time (minutes)	n=1050 14.77(±1.37)	n=605 17.99(±1.83)	0.000
Final APFT sit-ups completed in 2 minutes	n=1051 62.9(±10.6)	n=607 60.0(±12.0)	0.000
Final APFT push-ups completed in 2 minutes	n=1051 47.4(±12.0)	n=607 24.9(±10.5)	0.000

[1] n=1,902 (1,156 males, 746 females)

[2] The initial Army Physical Fitness Test (APFT) for this sample consisted of a one-mile run for time, sit-ups completed in two minutes, and push-ups completed in two minutes. The final APFT consisted of a two-mile run for time, sit-ups completed in two minutes, and push-ups completed in two minutes.

Table 20 describes selected medical history items from the RAP questionnaire. A greater proportion of male trainees in this sample reported no visits to a health care provider in the past five years (17.6 vs. 9.1%, males and females, respectively). Some males (12.8%) and females (9.1%) had been treated for a work-related injury and lost work time due to the injury (8.9%). Among work-related exposures addressed in the RAP questionnaire, exposure to loud noise was reported by 64% of trainees, followed by exposures to dust (59.9%) and fumes (35.8%). One quarter (25.4%) of all trainees reported a history of muscle aches, 13.8% had experienced swollen or painful joints, and 11.4% reported knee trouble.

Table 21 shows that over half of trainees (63.7%) believed their health to be very good or excellent, with only 6.2% believing their health was fair or poor. A fifth (21.0%) reported that their health had improved over the past year and 67.7% reported pain had not interfered with normal work during the past year.

Table 20. Selected medical history for study sample by gender[1]

Medical history from RAP survey	% Total (n=total non-missing)	% Males (n=total non-missing)	% Females (n=total non-missing)	X^2 p-value[3]
Medical care, last 5 years	n=1899	n=1154	n=745	
General, family, or other medical doctor	73.7	68.0	82.4	0.000
Dentist	54.3	53.3	55.8	0.277
Optometrist	31.3	27.8	36.6	0.000
Surgeon	7.9	7.6	8.3	0.583
Alternative health practitioner	5.2	3.7	7.4	0.000
Mental health professional	3.1	2.2	4.4	0.005
Specialist or counselor in alcohol problems	1.2	1.6	0.7	0.084
None of above	14.3	17.6	9.1	0.000
Health problems due to previous job(s)	n=1844 2.9	n=1116 2.8	n=728 3.2	0.635
Treated in medical clinic for work-related injury	n=1837 11.3	n=1113 12.8	n=724 9.1	0.016
Lost one or more days of work due to injury	n=1824 8.9	n=1101 9.4	n=723 8.3	0.439
Hospitalized due to work-related injury	n=1815 0.9	n=1096 0.8	n=719 1.1	0.525
Ever exposed at work to:	n=1523-1756[2]	n=919-1066[2]	n=604-693[2]	
Loud noise	64.0	68.2	57.4	0.000
Dust	59.9	65.4	51.6	0.000
Fumes	35.8	44.1	23.2	0.000
Smoke from burning things	23.2	27.8	16.0	0.000
Welding material	19.3	27.1	7.2	0.000
Insecticides/herbicides	12.5	14.7	9.4	0.001
Lead	8.1	10.6	4.5	0.000
Asbestos	5.6	7.4	3.0	0.000
Ionizing radiation	4.2	3.1	5.9	0.005
History of (ever had):	n=1779-1809[2]	n=1080-1098[2]	n=699-711[2]	
Muscle aches	25.9	23.0	30.4	0.000
Dizziness/fainting/ lightheadedness	15.8	10.6	24.0	0.000
Foot pain/corns/bunions	14.7	13.4	16.7	0.049
Swollen/stiff/painful joints	13.8	13.9	13.7	0.921
Shortness of breath	11.5	9.9	14.0	0.008
Knee trouble	11.4	10.4	13.0	0.093
Chest pain/pressure	8.7	7.7	10.3	0.053
Asthma	4.0	4.1	3.9	0.854
Scoliosis/curvature of spine	3.2	2.6	4.3	0.051
Arthritis/rheumatism/bursitis	2.4	2.3	2.5	0.745

[1] n=1,902 (1,156 males, 746 females)
[2] Range of valid responses for questions in group
[3] p-value for "yes" vs. "no" ("do not know" excluded)

Table 21. Selected self-assessed health for study sample by gender[1]

Self-assessed health from RAP survey	% Total (n=total non-missing)	% Males (n=total non-missing)	% Females (n=total non-missing)	X^2 p-value
In general, health is:	n=1676	n=1004	n=672	0.262
Excellent	25.1	27.0	22.2	
Very good	38.6	37.7	39.9	
Good	30.1	29.1	31.7	
Fair	5.8	5.8	6.0	
Poor	0.4	0.4	0.3	
In general, has your health changed in past year?	n=1663	n=999	n=664	0.000
Yes, worse	6.4	6.7	6.0	
Yes, better	21.0	24.8	15.4	
Pain interfered with normal work in past year?	n=1645	n=989	n=656	0.764
Not at all	67.7	67.1	68.6	
A little	24.1	24.7	23.3	
Moderately	6.8	7.1	6.4	
Quite a lot	0.9	0.8	1.1	
Extremely	0.4	0.3	0.6	

[1] n=1,902 (1,156 males, 746 females)

Responses to RAP questions concerning emotional and mental health (Table 22) indicated that the majority of trainees in this sample (97.1%) had one or more persons whom they could go to for help with personal problems. Church or other religious gatherings were a regular source of support for some (31.3%). Parental divorce was experienced by 39.3% and, of all major life events in the past year, death of someone close was the most common (20.7%). Over a third (35.6%) reported being angry enough to hit, kick, or throw things once a month or more.

While many trainees reported feeling that they had someone to take care of them (82.5%) and someone who loved them (77.4%) while growing up, 20.5% reported emotional abuse, 7.6% reported physical abuse, and 5.5% reported abuse between adults in the home (percentages represent trainees reporting "often or very often"). More females than males reported sexual abuse (13.7 and 2.7%, females and males, respectively; $p<0.001$) and living with someone who was depressed or mentally ill (21.6 and 14.1%, females and males, respectively). A fifth (20.8%) of trainees reported they had lived with a problem drinker or alcoholic. Data collected on past traumatic experiences indicated that more males than females had ever been in an accident where they could have been killed, seen a stranger badly injured or killed, and been threatened with a knife, gun, or other weapon ($p<0.001$). Seven percent of trainees had been in an accident where they were injured and spent at least one night in the hospital, 20% had seen a close family member or friend badly injured or killed, and 13% had been seriously assaulted. More females (17.0%) than males (1.6%) reported having been raped ($p<0.001$).

Table 22. Selected emotional and mental health indicators for study sample by gender[1]

Emotional and mental health indicators from RAP survey	% Total (n=total non-missing)	% Males (n=total non-missing)	% Females (n=total valid responses)	X^2 p-value
Number of close friends/relative to call for help re: personal problems	n=1801	n=1089	n=712	0.713
0	2.9	3.1	2.5	
1	6.7	7.1	6.0	
2	17.3	16.9	18.0	
3-4	31.2	30.5	32.3	
5 or more	41.9	42.4	41.2	
How often attended church, synagogue, or other religious gathering	n=1791	n=1081	n=710	0.001
Almost never	32.5	36.0	27.2	
Once or twice a year	18.6	16.7	21.4	
Once a month	17.6	16.0	20.1	
Once a week	22.9	22.8	23.0	
More than once a week	8.4	8.4	8.3	
Experiences in past year[3]:	n=1902	n=1156	n=746	
Married	7.7	7.8	7.5	0.824
Had child	4.6	5.0	4.0	0.313
Got divorced	1.5	1.5	1.6	0.810
Arrested by police	3.8	4.9	2.1	0.002
Fired from job	7.5	8.2	6.4	0.150
Death of someone close	20.7	17.6	25.5	0.000
Get mad enough to hit/kick/throw things	n=1752	n=1053	n=699	0.675
Never	36.6	36.3	37.1	
About once a year	27.9	27.7	28.2	
About once a month	21.6	21.1	22.3	
About once a week	8.7	9.4	7.6	
More than once/week	5.3	5.5	4.9	
Parents divorced	n=1795	n=1084	n=711	0.001
No	47.7	50.6	43.5	
Yes	39.3	39.0	39.5	
Don't know	1.2	1.0	1.5	
Never married	11.8	9.4	15.5	
When growing up, you felt there was someone to take care of & protect you	n=1736	n=1044	n=692	0.104
Never true	2.1	2.3	1.9	
Rarely true	4.5	4.1	5.1	
Sometimes true	10.9	10.6	11.3	
Often true	20.6	22.6	17.5	
Very often true	61.9	60.3	64.3	
When growing up, you felt loved.	n=1730	n=1039	n=691	0.142
Never true	1.7	1.8	1.6	
Rarely true	6.5	6.4	6.8	
Sometimes true	14.3	12.7	16.8	
Often true	21.0	22.1	19.2	
Very often true	56.4	57.0	55.6	

[1] n=1,902 (1,156 males, 746 females)

Table 22. Emotional and mental health indicators for study sample by gender[1], continued

Emotional and mental health indicators from RAP survey	% Total (n=total non-missing)	% Males (n=total non-missing)	% Females (n=total valid responses)	X^2 p-value
Adverse Childhood Experiences survey questions (Felitti, Anda et al. 1998)				
Parent/adult in home swore at you, insulted you, or put you down	n=1732	n=1041	n=691	0.117
Never	27.2	26.1	28.8	
Once/twice	27.7	28.5	26.5	
Sometimes	24.5	26.2	22.0	
Often	11.4	10.7	12.6	
Very often	9.1	8.5	10.1	
Parent/adult in home pushed, grabbed, or slapped you?	n=1751	n=1060	n=691	0.139
Never	47.8	48.5	46.7	
Once/twice	27.6	28.6	26.2	
Sometimes	17.0	16.6	17.7	
Often	4.5	3.9	5.4	
Very often	3.1	2.5	4.1	
Parents/adults in home pushed, grabbed, or slapped each other?	n=1747	n=1055	n=692	0.032
Never	67.1	68.6	64.7	
Once/twice	17.6	17.4	17.8	
Sometimes	9.8	9.8	10.0	
Often	3.8	3.1	4.9	
Very often	1.7	1.0	2.6	
Adult touched you sexually or tried to make you touch them	n=1732	n=1057	n=675	0.000
Never	93.1	97.4	86.4	
Once/twice	4.1	1.9	7.6	
Sometimes	1.6	0.7	3.0	
Often	0.8	0.0	2.1	
Very often	0.5	0.1	1.0	
Lived with someone who was depressed or mentally ill	n=1746 17.1	n=1055 14.1	n=691 21.6	0.000
Lived with someone who was a problem drinker or alcoholic	n=1752 20.8	n=1058 19.7	n=694 22.5	0.155

[1] n=1,902 (1,156 males, 746 females)

Table 22. Emotional and mental health indicators for study sample by gender[1], continued

Emotional and mental health indicators from RAP survey	% Total (n=total non-missing)	% Males (n=total non-missing)	% Females (n=total valid responses)	X^2 p-value
National Comorbidity Study questions				
Ever in an accident where you could have been killed but were not badly hurt	n=1730 37.6	n=1042 40.8	n=688 32.8	0.001
Ever in an accident where you were injured and had to spend at least one night in hospital	n=1730 6.9	n=1041 6.7	n=689 7.3	0.670
Ever saw close family member or friend being badly injured or killed	n=1725 20.4	n=1037 19.2	n=688 22.2	0.124
Ever saw a stranger being badly injured or killed	n=1726 23.9	n=1039 26.9	n=687 19.5	0.000
Ever seriously attacked, beaten up, or assaulted	n=1723 13.4	n=1036 13.9	n=687 12.7	0.461
Ever threatened with a knife, gun, or other weapon	n=1721 26.0	n=1034 31.0	n=687 18.5	0.000
Ever raped	n=1715 7.8	n=1033 1.6	n=682 17.0	0.000

[1] n=1,902 (1,156 males, 746 females)

Responses to RAP questions on tobacco use (Table 23) indicated that 42.1% had smoked a total of 100 or more cigarettes in their lifetime, approximately 40% smoked *regularly* at some point during their lifetime, and 31.8% had smoked on a regular basis for two or more years. The amount smoked differed by gender (p=0.016), with a greater proportion of males reporting they smoked a pack or more when they smoked regularly. Among smokers, over three-quarters (77.3%) had ever tried to quit and 31.7% initiated smoking before the legal age of eighteen. A greater proportion of males (20.3%) than females (19.4%) in this sample began smoking prior to age sixteen (p<0.001).

Less than half (43.9%) of trainees smoked cigarettes in the year prior to basic training. Over a third (35.3%) had last smoked less than a month ago. Smokeless tobacco, pipe, and cigar use were all higher among males (p<0.001). Eighteen percent of males had used smokeless tobacco three or more times in the past year, 7.4% had been using smokeless tobacco for two or more years, and only 3.0% used a can or more a day. Over half (54.8%) of trainees lived with a smoker as a child.

Looking at reported alcohol use (Table 23), 70.8% of trainees under age twenty-one and 86.2% of those age twenty-one or older had consumed one or more alcoholic drinks in the past year. A greater proportion of males (41.2%) than females (38.1%) had their first alcoholic drink prior to age sixteen (p=0.004). Among trainees age twenty-one or older, a greater proportion of males (56.1%) than females (46.8%) had been drinking alcohol regularly for two or more years (p=0.018). Among trainees less than twenty-one years of age, the difference in the proportions of males (21.7%) and females (18.8%) who had been drinking regularly for two or more years was not statistically significant (p=0.251).

Indicators of alcohol misuse or abuse revealed that more than 20% of trainees scored five points or more on the first three AUDIT questions (AUDIT-C) and more than 20% of trainees also scored a one or more on the CAGE screening tool. Compared to females, a higher proportion of males had an AUDIT-C score above five ($p<0.001$) and a CAGE score above zero ($p=0.016$). Nineteen percent of all trainees in the sample had ever driven a car within two hours of having two or more alcoholic drinks.

Looking at risk behaviors related to motor vehicle injury (Table 23), a greater percentage of males (36.5%) than females (24.1%) reported having received two or more traffic tickets for moving violations such as speeding or running a red light ($p<0.001$). More males (5.3%) than females (2.6%) reported never wearing a seat belt when driving or riding in a car ($p=0.005$).

Sexual risk behavior questions (Table 23) showed that a third (33.2%) of this sample first had sexual intercourse at age 15 or younger. A greater proportion of males (14.9%) than females (10.4%) reported never having had sex ($p=0.006$). Over half (52.1%) used a condom the last time they had sex. More women (7.3%) than men (2.1%) reported having had a medically-confirmed sexually transmitted disease ($p<0.001$).

The last set of questions described in Table 23 addressed issues surrounding diet and other miscellaneous health behaviors. A third (33.6%) of incoming trainees reported getting six or less hours of sleep on most nights. Nearly two-thirds (63.7%) reported watching television for two or more hours a day. A greater proportion of males (30.0%) than females (24.8%) drank an average of four or more caffeinated beverages a day ($p=0.013$). A greater proportion of males (67.0%) than females (61.9%) also ate fast food

two or more times per week (p=0.029). Approximately 20% of the trainees never ate breakfast.

Questions addressing weight and methods of weight control indicated that 42.2% of trainees reported weight changes in the past year. Of the three weight control methods included in the questionnaire, use of diet pills was the most common; 9.9% of males and 25.0% of females reported diet pill use. A greater proportion of females compared to males reported using diet pills, laxatives, and vomiting to lose weight ($p<0.001$). A greater proportion of males (2.3%) than females (0.9%), however, reported using steroids to lose weight or gain strength (p=0.022).

Finally, a greater percentage of males than females reported participating in vigorous physical activity four or more times per week (36.6% among males vs. 27.1% among females) in the year prior to basic training ($p<0.001$). Slightly more males (59.5%) than females (55.2%) reported participating on one or more sports teams during their last year of high school (p=0.070).

Table 23. Health and health risk behaviors for study sample by gender[1]

Health and health risk behaviors from RAP survey	% Total (n=total non-missing)	% Males (n=total non-missing)	% Females (n=total non-missing)	X^2 p-value
Tobacco use				
Ever smoked more than 100 cigarettes in life	n=1870 42.1	n=1133 43.1	n=737 40.6	0.284
Ever tried to quit smoking cigarettes[2]	n=722 77.3	n=447 77.5	n=275 76.9	0.504
Smoked cigarettes in last year	n=1853	n=1125	n=728	0.358
Not at all	56.2	56.2	56.2	
Some days	18.6	17.7	19.9	
Every day	25.3	26.1	23.9	
Age first started smoking	n=1788	n=1094	n=694	0.021
Never smoked regularly	58.3	59.0	57.2	
21 or older	2.0	1.8	2.3	
18-20 years old	7.9	7.1	9.2	
16-17 years old	11.7	11.7	11.8	
14-15 years old	10.3	11.8	7.9	
9-13 years old	9.7	8.5	11.5	
Years smoked >3 cigarettes on most days	n=1809	n=1104	n=705	0.997
Never smoked regularly	60.3	60.6	59.7	
≤1 year	8.0	8.0	8.1	
2-4 years	14.4	14.2	14.6	
5-7 years	10.2	10.1	10.4	
8 or more years	7.2	7.2	7.2	
Packs smoked each day when smoked regularly	n=1802	n=1100	n=702	0.016
Never smoked regularly	61.0	61.2	60.8	
Half pack or less	17.4	15.8	19.8	
1 pack	14.0	14.1	13.8	
More than 1 pack	7.6	8.9	5.6	
When last smoked a cigarette	n=1840	n=1118	n=722	0.506
Have never smoked	45.2	44.3	46.5	
> 1 year ago	9.5	10.0	8.7	
> 1 month ago	10.1	10.8	9.0	
> 1 week ago	23.9	23.3	24.8	
Within last few days	11.4	11.6	10.9	
Smoked pipe ≥3 times in past year	n=1802 4.7	n=1081 6.8	n=721 1.5	0.000
Smoked cigar ≥3 times in past year	n=1817 18.8	n=1093 24.4	n=724 10.4	0.000
Used smokeless tobacco ≥3 times in past year	n=1817 12.2	n=1098 18.2	n=719 3.1	0.000

[1] n=1,902 (1,156 males, 746 females)

[2] Percentages are out of 488 males and 299 females who reported smoking more than 100 cigarettes in their lifetime.

Table 23. Health and health risk behaviors for study sample by gender[1], continued

Health and health risk behaviors from RAP survey, continued	% Total (n=total non-missing)	% Males (n=total non-missing)	% Females (n=total non-missing)	X^2 p-value
Years used smokeless tobacco on most days	n=1812	n=1105	n=707	0.000
Never used regularly	90.7	86.2	97.9	
≤1 year	4.5	6.4	1.6	
2-4 years	2.5	4.0	0.3	
5-7 years	1.2	1.8	0.3	
8 or more years	1.0	1.6	0.0	
Cans used each day	n=1803	n=1104	n=699	0.000
Never used regularly	91.2	86.8	98.1	
Half can or less	6.8	10.2	1.4	
1 can or more	2.0	3.0	0.4	
Anyone in childhood home smoked regularly	n=1817	n=1100	n=717	0.442
	54.8	54.1	55.9	
Alcohol use				
During past year, had ≥1 alcoholic drink	n=1851	n=1122	n=729	
<21 years of age	70.8	70.5	71.4	0.747
≥21 years of age	86.2	87.2	84.8	0.358
Age when first had alcoholic drink	n=1843	n=1116	n=727	0.087
Never had a drink	13.5	13.9	12.8	
21 or older	6.1	5.9	6.5	
18-20 years old	15.8	13.8	19.0	
16-17 years old	24.6	25.2	23.7	
14-15 years old	19.9	20.6	18.7	
13 or younger	20.1	20.6	19.4	
Years been drinking alcohol regularly	n=1814	n=1102	n=712	
<21 years of age				0.717
Never had a drink	18.7	19.1	18.0	
Tried a few times	47.8	46.0	50.6	
1 year or less	13.0	13.2	12.6	
2-5 years	17.9	19.0	16.2	
6-10 years	2.4	2.4	2.2	
11 or more years	0.4	0.3	0.4	
≥21 years of age				0.161
Never had a drink	5.9	6.4	5.2	
Tried a few times	29.6	26.1	34.8	
1 year or less	12.0	11.3	13.1	
2-5 years	31.9	33.7	29.2	
6-10 years	13.1	14.5	10.9	
11 or more years	7.4	7.9	6.7	
Ever driven car within 2 hours of drinking ≥2 alcoholic drinks[2]	n=1788	n=1077	n=711	0.001
	19.1	21.6	15.2	

[1] n=1,902 (1,156 males, 746 females)

[2] Values represent percent reporting "Yes, but >1 year ago" and "Yes, during past year".

Table 23. Health and health risk behaviors for study sample by gender[1], continued

Health and health risk behaviors from RAP survey, continued	% Total (n=total non-missing)	% Males (n=total non-missing)	% Females (n=total non-missing)	X^2 p-value
In past year, how often had alcoholic drink	n=1765	n=1065	n=700	0.001
Never	22.2	22.3	21.9	
Once/twice	21.2	20.6	22.1	
A few times	23.6	21.3	27.1	
Monthly	10.6	10.0	11.4	
Weekly	18.9	21.3	15.3	
Daily	3.5	4.4	2.1	
In past year, how often ≥6 drinks at one sitting	n=1755	n=1057	n=698	0.000
Never	50.6	47.7	55.0	
Once/twice	16.9	16.4	17.8	
A few times	14.1	13.3	15.2	
Monthly	6.7	8.1	4.6	
Weekly	10.4	12.8	6.9	
Daily	1.3	1.7	0.6	
In past year, # alcoholic drinks on typical day of drinking	n=1723	n=1038	n=685	0.000
None	26.3	26.6	25.8	
1-2	35.7	31.9	41.5	
3-4	15.9	14.6	17.8	
5-6	8.2	8.6	7.7	
7-9	6.4	8.3	3.6	
10 or more	7.4	10.0	3.5	
Ever failed to do what normally expected of you because of drinking[2]	n=1817	n=1093	n=724	0.913
	8.8	8.7	8.8	
You or someone else physically injured due to your drinking[2]	n=1813	n=1092	n=721	0.131
	4.4	4.9	3.5	
Ever felt you could not stop drinking once started[2]	n=1791	n=1080	n=711	0.898
	6.4	6.5	6.3	
AUDIT-C score (first 3)	n=1705	n=1029	n=676	0.000
0-5	79.4	74.4	87.0	
6-12 (hazardous drinker)	20.6	25.6	13.0	

[1] n=1,902 (1,156 males, 746 females)

[2] Values represent percent reporting "Yes, but >1 year ago" and "Yes, during past year".

Table 23. Health and health risk behaviors for study sample by gender[1], continued

Health and health risk behaviors from RAP survey, continued	% Total (n=total non-missing)	% Males (n=total non-missing)	% Females (n=total non-missing)	X^2 p-value
Alcohol use: CAGE questions				
Ever felt needed to cut down on your drinking[2]	n=1798 12.2	n=1085 13.7	n=714 9.9	0.016
Ever felt annoyed because someone said you needed to cut down on your drinking[2]	n=1796 6.1	n=1083 6.4	n=713 5.8	0.591
Ever felt guilty after drinking[2]	n=1794 11.0	n=1084 10.9	n=710 11.3	0.801
Ever needed "eye-opener" in morning following day/night of heavy drinking[2]	n=1797 3.7	n=1083 4.1	n=714 2.7	0.052
Total CAGE score 0 1-4 (potential alc. abuse)	n=1789 20.7	n=1083 22.2	n=706 18.4	0.056
Motor vehicle injury risk behaviors				
# traffic tickets for moving violations None 1 2 3-4 5 or more	n=1748 50.3 18.1 13.4 12.0 6.1	n=1053 45.4 18.1 15.2 13.6 7.7	n=695 57.7 18.1 10.8 9.6 3.7	0.000
Wear a seat belt when driving/riding in car Always Usually Sometimes Never	n=1753 63.0 18.5 14.3 4.2	n=1053 60.1 19.6 15.0 5.3	n=700 67.3 16.9 13.9 2.6	0.004
Sexual history				
Age when first had sex Have never had sex 18 or older 16-17 15 or younger	n=1716 13.1 20.0 33.7 33.2	n=1040 14.9 19.7 31.9 33.5	n=676 10.4 20.4 36.4 32.8	0.029
Used condom last time had sex	n=1494 52.1	n=887 52.4	n=607 51.7	0.792
Ever told had sexually transmitted disease	n=1719 4.2	n=1036 2.1	n=683 7.3	0.000

[1] n=1,902 (1,156 males, 746 females)

[2] Values represent percent reporting "Yes, but >1 year ago" and "Yes, during past year".

Table 23. Health and health risk behaviors for study sample by gender[1], continued

Health and health risk behaviors from RAP survey, continued	% Total (n=total non-missing)	% Males (n=total non-missing)	% Females (n=total non-missing)	X^2 p-value
Diet and health				
Hours of sleep on most nights	n=1833	n=1106	n=727	0.344
10 hours or more	7.0	6.5	7.7	
9 hours	14.8	13.7	16.5	
7-8 hours	44.7	46.0	42.8	
6 hours	18.7	18.9	18.3	
5 hours	9.1	9.5	8.4	
4 hours or less	5.8	5.4	6.3	
Hours of TV on average day	n=1832	n=1106	n=726	0.248
0	5.7	5.1	6.6	
1 hour or less	30.6	29.7	32.0	
2-3 hours	45.0	46.6	42.6	
4 or more hours	18.7	18.6	18.9	
Amount of caffeinated beverages (average/day)	n=1831	n=1104	n=727	0.019
0 cups/bottles/cans	11.7	12.0	11.3	
1	21.4	19.7	23.8	
2	21.1	19.4	23.8	
3	17.9	18.8	16.4	
4-5	16.8	17.9	15.0	
6 or more	11.2	12.1	9.8	
Ate fast food	n=1825	n=1099	n=726	0.049
0 times/week	9.2	8.1	10.9	
1	25.8	24.9	27.1	
2-3	38.7	38.9	38.4	
4-7	19.2	20.7	16.9	
8-14	5.1	4.9	5.4	
15 or more	2.0	2.5	1.2	
Ate breakfast	n=1818	n=1095	n=723	0.514
5-7 times/week	26.2	27.5	24.3	
3-4 times/week	21.5	21.1	22.0	
1-2 times/week	32.5	31.8	33.6	
Never	19.8	19.6	20.1	
Weight in past year	n=1812	n=1096	n=716	0.025
Stayed same	57.8	58.1	57.3	
Lost >10lbs, dieting	12.0	11.7	12.6	
Lost >10lbs, no dieting	11.4	9.9	13.7	
Gained >10 lbs	18.8	20.3	16.5	

[1] n=1,902 (1,156 males, 746 females)

Table 23. Health and health risk behaviors for study sample by gender[1], continued

Health and health risk behaviors from RAP survey, continued	% Total (n=total non-missing)	% Males (n=total non-missing)	% Females (n=total non-missing)	X^2 p-value
Ever taken diet pills to lose weight	n=1814 15.9	n=1097 9.9	n=717 25.0	0.000
Ever taken laxatives to lose weight	n=1807 5.0	n=1088 2.8	n=719 8.3	0.000
Ever caused yourself to vomit to lose weight	n=1811 3.1	n=1091 1.4	n=720 5.7	0.000
Ever used steroids to lose weight or gain strength	n=1806 1.9	n=1091 2.3	n=715 0.9	0.022
In typical week during past year, participation in vigorous activity	n=1803	n=1088	n=715	0.000
4 or more times/week	32.8	36.6	27.1	
1-3 times/week	53.4	52.0	55.4	
Never	13.8	11.4	17.5	
Last year of high school, number of sports teams	n=1801	n=1089	n=712	0.151
3 or more	12.7	12.2	13.3	
2	20.3	21.5	18.4	
1	24.9	25.8	23.5	
None	42.2	40.5	44.8	

[1] n=1,902 (1,156 males, 746 females)

Health risk behaviors in the study sample vs. US population

Table 24 presents the self-reported prevalence of selected health risk behaviors among 17-20 year olds in this sample of persons entering Army basic training in 2003, and samples from national surveys of youth behavior conducted between 2002 and 2004. All comparisons that follow should be interpreted with caution, as proportions reported for the Army sample may reflect the higher proportion of males (60%) in the sample.

Data presented in Table 24 indicate that, while a higher proportion of the U.S. young adult population initiated cigarette use prior to age thirteen (22.1%, vs. 14.7% in the Army sample), measures of lifetime and current cigarette use in the basic training sample fell between similar measures in the general population. The proportion of basic trainees reporting smokeless tobacco use in the past year (11.7%) was higher than

proportions of the U.S. young adult population samples reporting smokeless tobacco use in the past month (7.8% and 8.2%). Cigar use three or more times in the past year among the Army sample (19.6%) was lower than reported cigar use in the past year among the U.S. young adult population (22.7%).

Measures of alcohol use in this sample of basic trainees compared to samples of the U.S. young adult population followed similar patterns. The percentage of young adults in the general population who initiated alcohol use before age thirteen (29.1%) was higher than the percentage of basic trainees who initiated alcohol use at age thirteen or younger (21.7%). Reported lifetime alcohol use in the Army population (81.3%) fell between proportions reported in national samples (87.1% and 78.2%). Proportions of basic trainees reporting current alcohol use over the past year (81.3%) are higher than alcohol use in the past month reported by U.S. population samples (61.4% and 47.1%). Heavy alcohol use among general population samples (15.1% and 29.9%) was higher than the Army sample (10.7%), but definitions of "heavy alcohol use" differed in all three surveys. The proportion of Army trainees who reported drinking and driving in the past year (10.2%) was lower than the proportion of young adults in the general population who reported drinking and driving in the past month (13.3%).

Measures of physical activity indicated that the Army sample had a lower proportion of persons reporting regular vigorous activity (54.6%) compared to a sample of high school students (64.6%). Reported participation in sports teams was similar (57.5% vs. 55.2%, Army and general population, respectively). The proportion of the young adult general population that reported watching three or more hours of television a

day (38.3%) was between the proportions of the Army sample reporting two to three hours of television viewing (42.5%) and four or more hours of viewing (20.6%) a day.

Looking at sexual health risk behaviors, 9.2% of the RAP sample reported first sexual intercourse at age thirteen or younger, while 6.6% of the U.S. population sample had reported first sexual intercourse before age thirteen. Condom use was within 2% of the national response (59.3% vs. 57.9%, Army sample vs. national sample respectively).

Reported traffic tickets for a moving violation were higher in the Army RAP sample compared to the U.S. population, however the RAP survey asked for this information in regard to one's lifetime ("*ever*"), while the YRBS asked for information regarding the last twelve months. Army trainees reporting using seat belts "sometimes or never" was slightly higher than high school students' reports of "never or rare" use (14.7% vs. 14.1%, Army vs. U.S. samples respectively). Finally, steroid use prevalence was higher among the U.S. population sample (1.9% vs. 5.0%, Army vs. U.S. samples respectively).

Table 24. Comparison of selected health risk behaviors in the study sample and selected U.S. population samples

Specific survey questions by category of health risk behavior	Army, age 17-20 (RAP) [1] %	U.S. population, age 18-25 (SAMHSA) [2] %	U.S. population, grades 9-12 (YRBS) [3] %
Tobacco use			
Age of initiation:			
Cigarette use before age 13	14.7		22.1
Lifetime cigarette use:			
Smoked more than 100 cigarettes in life	35.8		
Ever smoked part or all of a cigarette		70.2	
Ever smoked ≥1 cigarette every day for 30 days			20.0
Current cigarette use:			
Smoked cigarette less than one month ago	32.2		
Cigarette use in past month		40.2	
Smoked ≥ 1 day in past 30 days			28.5
Smokeless tobacco use:			
Smokeless tobacco use ≥3 times in past year	11.7		
Smokeless tobacco use in past month		7.8	
Smokeless tobacco use ≥1 time in past 30 days			8.2
Cigar use:			
Cigar use ≥3 times in past year	19.6		
Cigar use in past year		22.7	

[1] Sample from current study (2003), age 17-20 years only, n=1,191

[2] (Substance Abuse and Mental Health Services Administration (SAMHSA) 2004), n=22,738 (2003)

[3] (Grunbaum, Kann et al. 2002), n=13,601

Table 24. Comparison of selected health risk behaviors in the sample population and selected U.S. population samples, cont.

Specific survey questions by category of health risk behavior	U.S. Army, age 17-20 (RAP) [1] %	U.S. population, age 18-25 (SAMHSA) [2] %	U.S. population, grades 9-12 (YRBS) [3] %
Alcohol use			
Age of initiation:			
First drink at 13 years old or younger	21.7		
First drink before age 13			29.1
Lifetime alcohol use:			
Have been drinking alcohol on a regular basis	81.3		
Alcohol use in lifetime		87.1	
Ever had ≥1 drinks of alcohol			78.2
Current alcohol use:			
One or more alcoholic drink in past year	70.8		
Alcohol use in past month		61.4	
One or more alcoholic drink in past 30 days			47.1
Heavy alcohol use:			
Consumed ≥6 drinks at one sitting weekly or daily in past year	10.7		
Five or more drinks on the same occasion on 5 or more days in past 30 days		15.1	
Five or more drinks on ≥1 occasion on ≥1days in past 30 days			29.9
Drinking and driving:			
Drove within 2 hours of drinking ≥2 alcoholic drinks in past year	10.2		
Drove after drinking in past 30 days			13.3

[1] Sample from current study (2003), age 17-20 years only, n=1,191

[2] (Substance Abuse and Mental Health Services Administration (SAMHSA) 2004), n=22,738

[3] (Grunbaum, Kann et al. 2002), n=13,601

Table 24. Comparison of selected health risk behaviors in the sample population and selected U.S. population samples, cont.

Specific survey questions by category of health risk behavior	U.S. Army, age 17-20 (RAP) [1] %	U.S. population, grades 9-12 (YRBS) [3] %
Physical activity behaviors		
Vigorous activity:		
Participated in physical activity that made you sweat and breathe hard for at least 20 minutes ≥3 times/week in a typical week during past year	54.6	
Participated in physical activity that made you sweat and breathe hard for ≥20 minutes on ≥3 days in 7 days preceding survey times		64.6
Participation in sports teams:		
Played on ≥1 sports teams during last year of high school	57.5	
Played on ≥1 sports teams during past 12 months		55.2
TV viewing:		
Hours watch television on an average day (2-3; 4 or more)	42.5; 20.6	
Watched television ≥3 hours per day during average school day		38.3
Sexual health risk behaviors		
Age at first sexual intercourse:		
First sexual intercourse at age 13 or younger	9.2	
First sexual intercourse before age 13		6.6
Condom use:		
You or partner used condom during last sexual intercourse	59.3	57.9

[1] Sample from current study (2003), age 17-20 years only, n=1,191

[3] (Grunbaum, Kann et al. 2002), n=13,601

Table 24. Comparison of selected health risk behaviors in the sample population and selected U.S. population samples, cont.

Specific survey questions by category of health risk behavior	U.S. Army, age 17-20 (RAP) [1] %	U.S. population, grades 9-12 (YRBS) [3] %	U.S. population, age 16-20 (NHTSA) [4] %
Injury-related behaviors			
Traffic violations:			
One or more traffic tickets for moving violations ever (lifetime)	39.0		
Stopped ≥1 time for traffic violation in past 12 months			31.0
Seat belt use:			
Seat belt never worn; never or sometimes worn	3.7; 14.7		
Seat belt never or rarely worn		14.1	
Other behaviors			
Steroid use:			
Ever used steroids	1.9	5.0	

[1] Sample from current study (2003), age 17-20 years only, n=1,191
[3] (Grunbaum, Kann et al. 2002), n=13,601
[4] (Royal 2002), n=75

Creation of health risk behavior indices

The evaluation of missing variables in health risk behavior indices indicated that the two measures containing five items had the highest percentages missing within the study sample: the alcohol use risk behavior index (14.2%) and the personal health risk behavior index (10.3%). The missing percentages for the remaining indices were as follows: the cigarette use index (7.8%), weight control index (5.5%), and smokeless tobacco use index (0.8%). Inclusion of trainees missing only one index item resulted in the following additions to analyses that follow: n=49 (cigarette use), n=32 (smokeless tobacco use), n=158 (alcohol use), n=120 (personal health risk behaviors), and n=17 (weight control).

Review of descriptive analyses (Table 23) on the twenty-four health risk behaviors under consideration for the indices revealed that steroid use was reported by less than 2% of the sample, so this health risk behavior was removed from consideration. Next, correlation coefficients were obtained for the remaining twenty-three risk factors considered for the risk indices (Appendix C). Table 25 shows correlations between variables measuring sexual behaviors were very low (i.e., <0.10), suggesting that these measures were potentially invalid as an aggregate measure for a single construct of sexual risk. Preliminary factor analyses substantiated this finding, given the inconsistent behavior of the variable measuring age at first sexual intercourse; it grouped with alcohol use variables for males and cigarette use variables for females. These variables were dropped from further consideration for a risk index.

Table 25. Pearson correlation coefficients for sexual health risk behaviors items

	STD	Age at first intercourse	Condom use
STD	1.0	.07	.06
Age at first intercourse		1.0	.07
Condom use			1.0

Preliminary factor analyses also resulted in the measure of "tickets for moving violations" grouping with measures of alcohol use. This variable was removed from consideration for inclusion in a risk index, given the desire to create a homogenous factor representing alcohol use and existing evidence that this potentially injury-producing behavior could have an association with injury during basic training on its own, as seen in other populations (Soderstrom, Ballesteros et al. 2001). In the factor analysis that followed, the variable measuring hours of sleep remained independent from other health risk behaviors, forming its own factor. Given that factors containing only one variable are not of value, this variable was removed from consideration. A final factor analysis was performed on the remaining eighteen measures of health risk behaviors. Five factors were produced, each with an eigenvalue greater than 1.00 (Table 26). While the first factor explained the majority of the variance, as shown by the scree plot (Figure 4), all five factors together explained 54.5% of the variance. Final factor loadings are presented in Table 27.

Results of the factor analysis supported the creation of the following five health risk behavior indices: cigarette smoking (three items), smokeless tobacco use (two items), alcohol use (five items), weight control practices (four items), and items reflecting personal lifestyle choices, hereafter referred to as diet/lifestyle choices (five items).

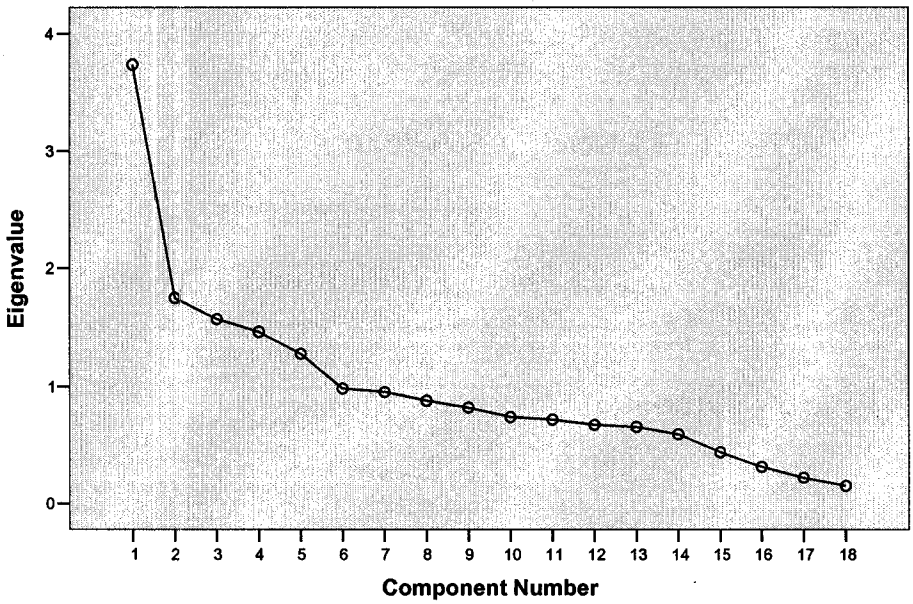
Table 26. Eigenvalues and total variance explained by five factor model

Component	Eigenvalue	% of Variance	Cumulative %
1	3.740	20.78	20.78
2	1.748	9.71	30.49
3	1.570	8.72	39.21
4	1.465	8.14	47.35
5	1.280	7.11	54.46

Table 27. Rotated factor loadings from principal components analysis of eighteen health risk behavior items

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Alcohol use					
Years had been drinking	0.800				
AUDIT-C score	0.786				
Drunk driving	0.706				
CAGE score	0.605				
Age at first drink	0.569				
Cigarette use					
Years smoked		0.809			
Age at first use		0.754			
Packs smoked		0.716			
Smokeless tobacco use					
Number of cans/packs			0.916		
Years used			0.915		
Diet/lifestyle choices					
Caffeine use				0.702	
Fast food consumption				0.653	
TV				0.566	
Breakfast				0.468	
Seat belt use				0.284	
Weight control methods					
Laxative use					0.753
Diet pill use					0.707
Vomiting					0.701

Figure 4. Scree plot of final factor analysis.



Results of tests for internal consistency of the five factors resulting from the factor analysis are shown in Table 28 and distributions are presented in Appendix D. Although the table displays results for males and females, decisions focused on results for the total population. In all cases, results supported retaining the index items as shown in **bold**, given that improvements in the alpha coefficients for the total population were no greater than 0.003 with removal of any one variable within each index.

Table 28. Internal consistency of final five health risk behavior indices

Index	Variables/items	Cronbach alpha coefficients		
		Total (n=1902)	Males (n=1156)	Females (n=746)
Cigarette use	**Retain: Age first cigarette use, packs of cigarettes smoked, years smoked**	**0.970**	**0.973**	**0.965**
	drop packs smoked	0.944	0.949	0.937
	drop age first cigarette use	0.973	0.973	0.973
	drop years smoked	0.948	0.956	0.934
Smokeless tobacco use	**Retain: Cans/packs smokeless tobacco used, years used smokeless tobacco**	**0.626**	**0.623**	**0.556**
Alcohol use	**Retain: Age at first drink, years of alcohol use, AUDIT-C score, CAGE score, drinking and driving**	**0.669**	**0.665**	**0.682**
	drop age at first drink	0.581	0.573	0.601
	drop years of alcohol use	0.530	0.519	0.560
	drop AUDIT-C score	0.613	0.622	0.596
	drop CAGE score	0.659	0.659	0.664
	drop drinking and driving	0.672	0.666	0.690
Diet/lifestyle choices	**Retain: Hours of TV/day, caffeinated beverages/day, fast food eaten/week, breakfast eaten/week, seat belt use frequency**	**0.449**	**0.432**	**0.471**
	drop TV viewing	0.416	0.414	0.416
	drop caffeine use	0.316	0.283	0.360
	drop fast food eaten	0.350	0.356	0.339
	drop breakfast eaten	0.411	0.377	0.448
	drop seat belt use	0.445	0.419	0.482
Weight control practices	**Retain: Diet pill use, laxative use, vomiting**	**0.502**	**0.497**	**0.478**
	drop diet pills	0.446	0.553	0.368
	drop laxatives	0.348	0.318	0.341
	drop vomiting	0.428	0.402	0.418

The relationship of these low, medium, and high risk categories to the combined risk index are presented in Table 29. For nearly all individual indices, the relationship with the combined risk-taking index is as expected; those in the lowest risk categories for

the individual health risk behavior indices have the lowest mean combined risk-taking score and those in the highest risk categories have the highest mean combined risk-taking score. The exception to this trend seen with smokeless tobacco use among females was most likely due to the rareness of this behavior among women (<2%).

Table 29. Mean combined risk-taking index score by low/medium/high risk category of individual health risk behavior indices[1]

Index	Males		Females	
	n	Mean combined score (±SD)	n	Mean combined score (±SD)
Cigarette use				
Low risk	665	44.7 (±25.1)	419	45.7 (±23.4)
Medium risk	76	103.1 (±35.3)	52	96.0 (±33.0)
High risk	361	129.7 (±33.9)	242	115.8 (±24.8)
Smokeless tobacco use				
Low risk	966	64.5 (±39.4)	698	71.7 (±40.4)
Medium risk	64	143.7 (±33.5)	11	129.2 (±47.4)
High risk	81	159.5 (±37.9)	3	107.0 (±51.0)
Alcohol use				
Low risk	507	46.6 (±31.8)	376	52.8 (±33.0)
Medium risk	336	85.5 (±40.1)	236	84.5 (±33.8)
High risk	239	126.3 (±44.3)	94	120.9 (±34.5)
Diet/lifestyle choices				
Low risk	653	62.6 (±43.1)	474	64.8 (±39.4)
Medium risk	401	91.6 (±49.7)	225	86.4 (±41.1)
High risk	45	137.3 (±40.8)	28	97.9 (±34.1)
Weight control practices				
Low risk	1070	74.8 (±48.2)	662	68.0 (±38.0)
Medium risk	16	123.1 (±39.9)	46	115.9 (±36.2)
High risk	8	184.1 (±37.3)	12	154.7 (±40.6)

[1]p-values from one-way analysis of variance by gender were ≤0.001 for all indices

Table 30 compares the distribution of risk scores by risk category (low/medium/high) by gender. The proportions of low, medium, and high risk cigarette users are similar among males and females (p=0.902). However, due to the greater number of male smokeless tobacco users, a greater proportion of males were captured in the medium and high risk smokeless tobacco index categories. Similarly, due to a greater number of females using diet pills, laxatives, and vomiting to control weight, a greater proportion of females were captured in the medium and high risk weight control index categories. A higher proportion of males were high risk alcohol users (p<0.001). Distributions within the diet/lifestyle index were fairly similar, with a slightly greater proportion of females in the low risk category (p=0.042).

Table 30. Distribution of risk categories by index and gender

Index	Category	Male %	Female %	p*
Cigarette use	Low risk	60.3	59.6	0.902
	Medium risk	6.9	7.4	
	High risk	32.8	33.0	
Smokeless tobacco	Low risk	86.9	98.0	0.000
	Medium risk	5.8	1.5	
	High risk	7.3	0.4	
Alcohol use	Low risk	46.9	53.3	0.000
	Medium risk	31.1	33.4	
	High risk	22.1	13.3	
Weight control practices	Low risk	97.8	91.9	0.000
	Medium risk	1.5	6.4	
	High risk	0.7	1.7	
Diet/lifestyle choices	Low risk	59.4	65.2	0.042
	Medium risk	36.5	30.9	
	High risk	4.1	4.0	

*from X^2 statistic

Table 31 shows the mean combined risk-taking index scores for all major categorical covariates by gender. Among both males and females, mean combined risk-taking scores were higher among trainees with the following characteristics: white race, married or other marital status, age 22 or older, earned a GED, joined the Regular Army, and overweight or obese. Among males, those who reported vigorous exercise four or more days a week prior to basic training had a higher mean combined risk-taking score, while females who reported never exercising vigorously prior to training had a higher mean combined risk-taking score.

Table 32 presents the correlation of the combined risk-taking score with continuous measures of fitness from the Army Physical Fitness Test. Among both males and females, the correlation between fitness and risk-taking was similar; those with lower levels of aerobic fitness (i.e., slower run times) had higher combined risk-taking scores. The relationship with measures of muscle endurance followed this pattern as well; negative correlations between sit-ups or pushups and the combined risk-taking score indicated that males and females with higher levels of muscle endurance (i.e., completed more sit-ups or pushups on the APFT) tended to have lower combined risk-taking scores.

Table 31. Mean combined risk-taking index scores for major categorical covariates by gender

Covariate	Category	Mean combined risk-taking score (± standard deviation)	
		Males	Females
Race/ethnicity	White	82.5 (±50.7)	80.8 (±43.9)
	Black	54.9 (±34.4)	59.6 (±30.9)
	Hispanic	65.1 (±44.8)	55.6 (±35.6)
	p-value[1]	0.000	0.000
Marital status	Single	73.7 (±48.2)	70.3 (±41.4)
	Married or other	91.2 (±52.5)	82.1 (±38.7)
	p-value[1]	0.000	0.004
Age	17-21 years old	72.2 (±47.8)	68.9 (±40.5)
	22-37 years old	85.7 (±51.2)	81.2 (±41.5)
	p-value[1]	0.000	0.000
Education level	Some college or more	66.1 (±42.9)	66.7 (±39.2)
	GED	108.4 (±49.1)	99.9 (±41.2)
	High school graduate	75.3 (±48.4)	71.6 (±40.2)
	No high school diploma or still in high school	61.5 (±45.3)	63.0 (±40.5)
	p-value[1]	0.000	0.000
Component	Regular Army	80.7(±49.1)	75.3 (±40.8)
	Army Reserve or National Guard	71.1(±48.9)	68.4 (±41.5)
	p-value[1]	0.002	0.034
Vigorous activity prior to basic training	4+ times/week	92.9 (±53.4)	70.2 (±39.3)
	1-3 times/week	77.1 (±49.2)	70.8 (±41.3)
	never	69.7 (±46.2)	81.7 (±41.6)
	p-value[1]	0.000	0.035
BMI	normal	72.4 (±48.4)	65.9 (±40.7)
	underweight	74.4 (±48.7)	69.9 (±40.8)
	overweight or obese	79.0 (±49.9)	81.3 (±41.2)
	p-value[1]	0.317	0.005

[1] p-value from t-test or ANOVA, separately for males and females

Table 32. Correlations between the combined risk-taking index and continuous covariates by gender

Covariate	Pearson correlation coefficients			
	Males	p-value	Females	p-value
Runtime on initial APFT	0.140	0.01	0.107	0.01
Pushups on initial APFT	-0.064	0.05	-0.117	0.01
Situps on initial APFT	-0.131	0.01	-0.137	0.01

Figures 5 and 6 show the percentages of trainees in the high risk categories of individual health risk behavior indices according to their category of combined risk. Among both male and female trainees in the lowest combined risk-taking index category (>1SD below the mean), none (0.0%) were in the high risk categories for any of the individual health risk indices. Among males in the highest combined risk index category (>2SD from the mean), over 90% were also in the high risk cigarette use category, over 79% were in the high risk smokeless tobacco use category, and over 81% were in the high risk alcohol use category. However, despite their high combined risk-taking score, the majority (86%) of males in the highest combined risk category (>2SD from the mean) were "low risk" with regard to weight control practices and 68% were "medium risk" with regard to diet/lifestyle choices.

Among females (Figure 6) in the highest combined risk index category (>2SD from the mean), over 70% were also in the high risk cigarette use category, over 83% were in the high risk alcohol use category, and over 33% were in the high risk weight control practices category. Similar to what was seen among males, most female trainees (89%) in the highest combined risk category were either "low risk" or "medium risk" with regard to diet/lifestyle choices. In addition, due to the very small number of

smokeless tobacco users among females, most females in the highest combined risk index category (>2SD from the mean) were in the low risk smokeless tobacco use index category.

Figure 5. Percentage of trainees in high risk categories of individual health risk behavior indices by category of combined risk-taking index, males

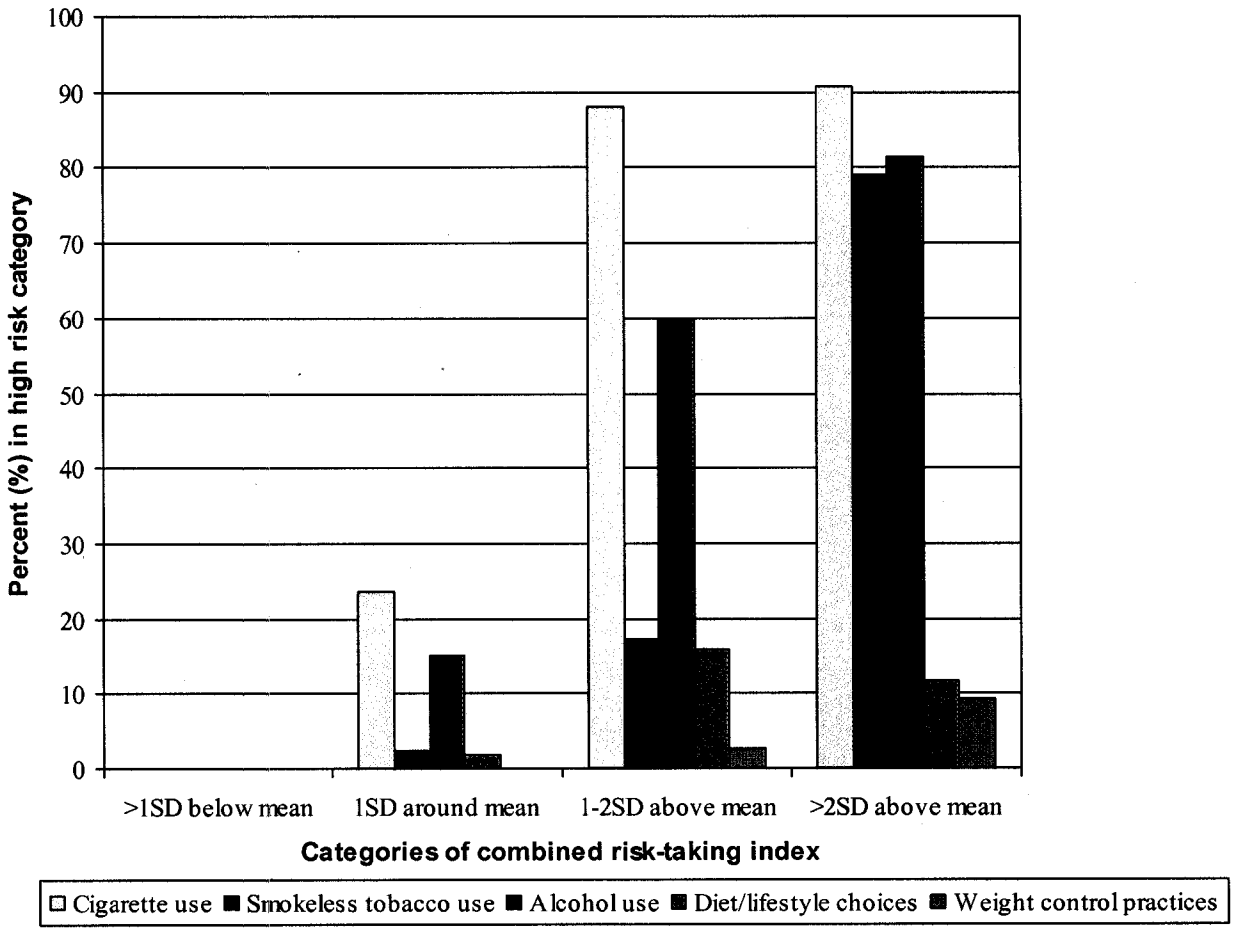
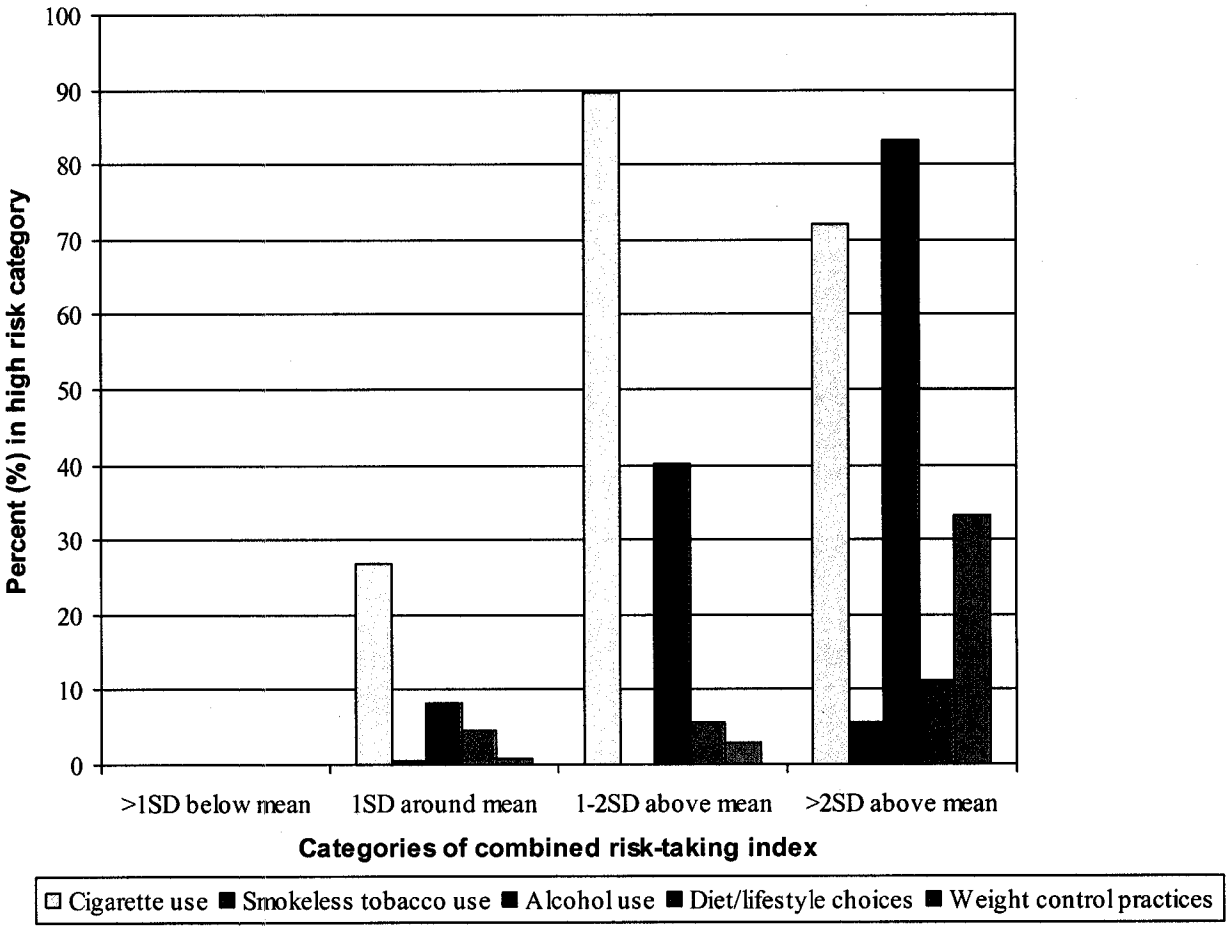


Figure 6. Percentage of trainees in high risk categories of individual health risk behavior indices by category of combined risk-taking index, females



Correlations of the individual health risk indices and the combined risk-taking index showed statistically significant correlations (p=0.01 level) of the combined risk-taking index with all individual risk indices for both men and women (Tables 33 and 34). Additionally, all correlations were positive. For both males and females, cigarette use was highly correlated with alcohol use and diet/lifestyle choices. For females, cigarette use was also correlated (p=0.05 level) with weight control practices and, for males, cigarette use was correlated with smokeless tobacco use. Also specifically among males, smokeless tobacco use was highly correlated with alcohol use, diet/lifestyle choices, and weight control practices. For both men and women, alcohol use was also significantly associated with weight control practices; for men only, alcohol use was significantly associated with diet/lifestyle choices.

Table 33. Spearman rank order correlations of individual health risk behavior indices and combined risk-taking index, males (n=1,030)

	Cigarette use index	Smokeless tobacco use index	Alcohol use index	Diet/lifestyle choices index	Weight control practices index	Combined risk-taking index
Cigarette use index	1.0	**0.337**[2]	**0.418**[2]	**0.227**[2]	0.052	**0.811**[2]
Smokeless tobacco use index		1.0	**0.273**[2]	**0.132**[2]	**0.105**[2]	**0.522**[2]
Alcohol use index			1.0	**0.130**[2]	**0.155**[2]	**0.724**[2]
Diet/lifestyle choices index				1.0	0.024	**0.423**[2]
Weight control practices index					1.0	**0.265**[2]
Combined risk-taking index						1.0

[2] Significant at the 0.01 level

Table 34. Spearman rank order correlations of individual health risk behavior indices and combined risk-taking index, females (n=665)

	Cigarette use index	Smokeless tobacco use index	Alcohol use index	Diet/lifestyle choices index	Weight control practices index	Combined risk-taking index
Cigarette use index	1.0	0.064	**0.343**[2]	**0.119**[2]	**0.095**[1]	**0.809**[2]
Smokeless tobacco use index		1.0	0.015	0.063	0.070	**0.167**[2]
Alcohol use index			1.0	0.049	**0.194**[2]	**0.638**[2]
Diet/lifestyle choices index				1.0	0.017	**0.326**[2]
Weight control practices index					1.0	**0.445**[2]
Combined risk-taking index						1.0

[1] Significant at the 0.05 level
[2] Significant at the 0.01 level

RESULTS PART II

The association of health risk behaviors and training-related injury

(Research Aim B)

Unadjusted Cox regression analyses

Time-to-first-injury for male and female trainees is displayed by injury type in the Kaplan-Meier plots of cumulative hazard (Figures 7-10). Regardless of injury type, females had a greater hazard of injury throughout training ($p<0.001$). Figure 7 demonstrates that half of the females were injured by approximately day thirty-six of training. One-quarter of male trainees were injured on or about forty-five days into training. Similar patterns were seen for training-related injuries that received work limitations (Figure 10). Half way through training (day 32), approximately 25% of females and 10% of males had sustained an overuse injury (Figure 8). At this same time point, half way through training, approximately 12% of females and 5% of males had sustained a traumatic injury (Figure 9).

Figure 7. Time to first training-related injury by gender

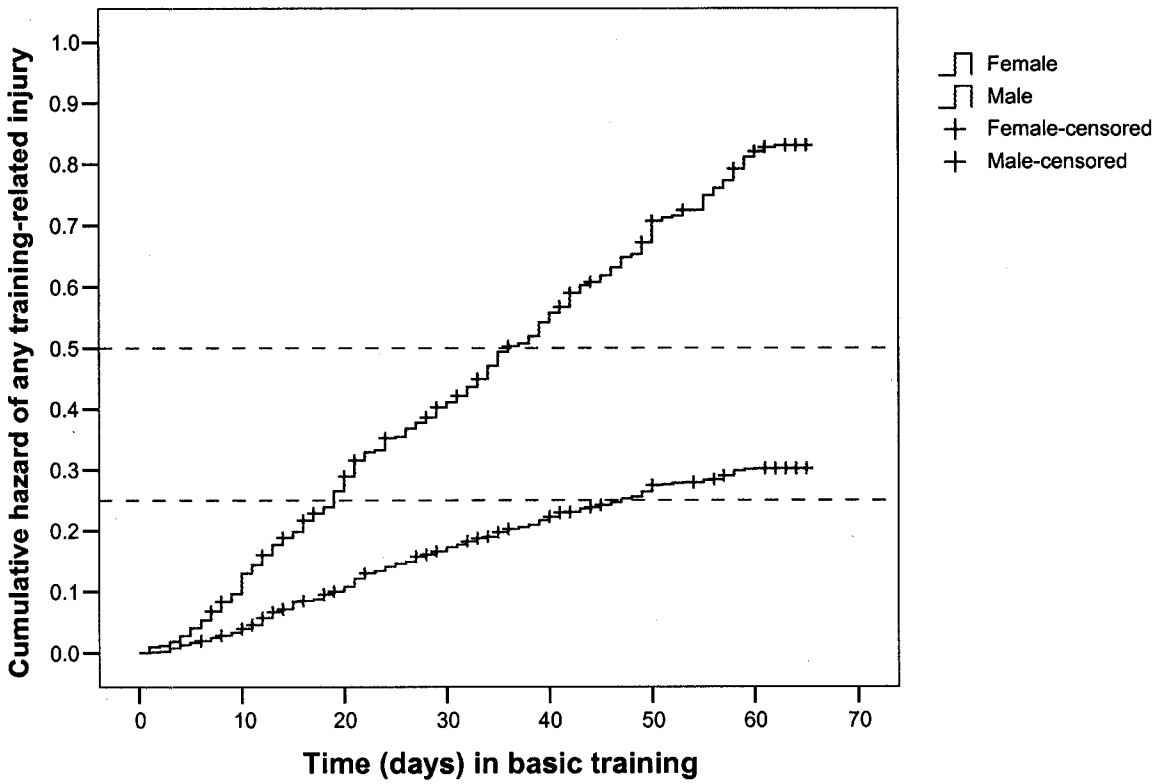


Figure 8. Time to first overuse training-related injury

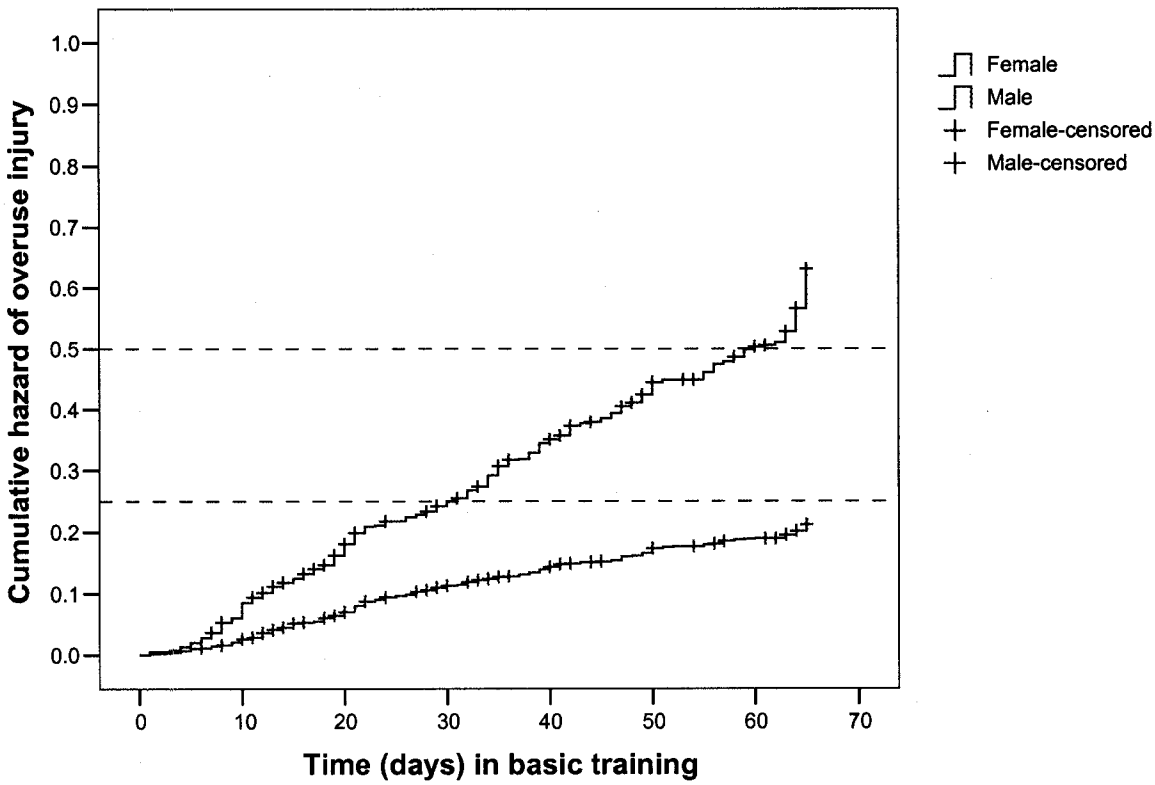


Figure 9. Time to first traumatic training-related injury

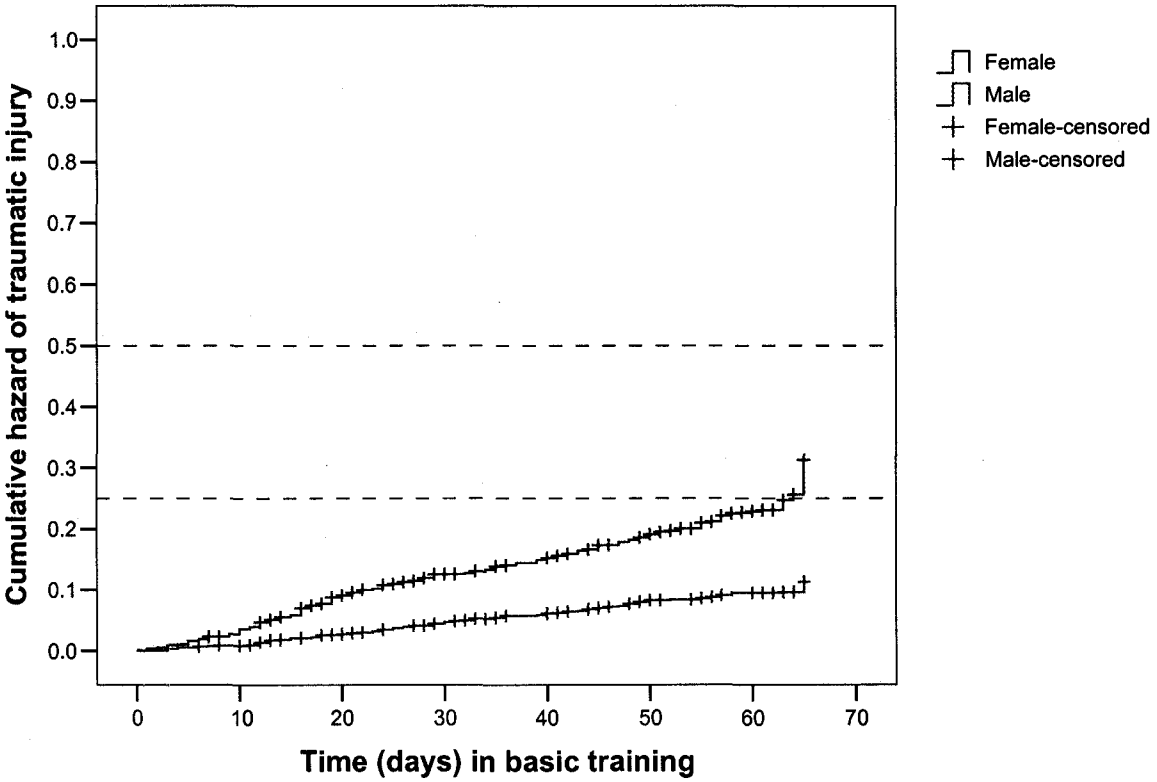
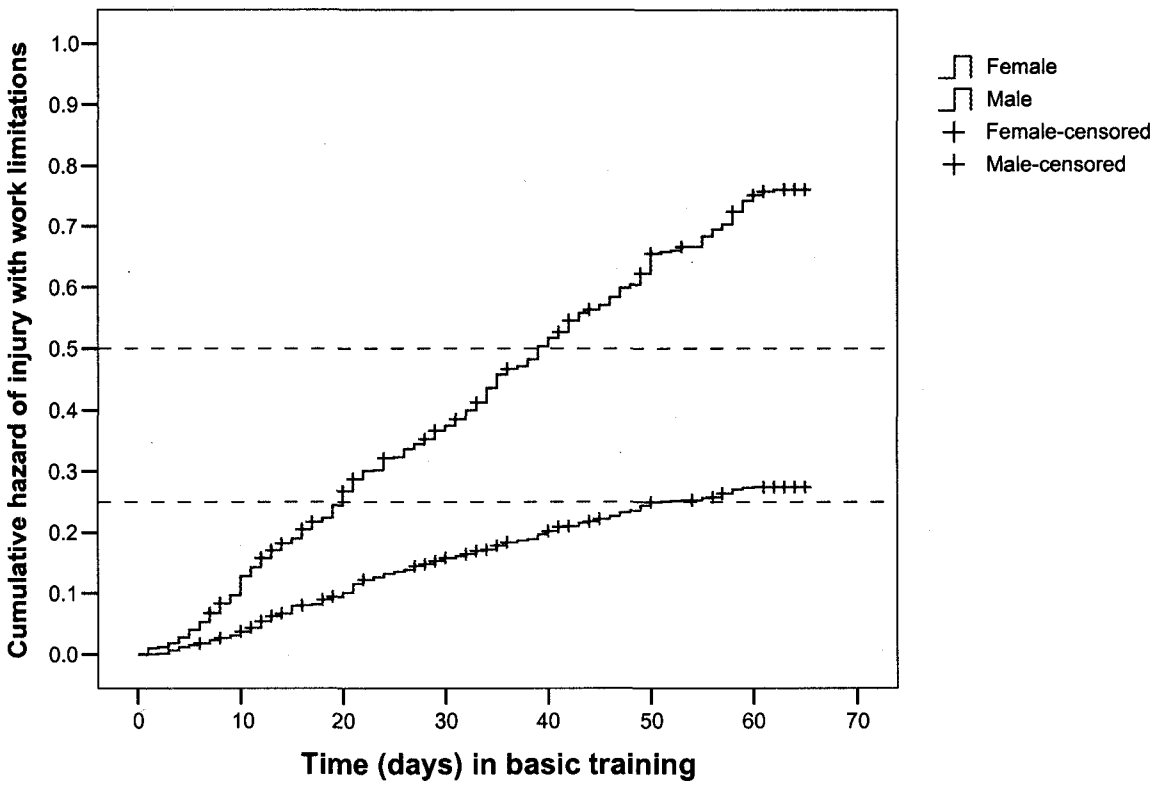


Figure 10. Time to first training-related injury with work limitations



Tables 35-38 show the unadjusted hazard ratios (HR) and 95% confidence intervals (95%CI) for univariate relationships of any training-related injury with the combined risk-taking index, individual health risk indices, and selected social and physiologic covariates for males and females in the sample. Looking first at the combined risk index, while not associated as a continuous variable, males in the highest combined risk-taking category (>2SD above the mean combined risk score) had twice the risk of any training-related injury compared to males within one standard deviation of the mean male combined risk score (HR: 2.0, 95%CI: 1.4, 2.8). Additionally, a trend existed such that injury hazard increased with increasing distance from the mean combined score. Such an association and trend were not observed among females.

Continuous measures of the individual risk indices (Table 35) were not associated with training-related injury risk among males. Among females, however, with each unit increase in the cigarette use and diet/lifestyle choices risk scores, training-related injury risk increased by 0.8% and 0.7% respectively. Among the categorical risk indices (low/medium/high risk) variables, only the cigarette use index among males and cigarette use and diet/lifestyle choice indices among females showed associations with training-related injury risk. More specifically, females in the high risk category of cigarette use had a 1.5 times greater risk of training-related injury compared to females in the low risk category (HR: 1.5, 95%CI: 1.1, 2.0). Among males, those in the medium risk category had a 1.5 times greater of injury compared to those in the low risk category (HR: 1.5, 95%CI: 1.4, 1.6). While the high risk cigarette use category showed a similar hazard, it did not reach statistical significance. The categorical diet/lifestyle risk index variable for

females indicated an 18% greater risk of training-related injury for females in the medium risk category and 63% greater risk of injury for females in the high risk category.

Table 36 presents the unadjusted association of health risk behaviors not in an index with any training-related injury. Compared to females who never received a ticket for a moving violation, those who received one to two tickets had a slightly higher injury hazard (HR: 1.09, 95%CI: 1.06, 1.11). This relationship was not seen among males.

Sexual risk behaviors (Table 36) were not associated with training-related injury risk for females. However, males who had sex for the first time between the ages of 16 and 17 had a 40% greater risk of injury (HR: 1.4, 95%CI: 1.2, 1.7). A similar, but not statistically significant, result was seen for males who reported sex for the first time at age 16 or younger. Compared to males who had never had sex, those who reported not using condoms had an elevated risk of injury (HR: 1.4, 95%CI: 1.1, 1.9).

Table 37 shows the unadjusted associations of social covariates with any training-related injury. Among females, the only variable with a statistically significant association with injury was the Army component which they had joined. In this unadjusted model, females who enlisted in the Army Reserves or National Guard had lower risk of injury relative to their female peers who had enlisted in the Regular Army (HR: 0.8, 95%CI: 0.7, 0.9). The trend among males was similar but not statistically significant.

Among males, educational level was associated with any training-related injury (Table 37). Males with a GED (HR: 1.8, 95%CI: 1.4, 2.3) or no high school diploma (HR: 1.3, 95%CI: 1.1, 1.6) had statistically significant higher injury hazard compared to

those with some college or more. In addition, male Hispanics in this sample had a lower risk of injury compared to white males.

Table 38 presents the results of unadjusted associations of physiologic covariates considered for the multivariate model. For females, all continuous measures of initial APFT results had statistically significant associations with training-related injury, such that females demonstrating higher aerobic fitness (faster run times) and higher muscle endurance (more sit-ups, more push-ups) had lower risks of injury (HR: 1.2, 95%CI: 1.1, 1.2; HR: 0.98, 95%CI: 0.97, 0.99; HR: 0.98, 95%CI: 0.97, 0.99, female run time, sit-ups, and push-ups respectively). Among males, a similar relationship existed for run time (HR: 1.2, 95%CI: 1.1, 1.4) and push-up performance (HR: 0.98, 95%CI: 0.97, 0.99). All categorical measures of fitness for both males and females showed a similar trend, although statistical significance was not always achieved; the hazard of injury compared to quartile one (most fit) increased for each successive quartile of decreasing fitness. As an example, the hazard of training-related injury is approximately 10, 60, and 80% higher among quartiles of males with successively slower run times.

Reported levels of the frequency of prior vigorous physical activity (Table 38) were also associated with training-related injury. Among both males and females, those who reported never exercising vigorously in a typical week during the past year had greater risk of injury compared to those who exercised four or more times a week (HR: 1.4, 95%CI: 1.3, 1.5 and HR: 1.5, 95%CI: 1.2, 1.8, males and females respectively). Continuous measures of age indicated that, for both males and females, the hazard of injury increased with increasing age (HR: 1.03, 95%CI: 1.02, 1.05 and HR: 1.02, 95%CI: 1.01, 1.02, males and females respectively). While continuous measures of BMI did not

indicate an association with injury, categorical measures of BMI suggested an increased risk of injury for the overweight and obese group (BMI=25.0 or higher) among both males and females (HR: 1.2, 95%CI: 1.1, 1.4 and HR: 1.2, 95%CI: 1.0, 1.4, males and females respectively).

Table 35. Unadjusted association of health risk behavior indices with any training-related injury by gender

		Males					Females				
Index	**Categories**	**n**	**Hazard Ratio**	**95%CI LL**	**95%CI UL**	**p-value**	**n**	**Hazard Ratio**	**95%CI LL**	**95%CI UL**	**p-value**
Combined risk-taking index											
Combined risk-taking index	continuous	1030	1.004	0.997	1.010	0.276	665	1.003	0.998	1.008	0.266
Combined risk-taking index, categorical	Average risk-taking (1SD around mean)	698	ref				412	ref			
	Low risk-taking (>1SD below mean)	138	1.304	0.956	1.777	0.093	128	0.818	0.656	1.020	0.075
	High risk-taking (1-2SD above mean)	151	1.429	0.649	3.146	0.375	107	1.061	0.845	1.332	0.611
	Highest risk-taking (>2SD above mean)	43	2.042	1.286	3.244	0.002	18	0.930	0.390	2.215	0.869
Individual health risk behavior indices											
Cigarette use	continuous	1102	1.007	0.997	1.017	0.193	703	1.008	1.001	1.014	0.022
Smokeless tobacco use	continuous	1111	1.005	0.994	1.016	0.388	712	0.988	0.964	1.012	0.315
Alcohol use	continuous	1082	1.006	0.991	1.021	0.452	706	1.001	0.992	1.009	0.140
Diet/lifestyle choices	continuous	1099	1.003	0.990	1.015	0.689	727	1.007	1.006	1.008	0.000
Weight control practices	continuous	1094	1.006	0.996	1.016	0.231	720	1.000	0.984	1.015	0.966
Cigarette use	low risk	665	ref				419	ref			
	medium risk	76	1.454	1.347	1.571	0.000	52	1.336	0.844	2.113	0.217
	high risk	361	1.426	0.771	2.637	0.258	232	1.491	1.096	2.029	0.011
Smokeless tobacco use	low risk	966	ref				698	ref			
	medium risk	64	1.385	0.694	2.765	0.355	11	n/r			
	high risk	81	1.198	0.705	2.037	0.505	3	n/r			
Alcohol use	low risk	507	ref				376	ref			
	medium risk	336	1.106	0.859	1.423	0.434	236	1.015	0.879	1.172	0.843
	high risk	239	1.353	0.703	2.605	0.365	94	1.044	0.763	1.428	0.787
Diet/lifestyle choices	low risk	653	ref				474	ref			
	medium risk	401	1.177	0.913	1.517	0.208	225	1.175	1.122	1.232	0.000
	high risk	45	0.619	0.339	1.129	0.118	28	1.631	1.288	2.066	0.000
Weight control practices	low risk	1070	ref				662	ref			
	medium risk	16	1.266	0.571	2.809	0.562	46	1.023	0.423	2.474	0.960
	high risk	8	0.995	0.413	2.396	0.991	12	1.221	0.457	3.265	0.690

Table 36. Unadjusted association of health risk behaviors not in an index with any training-related injury by gender

		Males				Females			
Variable	**Categories**	**n**	**Hazard Ratio**	**95%CI LL**	**95%CI UL**	**n**	**Hazard Ratio**	**95%CI LL**	**95%CI UL**
Moving violations	none	478	ref			401	ref		
	1 to 2	351	0.950	0.781	1.154	201	1.085	1.056	1.114
	3 or more	224	1.182	0.826	1.693	93	0.955	0.777	1.173
Age at first sexual intercourse	Never had sex	155	ref			70	ref		
	18 years or older	205	1.009	0.682	1.491	138	1.355	0.675	2.724
	age 16 to 17	332	1.425	1.231	1.650	246	1.217	0.690	2.145
	<age 16	348	1.351	0.989	1.847	222	1.339	0.638	2.810
Condom use last time had sex	Never had sex	152	ref			12	ref		
	Yes	465	1.374	1.026	1.839	70	1.383	0.757	2.529
	No	422	1.443	1.126	1.848	314	1.412	0.801	2.491
Ever diagnosed with STD	No	22	ref			50	ref		
	Yes	1014	0.692	0.316	1.519	633	1.126	0.858	1.477

Table 37. Unadjusted associations of social covariates with any training-related injury by gender

		Male				Female			
Variable	**Categories**	**n**	**Hazard Ratio**	**95%CI LL**	**95%CI UL**	**n**	**Hazard Ratio**	**95%CI LL**	**95%CI UL**
Race/ethnicity	White	779	ref			288	ref		
	Black	151	0.862	0.600	1.238	405	1.055	0.982	1.133
	Hispanic	136	0.647	0.513	0.816	190	0.999	0.691	1.446
Educational level	Some college or more	130	ref			94	ref		
	GED	152	1.809	1.435	2.281	73	1.706	0.793	3.670
	High school graduate	679	1.165	0.979	1.385	489	1.122	0.684	1.843
	No high school diploma or still in high school	193	1.303	1.081	1.570	87	0.948	0.498	1.804
Component	Regular Army	627	ref			464	ref		
	Reserves/NG	529	0.902	0.772	1.053	282	0.797	0.699	0.909
Army pay grade	E1	633	ref			163	ref		
	E2	231	1.007	0.794	1.276	377	0.925	0.768	1.114
	E3	222	1.147	0.679	1.936	145	0.864	0.730	1.023
	E4	70	0.758	0.518	1.107	183	0.525	0.189	1.463
Marital status	Single	968	ref			599	ref		
	Married or other	181	1.247	0.794	1.958	144	1.144	0.741	1.764

Table 38. Unadjusted associations of physiologic covariates with any training-related injury by gender

		Males				Females			
Variable	**Categories**	**n**	**Hazard Ratio**	**95%CI LL**	**95%CI UL**	**n**	**Hazard Ratio**	**95%CI LL**	**95%CI UL**
Run time on initial APFT	continuous	1115	1.168	1.103	1.361	93	1.153	1.081	1.231
Sit-ups on initial APFT	continuous	1121	0.981	0.963	1.000	717	0.976	0.967	0.985
Push-ups on initial APFT	continuous	1121	0.983	0.972	0.994	722	0.980	0.972	0.988
Run time quartiles	Q1(fastest)	284	ref			721	ref		
	Q2	265	1.136	1.144	1.514	188	1.543	1.348	1.767
	Q3	276	1.641	1.584	1.700	176	1.576	1.351	1.839
	Q4(slowest)	291	1.801	1.591	2.039	174	2.137	1.994	2.292
Sit-up quartiles	Q1(most)	255	ref			181	ref		
	Q2	245	1.065	1.025	1.107	165	1.461	1.402	1.522
	Q3	284	1.339	0.949	1.890	154	1.502	1.388	1.627
	Q4(least)	337	1.416	1.216	1.650	188	1.889	1.694	2.106
Push-up quartiles	Q1(most)	244	ref			215	ref		
	Q2	261	0.912	0.825	1.007	157	1.231	0.996	1.521
	Q3	286	1.106	1.037	1.179	188	1.336	1.083	2.070
	Q4(least)	330	1.603	1.485	1.731	174	1.487	1.083	2.040
Vigorous exercise in past year	4+ times/week	398	ref				ref		
	1-3 times/week	566	0.980	0.778	1.212	194	1.185	0.986	1.424
	never	124	1.379	1.256	1.515	396	1.481	1.220	1.797
Age	continuous	1156	1.032	1.016	1.049	125	1.017	1.012	1.022
Age groups	17-20 years old	733	ref				ref		
	21-37 years old	423	1.120	0.883	1.419	458	1.191	1.010	1.405
Body mass index (BMI)	continuous	1156	1.011	0.982	1.042	19	0.998	0.982	1.015
BMI groups - option 1	normal (<18.5)	627	ref			746	ref		
	underweight (18.5-24.9)	27	1.194	0.402	3.541	511	1.665	1.037	2.675
	overweight (25.0-29.9)	388	1.314	1.190	1.452	40	1.141	0.948	1.373
	obese (30.0+)	114	0.955	0.749	1.217	189	2.409	0.949	6.116
BMI groups - option 2	normal (<18.5)	627	ref			6	ref		
	underweight (18.5-24.9)	27	1.194	0.402	3.541	511	1.665	1.037	2.674
	overwgt or obese (25.0+)	502	1.229	1.078	1.401	40	1.168	1.009	1.353

Multivariate Cox regression analyses

For age, BMI, and the individual health risk behavior indices, the categorical forms of these variables showed univariate associations with training-related injury and were subsequently included in the multivariate analyses. For initial APFT results, continuous forms of the variables were retained in the multivariate analyses. Pay grade was dropped from consideration, given that univariate analyses indicated it was not significantly associated with training-related injury.

Other variables were excluded from multivariate analyses due to small sample sizes and concerns about the instability of statistical results using these measures. The excluded variables were as follows: STD diagnosis (n=22 males) for males, weight control practices index (n=24 medium and high risk males) for males, and smokeless tobacco use index (n=14 female smokeless tobacco users) for females.

Any training-related injury, males

Results of the multivariate modeling steps used to test the association of any training-related injury among males with the combined risk-taking index and individual risk indices are shown in Tables 39-41. In the unadjusted (univariate) model (Table 39, Model 1), males with the highest combined risk-taking scores (greater than two standard deviations above the mean score) had twice the hazard of training-related injury compared to those whose scores were within one standard deviation of the mean (HR: 2.0, 95%CI: 1.3, 3.2). In the second modeling step, social covariates were added and the combined risk-taking index, education level, and race remained in the model. Results with the inclusion of all social variables are shown in Table 39, Model 2. Component

(regular Army or Reserves/National Guard) was no longer statistically significant. The interaction between education and race was tested, but was not statistically significant.

In the third modeling step (Table 39, Model 3), physiologic covariates were added. The following variables remained in the model: the combined risk-taking index, education level, race/ethnicity, and run time on the initial APFT. An interaction was found between race/ethnicity and age; as a result, analyses that follow show hazard ratios by race within age groups.

Based on the results of the previous modeling steps, the social and physiologic covariates included in the final model testing the association of the combined risk-taking index with training-related injury among males were as follows: education level, initial APFT run time, race/ethnicity, age, and the interaction of race/ethnicity and age. The hazard ratios and 95% confidence intervals of covariates in this model are shown in Table 40. After adjusting for aerobic fitness, age, race, and education, males in the highest combined risk-taking index had a 2.4 times greater risk of training-related injury compared to those within one standard deviation of the mean combined risk-taking index (HR: 2.4, 95%CI: 1.6, 3.6). In addition, males with the lowest combined risk-taking scores had a 1.5 times greater risk of injury compared to those with average risk-taking scores(HR: 1.5, 95%CI: 1.1, 2.0).

The final adjusted model testing the association of the combined risk-taking index and individual health risk behavior indices with training-related injury among males contained the following covariates: combined risk-taking index, cigarette use index, run time on the initial APFT, education level, race/ethnicity, age, and the interaction between race and age. The hazard ratios and 95% confidence intervals are shown in Table 41.

Males in the highest combined risk-taking index had a 1.9 times greater risk of training-related injury compared to those within one standard deviation of the mean combined risk-taking index (HR: 1.9, 95%CI: 1.6, 2.3) after adjusting for aerobic fitness, age, race, education, and cigarette use. Additionally, males with the lowest combined risk-taking scores had 1.7 times greater risk of training-related injury compared to those within average risk-taking scores (HR: 1.7, 95%CI: 1.5, 2.0). Cigarette use was independently associated with training-related injury risk as well; males in the medium risk category of cigarette use were at 1.8 times greater risk of training-related injury compared to males in the low risk cigarette use category (HR: 1.8, 95%CI: 1.3, 2.4). The hazard ratio for males in the high risk cigarette use category was elevated, but not statistically significant (HR: 1.4, 95%CI: 0.9, 2.4).

All other individual health risk behavior indices (i.e., smokeless tobacco use, alcohol use, diet/lifestyle choices, weight control practices) were not associated with injury risk in the adjusted models. Other health risk behavior variables that were not included in a risk index (age at first sexual intercourse, condom use, number of tickets for moving violations) were also evaluated for association with training-related injury while adjusting for social and physiologic covariates. None of these health risk behaviors were retained in a multivariate model.

Table 39. Cox regression models testing the association of the combined risk-taking index with any training-related injury, males

Variable	Categories	Hazard ratio (95% confidence interval)
Model 1: Unadjusted		
Combined risk-taking index	Average risk-taking (1SD around mean)	ref
	Low risk-taking (>1SD below mean)	1.30 (0.96, 1.78)
	High risk-taking (1-2SD above mean)	1.43 (0.65, 3.15)
	Highest risk-taking (>2SD above mean)	2.04 (1.29, 3.24)
Model 2: Full model with all social covariates		
Combined risk-taking index	Average risk-taking (1SD around mean)	ref
	Low risk-taking (>1SD below mean)	1.44 (1.12, 1.83)
	High risk-taking (1-2SD above mean)	1.37 (0.67, 2.81)
	Highest risk-taking (>2SD above mean)	2.07 (1.24, 3.44)
Race/ethnicity	White	ref
	Black	1.12 (0.88, 1.64)
	Hispanic	0.65 (0.52, 0.83)
Education level	Some college or more	ref
	GED	1.74 (1.66, 1.82)
	High school graduate	1.13 (0.73, 1.75)
	No high school diploma or still in high school	1.60 (0.95, 2.69)
Component	Regular Army	ref
	Army Reserve or National Guard	0.86 (0.72, 1.02)
Marital status	Single	ref
	Married or other	1.07 (0.61, 1.90)

Table 39, continued. Cox regression models testing the association of the combined risk-taking index with any training-related injury, males

Model 3: Full model with all physiologic covariates and statistically significant social covariates from Model 2		
Variable	**Categories**	**Hazard ratio (95% confidence interval)**
Combined risk-taking index	Average risk-taking (1SD around mean)	ref
	Low risk-taking (>1SD below mean)	1.40 (0.93, 2.11)
	High risk-taking (1-2SD above mean)	1.38 (0.70, 2.73)
	Highest risk-taking (>2SD above mean)	2.08 (1.48, 2.92)
Race/ethnicity	White	ref
	Black	1.28 (0.96, 1.69)
	Hispanic	0.67 (0.50, 0.89)
Education level	Some college or more	ref
	GED	1.73 (1.41, 2.13)
	High school graduate	1.19 (0.77, 1.86)
	No high school diploma or still in high school	1.52 (0.95, 2.44)
Runtime on initial APFT	continuous	1.14 (1.03, 1.27)
Pushups on initial APFT	continuous	0.99 (0.98, 1.00)
Situps on initial APFT	continuous	0.99 (0.96, 1.02)
Age	17-21 years old	ref
	22-37 years old	1.03 (0.85, 1.26)
Vigorous activity prior to basic training	4+ times/week	ref
	1-3 times/week	0.88 (0.58, 1.33)
	never	1.02 (0.70, 1.49)
BMI	normal	ref
	underweight	1.17 (0.45, 3.04)
	overweight or obese	0.94 (0.76, 1.15)

Table 40. Final Cox regression model for males, combined risk-taking index only

Variable	Categories	Hazard ratio (95% confidence interval)
Combined risk-taking index	Average risk-taking (1SD around mean)	ref
	Low risk-taking (>1SD below mean)	1.51 (1.12, 2.03)
	High risk-taking (1-2SD above mean)	1.40 (0.68, 2.87)
	Highest risk-taking (>2SD above mean)	2.37 (1.57, 3.59)
Education level	Some college or more	ref
	GED	1.71 (1.51, 1.93)
	High school graduate	1.16 (0.85, 1.57)
	No high school diploma or still in high school	1.50 (1.09, 2.06)
Age 17-21	Whites	ref
	Blacks	1.28 (1.12, 1.46)
	Hispanics	0.43 (0.22, 0.81)
Age 22-37	Whites	0.96 (0.66, 1.38)
	Blacks	1.00 (0.45, 2.23)
	Hispanics	1.26 (0.79, 2.02)
Runtime on initial APFT	continuous	1.17 (1.09, 1.25)

Table 41. Final Cox regression model for males, combined risk-taking and cigarette use indices

Variable	Categories	Hazard ratio (95% confidence interval)
Combined risk-taking index	Average risk-taking (1SD around mean)	ref
	Low risk-taking (>1SD below mean)	1.73 (1.47, 2.05)
	High risk-taking (1-2SD above mean)	1.16 (0.79, 1.70)
	Highest risk-taking (>2SD above mean)	1.92 (1.57, 2.34)
Cigarette use index	Low risk	ref
	Medium risk	1.77 (1.31, 2.40)
	High risk	1.43 (0.80, 2.40)
Education level	Some college or more	ref
	GED	1.60 (1.28, 1.99)
	High school graduate	1.14 (0.86, 1.50)
	No high school diploma or still in high school	1.50 (1.13, 1.98)
Runtime on initial APFT	continuous	1.17 (1.08, 1.26)
Age 17-21	Whites	ref
	Blacks	1.35 (1.21, 1.50)
	Hispanics	0.43 (0.21, 0.88)
Age 22-37	Whites	0.96 (0.70, 1.31)
	Blacks	1.05 (0.46, 2.40)
	Hispanics	1.26 (0.81, 1.97)

Other training-related injury types, males

The model developed for any training-related injury was next used to test the associations of the combined risk-taking index with overuse training-related injury, traumatic training-related injury, and training-related injuries with work limitations among males (Tables 42-44). In the overuse injury model (Table 42), only those males with the lowest combined risk-taking scores were at greater risk of injury compared to males with "average" risk-taking scores (HR: 1.7, 95%CI: 1.3, 2.0). In addition, males in

the medium risk cigarette use category had a statistically significant higher hazard compared to males in the low risk cigarette use category (HR: 1.9, 95%CI: 1.3, 3.0).

For traumatic training-related injuries (Table 43), all levels of the combined risk-taking index were associated with training-related injury. Compared to males with average combined risk-taking scores, those with the lowest risk-taking scores had twice the risk of traumatic injury (HR: 2.2, 95%CI: 1.3, 3.7), those with slightly elevated risk scores had 1.6 times the risk of traumatic injury (HR: 1.6, 95%CI: 1.5, 1.7), and those with the highest risk-taking scores had 1.7 times the risk of traumatic injury (HR: 1.7, 95%CI: 1.2, 2.3). Additionally, males in the high risk category of cigarette use had twice the risk of traumatic injury compared to their peers in the low risk category (HR: 2.2, 95%CI: 1.4, 3.6).

Results for training-related injuries with work limitations (Table 44) were similar to results reported for any training-related injury (Table 41). Both the males with the lowest combined risk-taking scores and the highest combined risk-taking scores had statistically significant greater risk of injury compared to males of "average" risk-taking tendency (HR: 2.0, 95%CI: 1.6, 2.6 and HR: 2.0, 95%CI: 1.5, 2.5, lowest and highest combined risk-taking categories, respectively). As seen in models for any training-related injury and overuse training-related injury, males in the medium risk cigarette use category had an elevated hazard of injury resulting in work limitations (HR: 1.9, 95%CI: 1.4, 2.5).

Table 42. Final Cox regression model for males, *overuse* training-related injury

Variable	Categories	Hazard ratio (95% confidence interval)
Combined risk-taking index	Average risk-taking (1SD around mean)	ref
	Low risk-taking (>1SD below mean)	1.66 (1.34, 2.05)
	High risk-taking (1-2SD above mean)	1.07 (0.48, 2.39)
	Highest risk-taking (>2SD above mean)	1.40 (0.72, 2.73)
Cigarette use index	Low risk	ref
	Medium risk	1.94 (1.27, 2.97)
	High risk	1.16 (0.67, 2.00)
Education level	Some college or more	ref
	GED	2.10 (1.63, 2.70)
	High school graduate	1.30 (0.97, 1.75)
	No high school diploma or still in high school	1.39 (1.20, 1.62)
Runtime on initial APFT	continuous	1.14 (1.07, 1.23)
Age 17-21	Whites	ref
	Blacks	1.46 (0.98, 2.18)
	Hispanics	0.45 (0.16, 1.31)
Age 22-37	Whites	1.32 (0.84, 2.07)
	Blacks	1.37 (0.59, 3.17)
	Hispanics	1.29 (0.68, 2.47)

Table 43. Final Cox regression model for males, *traumatic* training-related injury

Variable	Categories	Hazard ratio (95% confidence interval)
Combined risk-taking index	Average risk-taking (1SD around mean)	ref
	Low risk-taking (>1SD below mean)	2.16 (1.25, 3.73)
	High risk-taking (1-2SD above mean)	1.58 (1.46, 1.71)
	Highest risk-taking (>2SD above mean)	1.65 (1.18, 2.31)
Cigarette use index	Low risk	ref
	Medium risk	1.27 (0.65, 2.47)
	High risk	2.22 (1.38, 3.56)
Education level	Some college or more	ref
	GED	1.22 (0.39, 3.79)
	High school graduate	1.42 (0.69, 2.91)
	No high school diploma or still in high school	2.69 (1.13, 5.36)
Runtime on initial APFT	continuous	1.09 (1.08, 1.11)
Age 17-21	Whites	ref
	Blacks	1.39 (0.74, 2.65)
	Hispanics	0.57 (0.24, 1.35)
Age 22-37	Whites	0.61 (0.43, 0.86)
	Blacks	0.47 (0.15, 1.48)
	Hispanics	1.71 (0.99, 2.94)

Table 44. Final Cox regression model for males, training-related injury *with work limitations*

Variable	Categories	Hazard ratio (95% confidence interval)
Combined risk-taking index	Average risk-taking (1SD around mean)	ref
	Low risk-taking (>1SD below mean)	2.02 (1.57, 2.59)
	High risk-taking (1-2SD above mean)	1.09 (0.70, 1.71)
	Highest risk-taking (>2SD above mean)	1.95 (1.53, 2.47)
Cigarette use index	Low risk	ref
	Medium risk	1.90 (1.42, 2.53)
	High risk	1.41 (0.78, 2.55)
Education level	Some college or more	ref
	GED	1.65 (1.14, 2.39)
	High school graduate	1.11 (0.88, 1.40)
	No high school diploma or still in high school	1.25 (1.96, 1.62)
Runtime on initial APFT	continuous	1.17 (1.10, 1.25)
Age 17-21	Whites	ref
	Blacks	1.52 (1.33, 1.74)
	Hispanics	0.44 (0.22, 0.86)
Age 22-37	Whites	1.06 (0.88, 1.29)
	Blacks	0.93 (0.44, 1.95)
	Hispanics	1.30 (1.09, 1.56)

Any training-related injury, females

Results of the modeling steps used to test the association of any training-related injury among females with the combined risk-taking index and individual risk indices are shown in Tables 45-47. In the unadjusted (univariate) model (Table 45, Model 1), the combined risk-taking score was not associated with training-related injury. In the second model, to which social covariates had been added, only component (regular Army or Reserves/National Guard) was statistically significantly associated with training-related

injury (Table 45, Model 2). Education, specifically the variable representing trainees with a GED, exited the backward stepwise regression model at $p<0.100$.

In the third modeling step, physiologic covariates were added. The following variables displayed statistically significant associations with training-related injury: run time on the initial APFT, sit-up performance on the initial APFT, component, and age (Table 45, Model 3). An interaction between BMI and age was found; tables that follow show results by age and BMI group.

Based on the results of the previous modeling steps, the social and physiologic covariates considered for inclusion in the final models were as follows: run time on the initial APFT, sit-up performance on the initial APFT, BMI, age, and the interaction between BMI and age. The hazard ratios and 95% confidence intervals of all covariates are shown in Table 46. The combined risk-taking index was not a predictor of training-related injury in this multivariate model.

The next step of the modeling process (Table 47), the inclusion of individual health risk behavior indices in the model, revealed that both the cigarette use and diet/lifestyle indices were associated with risk of training-related injury among females, while adjusting for the combined risk-taking index and social and physiologic covariates. Females in the high risk cigarette use category had an approximately 50% greater risk of injury compared to females in the low risk category (HR: 1.5, 95%CI: 1.1, 2.1). Females in the high risk diet/lifestyle index category also had an approximately 50% greater injury hazard compared to females in the low risk category (HR: 1.5, 95%CI: 1.2, 1.9). Alcohol use and weight control practices indices were not associated with training-related injury. No other health risk behavior variables (age at first sexual intercourse, condom use,

number of tickets for moving violations) were associated with training-related injury in a multivariate model.

Table 45. Cox regression models testing the association of the combined risk-taking index with any training-related injury, females

Variable	Categories	Hazard ratio (95% confidence interval)
Model 1: Unadjusted		
Combined risk-taking index	Average risk-taking (1SD around mean)	ref
	Low risk-taking (>1SD below mean)	0.82 (0.66, 1.02)
	High risk-taking (1-2SD above mean)	1.06 (0.85, 1.33)
	Highest risk-taking (>2SD above mean)	0.93 (0.39, 2.22)
Model 2: Full model with all social covariates		
Combined risk-taking index	Average risk-taking (1SD around mean)	ref
	Low risk-taking (>1SD below mean)	0.90 (0.68, 1.20)
	High risk-taking (1-2SD above mean)	0.86 (0.62 , 1.18)
	Highest risk-taking (>2SD above mean)	0.88 (0.33, 2.34)
Race/ethnicity	White	ref
	Black	0.98 (0.33, 1.29)
	Hispanic	0.96 (0.75, 1.45)
Education level	Some college or more	ref
	GED	1.80 (0.82, 3.93)
	High school graduate	1.24 (0.63, 2.43)
	No high school diploma or still in high school	1.15 (0.46, 2.87)
Component	Regular Army	ref
	Army Reserve or National Guard	0.86 (0.75, 0.99)
Marital status	Single	ref
	Married or other	1.28 (0.76, 2.15)

Table 45, continued. Cox regression models testing the association of the combined risk-taking index with any training-related injury, females

Variable	Categories	Hazard ratio (95% confidence interval)
Model 3: Full model with all physiologic covariates and statistically significant social covariates from Model 2		
Combined risk-taking index	Average risk-taking (1SD around mean)	ref
	Low risk-taking (>1SD below mean)	0.90 (0.72, 1.13)
	High risk-taking (1-2SD above mean)	0.99 (0.92, 1.06)
	Highest risk-taking (>2SD above mean)	0.85 (0.26, 2.84)
Component	Regular Army	ref
	Reserves or National Guard	0.88 (0.77, 0.99)
Runtime on initial APFT	continuous	1.11 (1.03, 1.19)
Pushups on initial APFT	continuous	0.99 (0.97, 1.02)
Situps on initial APFT	continuous	0.98 (0.97, 0.99)
Age	17-21 years	ref
	22-35 years	1.15 (1.06, 1.26)
Vigorous exercise prior to basic training	4+ times/week	ref
	1-3 times/week	1.00 (0.86, 1.16)
	never	1.13 (0.96, 1.32)
BMI	normal	ref
	underweight	1.50 (0.86, 2.60)
	overweight or obese	0.88 (0.73, 1.07)

Table 46. Final Cox regression model for females, combined risk-taking index only

Variable	Categories	Hazard ratio (95% confidence interval)
Combined risk-taking index	Average risk-taking (1SD around mean)	ref
	Low risk-taking (>1SD below mean)	0.90 (0.69, 1.16)
	High risk-taking (1-2SD above mean)	0.98 (0.87, 1.11)
	Highest risk-taking (>2SD above mean)	0.88 (0.31, 2.52)
Run time on initial APFT	continuous	1.12 (1.06, 1.19)
Sit-ups on initial APFT	continuous	0.98 (0.97, 0.98)
Age 17-21	Normal BMI	ref
	Underweight	1.27 (0.82, 1.98)
	Overweight or obese	0.98 (0.69, 1.41)
Age 22-35	Normal BMI	1.19 (0.97, 1.47)
	Underweight	2.86 (1.10, 7.42)
	Overweight or obese	0.97 (0.88, 1.07)

Table 47. Final Cox regression model for females, including combined risk-taking, cigarette use, and diet/lifestyle indices

Variable	Categories	Hazard ratio (95% confidence interval)
Combined risk-taking index	Average risk-taking (1SD around mean)	ref
	Low risk-taking (>1SD below mean)	1.08 (0.91, 1.29)
	High risk-taking (1-2SD above mean)	0.76 (0.57, 0.99)
	Highest risk-taking (>2SD above mean)	0.68 (0.29, 1.60)
Cigarette use index	Low risk	ref
	Medium risk	1.43 (0.96, 2.15)
	High risk	1.53 (1.10, 2.12)
Diet/lifestyle choices index	Low risk	ref
	Medium risk	1.08 (1.03, 1.14)
	High risk	1.52 (1.21, 1.93)
Run time on initial APFT	continuous	1.12 (1.05, 1.20)
Sit-ups on initial APFT	continuous	0.98 (0.97, 0.98)
Age 17-21	Normal BMI	ref
	Underweight	1.17 (0.66, 2.07)
	Overweight or obese	0.99 (0.68, 1.44)
Age 22-35	Normal BMI	1.20 (1.04, 1.39)
	Underweight	2.71 (0.98, 7.45)
	Overweight or obese	0.93 (0.80, 1.09)

Other training-related injury types, females

The model developed for any training-related injury was next used to test the associations of the combined risk-taking index with overuse training-related injury, traumatic training-related injury, and training-related injuries with work limitations among females (Tables 48-50). The combined risk-taking index was not associated with any of these injury types for females. However, in the overuse injury model (Table 48), females in the medium and high risk cigarette use index categories had a statistically significant higher hazard ratio compared to females in the low risk cigarette use category

(HR: 1.6, 95%CI: 1.3, 2.0 and HR: 1.2, 95%CI: 1.1, 1.4, medium and high risk cigarette use categories respectively). Females in the high risk diet/lifestyle index category had a statistically significant higher hazard ratio compared to females in the low risk category (HR: 1.5, 95%CI: 1.3, 1.7).

For traumatic training-related injuries (Table 49), the only statistically significant association was seen with cigarette use. Females in the high risk category of cigarette use had twice the risk of traumatic injury compared to females in the low risk category (HR: 2.0, 95%CI: 1.1, 3.6).

As seen with all previous injury types, females in the high risk cigarette use category had a higher risk of sustaining a training-related injury requiring work limitations (Table 50) compared to females in the low risk category (HR: 1.6, 95%CI: 1.2, 2.2). In addition, females in the medium risk cigarette use category had an approximately 50% higher hazard of injury compared to those in the low risk category (HR: 1.5, 95%CI: 1.0, 2.3). In addition, females with the highest diet/lifestyle risk scores had an elevated risk of injury resulting in work limitations compared to females in the lowest risk category (HR: 1.3, 95%CI: 1.1, 1.2) while controlling for statistically significant social and physiologic covariates.

Table 48. Final Cox regression model for females, *overuse* training-related injury

Variable	Categories	Hazard ratio (95% confidence interval)
Combined risk-taking index	Average risk-taking (1SD around mean)	ref
	Low risk-taking (>1SD below mean)	1.20 (0.75, 1.93)
	High risk-taking (1-2SD above mean)	0.87 (0.62, 1.21)
	Highest risk-taking (>2SD above mean)	0.61 (0.15, 2.51)
Cigarette use index	Low risk	ref
	Medium risk	1.58 (1.29, 1.95)
	High risk	1.22 (1.11, 1.35)
Diet/lifestyle choices index	Low risk	ref
	Medium risk	1.15 (0.85, 1.56)
	High risk	1.46 (1.27, 1.68)
Run time on initial APFT	continuous	1.15 (1.09, 1.21)
Sit-ups on initial APFT	continuous	0.98 (0.97, 0.99)
Age 17-21	Normal BMI	ref
	Underweight	1.64 (0.90, 2.99)
	Overweight or obese	1.04 (0.87, 1.24)
Age 22-35	Normal BMI	1.15 (1.12, 1.18)
	Underweight	3.58 (1.49, 8.61)
	Overweight or obese	0.90 (0.66, 1.23)

Table 49. Final Cox regression model for females, *traumatic* training-related injury

Variable	Categories	Hazard ratio (95% confidence interval)
Combined risk-taking index	Average risk-taking (1SD around mean)	ref
	Low risk-taking (>1SD below mean)	1.24 (0.59, 2.63)
	High risk-taking (1-2SD above mean)	0.73 (0.41, 1.31)
	Highest risk-taking (>2SD above mean)	0.88 (0.63, 1.21)
Cigarette use index	Low risk	ref
	Medium risk	1.13 (0.72, 1.80)
	High risk	2.00 (1.10, 3.63)
Diet/lifestyle choices index	Low risk	ref
	Medium risk	0.95 (0.71, 1.27)
	High risk	1.48 (0.63, 3.47)
Run time on initial APFT	continuous	1.11 (0.99, 1.23)
Sit-ups on initial APFT	continuous	0.98 (0.97, 1.00)
Age 17-21	Normal BMI	ref
	Underweight	0.79 (0.55, 1.14)
	Overweight or obese	0.91 (0.30, 2.77)
Age 22-35	Normal BMI	1.27 (0.82, 1.98)
	Underweight	1.41 (0.92, 2.18)
	Overweight or obese	1.28 (0.81, 2.02)

Table 50. Final Cox regression model for females, training-related injury *with work limitations*

Variable	Categories	Hazard ratio (95% confidence interval)
Combined risk-taking index	Average risk-taking (1SD around mean)	ref
	Low risk-taking (>1SD below mean)	1.19 (0.88, 1.64)
	High risk-taking (1-2SD above mean)	0.75 (0.53, 1.07)
	Highest risk-taking (>2SD above mean)	0.53 (0.13, 2.06)
Cigarette use index	Low risk	ref
	Medium risk	1.52 (1.02, 2.28)
	High risk	1.64 (1.21, 2.22)
Diet/lifestyle choices index	Low risk	ref
	Medium risk	1.08 (0.98, 1.18)
	High risk	1.34 (1.10, 1.63)
Run time on initial APFT	continuous	1.13 (1.07, 1.20)
Sit-ups on initial APFT	continuous	0.98 (0.97, 0.98)
Age 17-21	Normal BMI	ref
	Underweight	1.17 (0.62, 2.21)
	Overweight or obese	1.07 (0.83, 1.36)
Age 22-35	Normal BMI	1.28 (1.17, 1.39)
	Underweight	2.87 (1.12, 7.36)
	Overweight or obese	0.96 (0.71, 1.29)

DISCUSSION

As with previous studies of training-related injuries in U.S. Army basic training, this sample consisted of a substantial proportion of female trainees (39.2%), enabling the analysis of injury risk factors by gender. Analysis of RAP questionnaire responses allowed for an unusually detailed understanding of the sample. For example, most trainees reported entering the Army for practical purposes, i.e., to gain an education and job skills. Most believed their health was very good or excellent, and a large number of males had not seen a health care provider in the past five years. Emotional and mental health indicators reported by these trainees suggested that, while most seemed to have adequate social support systems, notable proportions had experienced negative life events (e.g., parental divorce, death of a loved one in the past year) and adverse childhood experiences (e.g., emotional abuse, sexual abuse, living with a problem drinker, and living with a depressed or mentally ill person). The proportions of trainees who experienced traumatic life events was also notable; 20% had seen a close family member or friend badly injured or killed, 26% had been threatened with a weapon, and 17% of women reported they had been raped.

The RAP survey also provided substantial insight into health risk behaviors. Approximately 40% of the trainees had smoked regularly during their lifetime, but 56% had not smoked in the year prior to basic training. Males tended to smoke a greater quantity of cigarettes when smoking regularly and a greater proportion of males than females reported smokeless tobacco and cigar use, as has also been reported in other populations (Grunbaum, Kann et al. 2002; Substance Abuse and Mental Health Services Administration (SAMHSA) 2004).

Lifetime and current cigarette use did not differ significantly by gender, a result contrary to what has been reported for general U.S. population samples with similar age distributions. U.S. surveys have reported lifetime and current use to be higher among adolescent males (Grunbaum, Kann et al. 2002; Substance Abuse and Mental Health Services Administration (SAMHSA) 2004). While it is known that reported substance use increases with age (Duberstein Lindberg, Boggess et al. 2000; Substance Abuse and Mental Health Services Administration (SAMHSA) 2004), females in this sample were not older than male trainees. Additionally, existing survey results indicated that black female students were less likely to report cigarette use compared to whites and Hispanics (Grunbaum, Kann et al. 2002). With a female population that was 25.5% black, the proportion of female cigarette users was expected to be lower than national survey results. Other samples of RAP survey participants reported difficulty understanding the wording of the smoking questions (Canham-Chervak, Hauret et al. 2003), therefore misclassification bias may have contributed to these results. Further exploration is warranted.

Males in this sample reported more high risk alcohol-related behaviors, as indicated by the statistically significant greater proportions of males reporting hazardous drinking behaviors (AUDIT-C score $\geq$5) and behaviors related to alcohol abuse and dependence (CAGE score $\geq$1). This result mirrors the civilian youth population, in which 21% of males age 18-25 reported heavy alcohol use in the past thirty days, compared to 9% of females (Substance Abuse and Mental Health Services Administration (SAMHSA) 2004). Additionally, as seen in YRBS data (Grunbaum,

Kann et al. 2002), males were more likely to report initiation of alcohol use at a younger age.

The higher proportion of males compared to females who reported drinking and driving, never wearing a seat belt, and having two or more tickets for moving violations indicated that males in this sample tended to take more risks that could result in physical injury. This is true in samples of the U.S. youth population as well; YRBS data has shown that 17.2% of males compared to 9.5% of females reported ever drinking and driving, and 18.1% of males compared to 10.2% of females reported never or rarely wearing a seat belt (Grunbaum, Kann et al. 2002).

For two out of three diet-related health risk behaviors, consumption of fast food and caffeinated beverages, males reported greater frequency of these behaviors. The National Heart, Lung, and Blood Institute recommends no more than two fast food meals a week (Pereira, Kartashov et al. 2005); 28.1% of males in this sample had four or more fast food meals a week and 67% had two or more fast food meals a week, compared with 23.5% and 61.9%, respectively, among females. In addition to its association with long-term health effects (Knight, Knight et al. 2004; McGee 2005), excessive caffeine use can lead to insomnia, sleep disruption, and subsequent daytime sleepiness (Millman and AAP Committee on Adolescence 2005), problems that are especially persistent in young adult populations and are associated with negative outcomes (e.g., poor school performance, motor vehicle accidents due to falling asleep at the wheel) resulting from poor cognitive functioning. Thirty percent of males in this sample reported drinking four or more caffeinated beverages a day, compared to 25% of females. In general, these measures

represent a tendency to, knowingly or unknowingly, take health risks that could result in health and life-compromising outcomes.

Despite a greater frequency of most health risk behaviors, males were more physically fit than females in the sample. Male trainees had higher APFT scores and reported greater frequency of prior vigorous activity compared to their female peers. Higher fitness likely contributed to their lower training-related injury rates.

Health risk behaviors in the study sample vs. U.S. population

In many cases, direct comparisons of the prevalence of health risk behaviors in the Army basic training population with results from national youth health risk behavior surveys were impossible due to differences in survey question wording or data grouping and reporting. For example, questions about smokeless tobacco use and alcohol use on national surveys ask about use during the past month, while the RAP survey asks about use during the past year (thus resulting in higher reported prevalence). Further complicating comparisons, the proportions shown were not gender or race-adjusted. However, these comparisons provided an *indication* of how 17-20 year olds in this sample of Army basic trainees compared to samples of similar age groups from the general U.S. population. In many instances, the proportions of health risk behaviors reported among Army trainees fell between proportions reported in national surveys. Such results are reasonable, given that the median age of the sample population fell between the age groups sampled in the national survey results presented.

Acknowledging the imperfections of these comparisons, it appears that the prevalence of lifetime and current cigarette use, lifetime and current alcohol use, sports team participation, TV viewing, sexual health risk behaviors, traffic violations, and seat

belt use in the study sample are comparable to the prevalence of these health risk behaviors in samples of U.S. youth. Differences were most apparent among the following behaviors: age of initiation of cigarette use and alcohol use, vigorous activity levels, drinking and driving, and steroid use.

The higher proportion of youth reporting cigarette use prior to age 13 in the U.S. sample (22.1% vs. 14.7% in the Army RAP sample) may be attributable to the higher proportion of blacks in the Army population. Even with over-sampling of black populations, only 13.0% of the 2001 Youth Risk Behavior Surveillance data was gathered from black students, while almost 18% of this basic training population sample were black. YRBS data have shown that black students were significantly less likely to have smoked a whole cigarette by age 13 (Grunbaum, Kann et al. 2002). Black youth were also less likely to report current tobacco and alcohol use compared to whites and Hispanics (Grunbaum, Kann et al. 2002). The higher proportion of blacks in the Army sample may also partially explain the lower proportion reporting their first alcoholic drink at age 13 or younger (21.7%) compared to the proportion of U.S. youth reporting their first alcoholic drink before age 13 (29.1%).

Lower vigorous activity levels among persons entering basic training compared to YRBS survey participants (54.6% vs. 64.6%, respectively) could be explained by the fact that many trainees who already graduated from high school no longer benefited from routine physical activity as is often mandated by school systems or encouraged through availability of organized sports activities. According to the YRBS, one third of students in grades 9 through 12 participated in physical education classes daily (Grunbaum, Kann et al. 2002). Data from the present study also indicate that the GED group contained the

highest proportion of trainees who "never exercised vigorously" prior to basic training as compared to all other educational groups ($p<0.001$).

Given that the Army sample contains a higher proportion of males (60.8%) compared to national samples (48.7% and 47.3%, YRBS and SAMHSA surveys respectively), it was surprising that the prevalence of certain health risk behaviors, such as alcohol and smokeless tobacco use, were not higher. National surveys have indicated that such behaviors are higher among males compared to females (Grunbaum, Kann et al. 2002; Vega, Aguilar-Gaxiola et al. 2002).

Co-occurrence of health risk behaviors

Concerning the co-occurrence of health risk behaviors, correlations of individual health risk behavior indices among males indicated that trainees with a high cigarette use index score also had high scores related to smokeless tobacco use and alcohol use. Among females, most of whom did not use smokeless tobacco, cigarette use and alcohol use had the highest positive correlations of all health risk behaviors examined. In an analysis of three national youth surveys, this result was also seen; co-occurrence was greatest among measures of substance use (Duberstein Lindberg, Boggess et al. 2000). Co-occurrence of substance use behaviors in this sample was confirmed by data that showed sizable proportions of males and females in the highest combined risk-taking category were also in the highest cigarette, smokeless tobacco (males only), and alcohol use categories. Correlations among the other health risk behaviors measured by indices (diet/lifestyle choices, weight control practices) were statistically significant, but not as strong, indicating that these health risk behaviors were less likely to co-occur.

Association of health risk behaviors and training-related injury risk

For males in this sample, multivariate analyses controlling for statistically significant social and physiologic covariates showed that males with combined risk-taking index scores at the extremes (lowest, highest) had a greater risk of any type of training-related injury. Among females, this relationship was not observed. When the multivariate model for any training-related injury was applied to other, more specific, injury outcomes, the combined risk-taking index was associated with overuse, traumatic, and injuries resulting in work limitations in different ways. Males in both categories above the "average" combined risk-taking level for this sample (within one standard deviation of mean male combined risk-taking score) were at greater risk of traumatic injury. Given that risk-taking behaviors have previously been linked to traumatic injury (Cohen and Lin 1991; Bell, Amoroso et al. 2000; Williams, Bell et al. 2002), this result is not surprising. Unexpectedly, however, risk of any training-related injury (overuse, traumatic, or injury with work limitations) among males was higher in the lowest risk-taking category as well. This result suggests that males who are less willing to take risks are at an increased risk of injury in the Army basic training environment. In this environment, in which numerous strenuous physical and mental tasks are required, a certain level of risk-taking may be advantageous.

Among females, the relationship between the combined risk-taking index and injury was different; females in the high risk-taking category had a *lower* risk of any training-related injury compared to females with an "average" risk-taking tendency. For females, a slightly higher risk-taking tendency provided some protection from training-

related injury. These results suggest that risk-taking and its link with training-related injury differs for males and females.

As has been seen in other studies of Army populations (Friedl, Nuovo et al. 1992; Jones, Cowan et al. 1993; Knapik, Reynolds et al. 1997; Knapik, Sharp et al. 1999; Lincoln, Smith et al. 2002), among both males and females, cigarette use was associated with injury, both overuse and traumatic. Among males, any smoking (i.e., both medium and high risk cigarette use) was associated with training-related injury, although the strongest associations were seen for male trainees who smoked a half pack or less a day, smoked for one year or less, and started smoking at an older age (i.e., medium risk cigarette users). Among females, the association was as expected; those who smoked more than one pack a day, smoked for more than a year, and initiated smoking at an early age (i.e., high risk cigarette users) had a statistically significant higher injury risk compared to non-smokers (i.e., low risk cigarette users).

The association between cigarette smoking and overuse injuries may be related to the adverse physiologic effects of nicotine that delay wound healing (White, Pedersen et al. 1988; Amoroso, Reynolds et al. 1996; Knapik, Canham-Chervak et al. 1999), although longer-term effects such as lower bone density among female smokers (Amoroso, Reynolds et al. 1996; Centers for Disease Control and Prevention 2002) and connective tissue atrophy may also play a role (Amoroso, Reynolds et al. 1996).

The link between cigarette use and traumatic injury is less clear, but the adverse effects of nicotine withdrawal (e.g., difficulty concentrating, depression) may impair judgment enough to lead to behaviors, such as stepping into a pothole while running or inappropriately negotiating an obstacle, that could result in an acute injury. Additionally,

the higher mean combined risk-taking index scores among medium and high risk cigarette use index categories (Table 29) suggests that, in general, cigarette users tend to take more health risks. Persons who risk health by smoking, drinking and driving, not wearing a seatbelt, or vomiting to control weight may also be more likely to make choices that increase their risk of traumatic training-related injury.

Among females, this tendency to take health risks may have also been captured by the diet/lifestyle index, which was associated with any training-related injury, overuse training-related injury, and training-related injury with work limitations. This index captured a tendency towards risk-taking that the combined risk-taking index, developed for both genders, did not capture for females. Whether they take these risks knowingly or unknowingly is not known, but problem-behavior theory would suggest that diet and lifestyle choices reflect "adherence to the norms of conventional society", the value an individual places on health, if they believe health can be influenced by daily choices (internal health locus of control), and if their social support systems enhance or detract from routine healthy decision-making (Jessor, Turbin et al. 1998). As stated above, such tendencies towards riskier health decisions may translate into choices that increase their risk of training-related injury as well.

Finally, there were two interactions of interest in the multivariate models. Among males, the effect of age differed by race/ethnicity. More specifically, younger Hispanic males had a lower risk of injury compared to younger white males. While a lower risk of injury among Hispanics compared to whites has been observed in other Army basic training populations (Jones, Cowan et al. 1993; Knapik, Sharp et al. 1999), risk has not been specified according to age. The lower risk of injury among younger male Hispanics

may be partially explained by their fitness; compared to young white males, they were more likely to report exercising vigorously four or more times per week (47.0% vs. 37.2%, Hispanics vs. whites; p=0.07) and had higher aerobic fitness upon entry to basic training as measured by performance on the run event of the initial APFT (p=0.034).

Among females, an interaction between age and BMI was found. In the older age group (22-35 years old), female trainees with a normal BMI (BMI=18.5-24.9) or those who were underweight (BMI<18.5) were had an increased injury risk. While overweight and obese BMI measures have been more commonly associated with increased injury risk, underweight females have been at higher risk of injury compared to those with a normal BMI in other injury studies (Benson, Geiger et al. 1989; Macera, Jackson et al. 1989), including investigations of injuries among Army basic trainees (Jones, Cowan et al. 1993; Mansfield, Knapik et al. 2001).

Limitations

Limitations of this study include its focus on one occupational group, thereby potentially limiting the generalizability of the results to the general U.S. young adult population. In fact, when compared to 20-24 year olds in the general U.S. population, the study sample had a greater percentage of males, blacks, and fewer persons with a college education. Given these differences, generalizations of results to the U.S. young adult population should be made with caution.

While the sample was comparable to previous basic training populations with regard to age, gender, and marital status, differences in distributions of race and education were found. Specifically, this sample contained a lower proportion of blacks than previous samples of U.S. Army basic trainees, most likely because of the lower RAP

participation rate among blacks. Reasons for lower participation among blacks is unclear; however analysis of anonymous evaluations of the RAP survey indicated that many non-participants were skeptical of the potential harms (e.g., self-incrimination, loss of insurability, threats to employability) communicated as part of the informed consent briefing (Canham-Chervak, Hauret et al. 2003).

The current study also had a higher proportion of trainees who had not completed high school than has been typically seen in previous samples of U.S. Army basic trainees. This was due to regulations during this time period that allowed high school juniors who enlisted in the Army to complete the basic training requirement during the summer between their junior and senior years of high school rather than waiting until after high school graduation (i.e., the "split option").

Another limitation of this study is the reliance on self-reported health risk behavior data. As with other large-scale surveys such as the Youth Risk Behavior Survey (Warren, 1997), the validity of responses to the RAP survey has not been established. Inaccurate or dishonest responses could have resulted in inappropriate risk assignments (misclassification bias). Given that many RAP questions asked about health risk behaviors "in the past year", recall bias was also possible. In addition, despite assurances that RAP questionnaire responses would not be shared with superiors or reported in a way that individuals could be identified, newly-enlisted trainees may not have been honest in their reporting of behaviors, due to fears of adverse consequences. This is especially true with regard to certain behaviors that are illegal (e.g., drinking and driving, steroid use, drinking prior to age twenty-one). Finally, comparisons of the prevalence of

health risk behaviors in the sample with national data were difficult, given differences in sample composition, question wording, and reporting of results.

Considering the injury data analysis, the follow-up visit coding methodology used in this study may have resulted in an underestimation of the number of unique (incident) injuries, and subsequently an underestimation of the number of persons with multiple injuries. However, the primary outcomes of interest in this analysis were dichotomous variables (one or more injuries, yes/no) used in prior investigations of Army basic training injuries that would not have been affected by multiple injury counts for the same individuals.

Construction of the risk indices was conducted with a number of limitations. First, given that factor analysis was designed for use with interval data, nonrandom measurement error due to groupings of ordinal responses into scaled items may distort the factor analysis results. However, Nunnally has suggested that it is legitimate to treat behavioral measures as interval scales and to use statistical analyses that rely on interval data (DeVellis 1991). Support for this argument is demonstrated in the literature, as factor analysis has been used in numerous studies of health risk behaviors (Donovan, Jessor et al. 1988; Alexander, Ensminger et al. 1992; Gullone and Moore 2000; Adelmann 2005; Koven, McColl et al. 2005)

Second, it has been suggested that factors should consist of at least four variables with loadings above 0.5; if a factor is not at least that strong, "it would be best to ignore it" (Nunnally 1978). Other researchers have also used this cut point when defining factors (Gullone and Moore 2000; Kulbok and Cox 2002). Validity of the analysis may have been reduced by the use of indices with less than four variables.

Third, measures of internal consistency indicated that the indices were not as reliable as might be desired (Cronbach alphas < 0.7). The limited variability of responses among certain questions used to create the risk indices (e.g., 60% never smoked regularly, 63% always wore a seatbelt, 88% did not use smokeless tobacco) may have contributed to these lower reliability results (Nunnally 1978). Alternatively, a higher percentage of missing values (e.g., 7% missing age first started smoking) or misclassification bias resulting from misinterpretation of questions could have also contributed to the lower reliability estimates. Fourth, the variance explained by the final factor analysis model (54.5%) was not as impressive as that seen with the YRBS, for which 74% of the variance in behaviors has been explained by factors created from its data (Kulbok and Cox 2002). However, this model's explanation of variance was comparable to other published behavioral measures (Alexander, Young et al. 1990; Gullone and Moore 2000).

This study also focused only on selected measures of health risk behaviors and did not distinguish between delinquent behavior, as was done in other studies (Alexander, Young et al. 1990; Greene, Krcmar et al. 2000; Gullone and Moore 2000; Flay, Graumlich et al. 2004). Inclusion of health risk behaviors that are not considered high-risk or delinquent may have lessened the strength of the combined risk-taking measure.

Finally, results suggested that the combined risk-taking measure more accurately summarized risk-taking tendencies among males than among females. This was not surprising, since the combined risk-taking index was developed based on the entire sample, and the sample contained a higher proportion of males than females. If a separate combined risk-taking index had been created by gender, indices such as

smokeless tobacco use would not have been included for females, thus creating a more accurate representation of female risk-taking tendency. Similarly, the combined risk-taking index might have been improved for males by dropping the weight control practices index and adding a risk index addressing sexual behaviors, since these behaviors were associated with injury risk in unadjusted analyses.

Strengths

Assessment of generalizability to the population from which the sample was drawn indicated that, while there were a number of demographic differences (race, age, marital status, pay grade, and component), neither males nor females were less likely to have completed a RAP questionnaire. Injury and illness rates, BMI, and run time on the initial APFT among participants and non-participants also did not differ statistically.

Comparison with U.S. population data indicated that, despite lower RAP participation among blacks, the proportion of blacks in the study sample was higher than the proportion of blacks in other surveys of health risk behaviors (Grunbaum, Kann et al. 2002; Substance Abuse and Mental Health Services Administration (SAMHSA) 2004). Thus, this study fills a gap in information on ethnically diverse populations (Jessor 1993).

Use of available military medical surveillance data offered a number of advantages. First, since demographic and medical surveillance data were obtained for all trainees in the basic training units included in this study, it was possible to evaluate differences between participants and non-participants. Second, injury outcome data were captured in the surveillance system using a standardized methodology and without regard to work-relatedness (Amoroso, Smith et al. 2002). All study subjects had access to comprehensive medical care, a powerful incentive to seek treatment and a situation that

removed potential bias due to differential access to care (Senier, Bell et al. 2002). Visits beyond the military health care system are also captured in the surveillance data, thus information on injury outcomes was very complete. All study subjects were also living in the same physical surroundings, under the observation of drill sergeants twenty-four hours a day, and were required to participate in and complete the same training. With little variation in environmental and occupational exposures, behavioral factors associated with injury risk were more likely to be identified.

The injury definition used in this study was consistent with previous studies of Army training-related injuries. Unlike other studies of occupational injury (Smith, Wellman et al. 2005), Army injury investigations routinely consider musculoskeletal disorders, typically overuse-related conditions (e.g., stress fractures, joint pain) related to occupational tasks. Given the effects and magnitude of chronic low back pain and other cumulative stress disorders on workplace performance (Andersson, Fine et al. 1995), inclusion of these codes is key to understanding the full magnitude of the occupational injury problem.

While there were limitations to the use of self-reported health risk behavior data, test-retest analysis has demonstrated the reliability of RAP health risk behavior information (Canada, Canham-Chervak et al. 2005). Additionally, this study offered the advantage of considering multiple measures (questionnaire items) of a health risk behavior in defining level of risk, rather than relying on one measure per health risk behavior, as has been done in several studies of injury risk and multiple health risk behaviors (Pickett, Garner et al. 2002; Pickett, Schmid et al. 2002).

Implications

This study adds to the existing literature in three important ways: (1) it contributes to knowledge on risk factors for an understudied subset of injuries, occupational injuries, in an understudied subset of the population, young adults; (2) it contributes to knowledge on risk-taking, an injury risk factor that has been identified as needing further study; and (3) it specifically addresses a gap in knowledge on behavioral risk factors for military training-related injury. As is evidenced by the identification of only six high-quality analytic studies in a recent review of the literature (Turner, 2004), the study of risk-taking behavior and unintentional injury is in its infancy.

Results of this study add to the body of knowledge supporting the need to consider effects of multiple health risk behaviors on injury risk (Jovic, Vorko et al. 2001; Pickett, Garner et al. 2002; Pickett, Schmid et al. 2002; Watt, Purdie et al. 2004; Koven, McColl et al. 2005). In addition, results add to the evidence of a "risk behavior syndrome", or co-occurrence of health risk behaviors within young adults and adolescents. This information is especially important for the military public health community, as these data suggest that a multi-faceted approach to prevention, addressing multiple health risk behaviors, is needed. This approach as has been suggested elsewhere, in reference to interventions for the general U.S. adolescent and young adult populations (Federal Advisory Panel on Health Promotion Strategies for High-Risk Youth 1993; DiClemente, Hansen et al. 1996; Wiley, James et al. 1997).

This study also adds to the literature demonstrating that surveys collecting multiple risk behavior data can be used to develop proxy indicators of risk-taking (Pickett, Garner et al. 2002; Pickett, Schmid et al. 2002; Koven, McColl et al. 2005).

This demonstrated utility of health risk behavior surveys is especially important for the military services, as completion of a health risk behavior survey based on the RAP will soon be required of all persons entering the U.S. military.

The comparison of this sample to the general U.S. population suggests that the U.S. Army does not necessarily consist of large numbers of 'risk-takers'. Rather, the Army basic training population appears to reflect health risk behavior trends reported in multiple surveys of the general U.S. youth population. Similarities in the prevalence of these behaviors suggest that, in the absence of routine analysis and reporting of health risk behavior data from Army basic training populations, results from routinely-reported national youth surveys could be used to inform decisions related to health promotion program and policy planning for Army basic training.

Finally, the results of this study suggest that risk-taking is an independent predictor of training-related injury risk during Army basic training. It appears that some level of risk-taking may protect females entering basic training from injury, but among males, both low and high levels of risk-taking lead to higher risks of injury -- injury that could result in an early end to an Army career. Given the growing demands on our nation's military services, it is in our best interest to provide the best chance for successful completion of this first phase of training for those who made the choice to "sign up". Providing the best chance for success means protecting trainees from injury. This could be accomplished by ensuring safe training practices, such as providing protective gear, ensuring protective gear is worn during training, maintaining safety equipment on training courses, and following Army physical training programs designed to prevent over-training injuries. In addition, it is possible that safety instruction could be

incorporated into training. Such an approach has proved beneficial in preventing occupational injuries among at least one other adolescent population (Reed, Westneat et al. 2003).

Recommendations for future research

These data can and should also be used to investigate the relationship between the combined risk-taking index and another life-compromising outcome, inability to complete basic training. With approximately 14% of personnel attriting during the first six months of enlistment (General Accounting Office 2000) and immediate costs of losing one recruit during basic training approximately $47,000 (2002 dollars) (Sheppard 2002), there is a great need to understand factors contributing to the inability to succeed in basic training.

Additionally, an investigation of the relationship between health risk behaviors and injury risk beyond basic training should be pursued. This relationship is likely to be very different after basic training, as Soldiers are given greater control over their time, training, and health risk behavior decisions. In these less restrictive environments, individual risk-taking tendencies may be more likely to be expressed and exposure to potential injury-producing events, such as drinking and driving, are likely to be greater.

The RAP survey offers a wealth of information on characteristics that are not often measured and could be linked, as done in this study, to health and life outcomes. For example, the concept of resiliency could be investigated by linking RAP data on protective factors (e.g., familial composition, social support) and measures of positive risk behaviors (e.g., exercise, nutrition, educational achievement) to outcomes such as attrition and injury. The association of childhood environmental factors with subsequent

pregnancy might also be evaluated, as has been done in a civilian population (Hockaday, Crase et al. 2000). In addition, in consonance with Jessor's model of adolescent risk behavior, the RAP survey data could be used to explore relationships between social environmental factors (e.g., parental divorce, stress in the home, lack of parental warmth or support) and the subsequent development of health risk behaviors; a relationship for which there is considerable support (Shedler and Block 1990; Jessor 1991; Flay, Petraitis et al. 1999), but for which additional research is needed (Jessor, Turbin et al. 1998; Moore and Parsons 2000).

The impact of health risk behaviors is not limited to long-term health effects; rather, a growing body of evidence suggests that health risk behaviors are also associated with short-term health and life-compromising outcomes such as injury and inability to perform occupational-related duties. Such short-term effects have immediate impact on employability or "readiness" of individuals and teams or units. As a step toward addressing these adverse effects, routine analysis and reporting of health risk behaviors in the U.S. Army and other military populations should be supported and pursued. As is seen in civilian populations (Everett, Kann et al. 1997), such health risk behavior surveillance is essential for the development of informed, evidence-based health promotion program and policy planning, appropriate focusing of scarce public health resources on leading health risk behaviors, and the evaluation of effects of programs established to reduce health risk behaviors.

APPENDICES

APPENDIX A

U.S. Army Recruit Assessment Program Pilot Study Questionnaire

Recruit Assessment Program

Please complete the questionnaire as accurately as possible.
DO NOT LEAVE ANY QUESTIONS BLANK.
Thank you for your assistance.

MARKING INSTRUCTIONS

Use BLACK or BLUE ink.
Mistakes must be crossed-out with an "X."

Print in CAPITAL LETTERS and avoid contact with the edge of the box. EXAMPLE:

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

Example of numbers:

0	1	2	3	4	5	6	7	8	9

Shade circles and boxes like this: ●

Not like this: ⊗ ✓

55337

CHPPM Form 429(TEST), Aug02 (MCHB-TS-EIP)

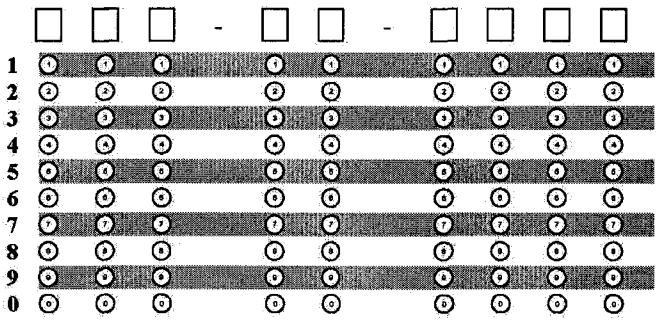
Demographic Information

Please begin by writing in your full name:

Last Name

First Name **Middle Initial**

Please write your Social Security Number in the boxes, and fill in the corresponding circles:



Please enter the correct letter or number of your company and platoon:

Company Platoon

Please write in the state and zip code of your most recent home address:

State **Zip Code**

AL	Alabama	IA	Iowa	NH	New Hampshire	TX	Texas
AK	Alaska	KS	Kansas	NJ	New Jersey	UT	Utah
AZ	Arizona	KY	Kentucky	NM	New Mexico	VT	Vermont
AR	Arkansas	LA	Louisianna	NY	New York	VA	Virginia
CA	California	ME	Maine	NC	North Carolina	WA	Washington
CO	Colorado	MD	Maryland	ND	North Dakota	WV	West Virginia
CT	Connecticut	MA	Massachussetts	OH	Ohio	WI	Wisconsin
DE	Delaware	MI	Michigan	OK	Oklahoma	WY	Wyoming
FL	Florida	MN	Minnesota	OR	Oregon	AS	American Samoa
GA	Georgia	MS	Mississippi	PA	Pennsylvania	DC	District of Columbia
HI	Hawaii	MO	Missouri	RI	Rhode Island	GU	Guam
ID	Idaho	MT	Montana	SC	South Carolina	TT	Marshall Islands
IL	Illinois	NE	Nebraska	SD	South Dakota	PR	Puerto Rico
IN	Indiana	NV	Nevada	TN	Tennessee	VI	U.S. Virgin Islands

SECTION 1: Induction Information

1. Have you ever served in the U.S. military before now?

O No O Yes

-- IF YES, from

[ ][ ][ ][ ] to [ ][ ][ ][ ]

Year Year

2. Which one of the following are you joining?

O Active Duty ARMY
O ARMY Reserve
O ARMY National Guard

3. Are you a National Guard or Reserve soldier still in high school (split-options program) ?

O No O Yes

4. What date did you begin current military training? (date you arrived at Fort Jackson)

[ ][ ] / [ ][ ] / [ ][ ]

Year Month Day

5. What is your gender?

O Male
O Female

6. Did your father serve in the U.S. military?

O No O Yes O Don't know

7. Did your mother serve in the U.S. military?

O No O Yes O Don't know

8. Why did you join the military? ***(mark all that apply)***

O For education and new job skills
O For travel or adventure
O For a job to earn money
O To leave problems at home
O Family member in the military
O 20-year career in military
O To serve my country
O Other reasons

9. What is your date of birth?

[ ][ ] / [ ][ ] / [ ][ ]

Year Month Day

10. Are you allergic to or do you have bad reactions to: (mark all that apply)

O Shell fish
O Milk
O Eggs
O Iodine
O Latex
O Adhesive tape
O Aspirin
O Penicillin
O Sulfa drugs
O Narcotic drugs (like Codeine)
O Any other drug
O Bee stings
O Other allergy
O Unsure
O I do not have any of these allergies

SECTION 2: General Information

1. Where were you born?

O United States or U.S. Territory
O Caribbean
O Africa
O Canada
O Europe
O Pacific Islands
O Mexico
O Asia
O Central/South America
O Other

2. If you were born in the U.S., in which state?

☐☐ *(See previous Address Page for a list of state/territory abbreviations)*

3. What best describes your racial/ethnic backround? *(mark all that apply)*

O Native American or Alaskan Native
O Asian
O Pacific Islander/Filipino
O Black (African-American)
O Hispanic, Latino, or Spanish descent
O White (Caucasian)
O Other

4. Where did you live most of the time as a child? *(choose only one answer)*

O On a farm, ranch, or in the country
O In a small town with less than 10,000 people
O In a small city with about 10,000 to 100,000 people
O In a large city or suburb with over 100,000 people
O Moved around a lot to different cities
O Not sure

5. What is the furthest you've gone in school? *(choose only one answer)*

O Some high school but no diploma
O Obtained GED (General Education Diploma)
O Graduated from high school
O Some college or technical school
O Graduated from trade or technical school
O Graduated from 4-year college or university
O Completed Masters or higher post-graduate degree

6. What is your current marital status? *(choose only one answer)*

O Single
O Married but separated
O Living together
O Divorced
O Married
O Widowed

SECTION 3: Work History

1. During your last year of high school, did you work full- or part-time after school or in the summer?

O No O Yes

2. Please mark if you ever had a job that lasted more than one month where you were around any of the following materials on most days:

	No	Yes	Don't Know
Dust	O	O	O
Loud noise	O	O	O
Fumes from gasoline, paint, or degreasers	O	O	O
Insecticides, pesticides, or herbicides (weed killers)	O	O	O
Asbestos	O	O	O
Ionizing radiation, like x-rays or radioactive material	O	O	O
Welding material	O	O	O
Smoke from burning things	O	O	O
Lead (like inside car batteries)	O	O	O

3. Do you have any health problems you feel were caused by a previous job?

O No O Yes

4. Have you ever been injured in a job that caused you:

	No	Yes
To be treated in a medical clinic by a doctor or nurse	O	O
To be hospitalized overnight or longer	O	O
To miss more than one day of work	O	O

SECTION 4: Family History

1. Were you <u>mostly</u> raised by: ***(Mark all that apply.)***

- O Two parents
- O One parent
- O Grandparent(s)
- O Other relative(s)
- O Foster parent(s) or guardian(s)
- O In a group home or institution
- O Other

2. Were you adopted as a child?

O No O Yes O Don't know

3. Are you a twin? (or triplet or one of a multiple birth set)

O No O Yes O Don't know

4. How many brothers and sisters were (including step-brothers and sisters) were raised in the same home with you? ***(add all together)***

Number of siblings: [ ][ ]

5. How far did the father who raised you go in school? ***(choose only one answer)***

- O Did not complete high school
- O Completed high school or earned a GED
- O Some college/technical school
- O 4-year college or university degree
- O Masters or higher degree
- O Don't know
- O This does not apply to me

6. How far did the mother who raised you go in school? ***(choose only one answer)***

- O Did not complete high school
- O Completed high school or earned a GED
- O Some college/technical school
- O 4-year college or university degree
- O Masters or higher degree
- O Don't know
- O This does not apply to me

7. Is the mother who raised you alive?

- O Yes
- O No, she died before I was 10 years old
- O No, she died after I was 10 years old
- O Don't know
- O This does not apply to me

8. Is the father who raised you alive?

- O Yes
- O No, he died before I was 10 years old
- O No, he died after I was 10 years old
- O Don't know
- O This does not apply to me

9. Has your <u>biological</u> mother or father ever had:

	<u>No</u>	<u>Yes</u>	Don't <u>Know</u>
High blood pressure	O	O	O
Heart attack	O	O	O
Stroke	O	O	O
Colon cancer	O	O	O
Lung cancer	O	O	O
Diabetes	O	O	O
Mental or emotional problems	O	O	O
Alcohol problem	O	O	O

10. Has your <u>biological</u> mother, sisters, or aunts ever had breast cancer?

- O No
- O Yes
- O Don't know

11. Has your <u>biological</u> father, brothers, or uncles ever had prostate cancer?

- O No
- O Yes
- O Don't know

SECTION 5: Clinical History

1. How tall are you without shoes?

☐ - ☐☐

Feet Inches

2. How much do you weigh without shoes?

☐☐☐

Pounds

3. Are you mainly right or left handed?

O Right O Left O Both

4. How many different prescription drugs provided by a doctor are you currently taking each week?

O None
O 1
O 2
O 3
O 4
O 5 or more

5. Which of the following health care providers evaluated or treated you in the last 5 years: ***(mark all that apply)***

O A general, family, or other medical doctor

O A mental health professional

O A dentist

O A surgeon

O An optometrist (eye doctor)

O A specialist or counselor in alcohol drinking problems

O An alternative health practitioner (acupuncturist, herbalist, chiropractor)

O None of the above

6. Have you *ever* had trouble with the following ANYTIME during your life? ***(mark each complaint)***

Yes	No	
O	O	Chronic cough or cough at night
O	O	Asthma
O	O	Shortness of breath
O	O	Hay fever
O	O	Arthritis, rheumatism, bursitis
O	O	Swollen, stiff, or painful joints
O	O	Foot trouble (pain, corns, bunions)
O	O	Knee trouble (locking or giving out)
O	O	Scoliosis or curvature of the spine
O	O	Dizziness, fainting, lightheadedness
O	O	Frequent or severe headaches
O	O	Difficulty concentrating
O	O	Skin diseases or rashes
O	O	Chest pain or pressure
O	O	Sleepwalking
O	O	Bed wetting
O	O	Trouble stuttering
O	O	Acne or skin problems
O	O	Frequent indigestion
O	O	Constipation or loose bowels
O	O	Muscle aches
O	O	Pain or problems during sexual intercourse

7. Have you ever been hospitalized overnight or longer?

O No

O Yes

O Don't know

SECTION 6: Use of Tobacco

1. **Have you smoked more than 100 cigarettes (5 packs) in your entire life?**

   O No O Yes

2. **Have you ever tried to quit smoking cigarettes?**

   O I have never smoked regularly
   O Yes, and I never smoked again
   O Yes, but I could not quit permanently
   O I smoke but have not tried to stop

3. **In the year before entering the military, did you smoke cigarettes?**

   O Not at all O Some days O Every day

4. **At what age did you first start smoking regularly (meaning, you smoked most days)?**

   O I have never smoked regularly

   Age you started: ☐☐ (Years old)

5. **How many years did you smoke more than 3 cigarettes on most days?**

   O I have never smoked regularly
   O 1 year or less O 5 years
   O 2 years O 6 years
   O 3 years O 7 years
   O 4 years O 8 or more years

6. **When you were smoking regularly, how many packs did you smoke each day?**

   O I have never smoked regularly
   O About 1/2 pack or less per day
   O About 1 pack a day
   O Between 1 and 2 packs
   O 2 packs or more

7. **When did you last smoke a cigarette?**

   O I have never smoked
   O More than 1 year ago
   O More than 1 month ago
   O More than 1 week ago
   O Within the last few days

8. **Did you use any of the following 3 or more times during the past year?**

	No	Yes
Pipe	O	O
Cigar	O	O
Smokeless tobacco (dip, chew, snuff)	O	O

9. **How many years did you use smokeless tobacco (chew, dip, snuff) on most days?**

   O I have never used dip/chew/snuff regularly
   O 1 year or less O 5 years
   O 2 years O 6 years
   O 3 years O 7 years
   O 4 years O 8 or more years

10. **When you were using smokeless tobacco regularly, how many cans did you use each day?**

    O I have never used dip/chew regularly
    O About 1/2 can or less per day
    O About 1 can a day
    O Between 1 and 2 cans
    O 2 cans or more

11. **Did your father or mother (or anyone else living in your home) regularly smoke tobacco when you were a child?**

    O No O Yes

SECTION 7: Use of Alcohol

The following questions refer to this definition:

ONE DRINK equals: *1 bottle or can of beer, 1 glass of wine, 1 wine cooler, or 1 shot of hard liquor*

1. **During the past 12 months, have you had at least one drink containing alcohol?**

O No O Yes

2. **How old were you when you first had a drink containing alcohol? *(choose only one answer)***

O I have never had a drink
O 13 years or younger
O 14 to 15 years old
O 16 to 17 years old
O 18 to 20 years old
O 21 years or older

3. **How many years have you been drinking alcoholic beverages on a regular basis? *(choose only one answer)***

O I have never drunk alcohol
O I just tried alcohol a few times
O 1 year or less
O 2 to 5 years
O 6 to 10 years
O 11 or more years

4. **During the year (12 months) before entering the military, how often did you have a drink containing alcohol? *(choose only one answer)***

O Never
O Once/Twice
O A few times
O Monthly
O Weekly
O Daily

5. **During the past year, how often did you have 6 or more drinks at one sitting? *(choose only one answer)***

O Never
O Once/Twice
O A few times
O Monthly
O Weekly
O Daily

6. **During the past year, how many drinks containing alcohol did you have on a typical day of drinking? *(choose only one answer)***

O None, I do not drink
O 1 or 2
O 3 or 4
O 5 or 6
O 7 to 9
O 10 or more

The following questions refer to alcohol-related events during the past year.

	Never	Yes, but more than 1 year ago	Yes, during the past year
7. Have you ever failed to do what was normally expected of you because of drinking?	O	O	O
8. Have you or has someone else been physically injured because of your drinking?	O	O	O
9. Did you ever feel as though you needed to cut down on your drinking?	O	O	O
10. Did you ever feel annoyed because someone in your life said you needed to cut down on your drinking?	O	O	O
11. Did you ever feel guilty after drinking?	O	O	O
12. Did you ever need a first drink, or eye-opener, in the morning following a day or night of heavy drinking?	O	O	O
13. Did you ever feel as though you could not stop drinking once you started?	O	O	O
14. Have you ever driven a car within two hours of drinking two or more alcoholic drinks?	O	O	O

SECTION 8: Diet and Health

Questions 1-5 refer to the past YEAR (12 months):

1. **About how many hours did you sleep on most nights?**

O 4 hours or less
O 5 hours
O 6 hours
O 7 to 8 hours
O 9 hours
O 10 hours or more

2. **About how many hours did you watch TV (television) on an average day?**

O None
O 1 hour or less
O 2 to 3 hours
O 4 or more hours

3. **On an average day, about how many cups, bottles, or cans of drink with caffeine did you drink (like coffee, tea, or coke/soda/pop)?**

O None
O 1
O 2
O 3
O 4 to 5
O 6 or more

4. **About how many times each week did you eat from a fast food restaurant (like hamburgers, tacos, or pizza)?**

O None
O 1
O 2 to 3
O 4 to 7
O 8 to 14
O 15 or more times

5. **About how often each week did you eat breakfast?**

O Never
O 1 or 2 mornings
O 3 or 4 mornings
O 5 to 7 mornings

6. **During the past year, in a typical week, how often did you participate in a physical sport or activity that made you sweat and breathe hard for at least 20 minutes (such as basketball, biking, or fast dancing)?**

O I never exercised that hard
O 1 time per week
O 2 times per week
O 3 times per week
O 4 or 5 times per week
O 6 or more times per week

7. **During your last year of high school, how many sport teams or organized physical activity programs did you participate in?**

O None
O 1
O 2
O 3 or more

8. **What has happened to your weight in the last year?**

O Lost more than 10 pounds because of dieting
O Lost more than 10 pounds without dieting
O Stayed about the same
O Gained more than 10 pounds

9. **Have you <u>ever</u> taken diet pills to lose weight?**

O No O Yes

10. **Have you <u>ever</u> used laxatives to lose weight?**

O No O Yes

11. **Have you <u>ever</u> caused yourself to vomit to lose weight?**

O No O Yes

12. **Have you <u>ever</u> used steroids to gain weight or increase muscle strength?**

O No O Yes

SECTION 9: General History

1. **How many close friends or relatives do you have that you can call on for help or talk to about personal problems?**

O None O 2 O 5 or more
O 1 O 3 to 4

2. **How often do you attend church, synagogue, or other religious gathering?**

O Almost never O About once a week
O About once or twice a year O More than once a week
O About once a month

3. **Are your parents divorced?**

O No
O Yes, before I was 10 years old
O Yes, after I was 10 years old
O Don't know
O They were never married

4. **During the year before entering the military, did you:** ***(mark all that apply)***

O Get married
O Have a child
O Get divorced
O Get arrested by the police
O Get fired from a job
O Experience the death of someone close to you
O None of these events happened to me

5. **Do you sometimes get mad enough to hit, kick, or throw things?**

O Never O About once a week
O About once a year O More than once a week
O About once a month

6. **How many traffic tickets for moving violations have you ever received (such as speeding or running a red light)?**

O None O 2 O 5 to 10
O 1 O 3 to 4 O 11 or more

7. **How often do you wear a seat belt when driving or riding in a car?**

O Never O Sometimes O Usually O Always

8. **How old were you when you had sexual intercourse for the first time?**

O I have never had sex O 16 to 17 years old
O 13 years of age or younger O 18 to 20 years old
O 14 to 15 years old O 21 years old or older

9. **Did you or your partner use a condom (rubber) the last time you had sex?**

O No O Yes O I have not had sex

10. **Have you ever been told by a doctor or nurse that you had a sexually transmitted disease or STD (like chlamydia, gonorrhea, genital herpes, or syphilis)?**

O No O Yes O Don't know

The following are statements about you when you were growing up, before you were 17 years old. Please choose the <u>ONE</u> answer that comes closest to the way you felt.

11. There was someone to take care of you and protect you.
O Never true O Rarely true O Sometimes true O Often true O Very often true

12. You felt loved.
O Never true O Rarely true O Sometimes true O Often true O Very often true

13. How often did a parent or adult living in your home swear at you, insult you, or put you down?
O Never O Once/Twice O Sometimes O Often O Very often

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SECTION 9: General History

(continued) While you were growing up...

14. How often did a parent or other adult living in your home push, grab, shove, slap, or throw something at you? O Never O Once/Twice O Sometimes O Often O Very often

15. How often did a parent or other adult living in your home push, grab, shove, slap, or throw something at each other? O Never O Once/Twice O Sometimes O Often O Very often

16. How often did an adult ever touch you sexually or try to make you touch them sexually? O Never O Once/Twice O Sometimes O Often O Very often

17. Did you live with someone who was depressed or mentally ill? O No O Yes

18. Did you live with someone who was a problem drinker or alcoholic? O No O Yes

Did any of the following events EVER happen to you in your entire life?

	No	Yes
19. You were in an accident where you could have been killed but were not badly hurt.	O	O
20. You were in an accident where you were injured and had to spend at least one night in the hospital.	O	O
21. You saw a close family member or friend being badly injured or killed.	O	O
22. You saw a stranger being badly injured or killed.	O	O
23. You were seriously attacked, beaten up, or assaulted.	O	O
24. You were threatened with a knife, gun, club, or other weapon.	O	O
25. You were raped (someone forced you to have sex against your will).	O	O

The following questions are about activities you might have done during a typical day before entering the military. Did your health limit you in these activities?

	NO Not limited at all	YES Limited a little	YES Limited a lot
26. Vigorous activities, such as running, lifting heavy objects, or participating in strenuous sports	O	O	O
27. Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	O	O	O
28. Climbing one flight of stairs	O	O	O
29. Climbing several flights of stairs	O	O	O
30. Bending, kneeling, or stooping	O	O	O

SECTION 9: General History, continued

These questions are about how you felt and how things were with you during the past year. Please choose the ONE answer that comes closest to the way you felt.

HOW MUCH TIME:	None of the time	A little of the time	Some of the time	Most of the time	All of the time
31. Did you feel calm and peaceful?	O	O	O	O	O
32. Did you feel downhearted and blue?	O	O	O	O	O
33. Has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc)?	O	O	O	O	O
34. Have you been a very nervous person?	O	O	O	O	O
35. Have you felt so down in the dumps nothing could cheer you up?	O	O	O	O	O
36. Did you have a lot of energy or pep?	O	O	O	O	O
37. Did you feel tired or worn out?	O	O	O	O	O
38. Did you have difficulty reasoning and solving problems, like making plans, decisions, or learning new things?	O	O	O	O	O
39. Did you forget things that happened recently, like where you put things and when you had appointments?	O	O	O	O	O
40. Did you have trouble keeping your attention on any activity for long?	O	O	O	O	O
41. Did you have difficulty doing activities involving concentration and thinking?	O	O	O	O	O

42. In general, your health is:

O Excellent O Fair
O Very good O Poor
O Good

43. In general, did your health change during the past year (12 months) before entering the military?

O No, my health stayed about the same
O Yes, my health got somewhat worse
O Yes, my health got somewhat better

44. During the year before entering the military, how much did bodily pain interfere with your normal work (including work both outside the home, and housework)?

O Not at all O Moderately O Extremely
O A little O Quite a lot

45. During the year prior to entering the military, did you have any of the following problems as a result of your PHYSICAL health?

a. Accomplished less than you would like	O No	O Yes
b. Were limited in any kind of work or other daily activities	O No	O Yes

46. During the year prior to entering the military, did you have any of the following problems as a result of any EMOTIONAL problems (such as feeling depressed or anxious)?

a. Accomplished less than you would like	O No	O Yes
b. Didn't do work or other activities as carefully as usual	O No	O Yes

APPENDIX B

ICD-9-CM codes included in the Army Medical Surveillance Activity Installation Injury Reports and Training-Related Injury Reports

(Training-Related Injury Report codes in **bold**)

Codes, by anatomical region:

Head and neck

363.61 363.63 364.04 364.41 364.76 364.77 365.65 366.20 379.32 379.33 379.34 525.11 722.0 722.71 723.1 723.4 800 801 802 803 804 805.0 805.1 806.0 806.1 807.5 807.6 830 839.0 839.1 847.0 848.0 848.1 848.2 850 851 852 853 854 870 871 872 873 874 900 910.0 910.1 910.2 910.3 910.6 910.7 910.8 910.9 918 920 921 925 930 931 932 933 935.0 940 941 947.0 950 951 952.0 953.0 954.0 957.0 959.0

Shoulder and arm

354.1 354.2 354.3 716.11 716.12 716.13 718.01 718.02 718.03 718.11 718.12 718.13 718.31 718.32 718.33 718.81 718.82 718.83 718.91 718.92 718.93 719.01 719.02 719.03 719.11 719.12 719.13 719.41 719.42 719.43 726.0 726.1 726.2 726.3 727.61 727.62 733.11 810 811 812 813 818 831 832 840 841 880 881.00 881.01 881.10 881.11 881.20 881.21 887 903.0 903.1 912.0 912.1 912.2 912.3 912.6 912.7 912.8 912.9 923.0 923.1 927.0 927.1 943 953.4 955.0 955.1 955.2 955.3 955.4 955.5 955.7 955.8 955.9 959.2

Hand and wrist

354.0 716.14 718.04 718.14 718.34 718.84 718.94 719.04 719.14 719.44 726.4 727.63 727.64 733.12 814 815 816 817 833 834 842 881.02 881.12 881.22 882 883 885 886 903.4 903.5 914.0 914.1 914.2 914.3 914.6 914.7 914.8 914.9 915.0 915.1 915.2 915.3 915.6 915.7 915.8 915.9 923.2 923.3 927.2 927.3 944 955.6 959.4 959.5

Leg

716.15 716.16 718.05 718.15 718.35 718.85 718.95 **719.05** 719.15 **719.45 726.5 727.65 733.14 733.15 733.93** 808.0 808.1 820 821 823 835 **843 844.3** 890 897 904.0 904.1 904.2 904.3 904.5 924.0 924.10 928.0 928.10 945.00 945.04 945.06 945.09 945.10 945.14 945.16 945.19 945.20 945.24 945.26 945.29 945.30 945.34 945.36 945.39 945.40 945.44 945.46 945.49 945.50 945.54 945.56 945.59 956 959.6

Knee

717 718.36 718.86 **719.06** 719.16 **719.46 726.6 727.66** 822 836 **844.0 844.1 844.2** 924.11 928.11 945.05 945.15 945.25 945.35 945.45 945.55

Ankle and foot

716.17 718.07 718.17 718.37 718.87 718.97 **719.07** 719.17 **719.47 726.7 727.67 727.68 728.71 733.94 734** 824 825 826 837 838 **845** 892 893 895 896 904.6 917.0 917.1 917.2 917.3 917.6 917.7 917.8 917.9 924.2 924.3 928.2 928.3 945.01 945.02 945.03 945.11 945.12 945.13 945.21 945.22 945.23 945.31 945.32 945.33 945.41 945.42 945.43 945.51 945.52 945.53

Chest, back, and abdomen
720.2 721.7 722.1 722.72 722.73 **724.2** 724.3 724.4 **724.5 724.9** 733.13 805.2 805.3 805.4 805.5 805.6 805.7 806.2 806.3 806.4 806.5 806.6 806.7 807.0 807.1 807.2 807.3 807.4 808.2 808.3 808.4 808.5 808.8 808.9 809 839.2 839.3 839.41 839.42 839.51 839.52 839.61 839.71 **846** 847.1 **847.2 847.3 847.4 847.9** 848.3 848.4 **848.5** 860 861 862 863 864 865 866 867 868 869 875 876 877 878 879.0 879.1 879.2 879.3 879.4 879.5 879.6 879.7 901 902 911.0 911.1 911.2 911.3 911.6 911.7 911.8 911.9 922 926 934 935.1 935.2 936 937 938 939 942 947.1 947.2 947.3 947.4 952.1 952.2 952.3 952.4 953.1 953.2 953.3 953.5 954.1 954.8 954.9 959.1 959.11 959.12 959.19

Environmental
363.31 370.24 388.10 388.11 388.12 692.71 692.76 692.77 910.4 910.5 911.4 911.5 912.4 912.5 913.4 913.5 914.4 914.5 915.4 915.5 916.4 916.5 917.4 917.5 919.4 919.5 990 991 992 993 994

Unspecified
716.10 716.18 716.19 718.00 718.08 718.09 718.10 718.18 718.19 718.30 718.38 718.39 718.80 718.88 718.89 718.90 718.98 718.99 **719.00 719.08 719.09** 719.10 719.18 719.19 **719.40 719.48 719.49** 722.2 722.70 **726.8 726.9 727.2 727.3** 727.60 727.69 728.83 **729.1** 729.2 **733.10 733.16 733.19 733.95** 805.8 805.9 806.8 806.9 819 827 828 829 839.40 839.49 839.50 839.59 839.69 839.79 839.8 839.9 **844.8 844.9 848.8 848.9** 879.8 879.9 884 891 894 903.2 903.3 903.8 903.9 904.4 904.7 904.8 904.9 913.0 913.1 913.2 913.3 913.6 913.7 913.8 913.9 916.0 916.1 916.2 916.3 916.6 916.7 916.8 916.9 919.0 919.1 919.2 919.3 919.6 919.7 919.8 919.9 923.8 923.9 924.4 924.5 924.8 924.9 927.8 927.9 928.8 928.9 929 946 947.8 947.9 948 949 952.8 952.9 953.8 953.9 957.1 957.8 957.9 959.13 959.14 959.3 959.7 959.8 959.9 995.81 995.83 995.85

Notes:
1. For overall rate of injury at specific locations a soldier is only counted once per month.
2. For rate by anatomical region, a soldier is allowed to be counted in each category once per month.
3. All subordinate codes are included for 3 digit and 4 digit ICD9 codes.

Sources: (U.S. Army Center for Health Promotion and Preventive Medicine 2004) and (Hauret 2006)

APPENDIX C. Correlation matrix (Pearson correlation coefficients) for 23 risk factors considered for health risk behavior indices

	Age first cigarette use	Cigarette packs/day	Years smoked cigarettes	Cans/packs smokeless tobacco	Years used smokeless tobacco	Age at first drink	Years of alcohol use	AUDIT-C score	CAGE score	Drinking and driving	Moving violations	Hours of sleep	Seat belt use frequency	Hours of TV	Caffeinated beverages/day	Fast food eaten/week	Breakfast eaten/week	Diet pills ever used	Laxatives ever used	Vomiting ever used	STD ever diagnosed	Age at first intercourse	Condom use last sex
Age first cigarette use	1.0	.22	.38	.02	.00	.32	-.06	.11	-.03	-.04	-.02	.00	.09	-.02	.03	.03	.06	-.04	-.02	-.02	-.04	.25	.02
Packs/day		1.0	.80	.24	.18	.27	.36	.38	.20	.24	.21	.06	.19	.00	.23	.09	.11	.06	.00	.04	.04	.28	.13
Years smoked			1.0	.21	.16	.28	.39	.35	.18	.22	.20	.09	.17	.01	.19	.06	.10	.06	.00	.03	.04	.32	.14
Amount smokeless tobacco/day				1.0	.76	.12	.19	.22	.14	.18	.12	.06	.16	-.01	.11	.03	.06	.01	.01	.05	-.02	.08	.04
Years smokeless used					1.0	.11	.22	.19	.11	.19	.15	.10	.17	-.01	.08	.05	.05	.02	.00	.04	-.03	.08	.05
Age at first drink						1.0	.50	.46	.25	.27	.13	.01	.13	-.03	.04	.07	.04	.11	.07	.10	.04	.33	.11
Years alcohol use							1.0	.64	.32	.41	.30	.07	.12	-.04	.04	.05	.04	.15	.05	.10	.07	.28	.18
AUDIT-C score								1.0	.36	.45	.25	-.01	.23	-.07	.07	.09	.08	.11	.05	.09	.03	.27	.13

APPENDIX C. Correlation matrix for 23 risk factors considered for health risk behavior indices, continued

CAGE score									1.0	.33	.12	.06	.11	-.02	.02	.01	.04	.14	.08	.11	.05	.14	.08
Drinking and driving										1.0	.27	.01	.18	-.03	.01	.07	.04	.10	.03	.08	.10	.14	.17
Moving violations										.27	1.0	.02	.15	-.08	.04	.09	.03	.10	.03	.05	-.03	.14	.15
Hours of sleep/day												1.0	.00	-.12	-.03	-.01	.03	.01	-.01	.02	.02	.05	-.02
Seat belt use													1.0	.05	.10	.09	.14	.03	.02	.03	.00	.19	.09
Hours of TV/day														1.0	.19	.16	.06	-.03	.00	-.02	.03	.02	.03
Caffeinated beverages/ day															1.0	.28	.18	.00	.00	.01	-.01	.09	.01
Fast food eaten/week																1.0	.12	-.02	-.01	-.01	-.01	.08	.07
Breakfast eaten/week																	1.0	.07	-.03	-.01	.00	.09	.02
Diet pills to lose weight																		1.0	.31	.27	.11	.05	.13
Laxatives to lose weight																			1.0	.29	.10	-.01	.02
Vomiting to lose weight																				1.0	.06	.04	.05
STD																					1.0	.07	.06
Age at first intercourse																						1.0	.07
Condom use																							1.0

APPENDIX D

Distribution of the five individual health risk behavior indices (Figures 1D-5D) and the combined risk-taking index (Figures 6D) by gender.

Figure 1Da. Distribution of *cigarette use* index score among male trainees in sample

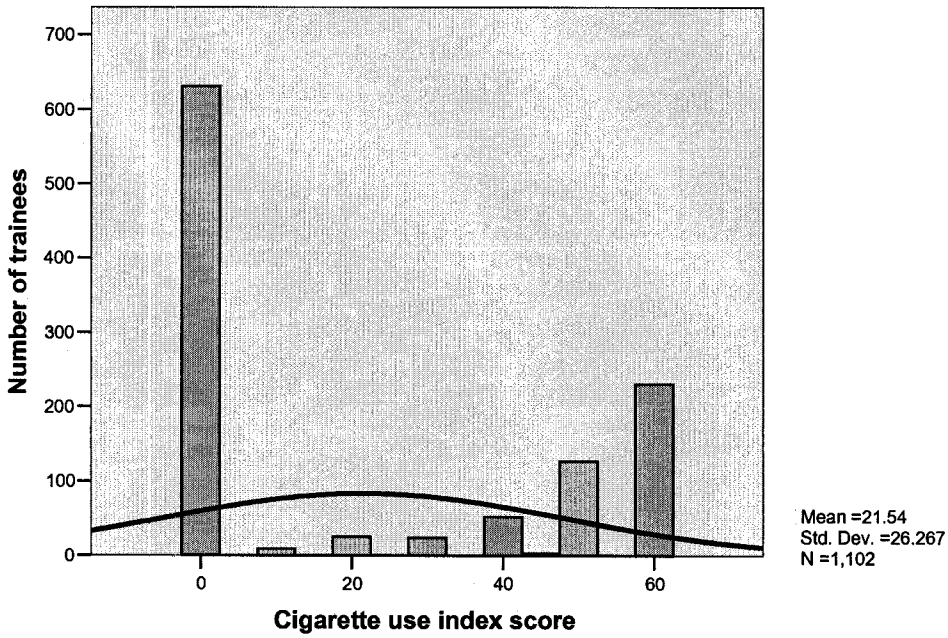


Figure 1Db. Distribution of *cigarette use* index score among female trainees in sample

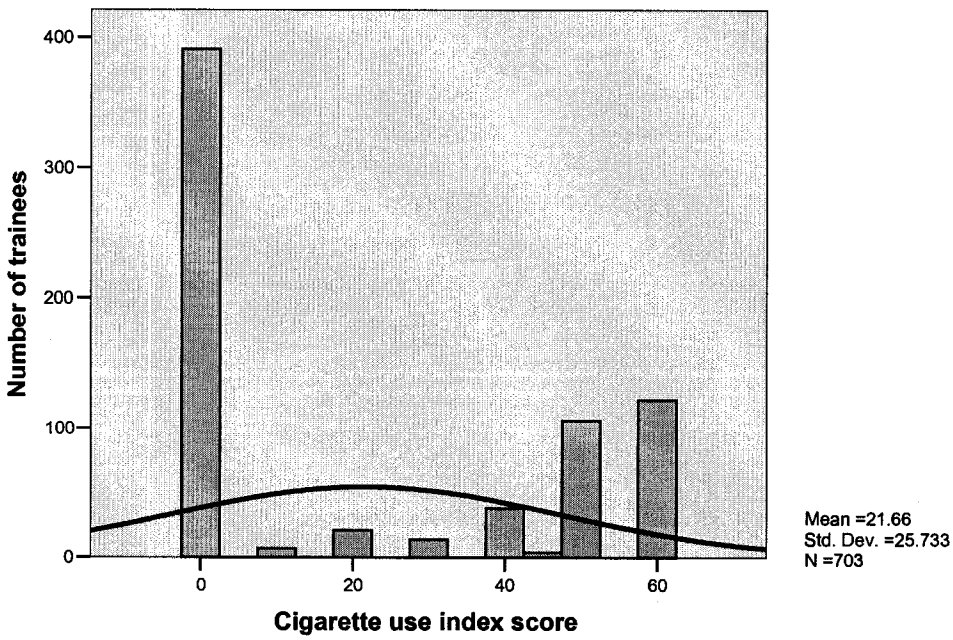


Figure 2Da. Distribution of *smokeless tobacco use* index score among male trainees in sample

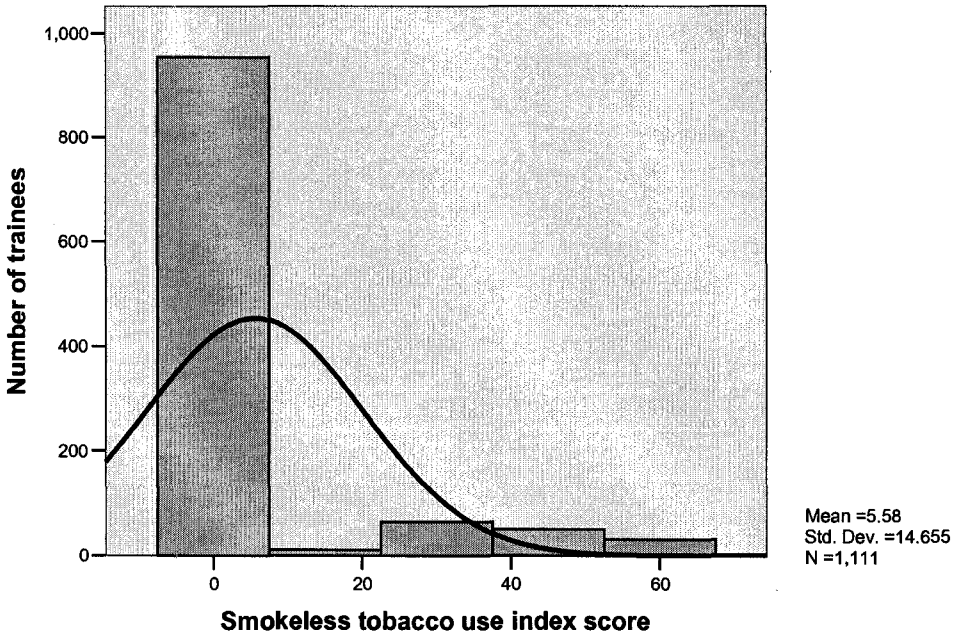


Figure 2Db. Distribution of *smokeless tobacco use* index score among female trainees in sample

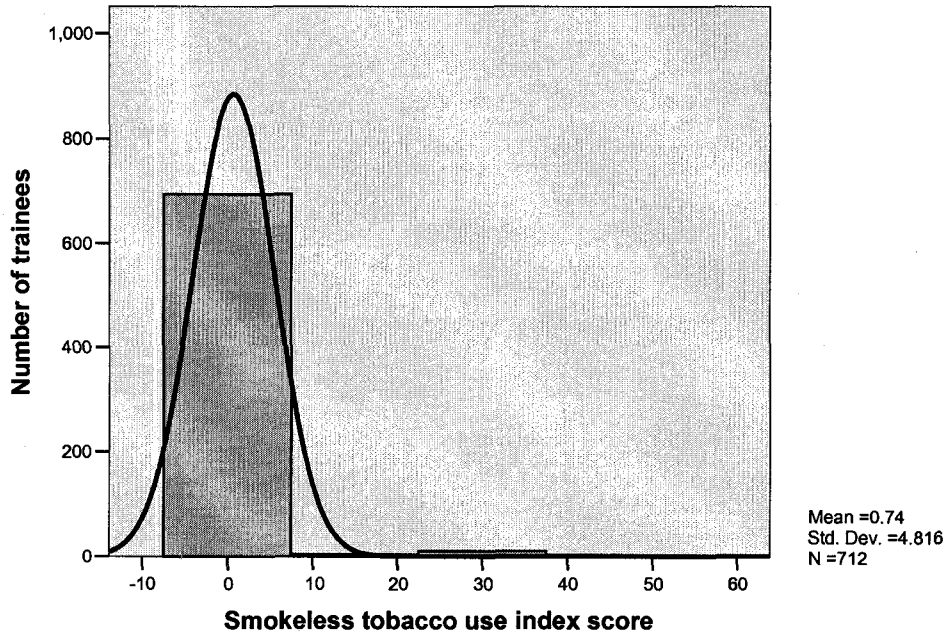


Figure 3Da. Distribution of *alcohol use* index score among male trainees in sample

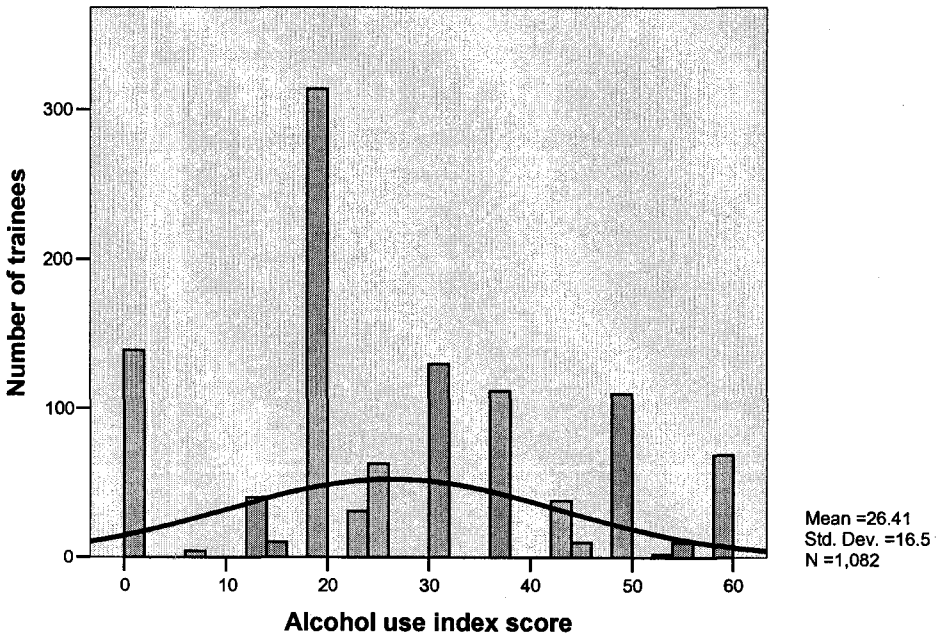


Figure 3Db. Distribution of *alcohol use* index score among female trainees in sample

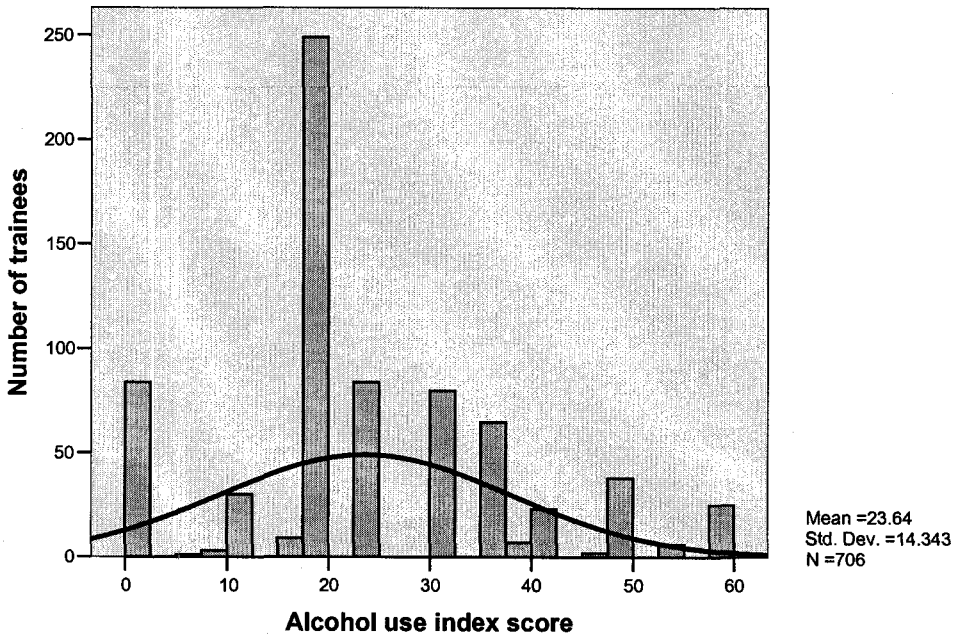


Figure 4Da. Distribution of *diet/lifestyle choices* index score among male trainees in sample

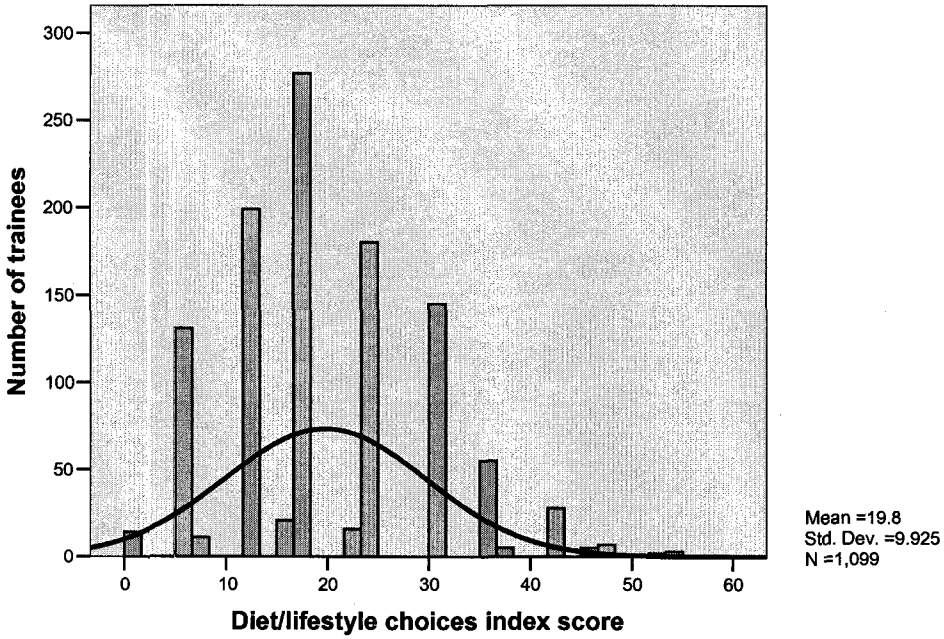


Figure 4Db. Distribution of *diet/lifestyle choices* index score among female trainees in sample

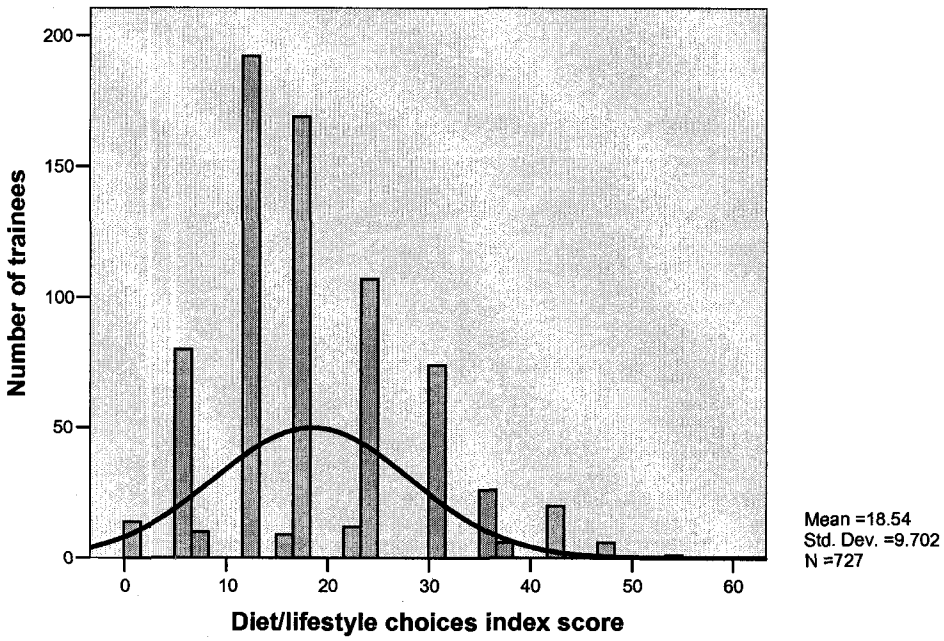


Figure 5Da. Distribution of *weight control practices* index score among male trainees in sample

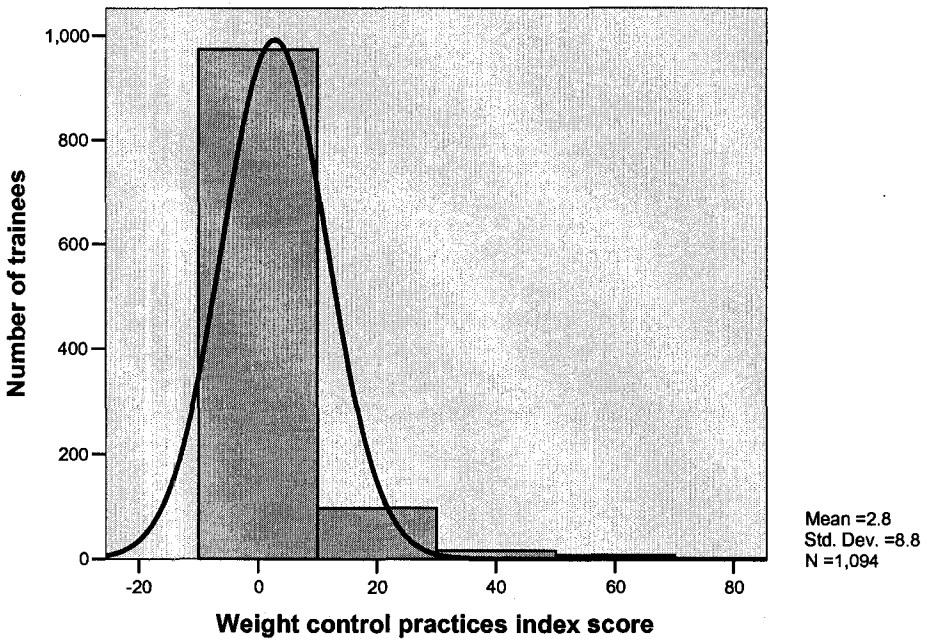


Figure 5Db. Distribution of *weight control practices* index score among female trainees in sample

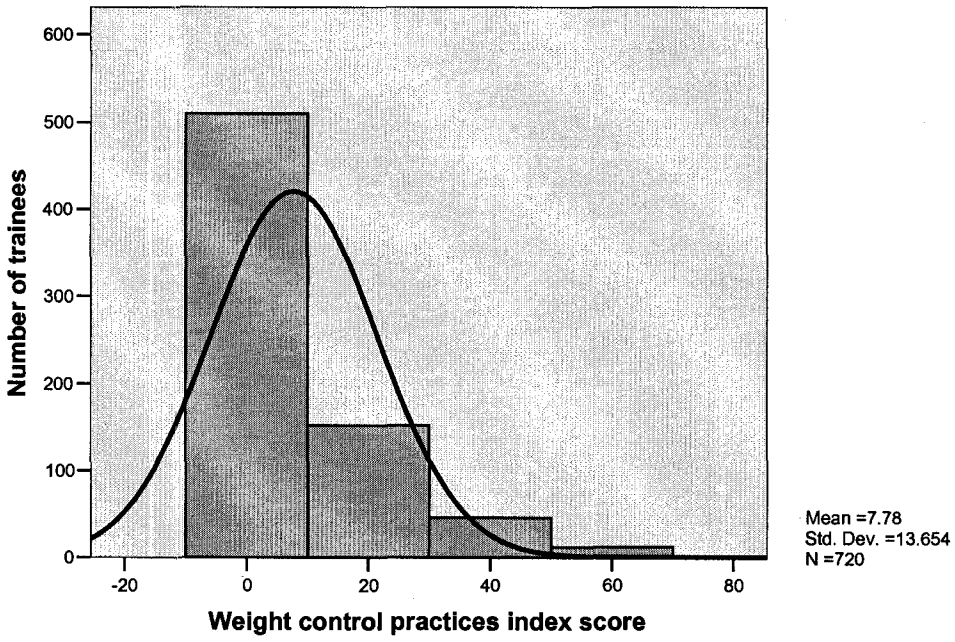


Figure 6Da. Distribution of *combined risk-taking index* score among male trainees in sample

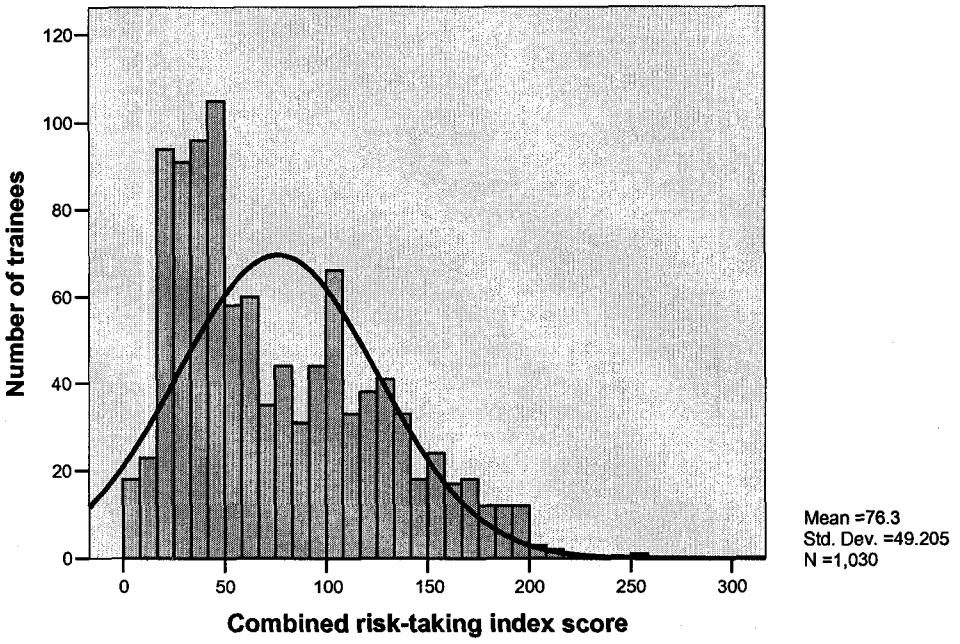
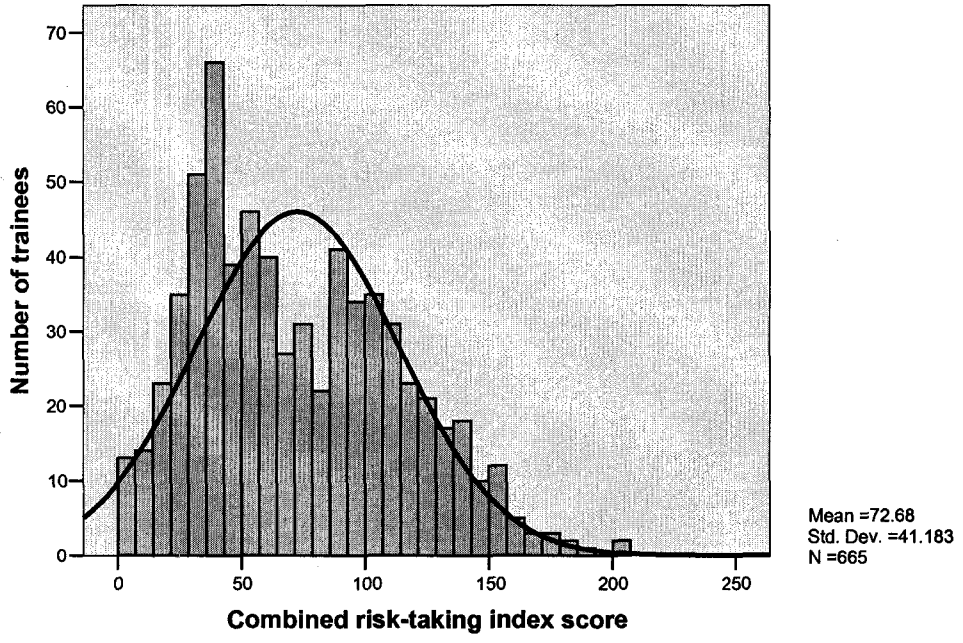


Figure 6Db. Distribution of *combined risk-taking index* score among female trainees in sample



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CURRICULUM VITAE

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EDUCATION

Johns Hopkins Bloomberg School of Public Health, Baltimore, MD
Department of Health, Behavior, and Society
Ph.D. candidate, 1999-present
Certificate in Injury Studies, 2002

Yale School of Medicine, New Haven, CT
Department of Epidemiology and Public Health
M.P.H. in Environmental Health Science. May 1995
Thesis: *An Evaluation of the Potential Health Hazards in the Toner Cartridge Recycling Industry*

University of Vermont, Burlington, VT
B.S. in Biological Science, minor in Nutritional Science. *Cum laude,* 1993

WORK EXPERIENCE

Oct 98-present **U.S. Army Center for Health Promotion and Preventive Medicine**, Aberdeen Proving Ground, MD
Epidemiologist, Directorate of Epidemiology and Disease Surveillance, Injury Prevention Program

Sep 95- Sep 98 **Oak Ridge Institute for Science and Education**, Oak Ridge, TN
Epidemiology intern, contracted to the U.S. Army Center for Health Promotion and Preventive Medicine, Directorate of Epidemiology and Disease Surveillance, Aberdeen Proving Ground, MD.

May 95-Aug 95 **National Center for Health Statistics**, Hyattsville, MD
Research Assistant, Office of Analysis, Epidemiology, and Health Promotion

Nov 94-May 95 **Yale School of Medicine**, New Haven, CT
Program Analyst, Pulmonary and Critical Care Section

May 94-Aug 94 **National Institute for Occupational Safety and Health**, Morgantown, WV
Assistant Industrial Hygienist, Health Hazard Evaluation Section

Jan 94-May 94 **New Britain General Hospital**, New Britain, CT
TB Risk Assessment Team Member, Yale-sponsored research, Infection Control Department

Jan 93-May 93 **Vermont Department of Health**, Burlington, VT
Assistant Coordinator, Vermont Lead Poisoning Surveillance Program

PEER-REVIEWED MANUSCRIPTS

Pollack KM, M Canham-Chervak, C Gazal-Carvalho, BH Jones, SP Baker. *Interventions to Prevent Softball-related Injuries: a Review of the Literature.* Inj Prev, 11: 277-281, 2005.

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Canham-Chervak M, Hauret K, Craig S, and Knapik JJ. *Aerobic fitness among US Army recruits.* Med Sci Sports Exerc, 32(5): S326, 2000.

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TECHNICAL REPORTS AND WHITE PAPERS

Young SYN, Leard CA, Hansen CJ, Chervak MC, Hauret KG, Spooner C, Ryan MAK. The Recruit Assessment Program (RAP) experience with adverse childhood experiences (ACE) questions. Department of Defense Center for Deployment Health Research: San Diego, CA, 2006.

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Canham-Chervak M, Canada, Hauret K, Hadley J, and Jones BH. *Risk factors for high mobility multi-purpose wheeled vehicle (HMMWV) accidents and other important injuries during Operations Iraqi Freedom and Enduring Freedom, CY 2003-2004.* USACHPPM EPICON Report No. 12-MA-03Z8-05.

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Knapik JJ, K Hauret, JM Bednarek, S Arnold, M Canham-Chervak, A Mansfield, E Hoedebecke, et.al. *The Victory Fitness Program: Influence of the US Army's emerging physical fitness doctrine on fitness and injuries in basic combat training.* USACHPPM EPICON Report No. 12-MA-5762-01.

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Knapik JJ, Canham ML, Sharp MA, Cuthie JC, Hewitson WC, Laurin MJ, Hoedebecke E, Gilchrist J, Polyak C, Nee MA, Hauret K, Carroll D, Jones BH. *Injury Incidence and Injury Risk Factors of U.S. Army Basic Trainees at Fort Jackson, SC, 1998: Emphasis on Fitness Training Unit Personnel, Discharges, and Newstarts.* USACHPPM EPICON Report No. 29-HE-8370-98.

Knapik JJ, Canham ML, Sharp MA, Cuthie JC, Hewitson WC, Laurin MJ, Hoedebecke E, Nee MA, Hauret K, Carroll D, Jones BH. *Injury Incidence, Injury Risk Factors, and Physical Fitness of U.S. Army Basic Trainees at Fort Jackson, SC, 1997.* USACHPPM EPICON Report No. 29-HE-7513-98.

SCIENTIFIC PRESENTATIONS

Focusing injury prevention efforts: Using objective criteria to set priorities, American Public Health Association Annual Meeting, Philadephia, PA, December 2005.

An Application of the CSTE Public Health Practice vs. Research Checklist. Invited speaker, State and Territorial Injury Prevention Directors Association Annual Meeting, Washington, DC, October 2005.

Preventing Softball Injuries in the Military: A Review of Potential Interventions, Eighth Annual Force Health Protection Conference, Louisville, KY, August 2005.

An Overview of the Army Recruit Assessment Program Pilot Survey, Fiscal Year 2003, Seventh Annual Force Health Protection Conference, Albuquerque, NM, August 2004.

Falls in the Army 1994 to 2002: Descriptive Analysis of Army Safety Center Data, Seventh Annual Force Health Protection Conference, Albuquerque, NM, August 2004.

The Association of Injury, Fitness, and BCT Attrition. US Army Accessions Command, Center for Accessions Research Working Group, Baltimore, MD, March 2004.

The Value of Understanding your Survey Population: Lessons from the Recruit Assessment Program at Fort Jackson. Sixth Annual Force Health Protection Conference, Albuquerque, NM, August 2003.

Application of the Intrinsic Motivation Inventory in US Army Basic Training. American College of Sports Medicine Annual Meeting, San Francisco, CA, May 2003. Abstract published in Med Sci Sports Exerc. 35(5) 2003.

Physical Training-Related Interventions to Reduce Injuries. American College of Sports Medicine Annual Meeting, Baltimore, MD, May 2001. Abstract published in Med Sci Sports Exerc, 33(5): S173, May 2001.

Outpatient Injuries in Army AIT: Results from One Year of Surveillance. Recruit & Trainee Healthcare Symposium, San Antonio, TX, April 2001.

Aerobic Fitness and Injury Risk among US Army Recruits. American College of Sports Medicine Annual Meeting, Indianapolis, IN, June 2000. Abstract published in Med Sci Sports Exerc, 32(5): S346, May 2000.

Outpatient Injuries in Ordnance AIT: Data from a Clinic-Based Medical Surveillance System. Recruit Healthcare Symposium 2000, Chicago, IL, April 2000.

Cigarette Smoking and Injuries during US Army Basic Training, American College of Sports Medicine Annual Conference, Seattle, WA, June 1999.

Risk Factors for Serious Injury during Army Basic Combat Training, Fifth Annual Recruit and Trainee Healthcare Symposium, Parris Island, SC. April 1999.

Acute Viral Gastroenteritis Outbreak in US Army Trainees, Fort Bliss, Texas. Prevention99, Washington, DC. March 1999.

Acute Viral Gastroenteritis Outbreak in US Army Trainees, Fort Bliss, Texas. International Workshop on Human Caliciviruses, Atlanta, GA. March 1999.

Training, Physical Performance, and Injuries among Men and Women Preparing for Occupations in the Army. XIIIth Annual International Occupational Ergonomics and Safety Conference, Ann Arbor, MI. June 1998.

Research and the Injury Control Process. US Army Safety Conference, San Antonio, TX. May 1998.

Traumatic Injuries in U.S. Army Infantry Trainees. National Occupational Injury Research Symposium, Morgantown, WV. October 1997.

Association of Injury and Physical Fitness: A Study of Male and Female Recruits in Gender-Integrated U.S. Army Basic Training Units. Eighth Annual US Army Health Promotion Conference, San Diego, CA. July 1997.

Association of Injury and Physical Fitness: A Study of Male and Female Recruits in Gender-Integrated U.S. Army Basic Training Units. Thirty-eighth Navy Occupational Health and Preventive Medicine Workshop, Virginia Beach, VA. February 1997.

Survey of Fitness and Training Injuries, Fort Benning, GA. Third Annual Uniformed Services Recruit and Trainee Health Care Symposium, Washington, DC. 1997.

CONTINUING EDUCATION

Professional training	TRICARE Management Agency's Working Information Systems to Determine Optimal Management (WISDOM) course, 2004; Creative Problem Solving and Decision Making, 2003; Quality Guard Senior Advisor Facilitator Course, 1998; Understanding and Managing Human Behavior, 1997; Conflict Resolution, 1997; Scientific Tools, Quality Concepts, and the Joiner 7-Step Method, 1997; Making the Difference and Participating in Meetings, 1996; Introduction to Facilitation, 1996.

Technical training	Outbreak Management Software training, 2005. Introduction to Business Objects, 2004; Full-time doctoral curriculum and training grant coursework, 2001-2002; American College of Sports Medicine Certified Group Exercise Leader, 2002; Survival Analysis, Johns Hopkins Summer Institute, 1999; Biological Warfare and Terrorism: The Military and Public Health Response, 1999; Microsoft Access Advanced Features, 1998; New England Epidemiology Institute, Introduction to Survival Analysis, 1996; Advanced Statistics in SPSS, 1996; Intermediate Topics: SPSS for Windows, 1996; The Basics: SPSS for Windows, 1996; Risk Communication Skills Development Workshop, 1997; Health Promotion Program Planning and Evaluation Workshop, 1997; Department of Defense Risk Communication and Public Dialogue Workshop, 1995.

AWARDS AND RECOGNITION

Academic:	National Institute for Occupational Safety and Health Doctoral Traineeship in occupational injury epidemiology, 2001-2006; National Environmental Health Association Scholarship, 1994; Mortarboard National Honor Society, 1992; U.V.M. Senior Women's Honor Society, 1992; Alpha Zeta Honor Society, 1990; Alpha Zeta Freshman Proficiency Award, 1990; National Merit Scholarship, 1989.
Professional:	Certificate of Recognition, Five Years of Government Service, BG William Bester, 2003.
	Department of the Army Official Commendation, BG William Bester, 2003.
	Army Achievement Medal for Civilian Service, BG Lester Martinez-Lopez, 2001.
	Letter of Commendation, Stephen L. Kistner, 2001.
	Baltimore Federal Executive Board Rookie of the Year silver medalist, 2000.
	US Army Center for Health Promotion and Preventive Medicine (USACHPPM) Quality Advocate Award, BG Bettye H. Simmons, 1999.
	USACHPPM Certificate of Achievement, COL Robert DeFraites, 1998.
	Second place poster presentation, 8th Annual Army Health Promotion Conference, 1997.
	First place poster presentation, 3rd Annual Uniformed Services Recruit and Trainee Health Care Symposium, 1997.
	USACHPPM Commander's Coins for injury projects and meeting facilitation services, 1997, 2000, 2001.

OTHER

Computer skills:	SPSS, SAS, STATA, EpiInfo, Business Objects, TELEform, MSAccess, MSExcel, MSPowerPoint, MSWord, WordPerfect
Professional memberships:	American Statistical Association, 2002-present American Public Health Association, 1994-1996, 2004-Present Sigma Xi Scientific Research Society, 2005-present