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National Collegiate Athletic Association Strength And Conditioning Coaches' Knowledge And Practices Regarding Prevention And Recognition Of Exertional Heat Stroke

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NATIONAL COLLEGIATE ATHLETIC ASSOCIATION STRENGTH AND CONDITIONING COACHES' KNOWLEDGE AND PRACTICES REGARDING PREVENTION AND RECOGNITION OF EXERTIONAL HEAT STROKE

by

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ABSTRACT

The purpose of this study was to assess and determine the current level of knowledge that National Collegiate Athletic Association (NCAA) Strength and Conditioning Coaches (SCCs) possess regarding exertional heat stroke (EHS) prevention and recognition and to determine if SCC certification type had any effect. Major findings of this study support the view that SCCs need more preparation, education and training to increase their competency in preventing and recognizing EHS. Research found that there was no significant difference in scores on the EHS scale based on SCC certification (CSCS vs. SCCC) after accounting for experience, education or division but the CSCS certified professionals scored higher on all the factors as compared to SCCs without the CSCS.. The major key finding was that SCCs lacked essential knowledge to prevent or recognize EHS. Furthermore, the study defines relevant EHS prevention and recognition competencies that an undergraduate curriculum, graduate curriculum and professional certification providers, should include and emphasize in their preparation programs.

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LIST OF ABBREVIATIONS & ACRONYMS

ACSM	American College of Sports Medicine
AHA	American Heart Association
AT	Athletic Trainer
AMA	American Medical Association
CSCS	Certified Strength & Conditioning Specialist
CSCCa	Collegiate Strength & Conditioning Coaches Association
CPR	Cardio Pulmonary Resuscitation
EAMC	Exertional associated muscle cramps
EHS	Exertional heat stroke
EHE	Exertional heat exhaustion
EHI	Exertional heat illness
ERF	Extrinsic risk factors
IRF	Intrinsic risk factors
NATA	National Athletic Trainers Association
NSCA	National Strength and Conditioning Association
R	Recognition of EHS
SCCC	Strength & Conditioning Coach Certified
WBGT	Wet bulb globe temperature

CHAPTER ONE: INTRODUCTION

In the last 10 years (2002-2012) 32 deaths have been attributed to exertional heat stroke (EHS) in football (including high school, collegiate & professional football). Mueller and Colgate (2012) in their survey of football injuries indicate that from 1960 to 2011, the EHS death rate in football equaled 2.5 deaths per year; with a total incidence of 132 deaths. Reports also show that the majority of these deaths occurred during conditioning sessions in the preseason (first 4 days) practice and not during competitive games (Grundstein et al., 2010). In National Collegiate Athletic Association (NCAA) football, these deaths occurred while athletes were training under the supervision of the team's strength and conditioning coach (SCC). The most troubling aspect noted by Grundstein et al (2012), is that all of these fatalities occurred when wet bulb globe temperature (WBGT), the "gold standard for measuring ambient temperature, was well above what is considered safe. It is likely that if American College of Sports Medicine (ACSM) and National Athletic Trainers Association (NATA) guidelines for exercise safety in the heat were followed by the SCC, many if not all of the EHS casualties may have been prevented.

Exertional heat stroke (EHS) deaths are preventable and the SCC, the professional responsible for implementing and supervising strength and conditioning programs, may be held responsible if EHS deaths occur as a result of inappropriate exercise prescription or monitoring programs (Casa et al.; 2012). EHS is a life threatening condition caused by increasing body temperature (hyperthermia), central nervous system dysfunction and multiple organ failure (Casa, Armstrong, Ganio, & Yeargin, 2005). There is a substantial body of scientific literature examining the etiology and incidence of EHS. These have led to a number of position stands and review articles providing recommendations for the prevention, recognition and treatment of EHS (Casa et al., 2005; Epstein & Roberts, 2011; Gonzalez-Alonso, Teller, Andersen, Jensen, Hyldig, & Nielsen, 1999; Moreau & Deeter, 2005). Despite this knowledge, deaths continue to occur. Football players appear to be particularly susceptible to EHS for two major reasons; much of the preseason training occurs during the warmer parts of the year, and football requires extra equipment (helmets and pads), that prevent effective cooling, increases metabolic heat production and increases the risk for hyperthermia (Grundstein, Ramseyer, Zhao, Pesses, Akers, Qureshi, & Petro, M. 2012).

The common message emanating from the various position stands and guidelines of various professional sports medicine organizations is that through education the ability to prevent EHS, recognize symptoms of EHS and treat EHS are enhanced (Casa et al., 2005; Rav-Acha et al., 2004; Wallace et al., 2006). For the SCC, it can be argued that their professional responsibilities are primarily concerned with the first two areas: prevention and recognition. These professional guidelines include assessment of intrinsic factors and extrinsic factors, recognition of early signs and symptoms of EHS and early treatment. The intrinsic factors (athlete's health history) include: underlying illness, low physical fitness, dehydration, sleep deprivation and overweight/obese athletes. Extrinsic factors (external/environmental) include: improper acclimatization to the environment, training practices that do not match athletes physical fitness level, and not using WBGT as a guide to determine if practices have to be modified, delayed or cancelled (Armstrong et al. 2007; Binkley et al, 2002; Casa et al., 2005; Casa, & Csillan, 2009; Grundstein et al., 2010).

The SCC is an integral part of support staff or coaching staff of all NCAA Division I, most Division II and many Division III programs (Massey, Schwind, Andrews, & Maneval, 2009). The two primary certifications for SCCs are the National Strength and Conditioning Association (NSCA) Certified Strength and Conditioning Specialist (CSCS) and the Collegiate Strength & Conditioning Coaches Association (CSCCa) Strength and Conditioning Coach Certification (SCCC). Both, the NSCA and the CSCCa, have defined a scope of practice and established guidelines for the profession, limit certification to those who have earned a bachelors degree from an accredited institution, and require the candidates to pass a standardized examination. Although, each of these organizations have different requirements of knowledge, skills and abilities (KSA) to become an SCC, neither of these certifications include EHS as part of their KSA requirements. Some differences in the certification process between the two certifications do exist. The NSCA CSCS certification exam is accredited by the National Commission for Certifying Agencies (NCCA) while the CSCCA SCCC is not. The NCCA is an independent agency that reviews and accredits certification providers. The NCCA was created in order to ensure that health/fitness certifications exam and the process of testing administration, are meeting minimum standards of quality, validity and reliability. Regardless of the rigor of either of these two certifications, no legal requirement exists (e.g. licensure) for a SCC to earn either of these two certifications, or any other certification, because the SCC profession is not a regulated profession. Therefore, the decision as to who may or may not be competent to work as a SCC in NCAA sports is made solely by each independent NCAA institution. Each individual school determines which credentials, knowledge, skills and abilities the SCC should possess.

Despite the extensive literature pertaining to EHS prevention and recognition, it remains unclear if the SCC possesses the necessary knowledge regarding the prevention and recognition of EHS. Previous studies have examined the knowledge of athletic trainers on issues relating to EHS (Mazzerolle et al., (2010); & Dombek et al., 2006). Those studies suggested that certified athletic trainers were not consistent regarding their breath of knowledge regarding their understanding of recognition and treatment recommendations of EHS. This study appears to be the first to investigate the current knowledge, attitudes and practices of SCCs regarding prevention and recognition of EHS. It will also be the first to compare the SCC's knowledge, attitudes and practices based on certification type (CSCS vs. SCCC).

Purpose of the Study

The primary purpose of this study was to investigate the knowledge of NCAA SCCs regarding exertional heat stroke (EHS) and to determine if there is a difference in their level of knowledge based on certification type; CSCS vs. SSSC. The secondary purpose was to gain additionally information about SCC's attitudes and current practices in dealing with prevention and recognition of EHS.

CHAPTER TWO: LITERATURE REVIEW

EHS Etiology

Exertional heat stroke EHS is the result of an athlete's inability to dissipate sufficient heat during exercise and maintain a normal body temperature range (36.1-37.8°C), resulting in hyperthermia (body temperature $\geq$ 40°C). Hyperthermia adversely affects the central nervous system temperature control center's efforts to unload excess heat. This excess heat can lead to organ failure and if left untreated, death could be imminent (Carter, Cheuvront, Williams, Stephenson, Sawka, & Amoroso, 2005; Knochel, 1989). Considerable metabolic heat is produced by the body during exercise regardless of ambient temperature (Mora-Rodriguez, Del Coso, & Estevez, 2008). Under normal conditions, as body temperature increases the brain's hypothalamus starts a chain of events to lower body temperature. Internal heat load is reduced as venous blood is brought to the skin surface through peripheral vasodilation and cooled. Under hot, dry conditions, when the sweat glands secrete onto the skin, the sweat is evaporated relatively quickly, which serves to cool the underlying blood. Under hot, wet conditions (i.e. High humidity), sweat beads build up on skin surface delaying evaporative cooling. If body temperature increases at a faster rate than the body can reduce it, exhaustion and fatigue sets in and the athlete will need to discontinue the exercise bout (King et al.1985; Rowell, L.B. 1974). However, in cases of EHS, this "safety switch" has been overridden by the athlete and/or the signs and symptoms of EHS have been missed by the athlete, coaches and medical staff (Fuller, Carter, & Mitchell, 1998; Gonzalez-Alonso, Teller, Andersen, Jensen, Hyldig & Nielsen, 1999). This process can happen relatively quickly if exercise intensity and duration do not match the athlete's current level of fitness. EHS mortality is directly related to the magnitude and duration of the hyperthermia (Walters, Ryan, Tate & Mason, 2000). Initial symptoms are characterized by profuse sweating and pale skin, altered mental status, tachycardia, hypotension, vomiting and diarrhea (Armstrong, Hubbard, & Kraemer, 1987; Brewster, Connor, & Lillegard, 1995; Knochel, 1989; Casa, 2005). Ambient air temperature, humidity, air velocity, thermal radiation and the use of excessive clothing or protective equipment during exercise can exacerbate the problem, increasing the total heat stress or load experienced by the athlete. For the athlete, EHS is a problem associated not only with extreme conditions, but can also happen in milder temperatures and during early morning practices (Armstrong et al, 2007; Binkley, 2002; Epstein & Roberts, 2011; Epstein, Roberts, 2006; Roberts & Thorton, 1991)

The National Athletic Trainers' Association (NATA) (Binkley et al,.2002) and the American College of Sports Medicine (ACSM) (Casa et al., 2007) position statements on exertional heat illness (EHI) describe the etiology, risk factors, signs and symptoms, and treatment for the three major categories of exercise induced heat illnesses that affect athletes. EHS is the most dangerous of all EHIs, and it is considered a life threatening medical emergency. The three major categories of EHI are: exercise associated muscle cramps (EAMC), exertional heat exhaustion (EHE), and EHS. Heat syncope is another heat illness but it is not considered exertional in nature; it often occurs after an individual is standing in the heat for long periods of time and not as a result of exercise. EAMC are muscle cramps often caused by dehydration, electrolyte imbalances (sodium loses), or neuromuscular fatigue. The cramps may be very painful and are commonly seen after prolonged exercise in warmer temperatures. Signs and symptoms include thirst, sweating, transient muscle cramps that are often described as "excruciating," and fatigue. EAMC can be prevented by proper hydration and maintenance of sodium balance. EHE, by definition, results in the inability of the athlete to continue exercise as a result of high-intensity exercise. It is caused by dehydration and it is more common in hot environments. The signs and symptoms include heavy sweating, dehydration, sodium loss, and energy depletion. It may also include muscle cramps, urge to defecate and nausea. Body temperature ranges could be normal or elevated. EHS is often difficult to distinguish or confused with EHS. Risk factors include: athletes with a body mass index (BMI) > 27 kgm^{-2}, exercise in high ambient temperatures and dehydration. EHIs do not follow a gradation of one illness to the other. Casa, Armstrong, Ganio & Yeargin (2005), clearly state that "athletes do not go through a continuum" before they develop EHS. EHS may happen very quickly or early in the training session if the exercise intensity does not match the athlete's fitness level. In many reported cases the athlete may have shown few, if any, initial signs and symptoms before collapsing.

EHS Incidence in Football

Mueller and Colgate (2012) have recently reported an incidence of 133 deaths in high school, collegiate and professional football attributed to EHS in football between the years 1960 - 2012. Twenty one deaths occurred from 1999- 2003 and 31 deaths occurred from 2003-2012. This is an increase of 50% more deaths attributed to EHS in the last decade. Since 2000, in NCAA football, four deaths have been documented to be caused by EHS. All four of these deaths occurred during conditioning practices. On August 15, 2000, Michael King, a football player from the University of Indianapolis, was participating in conditioning drills when he began complaining about exhaustion. He was taken to the hospital were he later died. His body temperature was recorded at 110° F (43.3°C). On July 25th, 2001, Eraste Autin, football player from the University of Florida, died following conditioning sprints. His core temperature was recorded at 108°F (42°C). Vince Bernardo, from Shippensburg University, died after only 19 minutes into the first day of conditioning practice on August 8, 2006. More recently, Sam Collins, from, Huntingdon College died following conditioning drills, on August 15, 2008; death documented as EHS (personal email communications, September 2010). The common factor for all of these deaths is that they happened early in the training season, where athletes might not have been acclimatized to the heat and WBGT temperatures were >85° (29.4°C). A study by Grunstein et al (2012) examined the environmental conditions, timing, and location (geography) of the recorded incidences of EHS. They noted an average of 2 deaths per year (all levels of football); with the greatest number occurring in 2008. Deaths occurred primarily between July and September but the majority of deaths (66%) occurred in August; with 71% of those deaths occurring in the first two weeks of August. Many of the deaths occurred in the morning (58%). The WBGT temperatures at the time of these deaths were all within the ranges considered high to extreme by ACSM and NATA (73.4°- 82.4°F or 23-28°C) and 60% of the deaths occurred when practices should have been cancelled (>82°F or >28°C).

EHS and Special Medical Conditions

There are several medical emergencies that can happen during exertion. These include: exertional sickling, heart attacks, exercise induced asthma, hypoglycemia leading to coma, and rhabdomyolysis. Many of the same factors that cause EHS also contribute to these conditions and share a common pathway. It appears that exercise intensity that does not match level of conditioning, lack of acclimatization, improper hydration, and insufficient work/rest cycles are the primary mechanism increasing the risk for sudden death in athletes. Initial diagnosis of sudden death in sports may involve any of the above emergencies but the similarities in the training environment (exercise intensity that does not match level of conditioning, lack of acclimatization, improper hydration, etc…) at the time of collapse are significant and should be noted (Casa, et al., 2012a; Casa et al., 2012b; Harmon, Asif, Klossner, & Drezner, 2011; Harmon, Drezner, Klossner, & Asif, 2012; Maron, Doerer, Haas, Tierney, & Mueller, 2009).

EHS in Hot Environments

Exercising in a hot environment increases the amount of heat stress experienced by the athlete. The factors that contribute to environmental heat are the air temperature, humidity, wind speed, radiant heat sources and clothing. These factors combined with exercise intensity add to the heat stress of the activity (Moreau & Deeter, 2005). The recommended instrument to measure heat stress is the wet-bulb globe temperature (WBGT). It provides an accurate measure of conduction, convection, evaporation, and radiation based on these three different thermometer readings; combining them into an index. This WBGT index can be used to assess the magnitude of thermal stress experienced by an athlete and should be used to make decisions about when to modify activity or cancel it (Binkley et al, 2002; Casa et al., 2007). The WBGT index guidelines state that at >85° F (29.4°C), athletic activities should be cancelled. From >79 ° - < 84°F (26°-28.9°C), activities should be stopped for unacclimatized individuals and those in high risk categories, and modified for all others. Temperatures of >75° to < 78.6 F, recommends longer rest periods in the shade and drinking fluids every 15 minutes. Only under temperatures < 75° F, are all activities permitted. However, vigilance over any signs and symptoms of EHI and any other medical emergency is still prudent and recommended (Binkley et al., 2002; Casa et al., 2007).

EHS and Dehydration

Dehydration increases the risk of EHS and other heat illness because dehydration contributes to hyperthermia and oxidative stress (Sawka, Latka, Matott, & Motain, 1998). Nadel, Fortey, & Wenger (1980) reported that dehydration that leads to hypohydration (body water deficit) reduces plasma volume and as a result, stroke volume is also decreased. In conditions of heat stress, there is a corresponding decrease in cardiac output that impairs thermoregulation. According to Hillman et al (2011), the goal during training in the heat should be to maintain hydration levels or euhydration (balanced body water). They analyzed the effects of exercise induced dehydration with or without hyperthermia to determine the level of stress between these two conditions. It was reported that maintaining euhydration attenuated the effects of exercising in the heat while some studies suggest that even low levels of dehydration (2% loss) interfere with the body's cardiovascular and thermoregulation which may lead to hyperthermia (Murray, 1996). Casa and colleagues (2000) in their review of exercise and dehydration noted that optimal hydration is necessary for the body to efficiently function to prevent hyperthermia. To maintain euhydration during exercise, the authors recommend establishing a protocol for hydration that: 1) is tailored to each athlete's needs, 2) considers the sport intensity and volume; 3) makes use of the WBGT index, 4) provides for fluids ad libitum; and 5) monitors sweat rates to ensure that fluid intake matches fluid loss. Since during exercise in hot conditions athletes can lose more than 1L of sweat per square meter of body surface, optimal euhydration can provide for optimal thermoregulation during exercise.

EHS and Uniforms

The type of uniform worn by the athlete affects the effectiveness of sweat as a cooling mechanism. The degree of equipment or extra layers worn may prevent evaporation and heat dissipation which may result in increased heat stress (Binkley, 2002; Casa et al., 2007; Shapiro, Pandolf, & Golman, 1982). The color of the garments may also be a factor. Nielsen (1990) studied participants wearing either black or white clothing and found heat stress to be greater when wearing black garments. The darker garments absorbed more heat, regardless of material type (cotton or polyester). In football, the addition of helmets and other protective equipment, coupled with a decrease in body surface area (body covered by uniform), exacerbates the heat stress (McCullough & Kenney, 2003; Rash & Cabanac, 1993; Rash, Samson, & Cote, 1991).

EHS Prevention

Extensive review of cases of EHS and EHS deaths has provided much information about the predisposing factors associated with EHS. Lopez et al. (2011) distinguishes these predisposing factors as intrinsic, extrinsic or a combination of both; with acclimatization being an important first step in prevention of EHS. Acclimatization can be considered intrinsic as it relates to the athletes level of acclimatization prior to engaging in activities in the heat. But the process of preparing the athlete to exercise in the heat is extrinsic. The SCC is responsible for the process of preparing the athlete to train and compete in the heat.

Acclimatization

It has been well documented that allowing athletes to gradually adapt to increasing heat stress decreases their risk of EHS and other EHIs (Armstrong et at., 1990; Armstrong et al., 1991; Maughan & Shireffs, 1997; Nadel et al., 1974). Lopez et al. (2011) concluded that acclimatization may be the "most important factor to consider" for the prevention of EHS. Athletes who are acclimatized to the heat will be at a lower risk for EHS. The process begins on the first day of exposure and continues for 10 to 14 days; with a gradual increase in the duration and intensity of physical activity in the heat. The athletes should begin practice in shorts and light colored shirts and progress gradually before increasing the layers of clothing and helmets. Protective equipment should not be used until the athletes are fully acclimatized.

Intrinsic Factors

Much variability exists in how athletes' respond to exercising in the heat. An athlete's tolerance to exercise in the heat is affected by the following intrinsic factors: obesity (high BMI), prior history of EHS, sleep deprivation, motivation, acclimatization status, hydration status, illness, level of physical fitness, sweat gland function, sunburn and certain medications. Conditions such as sickle cell trait, asthma and cardiovascular disease may also increase the risk of EHS or in the case of sickle cell and asthma, lead to exertional sickling or exercise-induced asthma during exercise in the heat (Lopez et al, 2011).

Extrinsic Factors

Factors outside of the athlete's control that increase EHS risk include: training at the hottest hours of the day, high solar radiation, WBGT >82° F, improper work/rest cycles, and improper or limited hydration available or allowed during training. Lopez et al. (2011), describes "old school" practices that are believed by some to increase the "mental toughness" of the athlete. These include: practicing during the hottest parts of the day in full football gear, withholding water, and more importantly, conveying the attitude that "quitting" is a sign of weakness.

EHS Recognition

McDermott et al (2006) discusses the role the SCC has in early recognition of EHS. Although the SCC is not responsible for diagnosing or treating EHS, he is often the first responder due to his closeness to the athlete in a training situation. Casa and Colleagues 2012 recommends that SCCs earn CPR and first aid certification in case they are the first responders to in an emergency situation. The SCC should be familiar with signs and symptoms of EHS and be prepared to handle emergency situations. For example, CPR training teaches and prepares first responders to recognize signs and symptoms of heart attack and stroke. First aid teaches signs and symptoms of heat exhaustion and heat illness. Knowing the classic EHS symptoms could save valuable time and provide the early treatment that is essential for EHS survival. The early signs and symptoms that precede EHS include: significant decreases in performance, personality changes, and profuse wet skin (most cases of EHS).

EHS Myths and Misconceptions

Several myths and misconceptions continue to prevail and interfere with an SCC's ability to prevent and recognize EHS. Some of these myths and misconceptions are that EHS is: 1) random and unpredictable; 2) only a risk in hot/humid environments; 3) a progression from, or a continuum of heat symptoms with heat stroke being the last stage; 4) can be ruled out if athlete is lucid; 5) that extreme dehydration must be present; and 6) that hot dry skin is a strong indicator of EHS and if the athlete is soaking wet he is ok (Binkley et al. 2002; Casa et al. 2007, Casa et al. 2005; Epstein et al; 2011).

Professional Preparation and History of the Strength and Conditioning Coach

The strength and conditioning profession's beginnings can be traced to the University of Nebraska in the 1970s, and the founding of the National Strength and Conditioning Association (NSCA) in 1981. The NSCA was the first organization to develop training and standards for the profession as well as to provide a unifying organization for SCCs to exchange information. The NSCA has become the professional home of SCCs from high school to the professional ranks. During the 1980' and 1990's the NSCA grew rapidly from an organization that focused primarily on strength and conditioning coaches to one that become inclusive to all individuals interested in strength and conditioning. This opened a large influx of personnel trainers that changed the landscape of the NSCA. However, not all members were happy in regards to the broad appeal to non-strength coaches. As a result, in 2000 the Collegiate Strength & Conditioning Coaches Association (CSCCa) was formed with the purpose of providing an association for coaches working primarily at the collegiate level. Although several other exercise science certifications exist in the industry, only the NSCA and CSCCa organizations provide professional certifications that are specifically designed for the scope of practice of SCCs. These two are the NSCA Certified Strength and Conditioning Specialist (CSCS) and CSCCa Strength and Conditioning Coach Certification (SCCC).The CSCS certification is the only SCC certification accredited by the National Commission for Certifying Agencies (NCCA). Although these certifications define the scope of practice, and set minimum standards and guidelines for entering the profession, there is currently no legal ramification for individuals practicing strength and conditioning coaching without any kind of certification. It is up to the employers to verify if SCCs credentials are sufficient before hiring them. For undergraduates wishing to pursue a career in strength and conditioning, there is no undergraduate degree that focuses solely on strength and conditioning either. This has been noted by the wide variety of undergraduate degrees reported by SCCs. These include physical education, education, exercise science, kinesiology, biomechanics, and biology (Duehring, Feldman, & Ebben, 2009). Considering the differences in curriculum and instruction, it is reasonably to assume that the knowledge, skills and abilities of these SCCs may be also quite varied.

The issue of professional regulation and lack thereof in the SCC career is of significant interest in any discussion of the occupation's knowledge, skills and abilities. Constanzo (2006) discusses the process that the evolution of a profession must follow. He postulates that a profession exists when certain conditions are in place: 1) a standardized system to develop skill through accredited academic curricula, 2) a standardized system to validate skill through an examination that is restricted to those who have completed training through accredited academic study and 3) an organized community to advocate for the profession, typically with eligibility restricted to those successfully completing standardized skills validation. This is the process that professions such as; physical therapy, nutrition and athletic training have achieved in order to limit the practice and protect their profession. Candidates in these professions must graduate from an approved program with a degree in that discipline, pass a licensure exam, and register in their state of practice. Although the SCC profession is striving for professionalization, it has yet to meet all of these conditions; specifically its ability to restrict entrance to the profession to those workers that have met minimum standards. Because of this fact, it is difficult to know if practicing SCCs posses the necessary knowledge to prevent or recognize EHS.

Assessment of Knowledge, Perceptions & Attitudes

There is no existing literature that has specifically studied SCC's knowledge of EHS. Therefore, little is known about the variables that affect SCCs' knowledge of EHS prevention and recognition. The literature supports the use of questionnaires to gather information about knowledge, practices, attitudes and opinions. Although there is no research conducted on SCCs knowledge of EHS, there is one study that has examined athletic trainer's knowledge of EHS. Mazerolle et al. (2010) studied the knowledge, attitudes, and practices of certified athletic trainers regarding the recognition and treatment of EHS and found that although the athletic trainers (ATs) were familiar with the NATA 2002 and the ACSM 2007 position stands on EHS; only 18% were following the guidelines as outlined. In order to assess ATs' knowledge, practices and attitudes; the researchers created an instrument that they validated through the use of expert review, and they pilot tested to establish content and face validity. The questionnaire was sent out to 2000 ATs working at the high school and college level and yielded a 25% response rate. The qualitative data in that study consisted of answers to the open ended questions in the survey. The open ended items were coded and analyzed. The found inconsistencies between the AT's knowledge about recognition and treatment versus what they actually practice.

Several studies have examined the SCC's general knowledge or practices pertaining to their duties as SCCs. (Durrell, Pujol & Barnes, 2003; Ebben & Blackard, 2001; Simenz,., Dugan,., & Ebben, 2005)). Most of these studies utilized a questionnaire that was reviewed by experts for content validity and pilot tested with a similar sample to the population of interest with a brief qualitative data section. One of the studies exclusively utilized a single subject observation to gather qualitative data (Dorgo, 2009). These studies provide support for the use of questionnaires to measure knowledge and to examine practices of professionals in the strength and conditioning coaching field. Creswell, (2008), in his book on conducting educational research, suggest that in order to gain a better understanding of a central phenomenon guiding an issue and to explore unknown variables, a qualitative research design may be preferred Considering the lack of research available on SCCs knowledge and practice, qualitative questions open-ended questions may be appropriate as well.

SCC Performance & Practice

Durrell, Pujol & Barnes (2003) surveyed NCAA Division I SCCs to determine the extent that scientific research guides their practices. The study utilized a 20 question survey design with the questionnaire having both open and closed ended questions. An expert review was used to validate the survey. They found that SCCs gave a low priority to peer review literature as their source of information when making program or training decisions for their athletes, and relied primarily on other NCAA coaches for information on training practices as well as their own former experience as an athlete. This study had a 42.7% response rate.

Ebben & Blackard (2001) conducted a survey of the National Football League (NFL) SCC's practices. The purpose was to describe which practices SCCs utilize most often. Although the survey included questions on physical testing, flexibility development, speed development, plyometrics, strength and power development, no questions were asked about training modifications due to heat or other medical pre-existing conditions. The survey was mailed to 30 NFL teams and the response rate was 87%. In a similar study, Simenz et al, (2005) utilized an adapted version of the survey used by Ebben et al. (2001) to analyze National Basketball Association (NBA) SCCs. The questionnaire contained the same subject areas as the original questionnaire by Ebben et al (2001) and no questions relating to EHS or other medical emergencies were asked. The study had a 68.9% response rate by using a combination of regular mail, phone calls and emails.

A few studies have used a qualitative approach to analyze attitudes and practices. Dorgo (2009) conducted the only qualitative case study on SCCs' knowledge. This study examined the practical knowledge of one "expert" coach to determine the origin of his practical knowledge. The researcher used observation to collect the qualitative data. The study found that the majority of the SCCs' practical knowledge was derived from field experiences, real-life practices and discussions with other professionals with very little obtained through formal education or scientific evidence. This conclusion supports Durrell et al (2003) findings that SCCs rely on each other more than scientific evidence for information. Although the study did not gather any information on EHS knowledge or practices, it did provide support for research via conducting interviews and observations as a means of assessing current practices of SCCs with a sample size of only one.

Assessment of Knowledge of Exercise Science Practitioners

Only one study is known that has analyzed SCCs' knowledge of an exercise science related concept. Rockwell (2001) investigated the nutrition knowledge, opinions and practices; not only of SCCs but also ATs and other coaches, in a Division I institution. Using a questionnaire comprised of 19 multiple choice, 11 true/false and 8 open ended questions, they compared three different groups of coaches and ATs (head coaches, assistant coaches, SCCs and ATs) found that SCCs had more correct responses but the differences were not statistically significant. But they did find that coaches with more than 15 years of experience scored significantly higher than other coaches with less experience. Overall they found that nutrition knowledge was low; with and overall mean on the questionnaire was of 67% correct. This study reveals that experience may be a factor in determining knowledge and should be considered when comparing different groups of SCCs. This study emphasized the need to continue to assess knowledge, skills and abilities (KSAs) in the profession to determine if and when more training is needed in a particular content area.

Abbott (1989) constructed a 30 question multiple-choice design to assess what he deemed to be a minimum standard of knowledge of exercise science in commercial fitness instructors and personal fitness trainers (PFTs). The results of his study indicated that the American College of

Sports Medicine ACSM certification was a strong predictor of success on the test as compared to fitness instructors that were not ACSM certified. It was reported that instructors that had obtained ACSM certification performed twice as well in the 30 question exercise science knowledge test as compared to non –ACSM certified instructors. The findings of this study support the view that the type of certification may have an effect on knowledge of exercise science and subsequent their overall knowledge, skills and abilities (KSA). The author further recommends that "On-the-job training cannot provide sufficient expertise to work safely and effectively with the public. Rather the fitness instructor needs to be well grounded in basic fundamentals of exercise science through both academic and practical preparations" (Abbott, 1989). Some of the limitations of this study are that exercise science knowledge may not necessarily equate with better professional practices as suggested by Mazerolle et al (2010) findings on AT; where knowledge did not transfer to actual practiced skills..

In a more recent study, Melton et al. (2008) attempted to examine the qualifications and competencies of effective exercise leaders using focus groups methodology and grounded theory. The study examined the views of local personal trainers in small southeast community. The study was not aimed at measuring expertise or KSA but attitudes of Personal Trainers. The main themes that emerged from the interviews were: 1) client selection rationale, 2) client loyalty, 3) credentials and 4) negative characteristics. Under the theme of credential, the Personal Fitness Trainers expressed their opinion that there is a need for one standard required of all Personal Fitness Trainers to be eligible to practice similar to what other professions such as massage therapy and physical therapy require. They felt this would add more credibility and optimize client safety.

CHAPTER THREE: METHODOLOGY

Sampling Method

The first part of the study required validation of the survey instrument. A panel of 9 experts was selected to validate the survey. The panel was chosen based on their research experience with EHS as determined by their degree, publication record and university affiliation. Experts were emailed and asked to participate in the study and to provide their feedback about the items on the questionnaire.

The entire population of SCCs with emails listed on the school's athletic/sports site were included in the study. These yielded a total of 1305 SCCs. The list of all NCAA SCCs was developed by conducting a web search of all NCAA institutions and their athletic websites. The search entailed finding the athletic site and the staff directory with emails. All of the SCCs in the list were emailed a link to the online questionnaire and asked to participate in the study with anonymity guaranteed. The goal was to achieve a ≥25% response rate.

Participants

One thousand three hundred and five SCCs, representing NCAA Division I, II & III were surveyed. The surveyed was conducted between June and August 2012.

Instruments

Since no validated instrument exists to measure SCC's EHS knowledge, one was developed for this study. An instrument previously used and validated for ATs was adapted for SCCs, pilot tested and validated (Mazerolle, et al., 2010, Mazerolle et al. 2011). A panel of EHS experts, and educators (n=9) was utilized to create relevant content items for SCCs and for help in defining the constructs of the Likert items. The panel was chosen based on their research experience with EHS and the SCC profession as determined by their degree, publication record, university affiliation and experience. The process yielded 4 major constructs in the areas of EHS knowledge: extrinsic risk factors (ERF), intrinsic risk factors (IRF), recognition of EHS (R) and general training safety knowledge (TSK) for a total of 30 Likert items. To determine internal validity the instrument, was pilot tested on a group of 210 undergraduate of graduate University of Central Florida strength and conditioning students s. The survey contained a letter explaining the purpose of the study, guaranteeing anonymity and that participation was voluntary. The return rate was 165 respondents for a 79% response rate. To estimate reliability of the Likert items, Cronbach's alpha was calculated for the Overall, IRF, ERF, R, and TSK. The Cronbach's alpha reliability of the 30-Likert items measuring EHS knowledge (Total score after reverse-scoring the appropriate items) was 0.74. Each of the 4 separate constructs was also tested for reliability and those results are shown on Table 1. After removing items with low reliability the final instrument consisted of 24 Likert items. The IRF section contained 7 items. ERF section contained 8 items, R contained 6 items and TSK contained 3 items. The 24 items were rated with a 7 point Likert scale (1= strongly disagree, 7=strongly agree). Six additional closed ended "yes" or "no" questions were also included. The open ended response section was used to ask questions about current practices. Ten demographics questions were included at the end of the survey. SurveyMonkey™ was used to create the instrument and to email the instrument in a survey style format. It also maintained anonymity of the participants (see Appendix F).

Table 1. EHS Questionnaire Content

Subscale/Concept	Item #	Item Score Range Total	Cronbach's Alpha
Prevention/Intrinsic factor knowledge (IRF)	2,3,5,7,10,19,21	7-49	.82
Prevention/Extrinsic factor knowledge (ERF)	6,8,9,13,16,17,18,20	8-56	.86
Recognition knowledge (R)	4,11,12,14,15,22	6-42	.85
Training Safety knowledge (TSK)	23,24,25	3-21	.76

Procedures

The study received approval from the University of Central Florida Institutional Review Board (see Appendix H). A list of all NCAA SCCs' emails was developed by first creating a list of all NCAA Colleges. The schools websites were visited and the athletic staff section of the website was searched for SCC contact information. All of the SCCs on the created list were emailed an asked to complete the online survey questionnaire (see Appendix A). The contact email provided instructions and a link to the surveys website, SurveyMonkey™ (see Appendix F). They were assured anonymity and the right not to participate in any part of the study. The SurveyMonkey™ website allows for non-respondents to be sent an email reminder and for to remain anonymous and unknown to the researcher (See Appendix B). The researcher was not aware of who had or had not responded. All of the information was kept anonymous.

Statistical Analyses

In order to better understand the population of respondents, descriptive statistics were generated. The frequencies for experience, education, gender, age, division of the institution and certification type were collected and generated. Other questions of interest were previous experience as a high school, college or professional athlete and those frequencies were generated as well. Frequencies for number of correct responses in each of the content areas were calculated using SPSS frequencies. The closed ended "yes" an "no" items were analyzed based on percentage response "yes" or "no" answers. To determine performance on the questionnaire containing the Likert items, the scale scores were coded correct and earned one point if the response marked was ≥ 5 and coded incorrect and earned 0 points if the response ≤ 4. For those statements where the correct answer was "disagree" or 1, the statements were reverse coded on SPSS. Means and SD were calculated for the Total, IRF, ERF, R and TSK scores. To compare the effect of certification on score and each sub construct score and test for interactions, the General Linear Model (GLM) (univariate) was utilized using SPSS. The main effects were certification type, education, experience, and NCAA Division. The dependent variable was Total Score on the EHS and four individual construct scores. Only when interaction among the variables was not significant were the main effects considered for the analysis. If no interactions were found a one way between subjects ANOVA was conducted to compare the effect of certification on the Total score, IRF, ERF, R and TSK, based on certification type (group). Participants were categorized into four certification groups in order to examine the differences in EHS knowledge by certification group. These categories included SCCs that had: (1) only earned the CSCS certification (CSCS group), (2) only earned the SCCC certification (SCCC group), (3) earned both certifications (CSCS/SCCC), and (4) neither of the two (NC group). The scale scores were tested for outliers (boxplot), normality (Shapiro-Wilk Test, ($p < .05$) and homogeneity of variance (Levene's Test of Homogeneity of Variance ($p = .01$)) and all assumptions for ANOVA were met. No significant interactions were found with education, experience and/or division.

The qualitative data examined the answers to open ended questions by searching for overall themes. The overall themes were compared with each of the score results to better understand gaps and problems in the knowledge of prevention and recognition of EHS and to further explore SCCs attitudes, beliefs and practices.

CHAPTER FOUR: RESULTS

Of the 1305 SCCs that were asked to participate, 354 responded to the survey. This resulted in a 27.1% response rate which met the desired goal of ≥25%. Of the 354 that responded, 319 had completed the necessary information to conduct analysis of the research questions relating to Total score, IRF, ERF, R and TSK knowledge scales.

Demographics

The last 10 questions of the survey asked several demographic questions. These included certifications earned, years of experience, highest educational degree attained, NCAA division, age, gender, job title, and athletic experience as a high school, college or professional athlete. Two hundred and one (64.3%) of the SCC sampled worked in NCAA Division I athletics. The majority of participants were ≤35 yrs. old (59%) and male (65%). Their professional background reflected that they had ≤10 years of experience as a SCC (67%) but the majority of these coaches had earned graduate degrees (59%). In addition to their coaching experience, the SCCs reported prior experience as either a high school (81.5%), collegiate (62%) or professional athlete (5.3%). One hundred and sixty two (50.8%) of the SCCs had one of the two strength coaching certifications: CSCS or SCCC, 62 (19.4%) had both, 25(7.8%) had certifications from other organizations (e.g. USA Weightlifting, National Academy of Sports Medicine) and 22% reported no certification (see Table 2).

Table 2. Demographics

	n(%)
Age	
<u><</u>25	28(8.7)
26-30	94(29.4)
31-35	67(21)
36-40	40(12.5)
41-45	21(6.5)
46-50	13(4.0)
51+	12(3.8)
Gender	
Male	208(65.0
Female	61(24.4)
Experience as a SCC	
<1	1(.3)
1-5	130(41.0)
6-10	82(25.7)
11-15	50(15.7)
16-20	30(9.4)
21-25	11(3.4)
>26	5(1.6)
Education	
High School (HS)	1(.3)
Bachelors (B)	83(26.0)
Masters (M)	186(58.3)
Doctorate (D)	4(1.3)
NCAA Division	
I	205(64.3)
II	31(9.7)
III	34(10.7)
Prior Athletic Experience	
High School Athlete	260(81.5)
College Athlete	198(62.0)
Professional Athlete	17(5.3)
Certification	
CSCS only	116 (36.4)
SCCC only	46(14.4)
CSCS/SCCC	62(19.4)
Other	25(7.8)
None	70(21.9)

<u>SCC Knowledge of Prevention and Recognition of EHS</u>

Table 3 describes the means and standard deviations for the Total, IRF, ERF, R and TSK scores. The means are expressed in percentage correct and Figure 1 depicts the distribution of scores based on percentage correct on the Total score. Of the 319 participants, 7 (2.2%) scored ≥ 90% (“A”) and 151(47%) scored ≤ 59% (“F”) on Total score.

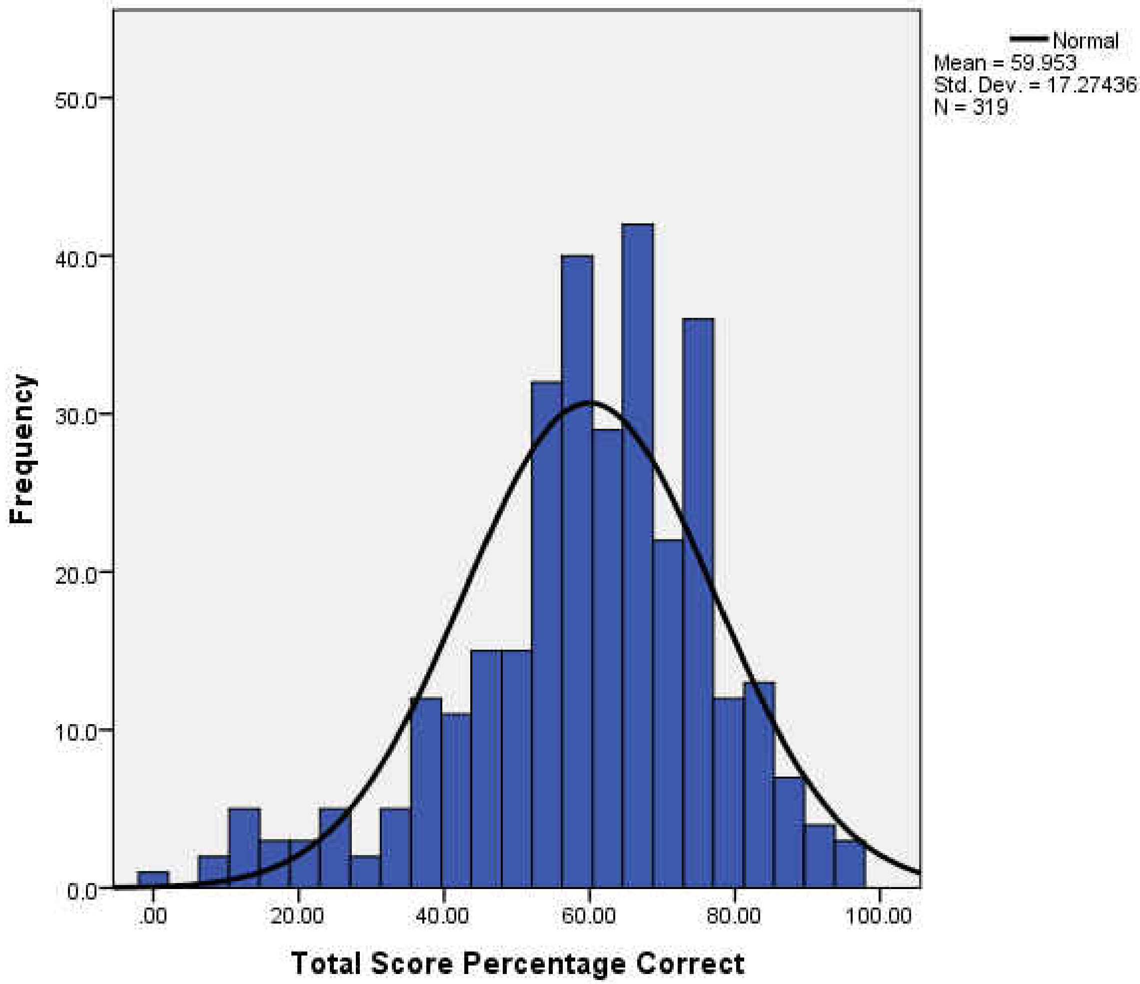

Figure 1. Frequencies and Percentage Correct and on EHS Scale

Analysis of the results for each the constructs on the scale reveals similar performance as found for Total score (see Table 3). For IRF, 56 (17.6%) scored ≥ 90% and 102 (32%) scored ≤ 59%. Only one participant scored ≥ 90% on ERF and 112 (35%) scored ≤ 59%. For R, 8 (2.5%)

participants scored ≥ 90% and 152 (54%) scored ≤ 59%. TSK results indicate that 21 (6.6%) participants scored ≥ 90% and 178 (55.8%) scored ≤ 59%.

Table 3. Exertional Heat Stroke Scale Results Percentage Correct

Scale	N=319 M ±SD	≥90% n (%)	≤ 59% n (%)
IRF	71.0 ±23.1	56 (17.6)	102 (31.9)
ERF	61.3 ±18.7	1 (.3)	112 (35.1)
R	52.2 ±5.3	8 (2.5)	172 (53.9)
TSK	46.2 ±26.1	21 (6.6)	178 (55.7)
Total	60.0 ±7.3	7 (2.2)	151 (47.3)

IRF, intrinsic risk factors scale; ERF extrinsic risk factors scale; R, recognition skills; TSK, training safety knowledge and Total, all correct responses on questionnaire

Differences between Certification Groups

The one way ANOVA to evaluate the relationship between certification group and Total score revealed a statistically significant difference between certification groups (p=.05) based on the Total score (F (3,315) = 10.376, p=.000). Comparisons of the percentage of correctly answered questions for the four certification groups are reported in Table 5 and depicted in Figure 2. Post-hoc test indicate that there was a statistically significant difference (p = .000) in the number of correctly answered questions between the CSCS group and the NC group (p =.000), and between the CSCS/SCCC group and the NC group (p=.000), but no significant differences were seen between the CSCS, SCCC and the CSCS/SCCC group. The NC group scored significantly lower in Total score in comparisons to all other certification groups. SCCs that had either the CSCS certification or both the CSCS and the SCCC certification scored significantly higher than those that did not have a SCC certification. Although the CSCS group had higher means in the Total score than the SCCC group, the difference was not statistically significant (p =.614).

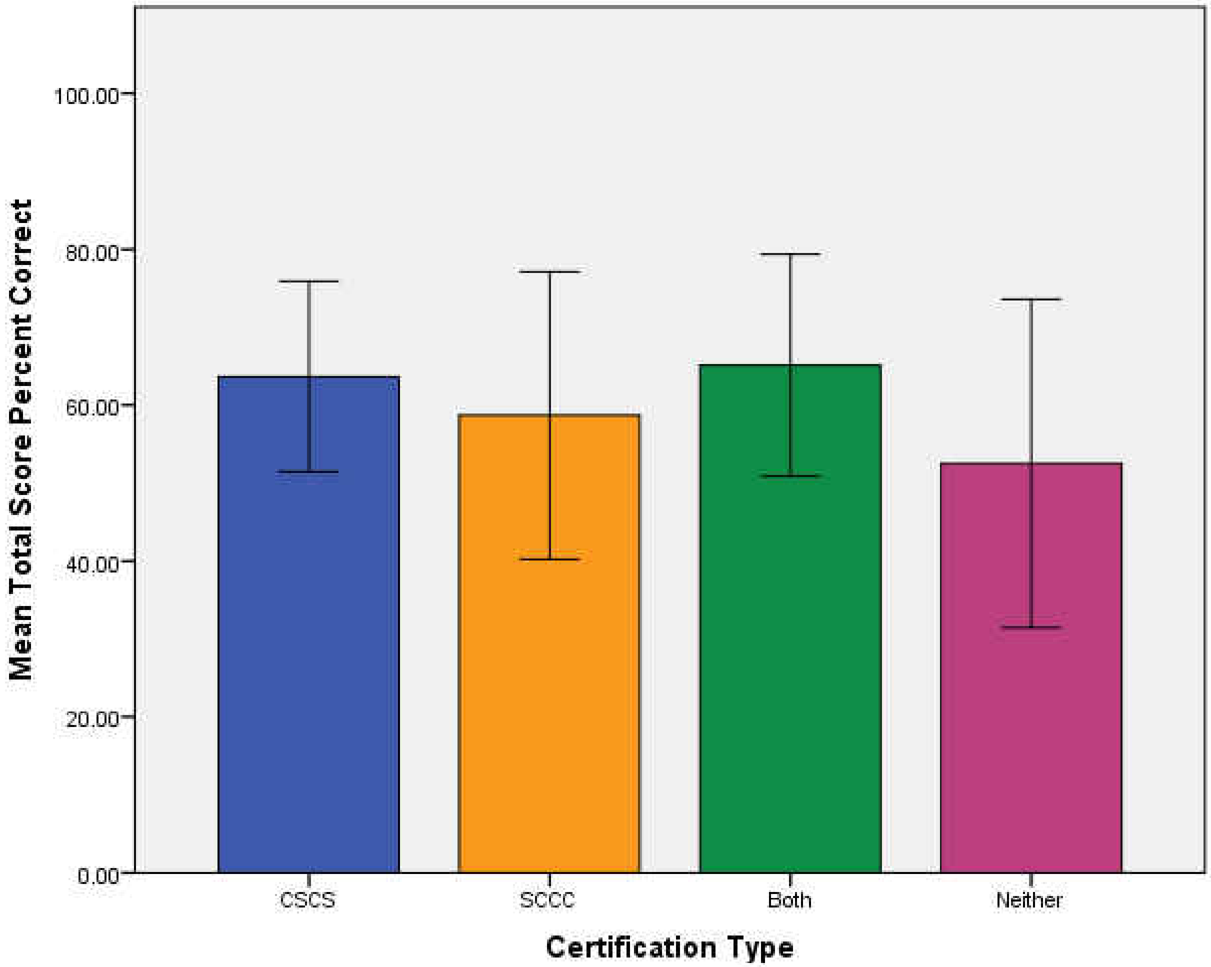

Figure 2: Total Percentage Correct and Certification Group

Table 4 describes the means and standard deviations for the certifications groups based on the five scales (Total, IRF, ERF, R and TSK). The results for the one-way ANOVA for IRF score indicate a statistically significant difference between certification groups (F (3,315) 10.455, *p*=.000). Post-hoc test indicate that the CSCS (*p* =.000), SCCC (*p* = .04) and the CSCS/SCCC (*p*= .000) group scored significantly higher than the NC group but were not significantly different from each other. The one way ANOVA for ERF score indicates differences between the groups (F (3,315) = 5.803, *p*=.001) Post-hoc test revealed that the CSCS (*p*=.002) and the CSCS/SCCC (p= .000) group scored significantly higher than the NC group while the SCCC group (*p* =.290) mean was not statistically different from the NC group. No other significant differences were found between the CSCS; SCCC or CSCS/SCCC groups. The one way ANOVA for TSK score indicates significant differences between the groups (F (3,315) = 7.089, *p*=.000). Post-hoc test reveal that the CSCS (*p* = .000) and the CSCS/SCCC (*p* = .002) group scored significantly higher than the NC group. However, the SCCC (p = .055) group score was not significantly different that the NC group. No other significant differences were found between the CSCS; SCCC or CSCS/SCCC groups. Review of the R scores indicates no significant differences were observed between any of the groups (*p* < .05).

Table 4. Certification Group Means and Standard Deviations

Certification Group	Total	IRF	ERF	R	TSK
CSCS	63.7 ±12.2*	75.8 ±17.0*	64.1 ±15.9*	55.3 ±22.0	51.0 ±23.0*
SCCC	58.7 ±18.5	71.1 ±22.0*	60.9 ±21.0	46.7 ±28.9	47.8 ±31.2
CSCS/SCCC	65.1 ±14.3*	77.4 ±20.1*	65.7 ±16.0*	57.0 ±24.3	51.1 ±24.7*
NC	52.5 ±21.1	60.6 ±28.2	55.1 ±20.8	47.9 ±27.0	36.2 ±25.7

CSCS = Certified Strength & Conditioning Specialist; SCCC = Strength & Conditioning Coach Certified; NC = No strength and conditioning certification. * = significantly different than NC

Individual Item Correct Responses and Frequencies

In order to further understand content areas where factual knowledge about EHS may be low or inadequate, the individual Likert items were analyzed based on percentage of SCCs that correctly agreed or disagreed with each of the statements.

Table 5 describes the percentage of SCCs that correctly identified the “true” or “false” statements from the IRF scale. The frequencies reveal that a only 55.7% of SCCs correctly agreed that highly self-motivated athletes may be at a higher risk for EHS, 62.7% correctly agreed that body composition should be used to assess risk, and only 61.4% correctly disagreed that athletes who are sick or febrile can continue playing or training provided they are given frequent rest periods.

Table 5. Percentage of SCCs that Correctly Answered IRF Statements

IRF Statement & Number		%correct
2	Prior history of heat illness in an athlete may increase his risk for exertional heat stroke.	84.3
3	Athletes with a low fitness level at are a higher risk for exertional heat stroke.	89.1
5	Athletes who are sleep deprived may be at a higher risk for exertional heat stroke.	70.9
7	Highly self-motivated athletes may be at a higher risk for exertional heat stroke.	55.7
10	An athlete's body composition should be used to assess their risk for exertional heat stroke.	62.7
19	Athletes who are sick or febrile can continue playing or training provided they are given frequent rest periods*	61.4
21	An athlete must be severely dehydrated for exertional heat stroke to occur.*	72.7

Review of ERF responses indicated that only 51.4% of SCCs correctly identified that EHS can occur in cool environments; with only 14% correctly disagreeing with the statement that EHS *can only* happen in hot environment. For use of WBGT to assess environmental temperature, only 65.8% agreed that environmental temperature should be assessed with the use of WBGT (see Table 6).

Table 6. Percentage of SCCs that Correctly Answered ERF Statements

ERF Statement & Number		%correct
6	External pressure from coaches to perform and train at higher intensities is an important risks factor in the cause of exertional heat stroke.	70.5
8	Uniforms that use protective equipment in sports such as football may contribute to exertional heat stroke.	85.0
9	Environmental temperature should be assessed using Wet Bulb Globe Temperature (WBGT) to reduce the risk of exertional heat stroke.	65.8
13	Exertional heat stroke can occur in cool environments (45-65 degrees Fahrenheit).	51.4
16	Forced dehydration is an important method to train athletes to compete in the heat*	89.0
17	Football uniforms with protective equipment should be used early in the training season to acclimate athletes to the heat*	38.2
18	Practices should be held during the hottest part of the day to acclimate athletes to the heat*	75.3
20	Exertional heat stroke can only occur in hot environments*	14.1

Review of R responses indicates several areas where knowledge level was inadequate. The most significant finding was that only 13% of SCC correctly identified that EHS victims *do no*t usually stop sweating in a case of EHS. Many missed the relationship between changes in personality and performance as a sign of EHS with only 50.2% of SCCs correctly identified that changes in athletic performance should trigger an assessment for EHS and 53.5% agreeing that changes in personality should trigger an assessment of EHS. Many incorrectly believed that the onset of EHS is random and unpredictable. Only 50.7% correctly identified that onset of EHS *is* *not* random and unpredictable by disagreeing with the statement that the "onset of EHS is random and unpredictable" (see Table 7).

Table 7. Percentage of SCCs that Correctly Answered R Statements

R Statement & Number		%correct
4	An athlete usually stops sweating during a case of exertional heat stroke.	12.9
11	Any changes in an athlete's athletic performance during training or competition should trigger an assessment for exertional heat stroke.	50.2
12	Any changes in an athlete's personality during training or competition should trigger an assessment for exertional heat stroke.	53.5
14	Increase body temperature may occur in the absence of significant dehydration.	78.3
15	The onset of exertional heat stroke is random and unpredictable.	50.7
22	The appearance of a lucid/clear mental status means everything is okay and the athlete is not experiencing exertional heat stroke.	67.7

For TSK knowledge, Table 8 describes the results. Many SCCs struggle with the concept of mental toughness and how it relates to exercise intensity. Only 59.3% (189) of SCCs *correctly* disagreed with the statement that the strain of an exercise session can enhance mental toughness of an athlete (130 SCCs or 40.7% go it wrong), and just 34.5% understood that creatine kinase would be elevated after training. The relationship between muscle soreness and exercise effectiveness was the one concept that appears to be well understood. Many correctly disagreed with the statement that severe muscle soreness is a desired outcome of hard training session (78.3%).

Table 8. Percentage of SCCs that Correctly Answered TSK

TSK Statement & Number		%correct
23	Severe muscle soreness is a desired outcome of a hard training session.	78.3
24	The strain of an exercise session can enhance the mental toughness of an athlete	59.3
25	Elevated creatine kinase concentrations are an expected outcome of a training session.	34.5

Acclimatization & WBGT

The second section of the questionnaire asked about practices regarding the use of WBGT and acclimatization. The SCCs were asked if they use WBGT to assess environmental temperature. Of the 319 participants, 240 participants answered the question, 79 skipped the question. Of the 240 that answered the question, 56 (23%) answered "Yes" and 184 (77%) answered "No". The results indicated that only 23% of SCCs that answered the question assess environmental temperature using WBGT as recommended by NATA and ACSM. The reported barriers for use of WBGT are shown in Table 9.

Table 9. Barriers to Using WBGT

Location of institution

“geographical location of my institution is rarely effected by humidity.”
“It is never hot enough over here”
“we don’t have to worry about heat”

Not in scope of practice

“The question is out of the strength and conditioning coaches scope of practice.”
‘This is done by the ATC”
“this is for the medical staff to know”

Don’t have WBGT instrument

“Do not have that resource at present time.”
“we don’t have that here”

Other methods

“We check the internet for heat conditions during summer workouts. All of our running sessions take place at 6am so that we can avoid any severe heat issues.”
“We use the internet”
“no mater the temperature, we will still have practice outside. depending on the temperature though we will change the duration and amount of breaks we give the athletes”
“I am not outside for long periods of time and i do look for signs of heat induced problems. I will also provide water on extremely hot days if we are on the field over a half hour!”
“The design of My program keeps the volume low and slowly progresses. I always try to be aware of the surroundings and environment for that day

Not familiar with WGBT

“Not familiar with the WBGT, however, humidity and temperature need to be taken into consideration when it comes to team conditioning/practices outdoors.”
“Don't do know what that is.”

Respondents were asked if an institution should follow a heat acclimatization period. Out of 242 responding to the question 88% (213) said that an institution should follow an acclimatization period. The remaining 12% (29) answered “no” to this question. The open ended section allowed for an explanation of acclimatization methods used and the major themes are described in Table 10.

Table 10. Acclimatization Themes

Follow NCAA guidelines

"I think the NCAA football 5 day acclimatization is sufficient

."As NCAA regulates, for football and the sports with protective gear

"I feel the NCAA 5 day acclimatization period for football works well.

"Follow NCAA Safety and rules"

Progression in equipment & uniform use

"Shorter bouts of practice should be performed to acclimatize athletes.

"5-7 Days of Practice w/out Full Pads"

"during fall camp for football an acclimatization day of helmets, followed by day two in helmets, day three spiders, day 4 half pads, day 5 half pads. This prior to two a day sessions."

"Start practice without pads and then had helmets, then shoulder pads (uppers), and then full gear over a period of days"

Modify practice

"Shorter bouts of practice should be performed to acclimatize athletes"

"Progress through intensity and volume of exercises and conditioning"

"Frequent breaks"

"modify for freshman.."

"First week in back to back practice days, no more than one practice a day".

Depends on location of Institution

"depends upon the geographical location of the institution and season that the sport is training or competing in".

"Policy should partially be based on climate in the region and discretion of weather conditions"

"An institution should create a plan based on the individual institutions location, facilities and resources"

Hydration available

"Have cold water and even ice buckets handy".

"I already follow a lot of the protocol recommended in the recent NSCA/NATA.

Other methods

"By using methods to increase body temperature mild amounts over extended periods of time. An example would be by wearing long sleeve workout gear and hats during the day, while consuming proper amounts of water

"Train during similar times of competition (ie if game time is 1pm, practices should be at this time) and then gradually progress to training during "worse" conditions (ie if games are expected to be played when its 80degrees at 7pm, progress to training under the hot sun at noon)."

"Begin practicing outside of the hottest daytime hours (12-3) in single sessions, increasing to double sessions after a few days, and depending on the protective equipment of the sport increasing the amount of equipment worn."

"Have at least an hour for athletes to see what the heat feels like"

"the NCAA does not do athletes any favors by banning football equipment during summer conditioning. They should be allowed to wear a helmet to acclimate to hot weather properly.

Return to Play Protocol

The open ended section asked the questions "if an athlete had exertional heat stroke at your institution, what should be the protocol to determine when the athlete is ready to return to play?" Review of the responses on return to play protocol reveals three major themes. The most common theme reported was that the medical staff (athletic trainers and team physicians) is responsible for making the decision about whether the athletes were ready to return to play. Other themes included assessment of body weight before return to play, and being fully hydrated. A few also answered “not sure” indicating they may not be familiar with what a return to play protocol may entail. Table 11 describes the most common responses.

Table 11. Return to Play- Who Makes the Decision?

Athletic Trainer/medical staff
“Discretion of athletic trainers release and after athlete has properly rehydrated and symptom free”.
“That is up the athletic trainer.”
“All determined by the team doctor and certified athletic trainer.”
“Physician clearance at least 1 week off from exercise then do light exercising with a athletic trainer or physician and moderately increase under their watch”
“That should be determined by Athletic trainers and physicians.”
“Whenever the athletic trainers say they are ready”
Athlete’s body weight
“Body weight check, concussion style testing"
“return to previous body weight full recovery - days off”
“Regained of body weight”
Hydration status & vitals
“Hydration status. Mental ability. The ability to move”
“Regular urination, heart rate and other homeostatic signs”
“Hydration levels, blood work, cognitive testing”
“Fully hydrated and feeling better”
Don’t know
“no idea”
“Not too sure-I'm not trained as an athletic trainer”
“have never had this a happen so don’t know”

Modifications to Outdoor Workouts

The SCCs were asked what changes, if any, they would make to outdoor workouts based on environmental temperature. The most interesting outcome was the lack of knowledge or utilization by the SCCs of WBGT to make decisions about modifying or cancelling practice. The major themes are depicted in Table 12. The major theme that prevailed was to decrease the volume, provide longer rest periods and allow for more water breaks. Other themes were to monitor the heat to make decisions, decrease duration, increase the number of breaks, allow more hydration, and change time of practice to cooler times of the day. Several SCCs reported that they would not make any changes to outdoor workouts based on temperature.

Table 12. Changes to Outdoor Workouts based on WBGT

Less volume, longer rest, more water breaks	
	"Shorten the workout and the intensity of the workout. In addition, provide longer rest."
	"lessen volume, increase rest time and water breaks"
	"reduce volume, encourage hydration"
	"Adjust overall volume and rest periods.
	"time and intensity and more rest and water breaks"
Monitor heat	
	"Exceptionally high heat indexes are grounds for shortening duration or lessening intensity"
	"Changes would be made if the temperature elevated (plus humidity)"
	"Practices never run in extreme heat"
	"Cancel if its too hot"
Duration alone	
	"Shorter duration"
	"we would change the duration of the workout"
	"not so long a workout"
Increase breaks alone	
	"Higher the temps, more frequent the breaks"
	"We have Trainers and cell phones at every session. Also I give very long breaks between sessions or sets"
Hydration alone	
	"Plenty of fluid breaks"
	"We allow them to access water at any time."
	"At every break I encourage them to get water if the want to or not."
	"Allow multiple water breaks."
	"Encourage frequent hydration."
Change time of practice	
	"Have certain practices schedule in the morning and night as well as having a few practices in the middle of the day"
	"Train them as early as possible."
	"Early morning practice or late evening"
None	
	"temperature, none"
	"Continue to slowly acclimate to high temps and don't change"
	"No changes. We have plenty of water and athletic trainers available at every workout"
	"none really but try to train and an earlier time"

CHAPTER FIVE: DISCUSSION

Despite the current scientific evidence on how to prevent and recognize its occurrence, EHS deaths during conditioning practices supervised by SCCs continue to occur in NCCA sports. The main purpose of this study was to assess SCCs current level of knowledge and to determine if SCC certification type was advantageous in regards to that knowledge. The results of this study demonstrate that a large discrepancy exists between the known scientific evidence regarding prevention and recognition of EHS and college SCCs' demonstrated level of knowledge on the EHS questionnaire exists. Although the overall content knowledge of SCCs regarding EHS was low, (60% correct responses), there is some indication that those coaches with the CSCS certification had a higher level of knowledge than SCCs without this certification. This study found that SCCs that had earned the CSCS certification scored significantly higher in Total, IRF, ERF, and TSK scales than SCCs with other or no certification. Coaches with the SCCC certification failed to score significantly greater than SCCs with other or no certification in any of the content areas tested. Considering the cost in time, effort and money involved with each of the two SCC certifications, the results of this study suggest that preparation for the CSCS certification may provide a greater knowledge base in regards to training athletes in hyperthermic conditions. Certainly more training is needed in EHS prevention and recognition for all SCC groups.

Prevention of EHS

Knowledge of Intrinsic Risk Factors

Review of knowledge of intrinsic risk factors indicates that IRF knowledge was lacking in several areas; with an average correct of 71%. The major intrinsic risk factors that were not correctly identified as increasing the risk for EHS included: 1) highly motivated or overzealous athletes, 2) obesity (BMI $\geq$ 30) or high body fat percentage and 3) current illness or fever. Participants that had either the CSCS certification or both the CSCS/SCCC certification performed significantly higher in knowledge of the IRF than those that did not have an SCC certification. The coaches with the SCCC certification did not score significantly higher than those that did not have an SCC certification.

Knowledge of Extrinsic Risk Factors

The average score for ERF knowledge (61.3%) identifies several areas where SCCs lacked a fundamental understanding about the relationship between ERF and EHS. The major ERF concepts where knowledge was low included understanding that: 1) EHS can occur in hot or cool environments; 2) uniforms with protective equipment should only be added *after* proper acclimatization has been completed and 3) WBGT should be the instrument used to assess ambient temperatures. SCCs appeared particularly unclear about the possibility that EHS can occur in cooler environments, or whether EHS can only occur in a hot environment. Many SCCs answered that they were not familiar with the WBGT to assess ambient temperature; with only 23% of SCCs reporting using it. More importantly, *none* of the SCCs answering the open ended response questions about acclimatization and adjustment of outdoor workouts based on ambient temperature described using WBGT to make these decisions. Instead of WBGT, SCCs reported using the heat index via the internet. This is a particularly troublesome finding because Grundstein et al (2012) found that the heat index was not a reliable source to determine “uncompensable” heat stress because it tended to underestimate the danger especially for athletes that were not fully acclimatized to the heat. They noted that most of the football related EHS deaths occurred under conditions rated as extremely dangerous by WBGT but assigned lower risk levels according to the heat index. The major problem with using the heat index is that it fails to account for sun exposure (radiation) whereas WBGT accounts for it. Although ERF knowledge was insufficient, CSCS and CSCS/SCCC certified SCCs did score significantly greater than SCC that had neither certification. No significant differences were noted in ERF knowledge between the SCCC and SCC without any certification.

The results of the open ended questions on acclimatization practices and the use of WBGT are consistent with the findings from the Likert scale items. Although 88% of SCCs reported following an acclimatization period for athletes, the methods reported were inconsistent between the SCCs, and many did not follow published guidelines as set forth by ACSM, NATA and NCAA. In particular, NCAA standards were cited by several SCCs as their source for how to follow acclimatization yet they described a 5-day acclimatization period and not the 7-10 days as it is actually described and recommended by NCAA (NATA, ACSM describe up to 14 days). More importantly, no mention was made that full equipment *would not* be added until acclimatization was complete. The results highlight that further training is needed in proper acclimatization procedures, use of WBGT and proper timing for adding protective equipment in the training season. Although the majority of SCCs reported practicing an acclimatization plan, their methods were varied and inconsistent.

On the relationship between hydration and hyperthermia, the findings of this study were encouraging. The majority of SCCs (89%) disagreed with the practice of "forced dehydration and were cognizant of the importance of proper hydration as a preventive measure for EHS. SCCs appear to understand that dehydration increases the risk for hyperthermia. This knowledge was particularly evident in the open ended section where proper hydration was a predominant theme consistently reported by SCCs as important to training and performance and described as essential in dealing with training in the heat, return to play and acclimatization.

Ability to Recognize Signs and Symptoms of EHS

The findings of this study indicate that SCCs lack the necessary knowledge and skills to properly recognize signs and symptoms of EHS. In the area of recognition, SCCs mistakenly believed that EHS victims will not be sweating. Of the SCCs that responded, 75% believed that an athlete experiencing EHS would not be sweating. This presents a significant problem because SCCs may continue to allow athletes to train/compete as long as they observe them still sweating; further delaying an assessment for EHS. Casa et al (2012) identified this as a potential risk and common problem and misconception in early detection of EHS. SCCs also exhibited a low level of understanding regarding the relationship between changes in personality and performance, and recognizing these changes as possible signs of impending EHS; with many erroneously believing that EHS is random and unpredictable. This finding is consistent with the work of Casa et al (2005) on EHS in competitive athletes, where they noted that this misconception existx in the field that" EHS is random and unpredictable." SCCs should be cognizant that any changes in athletes' performance or personality is a cause for concern requiring medical follow-up and that just because the athlete is sweating profusely, it does not mean everything is "ok" and it is not EHS (Casa et al 2012). The role of the SCC in recognition of EHS is to respond to atypical behavior or performance in their athletes, cease exercise and access medical care immediately. By knowing their athletes well enough to note any changes in personality or behavior, they can intervene early in the survival chain before the athlete collapses. Failure to do so may lead to death from EHS and other similar medical emergencies (e.g. exertional sickling, cardiac arrest, exercise induced asthma, diabetes, rhabdomyolysis etc...). The skill and ability needed to recognize EHS is very similar to the skill and ability needed in recognizing a case of a heart attack, stroke, diabetic coma (taught in CPR and first aid) and should not fall outside the scope of practice for an SCC. Part of the problem may be that confusion still exists in the health field about the differences between classic heat stroke and exertional heat stroke; with dry hot skin as a sign. First aid training traditionally covers heat illness but does not differentiate between classic heat stroke and exertional heat stroke that happens as a result of exercise (EHS). SCCs may need more specialized First Aid and CPR training that covers exertional medical emergencies.

Training Safety Knowledge

Unsafe training practices can increase the risk of EHS. SCCs were asked a few questions to determine if they were practicing "old school" methods with the belief that it can enhance mental toughness. Although many SCCs correctly identified that training intensity should not be used to enhance mental toughness, a high number of coaches (40.7%) still believed that it should be used for that purpose. This is a dangerous belief with no scientific evidence to support its use, and with new evidence that mental toughness may not be "trainable" but genetic in nature (Horsburgh, Schermer, Veselka & Vernon, 2009). In a recent study, Horsburgh, et al., (2009), compared fraternal and identical twins to determine if mental toughness was learned or if it was a genetic personality trait. They found that mental toughness correlated the highest in identical as opposed to fraternal twins; concluding that mental toughness was a personality trait that was genetic and not trained. Evidence of this "old school" attitude described in the literature as dangerous (Lopez et al. 2011) was observed in several of the open ended responses where SCCs noted that they would not make any changes to outdoor practices or would not allow football players to practice without helmets or pads regardless. In the domain of physiological responses to exercise, the majority (65.5%) of SCCs also lacked foundational knowledge about the effects on exercise on creatine kinase; which indicates that SCCs may need more education in this area. One positive finding in the area of TSK knowledge was that the majority of SCCs (78.3%) understood the concept that severe muscle soreness is not a desired outcome of hard training. Severe muscle soreness usually leads to rhabdomyolysis and is associated with an exercise intensity or volume that far exceeded the athletes' level of fitness. As previously discussed, if work /rest ratios and exercise intensity is unmatched with the athlete's fitness level, the risk for all medical emergencies increases. It does appear that most SCCs understand the positive relationship between increased muscle soreness and exercise risk.

Significant Findings of the Study

The results of this study support the view that SCCs are lacking crucial and fundamental information indispensable for their competency in preventing EHS deaths and recognizing EHS events. It is evident that more specialized training is needed to teach the skills necessary to prevent and recognize EHS. Many of these EHS concepts could be addressed through emergency response training, in First Aid and CPR workshops and classes. Relying on ATs and other medical personnel may be insufficient. The learning objectives could include prevention strategies, risk stratification, and recognition not only of EHS but other EHIs and exertional medical emergencies. Review of current exercise physiology texts reveals that very little time is devoted to covering EHS or any other medical emergencies and more work is needed in this area.

Due to limited research on the practices of SCCS s it is not possible to compare the results of this study to prior studies. The only possible comparison can be made with previous work on personal trainers (Abbot, 1989). It was suggested that certified fitness professionals, specifically from ACSM, earned a significantly higher score on an test of knowledge in exercise science. However, the limitations of that study were the lack of a clear link between theoretical knowledge of exercise science to its application in practice. Exploring an efficient method for assessing SCC practices for safety and effectiveness should be the goal of future research in this field. Education programs at the undergraduate and graduate level should include curriculum and instruction in the area of environmental physiology; including responses and adaptations to training/exercise in the heat.

Implications for Practice and Policy

Organizations such as the ACSM, NATA, NCAA, and NSCA, should continue their efforts to disseminate information about EHS prevention, recognition and treatment. Brochures, campus visits and even specific certifications that deal with heat stress and heat related ailments may be helpful. Educators in the field of Exercise Science should review their curriculum and instruction and develop goals and objectives that include exertional heat illness, prevention and recognition.

Furthermore, the occupation should consider upgrading their minimum standards for entry into the profession. One of the first steps in this process may be requiring SCCs to not simply have earned a bachelor's degree but requiring that the degree be in exercise sciences or exercise physiology. However, considering the inherent risk of exercise and the fact that exercise risk increases with increasing exercise intensities, SCCs may need a specialized degree in strength and conditioning and more restrictive regulation of the profession up to an including licensure

The findings of this study also highlight the problem associated with lack of occupational control. Many of the SCCs had no SCC certification (NC group) and those that had the SCCC certification did not perform significantly better than the NC group. The strength and conditioning industry remains largely unregulated and lacking in a unified governing body that limits entrance in to the occupation to those that have met minimum standards. It is up to the employers hiring SCCs to verify and determine if their credentials are sufficient. Licensure may be the only means available to exert minimal knowledge and standards to the industry that may provide for some degree of safety for the athlete. Licensure would set the scope of practice for the profession and accomplish two main goals; to protect the athletes from unsafe practices, and to limit the occupation to workers that have been licensed to do so by the state.

Recommendations for Future Research

Future research should assess how SCC stay informed and educated about practices in the field and their educational backgrounds. Continued assessment to determine if heat stress and heat illness was ever addressed in their preparation to become an SCC

Researcher Reflection and Conclusion

The SCCs sampled confirm findings from previous studies that NCAA SCCs are a homogenous group who more than likely acquire their information from each other rather than from scientific journals (Durrell et al, 2003). This may be one of the reasons why significant differences between the two certification groups were not found. As evidence by the proliferation of the knowledge of the importance of hydration, if EHS knowledge is transferred to the SCCs the message will spread quickly.

APPENDIX A: PRE-NOTICE EMAIL FOR SURVEY

Monday, June 5, 2012

Dear _,
Within the next ten days you will receive a request in the mail to fill out a brief questionnaire for an important research project being conducted by the Sport & Exercise Science department at the University of Central Florida (UCF).
The survey is concerned with the knowledge, attitudes and practices that strength and conditioning coaches have in regards to exertional heat stroke (EHS).
I am writing to you in advance because we have found that many people like to be informed prior to being contacted. The study is important in that it will help us here at UCF in understanding the needs of the strength and conditioning profession so that we can better prepare our students for the rigorous demands of the industry.
Thank you for your time and consideration. It is only with the generous help of people like you that our research can be successful.
Sincerely,

Anna Valdes
Instructor-Sport & Exercise Science
University of Central Florida
College of Education
Child Family and Community Sciences

APPENDIX B: COVER LETTER EMAIL AND LINK TO SURVEY

To: [Email] From:
"avaldes@knights.ucf.edu via surveymonkey.com" <member@surveymonkey.com>
Subject: Help with Doctoral Dissertation Research
Dear Strength and Conditioning Professional,
I am writing to ask your help in a study of the factors regarding exertional heat stroke (EHS). This study is part of an effort to learn what strength and conditioning coaches (SCCs) working with collegiate athletes know, feel, and perceive to be important factors reading EHS.
It is my understanding that you are currently working as a collegiate SCC. We are contacting current NCAA SCCs from every state and division to ask what their perceptions, attitudes, practices and knowledge is regarding EHS.
Results from the survey will be used to help the University of Central Florida, Sport and Exercise Science program, develop appropriate curriculum that addresses EHS based on industry needs. By understanding what you, the SCC, currently know, feel and practice regarding EHS, we can better accomplish this task.
Your answers are anonymous and will be released only as summaries in which no individual's answer can be identified. You can help us very much by taking a few minutes to share your knowledge, attitudes and practices regarding EHS. More information regarding this study can be found in the informed consent below.
Thank you very much for helping with this important study.
Here is a link to the survey:
http://www.surveymonkey.com/s.aspx
This link is uniquely tied to this survey and your email address. Please do not forward this message.
Thanks for your participation!
Sincerely

Anna Valdes, MA, CSCS, Doctoral Candidate
University of Central Florida
Instructor Sport & Exercise Science
College of Education
Child Family and Community Sciences
anna.valdes@ucf.edu

APPENDIX C: THANK YOU/REMINDER EMAIL

To: [Email] From:
"avaldes@knights.ucf.edu via surveymonkey.com" <member@surveymonkey.com>
Subject: Help with Doctoral Dissertation on EHS Body: Dear Strength & Conditioning Coach,

Two weeks ago a questionnaire seeking your knowledge, attitudes and practices regarding EHS was emailed to you. Your email was included because your name was listed on your school website as someone working in the Strength and Conditioning staff.

If you have already completed and returned the questionnaire, please accept our sincere thanks. If not, please do so today. I am especially grateful four your help because it is only by asking people like you to share your experiences that substantial progress can me made in the training and preparation of successful future SCCs.

Here is a link to the survey:

http://www.surveymonkey.com/s.aspx

This link is uniquely tied to this survey and your email address. Please do not forward this message.

I hope that you will complete the questionnaire soon, but if for any reason you prefer not to answer it, and or if you do not wish to receive further emails from us, please click the link below, and you will be automatically removed from our mailing list.

http://www.surveymonkey.com/optout.aspx

Sincerely,

Anna Valdes, MA, CSCS, Doctoral Candidate
University of Central Florida
Instructor Sport & Exercise Science
College of Education
Child Family and Community Sciences
anna.valdes@ucf.edu
407-808-8957

APPENDIX D: ENCOURAGEMENT TO PARTICIPATE/LINK TO SURVEY

[Email] From:
"avaldes@knights.ucf.edu via surveymonkey.com" <member@surveymonkey.com>
Subject: Help with Doctoral Dissertation Research -Final Notice Body: Dear Strength and Conditioning Professional,

During the last two months I have sent you several emails about an important research study I am conducting to fulfill the requirements for my dissertation at the University of Central Florida (UCF).

Its purpose is to help us here at UCF understand what collegiate strength and conditioning coaches (SCCs) know, feel and practice regarding exertional heat stroke (EHS).

The study is drawing to a close and this is the last contact that will be made with the individuals whom I think are collegiate SCCs.

I am sending this final reminder because of my concern that SCCs who have not yet responded may have had different knowledge, attitudes and practices regarding EHS than those who have. Hearing from everyone in this small sample helps assure that the survey results are as accurate as possible and everyone's voice gets heard.

We also want to assure you that your response in this study is anonymous,voluntary, and if you prefer not to respond, that is fine. If you have never worked as a collegiate SCC and you feel that I have made a mistake including you in this study, please let me know by answering the first question only in the study.

Finally, I appreciate your willingness to consider my request as I conclude this effort to better understand the knowledge, attitudes and practices of SCCs regarding EHS.

Here is a link to the survey:

http://www.surveymonkey.com/s.aspx

This link is uniquely tied to this survey and your email address. Please do not forward this message.

Thanks for your participation!

Sincerely,

Anna Valdes, Ed.D (ABD)

Instructor-Sport & Exercise Science

University of Central Florida

anna.valdes@ucf.edu

APPENDIX E: FINAL EMAIL AND LINK OF SURVEY

To: [Email] From:
"avaldes@knights.ucf.edu via surveymonkey.com" <member@surveymonkey.com>
Subject: Help with Doctoral Dissertation Research -Final Notice Body: Dear Strength and Conditioning Professional,

During the last two months I have sent you several emails about an important research study I am conducting to fulfill the requirements for my dissertation at the University of Central Florida (UCF).

Its purpose is to help us here at UCF understand what collegiate strength and conditioning coaches (SCCs) know, feel and practice regarding exertional heat stroke (EHS).

The study is drawing to a close and this is the last contact that will be made with the individuals whom I think are collegiate SCCs.

I am sending this final reminder because of my concern that SCCs who have not yet responded may have had different knowledge, attitudes and practices regarding EHS than those who have. Hearing from everyone in this small sample helps assure that the survey results are as accurate as possible and everyone's voice gets heard.

We also want to assure you that your response in this study is anonymous,voluntary, and if you prefer not to respond, that is fine. If you have never worked as a collegiate SCC and you feel that I have made a mistake including you in this study, please let me know by answering the first question only in the study.

Finally, I appreciate your willingness to consider my request as I conclude this effort to better understand the knowledge, attitudes and practices of SCCs regarding EHS.

Here is a link to the survey:

http://www.surveymonkey.com/s.aspx

This link is uniquely tied to this survey and your email address. Please do not forward this message.

Thanks for your participation!

Sincerely,

Anna Valdes, Ed.D (ABD)

Instructor-Sport & Exercise Science

University of Central Florida

anna.valdes@ucf.edu

APPENDIX F: SURVEY/QUESTIONNAIRE

Strength and Conditioning Coaches' Knowledge and Practices

Survey Instructions

Thank you for choosing to participate in this study. This study will require you to complete a questionnaire consisting of questions that are aimed at helping us assess NCAA Strength Coaches' knowledge, attitudes and practices regarding exertional heat stroke (EHS). We estimate it will take you approximately 10 minutes to complete the survey. You can save and finish at a later time if you desire.
Your answers are anonymous and will be released only as summaries in which no individual's answer can be identified. You will not be required to provide any identifying information. Participation in this study is voluntary. If you decide to participate, you are free to not answer any question or withdraw at any time without affecting those relationships. However, you can help us very much by taking a few minutes to share your knowledge, attitudes and practices regarding EHS. Thank you again for your time and efforts in helping us with our research.

1. How long have you been working as a NCAA strength and conditioning coach?

- ◯ <1
- ◯ 1-5 yrs
- ◯ 6-10 yrs
- ◯ 11-15 yrs
- ◯ 16-20 yrs
- ◯ 21-25 yrs
- ◯ >26 yrs
- ◯ not currently working as an NCAA strength coach

Strength and Conditioning Coaches' Practices Part I

This section consist of a series of statements asking about your opinion. Please rate the following statements based on the degree that you agree or disagree.

2. Prior history of heat illness in an athlete may increase his risk for exertional heat stroke.

◯ 1(strongly disagree) ◯ 2 ◯ 3(somewhat disagree) ◯ 4 ◯ 5(somewhat agree) ◯ 6 ◯ 7(strongly agree)

3. Athletes with a low fitness level at are a higher risk for exertional heat stroke.

◯ 1(strongly disagree) ◯ 2 ◯ 3(somewhat disagree) ◯ 4 ◯ 5(somewhat agree) ◯ 6 ◯ 7(strongly agree)

4. An athlete usually stops sweating during a case of exertional heat stroke.

◯ 1(strongly disagree) ◯ 2 ◯ 3(somewhat disagree) ◯ 4 ◯ 5(somewhat agree) ◯ 6 ◯ 7(strongly agree)

Page 1

Strength and Conditioning Coaches' Knowledge and Practices

5. Athletes who are sleep deprived may be at a higher risk for exertional heat stroke.

○ 1(strongly disagree) ○ 2 ○ 3(somewhat disagree) ○ 4 ○ 5(somewhat agree) ○ 6 ○ 7(strongly agree)

6. External pressure from coaches to perform and train at higher intensities is an important risk factor in the cause of exertional heat stroke.

○ 1(strongly disagree) ○ 2 ○ 3(somewhat disagree) ○ 4 ○ 5(somewhat agree) ○ 6 ○ 7(strongly agree)

7. Highly self-motivated athletes may be at a higher risk for exertional heat stroke.

○ 1(strongly disagree) ○ 2 ○ 3(somewhat disagree) ○ 4 ○ 5(somewhat agree) ○ 6 ○ 7(strongly agree)

8. Uniforms that use protective equipment in sports such as football may contribute to exertional heat stroke.

○ 1(strongly disagree) ○ 2 ○ 3(somewhat disagree) ○ 4 ○ 5(somewhat agree) ○ 6 ○ 7(strongly agree)

9. Environmental temperature should be assessed using Wet Bulb Globe Temperature (WBGT) to reduce the risk of exertional heat stroke.

○ 1(strongly disagree) ○ 2 ○ 3(somewhat disagree) ○ 4 ○ 5(somewhat agree) ○ 6 ○ 7(strongly agree)

10. An athlete's body composition should be used to assess their risk for exertional heat stroke.

○ 1(strongly disagree) ○ 2 ○ 3(somewhat disagree) ○ 4 ○ 5(somewhat agree) ○ 6 ○ 7(strongly agree)

11. Any changes in an athlete's athletic performance during training or competition should trigger an assessment for exertional heat stroke.

○ 1(strongly disagree) ○ 2 ○ 3(somewhat disagree) ○ 4 ○ 5(somewhat agree) ○ 6 ○ 7(strongly agree)

12. Any changes in an athlete's personality during training or competition should trigger an assessment for exertional heat stroke.

○ 1(strongly disagree) ○ 2 ○ 3(somewhat disagree) ○ 4 ○ 5(somewhat agree) ○ 6 ○ 7(strongly agree)

9. Any changes in an athlete's athletic performance during training or competition should trigger an assessment for exertional heat stroke.

○ 1(strongly disagree) ○ 2 ○ 3(somewhat disagree) ○ 4 ○ 5(somewhat agree) ○ 6 ○ 7(strongly agree)

10. Any changes in an athlete's personality during training or competition should trigger an assessment for exertional heat stroke.

○ 1(strongly disagree) ○ 2 ○ 3(somewhat disagree) ○ 4 ○ 5(somewhat agree) ○ 6 ○ 7(strongly agree)

11. Exertional heat stroke can occur in cool environments (45-65 degrees Fahrenheit).

○ 1(strongly disagree) ○ 2 ○ 3(somewhat disagree) ○ 4 ○ 5(somewhat agree) ○ 6 ○ 7(strongly agree)

12. Increase body temperature may occur in the absence of significant dehydration.

○ 1(strongly disagree) ○ 2 ○ 3(somewhat disagree) ○ 4 ○ 5(somewhat agree) ○ 6 ○ 7(strongly agree)

13. The onset of exertional heat stroke is random and unpredictable.

○ 1(strongly disagree) ○ 2 ○ 3(somewhat disagree) ○ 4 ○ 5(somewhat agree) ○ 6 ○ 7(strongly agree)

14. An athlete usually stops sweating during a case of exertional heat stroke.

○ 1(strongly disagree) ○ 2 ○ 3(somewhat disagree) ○ 4 ○ 5(somewhat agree) ○ 6 ○ 7(strongly agree)

15. Forced dehydration is an important method to train athletes to compete in the heat.

○ 1(strongly disagree) ○ 2 ○ 3(somewhat disagree) ○ 4 ○ 5(somewhat agree) ○ 6 ○ 7(strongly agree)

16. Football uniforms with protective equipment should be used early in the training season to acclimate athletes to the heat.

○ 1(strongly disagree) ○ 2 ○ 3(somewhat disagree) ○ 4 ○ 5(somewhat agree) ○ 6 ○ 7(strongly agree)

17. Practices should be held during the hottest part of the day to acclimate athletes to the heat.

○ 1(strongly disagree) ○ 2 ○ 3(somewhat disagree) ○ 4 ○ 5(somewhat agree) ○ 6 ○ 7(strongly agree)

18. Athletes who are sick or frebile can continue playing or training provided they are given frequent rest periods

○ 1(strongly disagree) ○ 2 ○ 3(somewhat disagree) ○ 4 ○ 5(somewhat agree) ○ 6 ○ 7(strongly agree)

19. Exertional heat stroke can only occur in hot environments.

◯ 1(strongly disagree) ◯ 2 ◯ 3(somewhat disagree) ◯ 4 ◯ 5(somewhat agree) ◯ 6 ◯ 7(strongly agree)

20. An athlete must be severely dehydrated for exertional heat stroke to occur.

◯ 1(strongly disagree) ◯ 2 ◯ 3(somewhat disagree) ◯ 4 ◯ 5(somewhat agree) ◯ 6 ◯ 7(strongly agree)

21. The appearance of a lucid/clear mental status means everything is okay and the athlete is not experiencing exertional heat stroke

◯ 1(strongly disagree) ◯ 2 ◯ 3(somewhat disagree) ◯ 4 ◯ 5(somewhat agree) ◯ 6 ◯ 7(strongly agree)

22. Severe muscle soreness is a desired outcome of a hard training session

◯ 1(strongly disagree) ◯ 2 ◯ 3(somewhat disagree) ◯ 4 ◯ 5(somewhat agree) ◯ 6 ◯ 7(strongly agree)

23. The strain of an exercise session can enhance the mental toughness of an athlete

◯ 1(strongly disagree) ◯ 2 ◯ 3(somewhat disagree) ◯ 4 ◯ 5(somewhat agree) ◯ 6 ◯ 7(strongly agree)

24. Elevated creatine kinase concentrations are an expected outcome of a training session

◯ 1(strongly disagree) ◯ 2 ◯ 3(somewhat disagree) ◯ 4 ◯ 5(somewhat agree) ◯ 6 ◯ 7(strongly agree)

Strength and Conditining Coaches' Practices Part II

In this section, we are interested in your personal experiences and personal opinion. Please answer to the best of your ability.

25. Should an institution follow a heat acclimatization period for athletes? If yes please describe the program

◯ Yes

◯ No

Describe "Yes" answer

26. If an athlete had exertional heat stroke at your institution, what should be the protocol to determine when the athlete is ready to return to play?

27. If an athlete had an exertional heat stroke at your institution, who should provide clearance for the athlete to return to full activity? Please select all that apply

☐ coach

☐ strength coach

☐ ATC

☐ MD

☐ none

☐ Other (please specify)

28. Do you assess environmental temperature (WBGT) before outdoor workouts? Please explain yes or no answers.

◯ Yes

◯ No

If "yes" explain how you assess environmental temperature

29. What changes, if any, would you make to outdoor workouts based on environmental temperature?

30. Have you observed or witnessed a diagnosed case of exertional heat stroke? If yes, please describe.

- ◯ Yes
- ◯ No

If "yes" please describe

31. Do you believe that a change in the shape of red blood cells can pose a grave risk for some athletes during physical exertion?

- ◯ Yes
- ◯ No

Please explain yes or no answer

32. Are you familiar with exertional sickling?

- ◯ Yes
- ◯ No

33. What precautions do you believe should be taken by the strength and conditioning coach to reduce the risk of exertional sickling?

34. Have you observed or witnessed a diagnosed case of exertional sickling? If yes, please describe the experience

◯ Yes

◯ No

Describe "Yes" answer

Please tell us about yourself!

35. What is your age?

- ◯ <25
- ◯ 26-30
- ◯ 31-35
- ◯ 36-40
- ◯ 41-45
- ◯ 46-50
- ◯ >50

36. What is your gender

- ◯ Male
- ◯ Female

37. What the highest degree that you have completed?

- ◯ B.A
- ◯ B.S
- ◯ M.A
- ◯ M.S
- ◯ Ph.D
- ◯ Dpt
- ◯ Other (please specify)

38. Which of the following certifications or licenses do you hold? Check all that apply

- ☐ CSCS
- ☐ CSCCa
- ☐ ATC
- ☐ MC
- ☐ ACSM HFS
- ☐ MD
- ☐ DPT

other

39. Which NCAA division is your institution?

- ◯ Division I
- ◯ Division II
- ◯ Division III
- ◯ Not currently working in NCAA athletics

Other (please specify)

40. How long have you been working as an NCAA strength and conditioning coach?

- ◯ <1
- ◯ 1-5 yrs
- ◯ 6-10 yrs
- ◯ 11-15 yrs
- ◯ 16-20 yrs
- ◯ 21-25 yrs
- ◯ >26 yrs
- ◯ not currently working as an NCAA strength coach

41. Where you a competitive athlete in high school? If yes, describe which sport

- ◯ Yes
- ◯ No

Describe the sport

42. Have you ever competed in collegiate sports? If yes, please describe the sport and division you played in.

- ◯ Yes
- ◯ No

Describe "yes" answer

43. Have you ever or do you currently play professional sports? If Yes, please describe the sport

- ◯ Yes
- ◯ No

Describe "yes" answer

APPENDIX G: INSTITUTIONAL REVIEW BOARD APPROVAL

University of Central Florida

University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Approval of Exempt Human Research

From: **UCF Institutional Review Board #1**
FWA00000351, IRB00001138

To: **Anna Sarmiento Valdes**

Date: **March 27, 2012**

Dear Researcher:

On 3/27/2012, the IRB approved the following activity as human participant research that is exempt from regulation:

Type of Review:	Exempt Determination
Project Title:	NCAA Strength and Conditioning Coaches' knowledge and Practices Regarding Prevention and Recognition of Exertional Heat Stroke
Investigator:	Anna Sarmiento Valdes
IRB Number:	SBE-12-08287
Funding Agency:	
Grant Title:	
Research ID:	N/A

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these changes affect the exempt status of the human research, please contact the IRB. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Sophia Dziegielewski, Ph.D., L.C.S.W., UCF IRB Chair, this letter is signed by:

Signature applied by Patria Davis on 03/27/2012 04:52:55 PM EST

IRB Coordinator

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