

MADRIGAL, LEILANI, Ph.D. *The Relationships among Mental Toughness, Hardiness, Optimism and Coping: A Structural Equation Modeling Approach* (2014)  
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Sport can be stressful with the time demands, emphasis on winning, and high expectations. Being able to positively reinterpret events, remain calm and relaxed under pressure, and maintain emotional control may be essential to athletes' ability to cope with the various demands of sport. These elements are characteristics of mental toughness (Crust & Clough, 2005), which may be a protective factor in coping with demands of sport. This research examined the reliability and validity of the Mental Toughness Scale (MTS) by investigating relationships of mental toughness with coping behavior, and related constructs of hardiness and optimism. Specifically, four aims were addressed in the current study. The first aim assessed the factor structure and gender variance of the MTS, while the second aim examined the validity of the MTS. The third aim assessed relationships of mental toughness with related constructs of hardiness and optimism and coping behavior within a structural model. The fourth aim explored gender differences on the main variables as well as relationships among these variables.

Five hundred and seventy collegiate athletes from various sports (i.e., soccer, baseball/softball, basketball, wrestling, track & field, cross-country, tennis, volleyball, field hockey, lacrosse, swimming, and rifle) and levels of play completed measures (either online or via a hard copy in group settings) assessing mental toughness, hardiness, optimism, and coping. Using correlation/regression analysis and Structural Equation Modeling, the MTS was found to be a valid measure of mental toughness and was

superior to hardiness or optimism in predicting approach styles of coping (i.e., problem-, emotion-focused coping) in response to sport-related stress. Additionally, there were no gender differences on the main variables or in the relationships between mental toughness and coping. Although research on mental toughness is still in its infancy, the findings demonstrate that the MTS is a psychometrically strong tool for assessing mental toughness and that mental toughness is superior to hardiness and optimism in predicting positive coping behaviors. More work is needed on the possible stress-buffering effects of mental toughness and benefits of this positive psychological characteristic. Future work can then determine how mental toughness can be developed and what populations (e.g., injured, transitioning athletes) may gain most from its benefits.

THE RELATIONSHIPS AMONG MENTAL TOUGHNESS, HARDINESS,  
OPTIMISM AND COPING: A STRUCTURAL EQUATION  
MODELING APPROACH

by

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APPROVAL PAGE

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## CHAPTER I

### INTRODUCTION

Stress within sport can come from a variety of areas: time demands, living up to expectations, emphasis on winning. Excessive stress can cause psychological and physiological disturbance, which can lead to performance problems, chronic fatigue, injury, emotional control difficulties, burnout, and decreased enjoyment (Andersen & Williams, 1999; Bink, Visscher, Coutts, & Lemmink, 2012; Coakley, 1992; Gustafsson & Skoog, 2012; Nicholls, Polman, Levy, & Hulleman, 2012). Specific sources of competition stress identified by elite and non-elite athletes include expectations, negative social evaluation, rivalry, injury, roles in the sport, player-coach relationships, and performance development issues (Mellalieu, Neil, Hanton, & Fletcher, 2009). Stress is “an ongoing process that involves individuals transacting with their environments, making appraisals of the situation they find themselves in, and endeavoring to cope with any issues that may arise” (Fletcher, Hanton, & Mellalieu, 2006, p. 329).

In most stress models used in sport and exercise psychology, a stressor is followed by a perception and appraisal of threat. It is this appraisal that determines the athlete’s subsequent behavior. Lazarus’s (1966, 1991, 2000) model of stress, the predominant model in psychology, conceptualizes stress as a complex system influenced by one’s personality and environment (Lazarus, 1986). According to this model, cognitive appraisal is key; if the athlete determines that he/she has the coping resources to

adjust to the stressor then the situation will be appraised as manageable. However, a situation is perceived as threatening when there are low available resources. When the situation is perceived as a threat, the athlete then evaluates potential actions or ways of coping, informed by past coping experience, personality, and personal resources. It is the ability to cope with the inevitable stressors and pressures associated with sport that is essential to maintaining athletic performance (Nicholls & Polman, 2007).

Within sport psychology, stress management interventions have focused on reducing stress through: a) reduction in stressors, b) modification of cognitive appraisals, c) reduction in negative affect and increase in positive affect, or d) facilitating effective coping behaviors (e.g., Anshel, Gregory, & Kaczmarek, 1990; Arathoon & Malouff, 2004; Kerr & Gross, 1996; Thomas, Maynard, & Hanton, 2007). Techniques that target the appraisal process by utilizing positive thoughts, attention training, self-talk, as well as relaxation, goal setting, and emotional control have been found to have positive effects on reducing stress (Bishop, Karageorghis, & Kinrade, 2009; Crocker et al., 1988; Haney, 2004; Kerr & Gross, 1996; Page, Sime, & Nordell, 1999). In essence, stress is best managed when positive thinking and other adaptive coping techniques (e.g., emotional control, self-talk) are used.

Being able to positively reinterpret events, remain calm and relaxed under pressure, and maintain emotional control may be essential to athletes' ability to cope with the various demands of sport. These characteristics have been proposed to be components of mental toughness (Crust & Clough, 2005), which may be a protective factor in dealing with the demands of sport. Mental toughness has been defined as the ability to cope with

the various demands of sport through remaining determined, focused, confident, and in control of emotions under pressure (Jones, Hanton, & Connaughton, 2007). Assessment of mental toughness has been problematic with most scales having poor psychometric properties (Crust, 2007; Golby, Sheard, & Lavalle, 2003; Golby, Sheard, & Wersch, 2007). Although researchers propose that mental toughness is multidimensional, this has not been consistently supported when evaluating factor structures of hypothesized multi-factored scales (Golby, Sheard, & Lavalle, 2003; Golby, Sheard, & Wersch, 2007; Madrigal, Hamill, & Gill, 2013). As the definition implies, mental toughness may be an overall protective construct that reduces stress through the coping efforts used by those who remain determined, focused, confident, and in control in their sport.

Although precise definitions and measures of mental toughness have not been established, mental toughness is related to several constructs that have received more attention in psychology, specifically hardiness and optimism, as well as the construct of “grit.” Hardiness, which involves perceiving stressful situations as challenges to be overcome rather than avoided, while maintaining commitment and control of one’s emotions, has been tied to mental toughness (Clough et al., 2002). While similarities exist between the two constructs, hardiness fails to capture the sport-specific nature of mental toughness (Clough et al., 2002). Another construct that has been paired with mental toughness is optimism. Optimism has been defined as “a major determinant of the distinction between two classes of behavior: a) continued striving versus b) giving up and turning away” (Scheier & Carver, 1985, p. 227). Gould, Dieffenbach and Moffett (2002) found that Olympic champions report high levels of mental toughness, coping

effectiveness, and optimism. Nicholls et al. (2008) found that mental toughness was positively related to optimism in athletes from a variety of athletic levels while being negatively correlated with pessimism. Both hardiness and optimism have been related to mental toughness, as well as to coping. The construct of “grit” has recently received considerable attention in psychology (Duckworth, Peterson, Matthews & Kelley, 2007) and in the popular media. Grit, which is characterized as perseverance and overcoming adversity in striving for long-term goals, has not been applied in sport settings, but seems to be closely related to mental toughness.

Mental toughness has been associated with greater use of problem-focused or approach coping strategies (e.g., mental imagery, thought control) and less use of avoidance coping strategies (e.g., distancing, mental distraction) (Nichols, Polman, Levy & Blackhouse, 2008). As for hardiness, the research outside of sport has consistently found positive relationships between hardiness and adaptive coping (e.g., active coping, positive reframing, acceptance) (Bartone et al., 2009; Carver et al., 1989; Eschleman et al., 2010; Zander et al., 2010). Wadey, Evans, Hanton, and Neil (2012) found that hardiness was positively correlated with problem and emotion-focused coping while negatively correlated with feeling dispirited and devastated. Similarly, increased optimism has been associated with the use of more problem-focused strategies, suggesting those who are more optimistic strive to overcome obstacles rather than avoid them (Fournier, de Ridder, & Bensing, 2002; Grove & Heard, 1997; Steed, 2002). Both hardiness and optimism literature suggest that coping is a mediator to a reduction in the perception of stress (Ford, Eklund, & Gordon, 2000; Sheppard & Kashani, 1991;



Westman, 1990). Because mental toughness is an overall protective personality characteristic that encompasses many of the related qualities that have been studied independently, and because mental toughness has been defined and measured as a sport-specific construct, it is a particularly relevant focus for sport psychology research.

The current study examines the construct of mental toughness and the validity of the Mental Toughness Scale (MTS) by investigating relationships of mental toughness with coping behavior, and related constructs of hardiness and optimism. Furthermore, this study will determine if mental toughness, as an overall protective characteristic, is superior to the separate components of hardiness and optimism in predicting coping behavior. The contribution of this research is three-fold: First, this study adds to the psychometric properties of the MTS by examining the internal consistency, factor structure, gender equivalence, and validity of the scale. Second, it adds to the understanding of how mental toughness relates to coping. Third, this study explores possible gender differences in mental toughness. Following are the specific aims and expected outcomes in the current study.

1. The first aim of this study is to examine the internal consistency (Cronbach's alpha) and factor structure of the Mental Toughness Scale (MTS).
  - a. Using a Confirmatory Factor Analysis (CFA) on the MTS, we expect all items to load on one factor.
  - b. Additionally, a multi-group CFA will be done to determine if the MTS is gender equivalent. No gender differences are expected in item functioning.

2. The second aim is to examine the convergent and divergent validity of the Mental Toughness Scale. Specifically, we examine validity with theoretically-related measures of hardiness, optimism, and grit, and a non-related measure (competitive trait anxiety).
  - a. It is hypothesized that mental toughness (MTS) will be positively related to measures of hardiness, optimism, and grit (convergent validity).
  - b. It is hypothesized that there will be no relationship between mental toughness (MTS) and competitive anxiety (divergent validity).
3. The third aim is to investigate the relationship of mental toughness to coping behavior using Structural Equation Modeling.
  - a. In the model tested, mental toughness influences coping, both directly and indirectly through optimism and hardiness (see Figure 1). Specifically, we predict that:
    - i. Mental toughness directly influences hardiness and optimism.
    - ii. Hardiness and optimism directly influence coping behavior.
      1. Hardiness and optimism have positive associations with problem-focused and emotion-focused coping.
      2. Hardiness and optimism have negative associations with avoidance coping.
    - iii. Mental toughness directly influences coping behavior while also indirectly influencing coping through optimism and hardiness.

1. Mental toughness has positive associations with problem-focused and emotion-focused coping.
  2. Mental toughness has negative associations with avoidance coping.
4. The fourth aim is to explore differences between male and female athletes in mental toughness and related constructs of hardiness, optimism, and coping behaviors.
- a. These analyses are exploratory and the literature doesn't provide a basis for hypothesizing any gender differences.

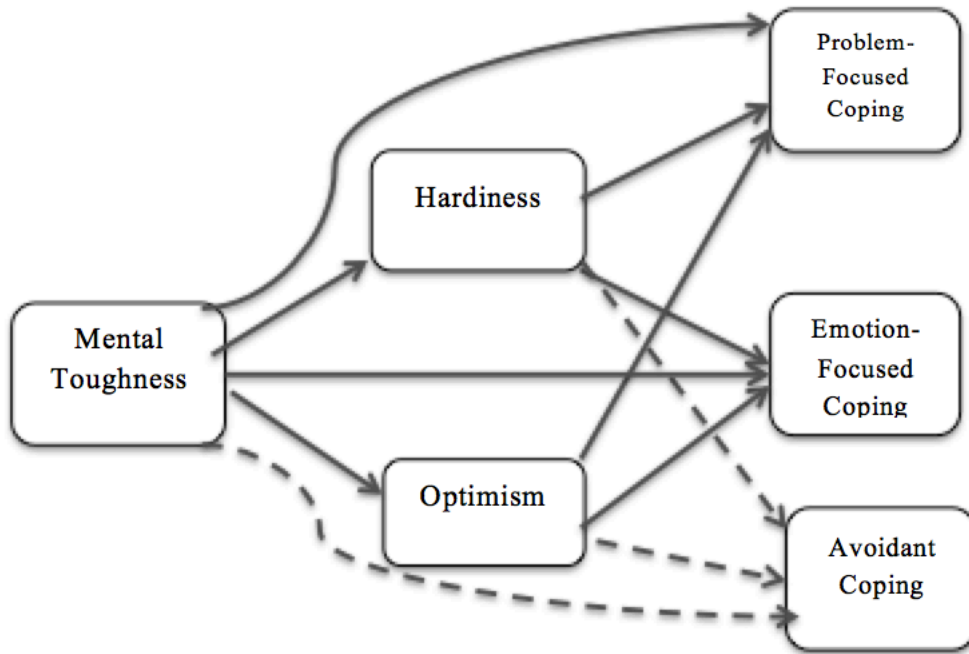


Figure 1. Main Model of Mental Toughness and Coping Relationships with Hardiness and Optimism.  
---- Indicates negative relationship

## CHAPTER II

### REVIEW OF THE LITERATURE

Stress and the inability to effectively cope with it are leading sources of decreased performance and related health issues (e.g., anxiety, depression, muscle tension, injury) in sport. The majority of research on stress management has focused on reducing elements of stress, such as anxiety, rather than enhancing protective qualities that may reduce the harmful effects of stress. Mental toughness is one protective personality characteristic that is sport-specific and encompasses positive qualities (e.g., confidence, commitment, resiliency, and effective coping) pertinent to dealing with the various demands of sport. The primary focus of this research is to examine mental toughness and develop a better understanding of how the construct is measured. Specifically, this study focuses on the psychometric and construct validity of a measure of mental toughness (the Mental Toughness Scale; Madrigal, Hamill, & Gill, 2013) by investigating relationships of mental toughness with coping behavior, and related constructs of hardiness, optimism, grit, and competitive anxiety.

This chapter begins with an overview of stress, models explaining the stress appraisal process, a brief coping overview, and description of mental toughness in terms of its definition, assessment, and related correlates of grit, hardiness, and optimism. The chapter then follows up with more specific information on coping in sport and concludes by bringing mental toughness and coping together in a model of relationships in sport.

## **Stress and Coping**

Stress is defined as “an ongoing process that involves individuals transacting with their environments, making appraisals of the situation they find themselves in and endeavoring to cope with any issues that may arise” (Fletcher, Hanton, & Mellalieu, 2006, p. 329). An athlete’s ability to cope with the demands of stress in competition is important to successful performance (Scorniaenchi & Feltz, 2010). For example, stress may have negative effects on performance (Haney & Long, 1995; Lazarus, 2000a), physical health and psychological well-being (Nicholls, Backhouse, Polman, & McKenna, 2009), and increase risk of injury (Smith, Ptacek, & Smoll, 1992).

### **Stress**

Stress has been an area of considerable research interest since Selye’s (1950) early work on the stress response to external stimuli. Stress research shifted in the 1960’s from a biological response-only perspective to examining perceptions and psychological experiences in the stress process. Masuda and Holmes (1967) and Holmes and Rahe (1967) proposed a stimulus-based theory of stress in which life changes or life events were deemed stressors to which a person responds. This stimulated research on life events and illness, which expanded into developing measures to assess life events and daily stressors. Research confirmed that the more negative life events one had, the more likely they were to become ill or injured (e.g., Andersen & Williams, 1999; Holmes, 1970; Kolt & Kirby, 1996). A key process in how negative life events lead to negative outcomes (i.e., injury, illness) is how the individual appraises the situation. The extent to which a potential stressor is interpreted as a threat or a challenge is a fundamental aspect

of the appraisal process (Lazarus & Folkman, 1984). Related literature on stress and sport emphasized stress appraisals, stress and performance, and stress management (Jones & Hardy, 1990). The conceptualization of stress shifted once again when Lazarus (1966) described stress as a dynamic experience that is influenced by person and environment characteristics. In this viewpoint, stress is not solely a response or a stimulus but an interaction between a person and his or her environment. This description of stress and the appraisal process moved the field into taking account of the individual's perceptions and cognitions.

Stress affects people differently (Aldwin, 2007). While some experience decreases in performance due to stress, others find ways of adapting to the stressful situations. Certain athletes seem to adjust to stressful conditions and are subsequently able to function more effectively. One mechanism for managing stress effectively is coping.

## **Coping**

*Defining and Categorizing Coping.* Coping has been a topic of interest to many researchers. Folkman and Lazarus (1980,1985) have laid down a foundation that guides much of the coping research. Coping is defined as “the cognitive and behavioral efforts made to master, tolerate, or reduce external and internal demands and conflicts among them” (Folkman & Lazarus, 1980, p 223). Coping has two major functions, “the regulation of distressing emotions [emotion-focused coping] and doing something to change for the better the problem causing the distress [problem-focused coping]” (Folkman & Lazarus, 1985, p.152). Coping involves reducing the discrepancy between

perceived situational demands and personal ability to handle such demands (Endler, Parker & Summerfeldt, 1993).

Coping efforts have been organized in a variety of different ways including whether they reflect cognitive (employ internal modes of coping such as diverting thoughts away from stressor and positive cognitive restructuring) or behavioral (seeking support, information seeking, employing direct efforts to maintain control) strategies (Curry & Russ, 1985; Worchel, Copeland, & Barker, 1987). Other distinctions of coping include whether they are problem-focused, (addressing external demands of stressors) or emotion-focused (addressing internal demands of stressors) and whether they are directed towards (i.e., approach) or away from (i.e., avoidance) the demands or conflicts (Folkman & Lazarus, 1980, 1985; Connor-Smith & Flachsbart, 2007; Littleton, Horsley, John & Nelson, 2007). In problem-focused coping, the individual participates in strategies to change or eliminate the stressor itself, whereas emotion-focused coping involves seeking to reduce or manage the emotional consequences associated with the stressor (Folkman & Lazarus, 1985; Lazarus & Folkman, 1984). Avoidance coping refers to disengaged coping, in which the goal is to ignore, avoid, or withdraw from the stressor or its emotional consequences (Aspinwall & Taylor, 1992; Endler & Parker, 1990).

Some have argued that specific coping strategies should be examined at the micro-level to capture the heterogeneity and complexity of subtypes of coping responses (Compas, Connor-Smith, Saltzman, Harding, Thomsen, & Wadsworth, 2001). However, broad dimensions of coping are useful in that they provide an overall characterization of athletes' responses to stress (Nicholls & Pollman, 2007). The most commonly reported



functions of coping are those related to problem-, emotion- or avoidance- coping (Nicholls & Thewell, 2010). In a recent review on coping, Nicholls and Polman (2007) revealed that over 80% of published studies adopted the problem- and emotion-focused classification of coping. In this paper coping categories are conceptualized as problem-, emotion-, and avoidance-focused.

*Changes in Coping.* Carver et al. (1989) suggest that people have a preferred set of coping strategies that they use consistently through time and different circumstances. In contrast, Folkman and Lazarus (1980) state that coping is dynamic and changes across time and within stressful situations. Gaudreau, Lapierre, and Blondin (2001) examined pre-competition, during competition, and post-competition coping strategies among adolescent golfers. Results indicated that golfers' coping strategies changed across all three phases of competition. Specifically, the use of wishful thinking, seeking social support, suppression of competing activities, behavioral disengagement, increased effort, and active coping changed across the phases of the competition. Gaudrea, Blondin and Lapier (2002) replicated the study and found that golfers' emotional responses and coping strategies changed across the 3 phases of sport competition. In addition, Gaudreau et al. (2002) found that golfers who did not achieve their performance goal for their round of golf had decreased task orientation, decreased emotion coping, and used more avoidance coping (i.e., behavioral disengagement) from pre- to post-competition. Golfers who did achieve their performance goal reported stable coping strategies from pre-to post-competition. Active coping, increased self-effort, and positive reappraisal were the most commonly used coping strategies by the adolescent golfers. In another study on

adolescent golfers, Nichols, Holt, Polman, and James (2005) found that stressors fluctuated through time and more than one coping strategy was used to manage stressors as they shifted.

Thus coping does fluctuate over time, as do emotional responses to stressful situations. These findings are logical as stress appraisals are in part due to environment characteristics. According to the study by Gaudreau et al. (2002) goal attainment (or lack of) may influence the stability and type of coping strategies the athlete utilizes when dealing with a stressful situation in sport. In other words, if an athlete feels he or she did not complete the intended task, there may be increases in negative coping strategies (e.g., behavioral disengagement) while more stable coping strategies would be used by athletes who perceived their task as being achieved.

In examining coping over time in non-sport injury settings, results suggest various coping strategies are used depending on the situation. Kristofferzon, Lofmark, Carlsson (2005) examined coping after myocardial infarction and found no significant changes over time (1, 4, 12-months) in coping assessment, except for fatalistic coping, which diminished over time in men. Women used more evasive coping (i.e., ignoring the stress, similar to avoidant-focused coping) than men, and confrontational coping (i.e., embracing the stress, similar to problem-focused coping), which has been shown to have positive outcomes (e.g., adapting better to stress) in the long term was used by both men and women. Research has shown that patients who use more problem-focused coping show better adaptation and experience fewer psychological symptoms (Bennett & Connell, 1999). Hepp, Moergeli, Buchi, Wittmann, Schnyder (2005) analyzed changes in coping

strategies of severely injured accident victims over time and found that active problem-focused coping was predominant immediately after the accident and declined over time. Rosenberger, Ichovics, Epel, D'Entremont, and Joki (2004) examined active and avoidant coping behaviors on knee and pain function over time (pre surgery, 3-, and 24- weeks post surgery). Researchers found avoidant coping was significantly associated with knee pain and active coping was associated with knee function. These divergent coping behaviors are differently associated with stress reactivity and physical outcomes in healthy patients undergoing minor knee surgery. Although this study examined changes in pain and knee function, coping was not assessed over time.

### **Models of Stress and Coping**

#### **Stress Models**

The Transactional Model of Stress and Coping (Lazarus, 1966) is one of the leading frameworks for understanding the processes of coping with stressful events. According to this framework, when a person is faced with a stressor, an appraisal is made to determine if the stressor is threatening. This primary appraisal encompasses perceptions about the event as stressful, positive, controllable, challenging or irrelevant (Lazarus, 1966; Lazarus & Folkman, 1984). A secondary appraisal follows in which assessments are made of available coping resources and options (Cohen, 1984). In essence, this secondary appraisal is when the person determines what can be done about the situation. If a situation is perceived as potentially stressful in the primary appraisal, then the secondary appraisal occurs, in which the individual evaluates potential actions or ways of coping, informed by past coping experience, personality, and personal resources.

According to Lazarus (1966) this system is recursive in that each variable and process can affect the other. Stress is dynamic and fluctuates due to the changing appraisal process as environmental or personal characteristics change.

### **Stress Models in Sport Psychology Research**

Stress models have been adapted and extended to the anxiety-performance relationship, exercise and stress, and stress-injury relationships. Stress models identify factors related to individual differences in the ability to adapt to stressful situations, and perception and interpretation is a key characteristic of these stress models. Those who view increased heart beat and rapid breathing as anxiety may view an event as stressful; in contrast to those who perceive the physiological response as a sign of readiness.

Research on anxiety and performance in sport draws from psychological theories on arousal and performance. These include Drive Theory and Inverted-U Theory, which explain the relationship between arousal and performance. According to the Drive Theory, increased arousal increases habit or dominant response performance. The Inverted-U theory suggests increased arousal beyond optimal levels interfere with performance. These early models fail to consider individual differences and perceptions, and thus miss a key element of the stress process, cognitive appraisal.

Stress models used in exercise and sport draw from cognitive stress models related to Lazarus's transactional view and incorporate the appraisal component. For example, in Smith's (1980) stress management for sport model, external events may trigger stress, but individual appraisal is the key. The response to stress is multidimensional with physiological, psychological, and behavioral correlates and

consequences. As for the stress management piece of this model, Smith (1980) proposed an integrated coping response, which involves both cognitive and behavioral strategies. Having integrated coping strategies allows the individual to tailor coping responses to the situation and individual preferences. Similar stress models have been applied to other sport psychology areas such as burnout and injury (Anderson & Williams, 1988; Smith, 1986). In these models, the injury is the stressor (i.e., event) but the cognitive appraisal piece is key to the individual perceiving the event as stressful or unmanageable. The basis for these models that incorporate the appraisal process is Lazarus' (1966) Transactional Model of Stress and Coping. Stress is a dynamic process in which personality and external factors influence how one cognitively appraises the situation. Stress models have guided work in stress and performance, exercise and stress, and burnout and injury in sport. One key factor that must be considered in an individual's appraisal of stress is personality. Additionally, the coping response is a key component of these stress models.

In summary, stress and coping have been paired in sport research on appraisal of stressors and coping responses to those stressors. Coping is a dynamic process that changes as one's appraisal of the situation changes over time. One key element in how an individual copes with stress is their personality. While some literature on stress and coping in the sport psychology field has focused on personality, there is a lack of research on positive personality characteristics that may protect an individual from perceiving situations as stressful. Specifically, there is a lack of research on how positive personality characteristics, like mental toughness, are related to stress and coping. The next section

focuses on the personality component with specific attention to the construct of mental toughness.

### **Mental Toughness and Personality in Stress and Coping Models**

Within the sport literature, an array of personality characteristics that have been examined in the appraisal of stress, including anger, depression, anxiety, mood, athletic identity, self-esteem, sport confidence, self-efficacy, physical self-perception, locus of control, narcissism, sensation-seeking, Type A, and psychological well-being. Although a multitude of personality components have been examined, there has been little follow-up, with few examined in more than one study.

The majority of research has focused on negative characteristics such as anxiety (Andersen & Williams, 1999; Ford et al., 2000; Maddison & Prappavessis, 2005; Ramella DeLuca, 2003; Rogers & Landers, 2005; Rozen & Horne, 2007). Endler, Kantor and Parker (1994) examined the relationships among anxiety, coping and academic performance in a sample of college undergraduates. They found that individuals with high levels of trait anxiety used more emotion-focused coping styles and had poorer academic performance. In examining specific coping strategies used by high and low trait anxious athletes, Giacobbi and Weinberg (2000) found that high trait anxious athletes responded to stressful situations using different coping behaviors (e.g., denial, self-blame, and wishful thinking) than did the low trait anxious athletes.

Although research on personality and stress has been extensive, that research lacks a positive spotlight of linking protective factors (i.e., mental toughness) to stress appraisal and coping behaviors. Mental toughness is one protective personality

characteristic that is particularly likely to alter the way a person appraises stress, leading to lower perceived stress and greater use of adaptive coping strategies (i.e., problem, emotion-focused) to cope with the demands in sport.

### **Mental Toughness**

Mental toughness is a personality characteristic that is receiving increasing attention in the sport literature. Although it is closely tied to related constructs such as hardiness, optimism, and grit, the literature suggests there is more to mental toughness than these separate, but related constructs. For example, hardiness is a personality construct similar to resiliency in which people view stressful situations as challenges to overcome, are committed to the process, and feel in control of the situation (Kobasa, 1979). Optimism involves expecting the best possible outcome or dwelling on the most hopeful aspects of a situation. Grit is defined as perseverance and passion for long-term goals, characterized by strenuously working toward challenges, maintaining effort despite failure, adversity, and plateaus (Duckworth, Peterson, Matthews, & Kelly, 2007). Mental toughness, as typically defined, is a broader construct that encompasses all these characteristics. In addition, although hardiness, optimism, and grit seem applicable to the sport setting, the majority of research on these constructs has been done in workplaces, health care settings, or academic settings, with little research on athletes.

As well as being a broader overall protective personality construct, mental toughness also differs from optimism, hardiness, or grit because it is typically defined, measured, and applied as a sport-specific construct. In fact, much of the mental toughness research is solely within the realm of sport and exercise psychology. The following

section gives an overview of the definition, composition, and development of the construct of mental toughness, as well as the measures and correlates of mental toughness.

### **Defining Mental Toughness**

Mental toughness is a term used by coaches, athletes, and sport psychologists, but the construct is lacking clear conceptual or operational definitions. Early attempts to define mental toughness were based on personal opinion or anecdotal evidence rather than empirical studies, resulting in definitions that were not compatible. Tutko and Richards (1971) defined mental toughness as the ability to refrain from becoming upset when losing or performing badly and to be able to withstand criticisms (cited in Dennis, 1978). Instead of describing performance, Goldberg (1998) loosely defined mental toughness as the “outward manifestation of an inner commitment” as well as the ability to cope with adversity. Loehr (1986) stated that mentally tough performers are able to stay calm and relaxed because they are able to increase their positive flow in times of adversity. This implies that mental toughness is only vital during times of hardship. Loehr (1994) later expanded his definition to include both times of success and failure, explaining that mental toughness involved performing toward the upper range of one’s ability despite the competitive circumstance. In addition, he changed his views on toughness from simply focusing on the mental aspect to a three-dimensional concept involving physical, mental, and emotional components. All of these conceptualizations were generated using personal opinion and anecdotal evidence, which resulted in



different interpretations, causing confusion in understanding the construct of mental toughness.

Graham Jones took an alternative approach. Rather than generating his own definition based on personal observations, he and his colleagues interviewed elite international athletes (those who performed in the Olympics or Commonwealth games), soliciting their thoughts on what constituted mental toughness. Subsequently, Jones et al. (2002) defined mental toughness as:

the natural or developed psychological edge that enables you to generally cope better than your opponents with the many demands that sport places on a performer. Specifically, be more consistent and better than your opponents in remaining determined, focused, confident, and in control under pressure (Jones et al., 2002, p.209).

Jones views mental toughness as a defining trait in which “people who become champions aren’t necessarily more gifted than others; they’re just masters at managing pressure, tackling goals, and driving themselves to stay ahead of the competition” ( Jones, 2008, p.123). This definition implies that mental toughness can either be a natural personality trait or developed through experience. Evidence has been presented on both sides of this debate.

Those who believe mental toughness is a personality trait draw from studies that examine the potential roles of genetic factors in the development of mental toughness. Past studies have found that serotonin transporter 5-hydroxytryptamine (5-HTT) might provide a protective effect against stress and trauma (Caspi, Sugden, Moffit, Taylor, Craig, Harrington, et al., 2003). The release of serotonin can act as a stress-reducing

hormone and it is transported into a cell by the 5-HTT gene. Therefore, individuals with this gene may be better able to deal with stress. Although support was found linking the 5-HTT gene to lowered depression and stress in non-athletes (Caspi et al.,2003), the finding could not be replicated in athletes (Golby & Sheard, 2006). No study has directly examined genetic associations within mentally tough individuals. Whereas the findings regarding a genetic component are ambiguous, there is more consistent support for the role of the environment in determining mental toughness.

Those who believe that mental toughness is a dynamic characteristic draw support from studies that examine the role of environment. Thewell, Weston, and Greenless (2005) explored participants' perceptions of attributes of mentally tough soccer players. Based on interviews with 6 male professional soccer players, and ranking of mentally tough attributes by 48 professional soccer players, Thewell et al. (2003) found that although players believed mental toughness could be both natural and/or developed, some players claimed it was their experiences during their formative years that fostered development of their mental toughness. In a study by Jones and Connaughton (2007), elite athletes reported that mental toughness developed throughout their careers but also fluctuated during the time they spent in their own sports. Although at an elite level, these athletes went through periods of high mental toughness and low mental toughness. According to reflections of elite level athletes, mental toughness appears to continuously fluctuate and is not automatically maintained at high levels in sport.

Mental toughness is an overall personality characteristic shaped by an interaction of both environmental and innate characteristics, encompassing attributes such as being

resilient, having unshakeable self-belief, being committed, having superior concentration skills, thriving on pressure, and coping effectively with pressure and adversity (Connaughton, Hanton, & Jones, 2010; Crust, 2008; Sheard, 2009). As such, mental toughness represents a constellation of positive psychological variables that help to buffer the harmful effects of stress and allow individuals to perform consistently well regardless of situational factors (Clough, Earle, & Sewell, 2002). Based on the literature and existing research, for this study mental toughness is defined as the ability to adaptively cope with the demands of sport while maintaining determined, focused, and having a positive outlook on the present situation.

### **Development of Mental Toughness**

Mental toughness can be developed in several ways. In a sample of elite cricketers from the 1980's to the 1990's, Bull and colleagues (2005) found that attributes of being mentally tough can be achieved through a variety of means depending on the individual. For example, Bull et al. (2005) found that parental influence and childhood background were developmental foundations for mental toughness in top cricketers' formative years. Additionally, the "need to earn success" or "competitiveness" was instrumental in stimulating growth of mental toughness throughout the player's careers. However, Bull et al. (2005) caution that while the need to find shared qualities in development of mental toughness is critical, it is also important to not limit individuals from developing their own unique way of obtaining mental toughness. This research suggests that the environment has a strong influence on how people acquire mental toughness. Family

upbringing and experiences within sports are two key elements that may affect an athlete's mental toughness.

Further support for the notion that the environment aids the development of mental toughness has been found in other qualitative studies. Connaughton, Wadey, Hanton and Jones (2007) interviewed coaches, athletes and sports psychologists for their views on the development and maintenance of mental toughness during a child's formative years. According to these interviews, mental toughness is developed through opportunities that arise as children's participation and competition in sport increases. In developing skills that may be foundational for mental toughness, Connaughton et al. (2007) discovered that in the early years (involvement in sport with training once a week between the ages 7-10), encouragement from significant others who may act as a source of knowledge and inspiration may facilitate the development of mental toughness in individuals. As children age and competition increases, new challenges arise for athletes such as experiencing performance setbacks, physical and emotional pain, competitive anxiety, and competition pressure (Connaughton et al., 2007). Thus, during these years, athletes are presented with the opportunity to develop the ability to accept and deal with the internal anxiety responses that come from competitive pressure. As athletes transition into older adolescents (ages 12-16) and begin competing at higher competitive standards, become more committed to sport and training most days of the week, learning techniques to remain focused and regain psychological control (visualization, self-talk, and goal setting) were prominently reported as mentally tough attributes (Connaughton et al.,

2007). Qualitative studies suggest that the environment in which one grows up and competes plays a crucial role in the development and maintenance of mental toughness.

Whereas previous research has provided limited evidence for genetic influences and greater support for environmental variables, it is likely that one's level of mental toughness is determined by the combination of stable traits and environmental context. Horsburg, Schermer, Veselka and Vernon (2009) conducted the first study on mental toughness that simultaneously examined effects of genes and environment on adult twins (monozygotic and dizygotic). Participants completed mailed questionnaires, separate from their twin, on mental toughness, zygosity (e.g., physical similarity with twin), and the Big-5 factors of personality. Results showed that both genetic and non-shared environmental factors contributed to the development of individual differences in mental toughness. They found stronger genetic correlations for MZ twins than DZ twins among the mental toughness variables of challenge, commitment, control, emotional control, control over life, confidence, confidence in abilities, and interpersonal confidence. In addition, non-shared environment effects were highly correlated to challenge (.57), commitment (.64), control (.53), emotional control (.44), control over life (.56), confidence (.56), confidence in abilities (.51), and interpersonal confidence (.48). Perhaps mental toughness depends on both innate characteristics and learned processes.

Mental toughness is the psychological advantage that allows individuals to rise above challenges and obstacles that may come their way. Given this definition, it is important to examine how mental toughness has been measured. Although there has

been great activity in the development of mental toughness measures little follow up research has been conducted on the psychometric properties of those scales.

### **Assessing Mental Toughness**

Early studies on mental toughness provided little information because of the lack of established measures. For example, Dennis (1978) examined the interaction effects of feedback (success or failure information) and mental toughness on performance using a 5-item subscale from the Motivation Rating Scale to assess mental toughness, and found that the interaction between mental toughness and feedback type was not significant. Although the Motivation Rating Scale had been used in previous studies, the reliability and validity of the scale were unknown. The failure to adequately assess mental toughness spurred a number of researchers to begin creating scales. Although some mental toughness scales have been published, few have established psychometric properties. Research with these measures focuses primarily on other factors (e.g., performance enhancement, physical endurance and pain tolerance) rather than the construct and assessment of mental toughness itself (Crust & Clough, 2005; Sheard & Golby, 2006). Six scales, some stemming from others and some developed independently, have been developed to assess mental toughness: The Psychological Performance Inventory (Loehr, 1986), the Psychological Performance Inventory-A (Golby, Sheard, & vanWersch, 2007); the Sports Performance Inventory (Jones, Newman, Altmann & Dreschler, 2001), the Mental Toughness Questionnaire (cited from Crust & Clough, 2005), the Mental, Emotional, and Bodily Toughness Inventory (Mack

& Ragan, 2008), and The Mental Toughness Scale (Madrigal, Hamill, & Gill, 2013).

Further information on these measures is provided in the following section.

*Psychological Performance Inventory (PPI)*. The first scale developed solely for the assessment of mental toughness was the Psychological Performance Inventory (PPI) created by Loehr (1986). The PPI consists of the following seven psychological factors that reflect mental toughness: self-confidence (e.g., sample item of factor; “*I believe in myself as a player*”), negative energy (e.g., “*I can change negative moods into positive ones by controlling my thinking*”), attention control (e.g., “*I can clear interfering emotion quickly and regain my focus*”), visual and imagery control (e.g., “*I visualize working through situations prior to competition*”), motivation (e.g., “*I am highly motivated to play my best*”), positive energy (e.g., “*I practice with high positive intensity*”), and attitude control (e.g., “*I can keep strong positive emotion flowing during competition*”). Loehr introduced the PPI in a self-help book used for strengthening one’s mental toughness, but never addressed how the scale was created or its psychometric properties.

In a separate study, Golby, Sheard, and Lavallee (2003) examined the psychometric properties of the PPI and used the PPI to examine mental toughness and hardiness in international rugby players. In order to examine the construct validity of the PPI, Golby et al. (2003) compared it to another contemporary measure of mental toughness, the Personal Views Survey III-R, which measured an individual’s general level of hardiness in commitment, control, and challenge. Golby et al. (2003) found a strong positive relationship between scores on the PPI and scores on the Personal Views Survey III-R, suggesting that both scales measured related but different aspects of mental

skills. Commitment, control, and challenge are factors that make up the construct of hardiness but mental toughness is a broader construct that includes other characteristics. Mental toughness has been thought to incorporate hardy qualities and perhaps be one in the same (Clough, Earle, & Sewell, 2002). According to Clough et al. (2002), hardiness differs from mental toughness in that it fails “to capture the unique nature of the physical and mental demands of competitive sport” (p. 37). Additionally, researchers have found weak correlations between mental toughness and hardiness and have concluded that they are two separate constructs (Sheard & Golby, 2006a; Sheard, Golby, & van Wersch, 2009).

Whereas the original studies did little to address the psychometric properties of the PPI, later studies focused on the scale’s reliability and validity. Middleton, Marsh, Martin, Richards, Savis, Perry, and Brown (2004) evaluated the PPI’s factor structure, reliability and construct validity. The researchers gave the PPI, as well as the Global Mental Toughness Measure (GMTM), the Physical Self-Description Questionnaire (PSDQ), the Perceptions of Success Questionnaire (PSQ), Elite Athlete Self-Descriptions Questionnaire (EASDQ), and Flow Trait Scale (FTS) to 263 college student-athletes to conduct a confirmatory factor analysis. The seven factors of the PPI showed low to moderate reliabilities (self confidence  $\alpha=.77$ ; negative energy  $\alpha=.63$ ; attention control  $\alpha=.65$ ; visual and imagery control  $\alpha=.75$ ; motivation level  $\alpha=.77$ ; positive energy  $\alpha=.73$ ; attitude control  $\alpha=.76$ ). However, the 7-factor PPI produced a poor model fit and items needed to be deleted to make a better fit. An exploratory factor analysis with a principal components analysis (PCA) extraction was then done using an oblique rotation on the



PPI. PCA differs from confirmatory factor analysis in that items are placed under factors based on their loading score and are not pre-determined by the researcher. PCA relies on data rather than the authors' judgments about the construct in order to derive factors. When researchers deleted items and re-specified factors to a 5-factor scale, a good fit was achieved,  $\chi^2(94)=142.17$ . To further explore results from the PCA, correlations were examined using both the 5-factor structure and 7-factor PPI with the other key correlates: (GMTM), (PSDQ), (PSQ), (EASDQ) and (FTS). Researchers found the 7-factor PPI factors to be more strongly related to the key correlates than the 5-factor structure. Based on these results, researchers concluded that the main fault of the PPI was not the factors, but the items used to assess the factors.

Building upon the work of Middleton and colleagues (2004), Golby, Sheard and Wersch (2007) re-evaluated the psychometric properties of the PPI. Golby et al. (2007) conducted a principal components analysis (PCA) with an oblique rotation using a larger sample of 408 athletes who completed only the PPI. Because the factors were selected based on item-loading scores, the resulting factors differed from the original seven factors in terms of the items that belonged to each subscale. From the seven factors proposed by Loehr (1986), only two remained: Visualization and Imagery Control, and Motivation. However, the PCA solution resulted in two additional factors, and a 4-factor model was proposed (PPI-A); this solution contained the newly named factors of Determination, Self-belief, Positive Cognition, and Visualization (see Figure 2). The four factors showed significant positive inter-correlations ranging from .50 to .63, suggesting related yet separate factors. Cronbach alphas also showed acceptable internal consistency

with each factor having an alpha of .70 or greater. Consequently, the PPI-A is psychometrically stronger than the original; however additional investigations as well as comparisons between men and women and among athletes in different sports are needed to establish validity. Thus, the PPI was not a valid and reliable measure and further work was required to develop a scale to measure mental toughness.

*Other Measures of Mental Toughness.* Given the mixed results and lack of a clear factor structure with the PPI, other researchers sought to develop scales related to mental toughness. One example was the Sports Performance Inventory (SPI) (Jones, Neuman, Altmann & Dreschler, 2001). Examples of items include: “I am always willing to work long and hard to be the best I can at this sport”; “I think it is time to quit this sport and move on to other pursuits in my life.” College athletes and participants from an introductory psychology class ( $N=274$ ) completed the SPI. Results indicated that the SPI was composed of six factors which the researchers labeled: competitiveness, emotional control, mental toughness, positive attitude, safety consciousness, and team orientation (see Figure 3). Cronbach’s alpha for each subscale was .79 or higher. In addition, college athletes were found to have a higher SPI score and be more competitive than non-athletes. Although the scale showed good internal reliability, little work was conducted on the validity of the scale.

Some researchers felt that the available data on the PPI, PPI-A and SPI were insufficient, lacking follow-up work on external validity and internal consistency. In an attempt to create a new measure that investigated more specific aspects of mental toughness such as confidence and commitment to sport, Clough and colleagues (2002)

developed the Mental Toughness Questionnaire (MTQ48) to measure an individual's level of control, challenge, commitment, and confidence. This questionnaire incorporated the concept of hardiness as an aspect of mental toughness. Hardiness had previously been proposed by Kobasa (1979) to contain three key components: control, commitment, and challenge. The four subscales of the MTQ48 have been shown to have moderate internal consistency with Cronbach alphas of .71-.80, and the overall scale has an acceptable test-retest reliability equal to .90. In addition, the scale has been related to other constructs such as optimism ( $r=.48$ ), self-image ( $r=.42$ ), self-efficacy ( $r=.68$ ) and trait anxiety ( $r=.57$ ), providing good evidence of construct validity. Crust and Clough (2005) measured the scale's criterion validity by having 41 male undergraduate students perform a physical endurance task of lifting a dumbbell to fatigue, then completing the MTQ48. Pearson correlations between endurance time and MTQ48 were moderate and significant for overall mental toughness ( $r=.34$ ); control ( $r=.37$ ), and confidence ( $r=.29$ ). However, there were no significant correlations between endurance time and challenge ( $r=.22$ ) or commitment ( $r=.23$ ). Although possessing moderate psychometric qualities, the MTQ48 has not been widely accepted as an adequate assessment of mental toughness. Perhaps researchers have not consistently adopted the MTQ48 because it has been argued that hardiness is a construct distinct from mental toughness.

With no agreed upon scale to measure mental toughness, Loehr (1994) offered a new definition that expanded his previous take on the construct by suggesting that mental toughness is a combination of physical, emotional, and mental components. Thus, he shifted from a seven-construct model to a nine-construct model. The mental dimension

involved the ability to create an optimal performance state, to access empowering emotions, and to cope. The physical dimension involved being well prepared and acting tough. The emotional component involved flexibility, responsiveness, strength, and resiliency. Mack and Ragan (2008) constructed a new measure of mental toughness incorporating Loehr's (1994) revisions. Using Loehr's nine constructs, they generated items for each, resulting in the Mental, Emotional, and Bodily Toughness Inventory (MeBTough), a 43-item measure. The MeBTough was administered to 261 undergraduate students; in addition, participants were asked to rate their mental toughness on a scale of 1 to 20. They opted to use the Rasch analysis model because they believed it enabled a better evaluation of items and offered a more precise measurement of the test. The Rasch analysis model is based on item-response theory (IRT), which allows the researcher to create a scale reflecting a person's ability to answer correctly and a scale reflecting the difficulty of items. The Rasch model calculates the probability that a particular person will get an item correct (ability). In addition, the probability that an item will be answered correctly (item difficulty) is also estimated. When the expected probabilities are very different from what actually occurs, the data do not fit the mathematical model. In essence, the Rasch model identifies which items are easy (i.e., will be rated higher more frequently) and which are difficult (i.e., will be rated lower more frequently). In relation to the MeBTough, the Rasch model determines whether the category of mental toughness is the most appropriate one. The Rasch model helps identify items that do not fit the model; poor model fit indicates problems with the validity and reliability of the test. The Rasch model also allows researchers to gauge item

difficulty as well as identify people whose scores are not consistent with the model (<http://www.rasch-analysis.com/rasch-analysis.htm>). Results from the Rasch calibration showed a good model-data fit for the new 43-item measure and an item separation reliability of 0.98; thus, items were consistent and showed good variability and degree of difficulty. In addition, a moderate positive relationship was found between participants' perceived level of mental toughness and the Rasch-calibrated ability estimates ( $r = .60$ ,  $p < .001$ ). The MeBTough showed potential for assessing mental toughness; however, further work is needed to apply the scale to athletes of different levels, gender, and sports.

*Conceptual Framework for Mental Toughness Assessment.* Rather than develop a measure, Jones et al. (2007) focused on the construct and developed a conceptual framework for mental toughness. Because mental toughness contains elements that relate to successful outcomes, using elite athletes to help develop a conceptual framework was warranted. Jones et al. (2007) surveyed eight elite performers who had either won a gold medal or world championships as well as, three coaches, and four sport psychologists. Participants generated a list of mentally tough attributes, then in a group ranked 30 attributes, developing a framework of mental toughness. The 30 attributes were clustered into four separate dimensions: attitude/mindset (belief, focus), training (using long-term goals as the source of motivation, controlling the environment, pushing yourself to the limit), competition (handling pressure, belief, regulating performance, staying focused, awareness and control of thoughts and feelings, controlling the environment), and post-competition (handling failure, handling success). Although this study provided the first

empirical framework of mental toughness, no further investigations have been done using this framework.

*Mental Toughness Scale (MTS)*. Using the framework developed by Jones et al. (2007), Madrigal, Hamill and Gill (2013) developed the Mental Toughness Scale (MTS). Thirty items were generated directly from the attributes listed under the dimensions of attitude/mindset (7 attributes), training (6 attributes), competition (13 attributes) and post competition (4 attributes). Four college athletes and assistant coaches reviewed the items, re-formatting phrases and separating compound items. This process created an additional 24 items in a 54-item measure to assess the four dimensions proposed by Jones et al. (2007): attitude/mindset (21 items; e.g., “Having an inner arrogance that makes you believe that you can achieve anything you set your mind to”), training (12 items; e.g., “I use all aspects of a very difficult training environment to my advantage”), competition (14 items; e.g., “I love the pressure of competition”), and post-competition (7 items; e.g., “I know when to celebrate success but also know when to stop and focus on the next challenge”). A factor analysis on the 54 items from the MTS resulted in all items loading strongest on a single factor, providing evidence for a general factor of mental toughness.

Based on recommendations from Tabachnick and Fidell (2007) to retain items with standardized factor loading of .60 and above, 11-items remained in the final Mental Toughness Scale. The MTS demonstrated good internal consistency (Cronbach’s alpha=.86,  $p < .001$ ) as well as test-retest reliability at one week ( $r = .90$ ,  $p < .001$ ; Madrigal, Hamill, & Gill, 2013). Additionally, the MTS showed convergent validity with relationships to flow, optimism, and hardiness. Criterion validity has also been

established through relationships with the MeBTough and PPI-A. A confirmatory factor analysis (CFA) was conducted in a subsequent study on college basketball players (Madrigal et al., 2013). Data from 140 athletes resulted in a one-factor model, which was consistent with the view of mental toughness being a unidimensional construct. In this model, all 11 items loaded on a single factor.

### **Correlates of Mental Toughness**

Mental toughness is the ability to cope and to remain determined, focused, confident and in control under pressure. In addition, other factors that contribute to enhanced sport performance and enjoyment include having a strong belief in self, motivation towards goals, control of emotions as well as environment, mental determination and ability to manage both successful and unsuccessful outcomes (Jackson, 1992, 1995; Harmison & Casto, 2012; Hayslip, Trent, MacIntire & Jones, 2010). Resilience, positive self-perceptions, optimism and confidence are components that contribute to mental toughness. The stronger one's mental toughness, the more one can concentrate and perform at a higher level.

The majority of the literature on mental toughness has not focused directly on the construct but rather on related factors, in an attempt to identify the characteristics, attributes, or behaviors exhibited by mentally tough athletes (Bull et al., 2005; Gucciardi, et al., 2009; Jones et al., 2002, 2007; Middleton et al., 2004). Themes that have emerged from this research include high self-belief and self-efficacy, ignoring distractions, remaining focused, and thriving under pressure (Jones et al. 2002; Middleton et al., 2004; Thelwell et al., 2005). Related research has also referred to resilience, optimism, and

positive self-perceptions as characteristics that can affect athletic performance, and optimism has specifically been identified as a key characteristic of mental toughness (Coutler, Mallett, & Gucciardi, 2010).

Mental toughness has been linked to performance, coping styles, positive attitudes, and other behavioral tendencies (Crust & Clough, 2005; Golby & Sheard, 2004, Jones, Neuman, & Dreschler, 2001; Nicholls, Polman, Levy, & Backhouse, 2008). Studies have examined mental toughness in relation to individual reactions to challenging situations. Golby and Sheard (2004) examined mental toughness in professional rugby players at three different levels: international, super league and Division I. Results showed that international players were better able to cope with highly stressful athletic events (e.g., they could remain calm and relaxed under pressure situations) and maintain higher levels of competitive performance than the other groups.

Mental toughness has also been linked to other behavioral tendencies. In a sample of college athletes and introductory psychology students, college-level athletes expressed higher levels of positive attitudes towards sports and greater competitiveness than non-athletes (Jones, Neuman, & Dreschler, 2001). Mental toughness has also been found to be related to optimism and coping strategies. Nicholls, Polman, Levy, and Backhouse (2008) found that higher levels of mental toughness were associated with more problem or approach coping strategies and less with avoidance coping strategies. Thus, athletes with higher levels of mental toughness may use mental imagery or thought control rather than resignation and mental distraction to work through problems such as missed free throws or negative self-talk.



Overall, the literature suggests that mental toughness is related to lower stress and greater use of positive or adaptive coping. The literature also suggests that mental toughness is closely related to the constructs of hardiness and optimism, which have been shown to relate to stress and coping in many areas, including sport. Although not specifically associated with mental toughness in the literature, grit is another similar construct. The following sections review the research on those related constructs of hardiness, optimism, and grit.

*Hardiness.* Hardiness was conceptualized by Kobasa (1979) as a personality component similar to resiliency. Kobasa (1979) characterized hardiness as encompassing three main components: commitment, control and challenge. Commitment is defined as becoming involved in whatever one experiences rather than becoming alienating or avoiding the experience. Control is defined as the feeling of being influential in the face of contingencies in life rather than feeling helpless. Challenge involves believing that change is normal and anticipating growth rather than viewing change as threats to security. Thus, an individual high in hardiness feels committed to the activities in their lives because they believe they have a sense of control and view challenges as opportunities for growth and development.

According to Kobasa's (1979) model of hardiness, and consistent with past research, hardiness has three possible roles: a direct effect on stress and illness, an indirect effect (e.g., through coping) on these outcomes; and a buffering or moderating effect (Sheppard & Kashani, 1991; Westman, 1990). Wadey, Evans, Hanton, and Neil (2012) found that hardiness was positively correlated with problem- and emotion-focused

coping while negatively correlated with feeling dispirited and devastated. Additionally, as hardiness increased, the likelihood of injury occurrence decreased.

In hardiness literature outside of sport, the relationship between hardiness and adaptive coping is a robust finding (Bartone et al., 2009; Carver et al., 1989; Eschleman et al., 2010; Zander et al., 2010). Using structural equation modeling, Cash and Gardner (2011) found that higher levels of hardiness were associated with more positive appraisals and more effective coping responses. Hardy individuals perceive stress as less threatening and remain optimistic about their ability to cope with demands (Pagana, 1990; Westman, 1990; Wiebe, 1991). In essence, hardiness influences two appraisal components: reducing the appraisal of threat and increasing the expectations of successful coping. Florian, Mikulincer, and Taubman (1995) found that the hardiness component of commitment improved mental health in Israeli Defense Force recruits by reducing the appraisal of threat and increasing the use of emotion-focused strategies. Additionally, control improved mental health by reducing the appraisal of threat and by increasing the use of problem-solving and support-seeking strategies. Klag and Bradley (2004) found that hardiness buffered the effects of stress on illness for males but not for females. However, not many other studies have compared gender differences in hardiness.

Although many hardiness studies have been correlational in nature, the few intervention studies have supported the effectiveness of hardiness training (Khoshaba & Maddi, 2001; Maddi, Khan, & Maddi, 1988; Maddi et al., 2002). Implementing hardiness training as a course in stress management, undergraduates enrolled in an 11-week course

showed higher levels of hardiness and grade point average (GPA) than did undergraduates enrolled in other courses taught by the same teacher (e.g., Health Psychology, Personality, Clinical Psychology; Maddi, Harvey, Khoshaba, Fazel, & Resurreccion, 2009). In addition to emerging as a factor in performance effectiveness in both working adults and college students, hardiness has also been shown to be related to other factors related to performance effectiveness such as attitudes toward school and a sense of life's meaning and one's well-being (Maddi, Harvey, Khoshaba, Fazel, & Resurreccion, 2012). Another stress-reducing personality characteristic related to mental toughness is optimism.

*Optimism.* Optimism is described as the tendency to expect the best possible outcome or dwell on the most hopeful aspects of a situation. It is generally measured as a set of expectations regarding the likelihood of positive and negative outcomes and events (dispositional optimism) and as a method of explaining positive and negative outcomes (explanatory/attributional style). Research has shown that those who are more optimistic report less distress across a broad range of situations, including stressful situations (Andersson, 1996). Additionally, increased optimism has been associated with the use of more problem-focused strategies, suggesting those who are more optimistic strive to overcome obstacles rather than avoid them (Fournier, de Ridder, & Bensing, 2002; Grove & Heard, 1997; Steed, 2002).

Fontaine, Manstead, and Wagner (1993) found a positive relationship between optimism and the belief that one has control of stress in one's life. Subsequently, athletes who reach high levels of performance and success are found to have greater control over

their behavior, and more optimistic perceptions about their future (Taylor & Brown, 1998). Because optimism is associated with a sense of control and confidence, optimists are more likely to adopt active and proactive coping (Aspinwall & Taylor, 1992), thereby preventing the negative consequences of stress such illness or injury (Taylor, Kemeny, Reed, Bower, & Gruenewald, 2000). Research on optimism and coping suggest that optimists are less reactive to life stressors than pessimists and, therefore, perceive life as less stressful (Carver et al., 2010). This viewpoint taken by optimists may have to do with the coping styles they adopt.

Positive associations have been found between optimism and coping strategies (e.g., mental imagery, effort expenditure, thought control, seeking support, relaxation, logical analysis, and mental distraction) (Nicholls, Polman, Levy, & Backhouse, 2008). Solberg-Nes and Segerstom's (2006) meta-analysis on 50 optimism and coping studies reported significant effect sizes for relationships between optimism and problem-focused coping as well as approach coping. They also found that optimism appeared to correlate differently with various coping strategies depending on the stressor at hand (Solberg Nes & Segerstom, 2006). For example, trauma-related stressors revealed a strong association between optimism and emotion-focused coping while academic stressors showed a relationship between optimism and problem-focused coping. In a more recent review with 84 studies, Rasmussen, Scheier, and Greenhouse (2009) found significant effect sizes ranging around .17 for relationships between optimism and physical health outcomes.

Research that has focused on optimism and performance-related factors has found that optimism enhances motivation, persistence, and performance (Carver & Scheier, 2002b; Taylor & Brown, 1988). Optimism has also been related to lower perceptions of burnout in sport. Gustafsson and Skoog (2012) found that optimistic athletes displayed lower levels of emotional/physical exhaustion and sport devaluation and less of a reduced sense of accomplishment. Similar results had been reported by Hung et al (2008) in high school athletes, in which optimism negatively predicted burnout in sport. This evidence suggests optimism may be a protective factor in athlete's avoidance of burnout. Optimism has also been linked to sport performance. Norlander and Archer (2002) found that optimism was the best predictor of performance in elite male and female cross country skiers and ski-marksman and swimmers. Alternatively, less optimistic individuals are more likely to withdraw or disengage from attempts at achieving a goal (Gaudreau & Blondin, 2004; Solberg-Nes, Segerstrom, & Sephton, 2005).

Ford, Eklund, and Gordon (2000) hypothesized that dispositional optimism and hardiness would have significant moderator effects on the relationship between life stress and injury. One hundred and twenty-one athletes from various sports completed the Sport Competition Anxiety Test and the Life Orientation Test (LOT) preseason, while injury was recorded throughout the season. Dispositional optimism and subscales of hardiness appeared to moderate the relationship between stress and injury. Athletes low in optimism, when experiencing high positive life event stress and who are less hardy in general, or perceive they lack situational control, tend to experience greater injury time-loss. Optimism and hardiness were related to decreased injury time loss in athletes when

positive life change increased, and global self-esteem was associated with decreased injury time loss when both negative life change and total life change increased.

*Grit.* Grit is a similar construct that is gaining popularity in psychology, and one that seems similar to hardiness, optimism, and mental toughness. Grit is defined within the academic setting as perseverance and passion for long-term goals, characterized by strenuously working toward challenges, maintaining effort despite failure, adversity, and plateaus (Duckworth, Peterson, Matthews, & Kelly, 2007). Similar to mental toughness and resilience, a gritty individual stays focused on the task despite roadblocks that may emerge. The underlying premise for grit is the capacity for hard labor and persistence over a long period of time (Duckworth, Peterson, Matthews, & Kelly, 2007). In essence, gritty individuals work hard seeking long term goals, rather than being satisfied when short-term goals are achieved.

The Grit Scale (GRIT-O), is a 12-item scale to measure overall grit, as well as subscales of Consistency of Interests and Perseverance of Effort (Duckworth, Peterson, Matthews, & Kelly, 2007). Early work on the grit scale demonstrated that grit was positively associated with education attainment, age, conscientiousness, agreeableness, extraversion, and openness to experience while negatively correlated with neuroticism (Duckworth, Peterson, Matthews, & Kelly, 2007). A shorter 8-item version of the GRIT Scale (Short Grit Scale; GRIT-S) has been validated through associations with the Big 5 personality traits, education, age, and GPA. Additionally, reliability has been shown with one-year test-retest reliability of the GRIT-S,  $r = .68$  (Duckworth & Quinn, 2009).

Gritty students have been found to have higher Standardized Achievement Testing (SAT) scores and GPA than less gritty students (Duckworth, Peterson, Matthews, & Kelly, 2007). Grit predicted retention in cadets remaining in the military academy, and children making it to the final round in a national spelling bee contest (Duckworth, Peterson, Matthews, & Kelly, 2007). Research on grit is in its infancy, and it has not been as prominent in the research on stress and coping, or in sport-related research as hardiness and optimism. While grit predominately focuses on perseverance and achieving long-term goals, mental toughness encompasses *how* one might persevere and achieve their goals (i.e., through remaining determined, focused, confident, and in control of their emotions). Still, grit is similar to mental toughness, and will be examined in the current study as a correlate of mental toughness.

### **Research on Stress and Coping in Sport**

#### **Stress and Performance in Competitive Sport**

In the literature on stress and performance, researchers have examined the strategies utilized by athletes to cope with demands such as performance slumps and performance anxiety. These strategies can be categorized into problem-focused, emotion-focused, or avoidance-focused. Problem-focused strategies involve strategies in which external demands of stressors are addressed while emotion-focused strategies address internal demands of stress. Avoidance-focused strategies involve moving away from the demands or conflicts (Folkman & Lazarus, 1980/1985). Madden, Kirby, and McDonald (1989) retrospectively examined coping strategies used by competitive middle distance runners in regards to performance slumps, and found seeking social support, increased

effort and resolve, and problem-focused coping to be the most frequently used strategies by athletes. Age was a strong predictor of athletes' strategies, with older individuals using more problem-focused coping mechanisms with slumps in performance.

In research on stress from performance slumps and losses, basketball players who reported high competitive stress used more increased effort and resolve, problem-focused coping, social-support seeking, and wishful thinking than those with low competitive stress (Madden, Summers, & Brown, 1990). Based on these studies, it appears those who are older and who view the situation as more stressful adopt more problem-focused coping strategies. In examining the affect-coping relationship, Crocker and Graham (1995) found problem-focused variables to be positively related to positive affect, while the emotion-focused and social support variables were associated with negative affect. While emotion-focused coping has been portrayed as less effective in managing stress than problem-focused coping, that is not always the case. Baker and Berenbaum (2007) found those encouraged to express emotions were very effective in dealing with stressors. Additionally, Park et al. (2001) report research on coping has shown that neither problem-focused nor emotion-focused coping strategies are superior for dealing with stress. Problem-focused coping has been found to be superior when direct action is possible (Lazarus, 1999). When direct action to remove stressors is not possible, emotion-focused coping has often been found to be superior (Lazarus, 1999). Thus, both problem- and emotion-focused coping have been demonstrated to be effective ways to manage stress.



Qualitative approaches have also been used in examining athletes' coping strategies of performance stress. Gould, Eklund, and Jackson (1993) explored coping strategies of U.S. Olympic wrestlers and found four dimensions of coping used by the athletes: Thought Control Strategies, Task-Focus Strategies, Emotional Control Strategies, and Behavioral Based Strategies. Thought control strategies (i.e., blocking distractions, perspective taking, positive thinking, coping thoughts and prayer) were utilized most by wrestlers. Following the study on Olympic wrestlers, Gould, Finch and Jackson (1993) examined coping strategies used by U.S. National Champion figure skaters. Major sources of stress included the physical, psychological, and environmental demands on skaters' resources, expectations and pressure to perform, relationship issues, life direction concerns and uncategorized stress sources. In an effort to cope with these stressors, skaters reported using rational thinking and self-talk most, which consisted of attempts to rationally examine stressors and focus on what could be controlled. The second most used strategy was positive focus and orientation, characterized by thinking and talking positively. Consistent with the Gould, Eklund, and Jackson (1993) skaters used multiple coping strategies to address the various stressors experienced during their career. Olympic wrestlers and National Champion figure skaters differed in the situation they reflected back on. The wrestlers focused on the previous Olympic games, while the figure skaters thought back to stressors experienced from the time they won their title to when they retired or partook in the interview. Both studies revealed that athletes employed a variety of strategies, which differed depending upon the nature and source of the stressor.

In contrast to retrospective studies, Nicholls, Holt, Polman and James (2005) explored stressors perceived by elite adolescent golfers over a 31-day competitive period and the coping strategies used to manage these stressors. The four most frequently reported stressors included making a physical error, making a mental error, observing an opponent play well, and difficult weather conditions. Blocking and problem-focused coping were used most frequently by golfers. However, problem-focused, avoidance and emotion-focused coping strategies declined during days 6-10 but then increased from days 11-15 (in which the two most important competitions of the season occurred). More than one coping strategy was used to cope with each stressor. This study addressed some of the limitations of other studies in that it replaced the retrospective approach with daily diaries. This design allows for detection of immediate responses to stressors and how they may change over time. This is important because coping is a dynamic process and daily diaries allow researchers to discover possible trends over time (Lazarus & Folkman, 1984).

Literature on athletes' response to stressors has revealed many interesting findings. First, different strategies are used by athletes depending on the situation and source of stress. Second, coping is a complex, multidimensional process in which multiple coping strategies can be used to address a single stressor (Gould et al., 1993; Nicholls et al., 2005). Third, coping is an interactional process involving both the person and the situation in determining the coping responses of athletes (Hardy et al., 1996). Fourth, few studies have examined the relationships between protective personal variables (i.e., mental toughness) and coping responses. Trait anxiety is one variable that

has been shown to affect coping. Those with high trait anxiety use more emotion-focused coping and different coping strategies than those with low trait anxiety. The literature on coping to date has focused primarily on performance slumps, pressure, dealing with adversity, and expectations. One area that may facilitate performance enhancement is linking mental toughness to coping strategies used by athletes.

### **Gender and Coping**

In the current study gender is examined as possible moderator of relationships among mental toughness and coping. The literature on mental toughness offers little information on gender. One of the few studies considering gender (Nicholls, Polman, Levy & Backhouse, 2009) examined differences in mental toughness among athletes based on gender, achievement level, age, and sporting experience. They found that males had a higher total score on mental toughness, and scored higher than females on the confidence subscale. They suggested that perhaps males have a higher level of mental toughness because they are more confident than females. In a study on sports-confidence and competitive orientation, Vealey (1988) found high school and college male athletes to be more confident than female high school and college athletes. In a sample of adolescent elite soccer players, Findlay and Bowker (2009) found that boys had higher competitive (i.e., the desire to strive for success in sport achievement situations), goal (i.e., the desire to meet personal standards) and win (i.e., the specific desire to win) orientation than girls. Competitive orientation has been positively related to self-concept, self-worth, and self-esteem in adolescents (Ryska, 2003; Swain & Jones, 1992). Perhaps

males are more competitive than females because they are more likely to be driven to compete and feel more confident in a competitive environment.

In one of the few studies examining gender in relation to stress and coping, Crocker and Graham (1995) found that females used more seeking social support for emotional reasons and increasing effort to manage goal frustration than did males, whereas males experienced higher levels of positive affect (Crocker & Graham, 1995). Few studies have examined gender differences in coping strategies in sport. Haney and Long (1995) investigated the coping effectiveness of female athletes on a sport competition task, and found that athletes with more experience on the competition task felt more in control and more self-efficient and used less disengagement coping. Performing well in the first round of the task had a positive effect on the athlete's sense of control, self-efficacy and adaptation of engagement coping strategies. Although athletes used both engagement and disengagement coping, performance outcomes played a big role in how strongly the athlete chose to adapt one coping strategy over the other. Johnson (1997) found that injured women used more coping strategies of religion, wishful thinking and self-blame than injured men, and individual-sport athletes who were injured used more problem solving and had lower acceptance-resignation than injured team-sport athletes.

Although there is some support for gender differences in coping with stress, the findings of studies are questionable due to not controlling the nature of the stressor and stressor appraisal. Research has indicated that men and women in sport tend to experience similar stressors (Nicholls et al., 2007). However, appraisal of stressors is a

key element. In a meta-analysis on coping, Tamres et al. (2002) found that females appraise stressors as more severe than males. Given the limited research, no conclusions can be drawn about gender in relation to mental toughness, stress and coping.

### **Summary**

In summary, stress is determined by environmental and personality characteristics of an individual. A key element of stress is the appraisal process, in which an individual determines if they have the adequate coping resources to combat the stressful experience. Cognitive appraisal of stress is influenced by personality as well as external factors, and appraisal, in turn, influences coping strategies. Stress and coping are in a dynamic transactional relationship that may change over time. Personality has a leading role in the relationships among stress, coping, and performance. However, the majority of research on personality has focused on negative characteristics with little research on characteristics that may be protective and have a positive influence on stress appraisal and use of positive coping strategies. Mental toughness is one protective personality characteristic that is particularly relevant to sport. By developing a better understanding of mental toughness and how it relates to coping with stress in college athletes, researchers and applied practitioners can be better assisted with developing strategies to teach males and females to cope more effectively with stress in sport and as such improve performance or increase sport enjoyment.

### **Current Study**

The current study examines the construct of mental toughness and validity of the Mental Toughness Scale (MTS) by investigating relationships of mental toughness with

coping behavior, and related constructs of hardiness and optimism. Using structural equation modeling, we examined mental toughness as an overall protective positive influence on coping, and whether hardiness and optimism also contribute to the relationships of mental toughness with coping behavior.

## CHAPTER III

### METHODS

Correlation/regression analyses and structural equation modeling were used to address the main purpose of investigating the relationships among mental toughness, optimism, hardiness, and coping behavior in collegiate athletes. Athletes were recruited from National Collegiate Athletic Association (NCAA) Division I, II, and III university sports as well as National Association of Intercollegiate Athletics (NAIA) Division I and community college-level play. Participants completed a survey including measures of mental toughness, hardiness, optimism, grit, competitive anxiety, and coping behavior during their season (for fall sports) or prior to the beginning of their season (for spring sports).

#### **Participants**

A total of 570 current collegiate athletes were recruited from a wide range of sports and several universities and colleges using convenience sampling. Due to missing data 45 cases were removed, leaving a total sample of 525 for analyses. Inclusion criteria included being a current college athlete over the age of 18. Injured athletes as well as red-shirt athletes were included. Table 1 provides a summary of demographic information (i.e., gender, age, class standing, ethnicity) for the participants. Table 2 summarizes sport participation (i.e., sport, sport level, playing status, injury status) of the athletes.

Table 1.

*Demographic Information of Athletes\**

<hr/>	
Gender	Total
Female	322
Male	202
Age	
18-20	387
21-23	131
24-28	3
Class Standing	
Freshman	173
Sophomore	119
Junior	119
Senior	98
Ethnicity	
Caucasian	331
African American	119
Multi-ethnic	41
Hispanic/Latin	24
American Indian	4
Asian-Pacific Islander	2

\*Some values do not add up to the total 525 due to missing data.

Table 2.

*Sport Participation of Athletes\**

<hr/>		
Sport	Males	Females
Soccer	83	113
Baseball/Softball	72	71
Basketball	40	29
Wrestling	24	-----
T&F/ X-country	13	28
Tennis	1	1
Volleyball	-----	55
Field Hockey	-----	20
Lacrosse	-----	11
Swimming/Diving	-----	4
Rifle	-----	3



Sport Level	
NCAA Division I	220
NCAA Division II	107
NCAA Division III	87
NAIA Division I	91
Junior/Community College	20
Playing Status	
Starter	255
Regular Substitute	156
Rarely Play	98
Injury Status	
Currently Injured	105
Not Injured	418

\* Some values do not add up to the total 525 due to missing data

## Measures

### **Mental Toughness: Mental Toughness Scale (MTS)**

The MTS (Madrigal, Hamill, & Gill, 2013) is an 11-item scale used to measure mental toughness. Participants rate their agreement with each statement on a 5-point Likert-scale. Items are summed and higher scores indicate a greater degree of mental toughness. The MTS has demonstrated good reliability and validity, converging with related measures such as flow ( $r(269) = .62, p < .05$ ) and maintaining internal reliability (Cronbach's  $\alpha = .86, p < .001$ ) and 1 week test-retest reliability ( $r = .90, p < .05$ ).

### **Grit: Short Grit Scale (GRIT-S)**

The GRIT-S (Duckworth, Angela Lee, & Quinn, 2009) is an eight-item measure to assess the personality trait of grit. The GRIT-S has demonstrated construct and predictive validity (Duckworth & Quinn, 2009). Participants respond using a 5-point scale to rate the degree of their agreement with statements reflecting consistency of

passions (e.g., “I have been obsessed with a certain idea or project for a short time but later lost interest”; 4 items) and consistency of effort (e.g., “Setbacks don’t discourage me”; 4 items). The GRIT-S has internal reliability of .82 (Duckworth, Kirby, Tsukayama, Berstein, & Ericsson, 2010).

### **Optimism: The Revised Life Orientation Scale (LOT-R)**

The LOT-R (Scheier, Carver, & Bridge, 1994) is a 10-item scale used to measure optimism. Participants use a 5-point Likert- scale to indicate the level of agreement with each item. Three items (1,4, and 10) assess optimism, three items (3, 7, and 9) assess pessimism, and there are four filler items. The scores of the optimism and pessimism subscales are the sum of the scores of the corresponding items. A total score can be calculated, adding the optimism and the inverted pessimism score, with higher scores indicating more optimism. Scheier, Carver, and Bridges (1994) report an internal reliability coefficient of .78 with college students. Additionally, test-retest has been established ( $r=.56 - r=.79$ ) at four months, 12 months, 24 months, and 28 months, indicating that the LOT-R is fairly stable over time (Scheier, Carver, & Bridges, 1994).

### **Hardiness: The Dispositional Resiliency Scale-15 (DRS-15)**

The DRS-15 is used to measure hardiness and its three subcomponents: commitment, control, and challenge (Bartone et al., 1989). The shortened DRS consists of 15 statements about life in general (5 items per subcomponent). Six items are reverse coded. Participants are asked to indicate the truthfulness of each statement for them on a 4-point Likert scale anchored at 0 (not at all true) and 3 (completely true). Scores for each subcomponent range from 0 to 15. The composite hardiness score ranges from 0 to 45. In

a critical review of hardiness research, Funk (1992) recommended the DRS as the best available instrument to measure hardiness. The DRS-15 is a widely-used scale in health and sport psychology literature and has internal reliability of .80 and 3-week test-retest reliability of .78 (Bartone, 2007).

### **Stress Appraisal**

In order to prime individuals for the Coping Function Questionnaire, five items are used to assess the characteristics and stress appraisal of a situation. Participants are asked to describe in writing the most stressful sport situation they have faced in the last 12 months, how long it lasted (< 1 week, 1-4 weeks, 1-3 months, > 3 months), and when it occurred (the past week, > 1 week ago but < 1 month ago, > 1 month ago but less than 3 months ago, > 3 months ago but < 12 months ago). The fourth item assesses perceived stressfulness using a stress scale. Participants are asked “Please indicate the amount of stress that you experienced in the situation by circling the degree of stress you felt on the scale,” with responses ranging from 0 (no stress at all) to 100 (intolerable stress). The last item asks students to describe in writing why the situation was stressful.

### **Coping: The Coping Function Questionnaire (CFQ)**

The CFQ (Kowalski & Crocker, 2001) is an 18-item questionnaire that assesses three coping functions: problem-focused coping, emotion-focused coping, and avoidance coping. Problem-focused coping is defined as an effort to actively change and remain in the situation that caused the stress. Items for this subscale include “I tried to find a way to change the situation” and “I looked for ways to solve the problem and change the situation.” Emotion-focused coping refers to efforts to control thoughts or emotions while

remaining in the situation that caused the stress and includes items such as, “I stayed in the situation and tried to control my emotions to better deal with the situation” and “I tried to find ways to control my emotions.” Lastly, avoidance coping is characterized by an effort to remove oneself from the situation that caused the stress (Kowalski & Crocker, 2001). Items representative of this coping function include, “I tried to get away from the situation to reduce the stress” and “In order to reduce the stress I tried to get myself out of the situation.” Response options for each item range from 1 (not at all) to 5 (very often/very much). The CFQ has been shown to have good internal reliability with all three coping functions above .80 as well as concurrent validity with relationships to subscales from the COPE, the MCOPE, and the Life Situations Inventory (Kowalski et al., 2001). Predictive validity has been supported through relations with control beliefs, perceived stress, and trait anger (Bolgar, Janelle, & Giacobbi, 2008; Kowalski, Crocker, Hoard, & Niefer, 2005).

### **Competitive Anxiety: The Sport Competitive Anxiety Test (SCAT)**

The SCAT (Martens, Vealey, & Burton, 1990) is a 15-item scale that measures the tendency to perceive competitive situations as threatening and/or to respond to these situations with elevated state anxiety. Participants respond on a 3-point ordinal scale (hardly ever, sometimes, or often). Ten of the items assess individual differences in competitive trait anxiety proneness (e.g., “Before I compete I worry about not performing well”); five unrelated filler items are also included to reduce possible response bias. Total scores on the SCAT range from 10 (low competitive trait anxiety) to 30 (high competitive trait anxiety). The SCAT has demonstrated good test-retest reliability across four time

intervals: 1 hour, 1 day, 1 week, and 1 month (mean  $r = .77$ ) (Martens et al., 1990).

Convergent validity has been supported by relationships of the SCAT with measures of sport-specific dispositions of fear of failure, ineffective attentional focus, and cognitive and somatic anxiety. Divergent validity has been evident by showing SCAT scores to be inversely related to sport-specific dispositions of need for power and self confidence.

### **Demographic Information**

Information was also collected on age, gender, sport, level of play, playing status and injury status. The full survey is included in Appendix B.

### **Procedure**

Following IRB approval, recruitment began by contacting athletic directors and coaches requesting and coordinating times to meet with the targeted teams. At the time arranged with the coach, a meeting with the athletes was conducted to explain the study and informed consent. Those who agreed to participate were given either a hard copy survey completed in group settings with the lead researcher or sent an electronic questionnaire by their coach or athletic director. Those who surveyed in group settings were done so in a team locker room, study hall, or classroom. No names were collected and responses were placed in envelopes or submitted online. Those that agreed to participate were entered in a drawing to win one of five \$20 gift cards to Amazon.com The questionnaire includes measures of mental toughness, hardiness, optimism, grit, competitive anxiety, coping behavior, demographic information, and injury status and took about 30 minutes to complete.

## Analyses

In structural equation modeling, statistical power is determined by the model complexity. Schreiber, Stage, King, Nora and Barlow (2006) state that “there is no exact rule for the number of participants needed; but 10 per estimated parameter appears to be the general consensus” (pg 326). In the most complex model tested (see Figure 1), there are 6 observed variables and we specify 11 regression coefficients, 6 variances, and 10 covariances, totaling 27 parameters that need to be estimated. In doubling the estimated 10 per parameter rule, it was estimated that 540 participants were needed to test the model. To determine model fit, Hu and Bentler’s (1999) suggestion for continuous data were used – RMSEA <.06, TLI >.95, CFI>.95. Descriptive analyses were first conducted on all measures. To address the specific aims of this study the following analyses were used:

### **Aim 1**

The first aim of this study was to examine the internal consistency and factor structure of the Mental Toughness Scale (MTS). A *Confirmatory Factor Analysis* was conducted on the MTS with the expectation that all items load strongly onto a single factor. Analyses were performed using AMOS and unit loading identification to examine the factor structure. Maximum likelihood estimates produced from covariance matrices were used to explain the factor loadings. Additionally, *item analyses* were conducted to determine if the MTS functions similarly for both males and females.

## **Aim 2**

The second aim was to examine the validity of the Mental Toughness Scale. *Pearsons correlations* were used to determine whether mental toughness is positively related to measures of hardiness, optimism, and grit (convergent validity) but not related to competitive anxiety (discriminant validity).

## **Aim 3**

The third aim is to investigate the relationship of mental toughness to coping behavior in college athletes. Structural equation modeling (SEM) was used to test our main model of mental toughness and coping relationships. In this model we predict that mental toughness directly influences hardiness and optimism, while hardiness and optimism directly influence coping behavior. Specifically, hardiness and optimism have positive relationships with problem-oriented, and emotion-oriented coping, and negative relationships with avoidance coping. Mental toughness directly influences coping behavior (positive associations with problem-, emotion- oriented coping, negative associations with avoidance coping) while also indirectly influencing coping through optimism and hardiness (see Figure 1).

## **Aim 4**

Our fourth aim was to explore differences between male and female athletes on constructs and relationships in the model. A multivariate analysis of variance (MANOVA) was used to examine gender differences in all variables. A Multiple Group SEM was used to examine possible moderating effects of gender on the model of mental toughness, hardiness,

optimism, and coping behavior. As well as identifying moderating effects in the model, the analyses indicate whether groups differ on the constructs in the model (i.e., latent factors).



## CHAPTER IV

### RESULTS

The results are organized by first presenting the checks on normality, outliers, and descriptive statistics on all measures, followed by confirmatory-factor analyses on the primary scales used for the path analysis. The analyses and results are then described for each aim, starting with psychometric properties of the MTS and evidence of criterion and divergent validity of the MTS. Next, results from the path analysis of the hypothesized model are presented followed by alternative models. The final section addresses gender differences in measures and relationships in our final model.

#### **Descriptive Analysis of Measures**

Prior to analyses, tests for normality and outliers were conducted. A listwise deletion was conducted excluding cases for which participants did not answer one or more complete scales. This action resulted in removing 45 cases, giving a total sample of 525 for analyses. All data met univariate and multivariate normality assumptions. Also, measurement checks on reliability and factor structure were conducted on all scales. Means, standard deviations, and internal reliability (Cronbach's alpha coefficient) on all scales and sub-scales are provided in Table 3 (Appendix B, Table 8 provides summary descriptive statistics separated by gender).

Table 3.

*Descriptive Statistics n=525*

	M	SD	$\alpha$
Stress Thermometer Scale (range 0-100)	59.09	21.31	-----
MTS (range 11-55)	45.97	5.74	.878
LOT-R (range 6-24)	22.55	3.74	.728
DRS-O* (range 15-60)	43.69	4.05	.691
Commitment (5-20)	12.58	2.03	.575
Challenge (5-20)	7.83	1.89	.667
Control (5-20)	16.26	1.74	.632
DRS-R* (range 9-36)	18.90	3.29	.593
Challenge (4-16)	5.01	1.64	.728
Control (5-20)	16.26	1.74	.632
GRIT (range 8-40)	29.54	5.09	.764
Consistency (4-20)	13.21	3.56	.787
Effort (4-20)	16.33	2.66	.716
CFQ Scale (range 16-80)	54.64	10.29	.855
Problem-focused Coping (4-20)	21.40	5.25	.836
Emotion-focused Coping (7-35)	26.75	5.00	.836
Avoidance Coping (5-25)	13.30	6.06	.903
SCAT (range 10-30)	19.20	4.72	.862

\*DRS-O= original 15-item hardiness scale with three subscales; DRS-R=Revised 9-item 2 factor hardiness scale. Note: Mental Toughness Scale (MTS), Life Orientation Test-Revised (LOT-R), Dispositional Resiliency Scale (DRS), Coping Function Questionnaire (CFQ), Sport Competitive Anxiety Test (SCAT).

### **Mental Toughness**

The 11-item MTS used to measure mental toughness had good reliability ( $\alpha=.88$ ) with item-total correlations ranging from .44-.68. On average, participants reported high levels of mental toughness (M=45.97, SD=5.74). A confirmatory factor analysis (CFA) as detailed in the next section, supports the single factor structure of the MTS.

## **Optimism**

The LOT-R is composed of 6 items and 4 fillers. The LOT-R had acceptable reliability ( $\alpha=.73$ ) with item-total correlations ranging from .32-.59. On average, participants reported high levels of optimism ( $M=22.55$ ,  $SD=3.74$ ). Results from the CFA indicated the 6-item unidimensional model resulted in acceptable fit. Based on CFI approaching .95 (CFI= .93) and RMSEA marginally above .06 (RMSEA= .09), the LOT-R was used in its original form to assess optimism. Full CFA fit statistics, standardized factor weights and the standardized coefficients are presented in Table 9 of Appendix B.

## **Hardiness**

The DRS-15 is composed of three factors (control, challenge, commitment) yielding factor scores as well as having a total score. Participants reported high levels of hardiness ( $M=43.69$   $SD=4.05$ ). Checks of internal consistency of each score as well as the total score indicated problems with reliability (control,  $\alpha=.67$ ; challenge,  $\alpha=.67$ ; commitment,  $\alpha=.58$ ; total,  $\alpha=.69$ ). Item-total correlations ranged from .19-.39. The three-factor model was tested in a CFA, which resulted in a poor fit,  $DF=87$ ;  $\chi^2=508.53$ ;  $CMIN/DF=5.85$ ;  $CFI=.71$ ,  $RMSEA=0.096$ ,  $LO\ 90=0.088$ ,  $HI\ 90=0.104$ ,  $PCLOSE=.000$ ,  $TLI=.67$ . Based on a poor fit and weak reliability, post-hoc analyses were performed to find a better fitting model.

Several of the 15 items had weak standardized factor loadings (i.e., below .40), and most items came from the Commitment subscale. CFA on each factor revealed a poor model fit for Commitment (see Appendix B for CFA fit statistics). Therefore, the Commitment subscale (5-items) was dropped as well as item 9 (due to low factor loading

on the Challenge subscale). The revised 9-item two-factor model resulted in a better (though still marginal) fitting model,  $DF=26$ ;  $\chi^2=77.69$ ;  $CMIN/DF=2.99$ ;  $CFI=.94$ ,  $RMSEA=0.06$ ,  $LO\ 90=0.046$ ,  $HI\ 90=0.078$ ,  $PCLOSE=.105$ ,  $TLI=.91$ .

The reliability for the original scale was .69 but reducing the scale to 9-items lowered the total score reliability to .59. Control maintained minimally acceptable reliability ( $\alpha=.63$ ), while the Challenge subscale improved ( $\alpha=.73$ ). The revised 9-item two-factor scale was used to measure hardiness. Analyses were also run with the original 15-item hardiness scale for comparison and interpretation with existing literature. Those results are in Tables 10-12 of Appendix B.

### **Coping Style**

The CFQ is composed of three factors (problem-focused, emotion-focused, avoidant coping) yielding factor scores as well as a total score. Internal consistency of each score as well as the total score indicated good reliability (problem-focused,  $\alpha=.84$ ; emotion-focused,  $\alpha=.83$ ; avoidant coping,  $\alpha=.91$ ; total,  $\alpha=.85$ ). Item-total correlations ranged from .15-.62. On average, participants used moderate levels of problem-focused and emotion-focused coping with avoidant coping used less by participants. The three-factor model was tested in a CFA, which resulted in a minimally adequate fit,  $DF=132$ ;  $\chi^2=585.60$ ;  $CMIN/DF=4.44$ ;  $CFI=.90$ ,  $RMSEA=.082$ ,  $LO\ 90=.076$ ,  $HI\ 90=0.089$ ,  $PCLOSE=.000$ ,  $TLI=.88$ , with some cross-loading. After reviewing the two items that cross-loaded onto two factors and confirming they were specific to problem-focused coping, the items were retained and the scale was used in its original form. Full CFA fit

statistics, standardized factor weights and the standardized coefficients are presented in Table 13 and 14 of Appendix B.

### **GRIT**

The GRIT scale is composed of two factors (Consistency and Effort) as well as yielding a total score. Internal consistency of each scale as well as the total indicated moderate reliability (consistency,  $\alpha=.79$ ; effort,  $\alpha=.72$ ; total,  $\alpha=.76$ ). Item-total correlations for the entire scale ranged from .28-.59. The GRIT scale was used to establish convergent validity with the MTS thus no CFA analyses were performed on this scale.

### **Competitive Anxiety**

The SCAT scale measures competitive trait anxiety. The SCAT had good internal consistency ( $\alpha=.86$ ) and item-total correlations ranging from .53-.66, suggesting good reliability. Competitive anxiety scores were in the moderate range. The SCAT scale was used to establish divergent validity with the MTS, thus no CFA analyses were performed on this scale.

### **Stress**

Stress was assessed as part of the coping measure before completing the CFQ. Participants reflected on the most stressful sport experience in the past 12 months and indicated the degree of stress experienced on a scale from 0-100. On average, participants reported high degrees of stress with a wide range of variability ( $M=59.09$ ,  $SD=21.31$ ). Participants also described the stressful situation, and the top four stressors, 61 percent of

reported stress, came from injury, conditioning or training for one's sport, playoffs, or lack of playing time.

### **Aim 1: Factor Structure of the MTS**

The first aim of this study was to establish that the MTS was an unidimensional scale and that there was no gender variance.

#### **MTS Factor Structure**

A CFA on the 11-item MTS was conducted to establish that the one-factor model of mental toughness as a unidimensional construct was a good fit (CFI>.95, RMSEA<.06, TLI>.95). Analyses resulted in a model of minimally adequate fit (DF=44;  $\chi^2=218.93$ ; CMIN/DF=4.98; CFI=.92, RMSEA=.087, LO 90=.076, HI 90=0.099, PCLOSE=.000, TLI=.90. Based on the CFI approaching .95 and RMSEA slightly over .60, the one-dimensional model is confirmed. Factor loading estimates are reported in Table 4.

*Table 4.*

*MTS Factor Loading Maximum Likelihood Estimates and Squared Multiple Correlations*

	Unstandardized	Standard Error	Standardized	R <sup>2</sup>
MTS 1	1.000			
MTS 2	.946	.104	.612*	.375
MTS 3	1.071	.121	.577*	.333
MTS 4	1.009	.110	.626*	.392
MTS 5	1.188	.126	.660*	.436
MTS 6	1.200	.123	.713*	.508
MTS7	1.159	.122	.668*	.446
MTS 8	.979	.106	.631*	.398
MTS 9	1.018	.105	.699*	.489
MTS 10	1.222	.132	.637*	.406

MTS 11	1.275	.130	.735*	.541
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\*indicates significant at  $p < .05$

### MTS Structure by Gender

To determine whether the items within the MTS operated equivalently across gender, a multi-group confirmatory factor analysis was conducted using AMOS. First the configural model was tested in which the model of the MTS scale was run with both groups allowing all estimates to run freely. This produced a minimally adequate model fit,  $DF=88$ ;  $\chi^2=281.41$ ;  $CMIN/DF=3.20$ ;  $CFI=.91$ ,  $RMSEA=.065$ ,  $LO\ 90=.057$ ,  $HI\ 90=0.074$ ,  $PCLOSE=.002$ ,  $TLI=.89$ ,  $SRMR=.06$ . In testing for measurement invariance each parameter was assigned a label so that it was held equal across groups. Thus, the factor loadings were constrained and a model was re-run using unit variance identification. This model also produced a good fit,  $DF=99$ ;  $\chi^2=296.83$ ;  $CMIN/DF=2.99$ ;  $CFI=.91$ ,  $RMSEA=.062$ ,  $LO\ 90=.054$ ,  $HI\ 90=0.070$ ,  $PCLOSE=.222$ ,  $TLI=.90$ ,  $SRMR=.06$ . Evidence of invariance is based on the chi-square difference test, in this case, the  $\chi^2$  difference ( $\chi^2_D(11)=15.42$ ) did not exceed the 19.68 cut-off score from the chi-square distribution table, thus giving support for invariance. In testing for residual invariance (in which variances for each item and error term) were constrained equal for both groups), the model produced a good fit,  $DF=110$ ;  $\chi^2=304.64$ ;  $CMIN/DF=2.77$ ;  $CFI=.91$ ,  $RMSEA=.058$ ,  $LO\ 90=.051$ ,  $HI\ 90=0.066$ ,  $PCLOSE=.006$ ,  $TLI=.91$ ,  $SRMR=.07$ . Evidence of intercept invariance is based on the chi-square difference test of the unconstrained model to the intercept constrained model, in this case, the  $\chi^2$  difference ( $\chi^2_D(12)=7.81$ ) did not exceed the 19.68 cut-off score from the chi-square distribution

table, thus indicating variance equivalence. The factor configuration, factor loading, and residual variance are equivalent across gender. Table 15 in Appendix B shows factor loadings for the MTS by gender.

Based on results of the CFA and test of gender invariance at the factor configuration and factor loading level, the predictions for the first aim were confirmed. Specifically, the single-factor MTS is an adequately fitting model, and the items operated equally across gender. Based on these results we can assume that any gender differences on the MTS indicate true differences on mental toughness and not due to instrumentation.

### **AIM 2: Validity of MTS**

The second aim was to examine the convergent and divergent validity of the MTS. It was expected that scores on the MTS would be positively related to measures of hardiness, optimism, and grit, while not being related to competitive anxiety.

#### **Convergent Validity**

Pearson product-moment correlations were computed between the MTS, the revised and original DRS (i.e., hardiness), LOT-R (i.e., optimism), and the Grit Scale. As predicted, higher mental toughness scores were related to a higher degree of hardiness ( $r(523) = .23, p < .001$ ), optimism ( $r(523) = .34, p < .001$ ), and greater grit ( $r(523) = .36, p < .001$ ). Correlations with the DRS and GRIT subscales as well as totals are in Table 3.

#### **Discriminant Validity**

The discriminant validity of the MTS was examined with Pearson product-moment correlations between the MTS and competitive anxiety (SCAT). No relationship between the MTS and SCAT was expected. Results indicated that mental toughness and



competitive anxiety were negatively related,  $r(523)=-.20, p<.001$ . Table 5 shows all correlations and validity evidence.

Table 5.

*Correlations among Convergent and Divergent Measures*

	Total scale scores				
MTS	DRS-Original .16*	DRS-Revised .23*	LOT-R .34*	GRIT .36*	SCAT -.20*
	Subscales				
MTS	DRS-R: Control .26*	DRS-R: Challenge .10*	GRIT: Consistency .14*	GRIT: Effort .49*	

\* significant at  $p<.05$

Convergent and discriminant validity for the MTS were supported in this sample. As hypothesized in the second aim, mental toughness correlated positively with optimism, hardiness and grit as well as with subscales of hardiness (i.e., control, challenge), and grit (i.e., consistency, effort). Discriminant validity was supported through a low negative relationship between the MTS and SCAT.

### **Aim 3: Path Analyses of Mental Toughness to Coping**

The third aim was to investigate the relationship of mental toughness to coping behavior in college athletes using structural equation modeling.

#### **Correlations among Variables**

Prior to analyzing the structural model for aim 3, correlations among variables in the model were examined. As indicated in Table 6, mental toughness had the strongest correlations with positive coping and predicted variables, while hardiness, optimism, and

mental toughness had moderate to low relationships among each other. The revised hardiness scale had stronger correlations with other variables than the original version.

*Table 6.*

*Correlations among Path Variables*

	MTS	DRS-OT	DRS-R: CH	DRSR: CO	LOT-R	PFC	EFC
DRS-OT	.16*	-----					
DRS-R: CH	.10*	.50*	-----				
DRS-R: CO	.26*	.53*	-.05	-----			
LOT-R	.34*	.19*	.08	.27*	-----		
PFC	.26*	.19*	.10*	.20*	.16*	-----	
EFC	.35*	.13*	.06	.17*	.25*	.37*	-----
AC	.003	.03	-.06	.01	-.09	.31*	.08

DRS-OT= Original total DRS, DRS-R: CH= Revised DRS challenge subscale, DRS-R: CO= control subscale, PFC=Problem-Focused Coping, EFC=Emotion-Focused Coping, AC=Avoidant Coping

\*significant correlation at  $p < .05$

### **Model 1: Partial Mediation Model (Figure 2)**

In the hypothesized model, mental toughness influences coping, both directly and indirectly through optimism and hardiness. Specifically, we predict that mental toughness directly influences hardiness and optimism. Hardiness and optimism directly influence coping behavior (positive associations with problem-focused, emotion-focused coping, and negative associations with avoidance coping). We also predicted that mental toughness directly influences coping behavior (positive associations with problem-focused, and emotion-focused coping, and negative associations with avoidance coping). Based on results of the CFA for hardiness, scores for the two-factor structure (i.e.,

control, challenge) were used instead of a total hardiness score for paths involved with hardiness (Figure 2).

This model produced a poor fit,  $DF=6$ ;  $\chi^2=134.12$ ;  $CMIN/DF=22.35$ ;  $CFI=.65$ ,  $RMSEA=.202$ ,  $LO\ 90=.173$ ,  $HI\ 90=0.232$ ,  $PCLOSE=.000$ ;  $TLI=-.23$ ,  $SRMR=.09$ .

Because of poor model fit, the path analysis results are only discussed for completeness in reporting. Individual results should not be over-interpreted. In examining the standardized path coefficients of the model, mental toughness significantly predicted optimism (.34), hardiness-control (.26) problem-focused coping (.20), emotion-focused coping (.29) but not avoidant coping or hardiness-challenge. Optimism significantly predicted emotion-focused coping (.13) and avoidant coping (-.10), while hardiness-control only significantly predicted problem-focused coping (.14). All estimates for Model 1 are reported in Table 16 of Appendix B.

Despite the model having poor fit, it appears mental toughness is a predictor of problem-focused and emotion-focused coping. Optimism only significantly predicted emotion-focused coping, and the hardiness-control only significantly predicted problem-focused coping. Given that mental toughness, optimism, and hardiness are positive psychological characteristics theorized to predict positive coping strategies it seems logical that avoidant coping is not in the model. Additionally, because problem and emotion-focused represent remaining in the stressful situation to cope with stress (Kowalski & Crocker, 1990), and an examination of model modification indices indicated shared variance, their errors were allowed to covary. However, prior to testing

this revised model, model 1 was re-analyzed with the original hardiness scale total score in place of the revised two-factor structure.

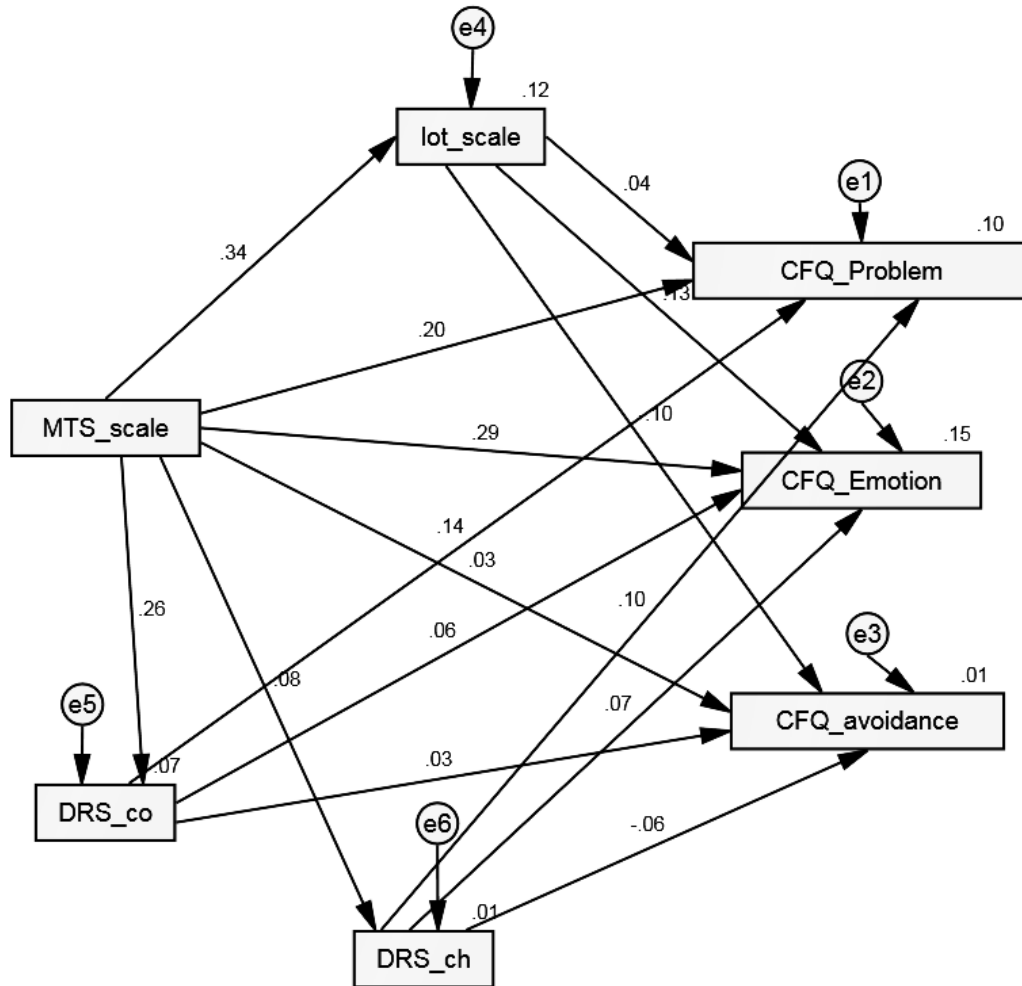


Figure 2. Path Diagram for Model 1.

### **Model 2: Partial Mediation Model (using original hardiness score)**

All predictions were the same with the exception of using the original total hardiness score rather than the revised two-factor hardiness scale. This model produced a poor fit,  $DF=4$ ;  $\chi^2=169.09$ ;  $CMIN/DF=42.27$ ;  $CFI=.67$ ,  $RMSEA=.281$ ,  $LO\ 90=.245$ ,  $HI\ 90=0.318$ ,  $PCLOSE=.000$ ;  $TLI=-.24$ ,  $SRMR=.11$ . The standardized path coefficients related to mental toughness, optimism, and coping were similar to those in model 1. The original hardiness total paths were similar to those with hardiness-control in model 1; hardiness significantly predicted both problem-focused coping (.28) and emotion-focused coping (.23). All estimates for Model 2 are reported in Table 17 of Appendix B.

### **Model 3: Partial Mediation with Modifications (Figure 3)**

All predictions were the same with the exception of avoidant coping being removed and allowing the error of problem-focused and emotion-focused coping to covary. This revised model produced a poor fit,  $DF=3$ ;  $\chi^2=26.06$ ;  $CMIN/DF=8.69$ ;  $CFI=.92$ ,  $RMSEA=.12$ ,  $LO\ 90=.081$ ,  $HI\ 90=0.166$ ,  $PCLOSE=.002$ ;  $TLI=.61$ ,  $SRMR=.04$ . Because of poor model fit, the path analysis results are only discussed for completeness in reporting. Individual results should not be over-interpreted. In examining the standardized path coefficients of the model, mental toughness significantly predicted optimism (.34), hardiness-control (.26) problem-focused coping (.21), and emotion-focused coping (.29). Optimism significantly predicted emotion-focused coping (.13), while both hardiness-challenge (.10) and hardiness-control (.14) predicted problem-focused coping. The relationship between problem-focused and emotion-focused coping

was moderate ( $r(523) = .29, p < .05$ ). All estimates for Model 3 are reported in Table 18 and 19 of Appendix B.

While the third aim was to examine the relationship of mental toughness to coping behavior in college athletes, it appears no model produced adequate fit statistics. So, results should only be interpreted as possible indications of future modeling attempts. The best-fitting model revealed significant paths in which mental toughness predicted optimism, hardiness-control, problem-focused and emotion-focused coping. Of these predictions, the strongest prediction was from mental toughness to emotion-focused coping. Additionally, while the hardiness subscale predicted the use of more problem-focused coping, mental toughness had a stronger effect on problem-focused coping. Optimism only significantly predicted emotion-focused coping but again, mental toughness had a stronger prediction to this coping strategy as well. These results indicate mental toughness may play a larger role in coping behavior of college athletes than hardiness or optimism and provide no evidence of mediation.

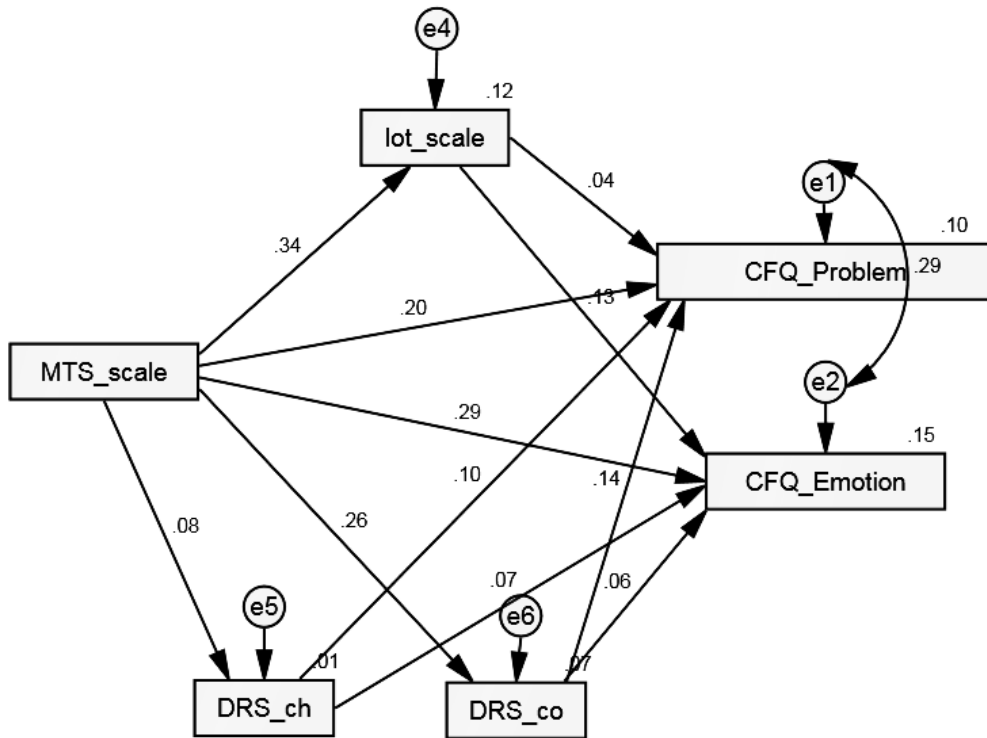


Figure 3. Path Diagram for Model 3.

#### Aim 4: Gender Differences

Our fourth aim was to explore differences between male and female athletes in mental toughness and related constructs of hardiness, optimism, and coping behaviors. There were no hypothesized gender differences. To examine gender differences among mental toughness, hardiness, optimism, coping style, grit, and competitive anxiety, a multivariate analysis of variance (MANOVA) was conducted. The independent variable was gender, while the ten dependent variables consisted of mental toughness, hardiness-control, hardiness-challenge, optimism, problem-focused coping, emotion-focused coping, avoidant coping, GRIT-consistency, GRIT-effort, and competitive anxiety scales. With

the use of Wilks' criterion, there was a significant effect for gender on the dependent variables (Wilks' criterion= .931,  $F(10, 513) = 3.82, p < .05$ ). Univariate analyses revealed significant effects for gender emotion-focused coping ( $F(1, 522) = 4.64, p < .05$ , Cohen's  $d = .20$ ), GRIT-effort ( $F(1, 522) = 5.13, p < .05$ , Cohen's  $d = .20$ ), and competitive anxiety ( $F(1, 522) = 11.76, p < .05$ , Cohen's  $d = .31$ ). Full results are found in Table 7.

As Table 7 shows female athletes reported higher emotion-focused scores, higher GRIT-effort, and higher competitive anxiety than male athletes. There were no significant differences on mental toughness, hardiness-control, hardiness-challenge, optimism, problem-focused, avoidant coping, or GRIT-consistency.

Table 7.

*Univariate Results for Gender Differences on Psychological Variables*

	<u>Males</u>		<u>Females</u>		<u>Analysis of Variance</u>		
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>F</i>	<i>P</i>	<i>d</i>
MTS	45.79	6.18	46.12	5.44	.406	.524	----
Optimism	22.85	3.82	22.39	3.68	1.90	.169	----
Hardiness-Control	16.20	1.85	16.31	1.66	.493	.483	----
Hardiness-Challenge	9.87	2.36	10.29	2.69	3.32	.069	----
GRIT-Consistency	10.63	3.55	10.77	3.56	.957	.076	----
GRIT-Effort	16.01	2.71	16.54	2.61	5.13	.024*	.20
Problem-Focused	21.85	4.53	21.14	5.63	2.27	.133	----
Emotion-Focused	26.18	4.75	27.14	5.09	4.64	.032*	.20
Avoidant Coping	13.56	5.86	13.11	6.16	.69	.407	----
Competitive Anxiety	18.30	4.44	19.74	4.79	11.76	.001*	.31

\*indicates significance  $p < .05$



### **Gender Differences on Relationships of Mental Toughness to Coping Behavior**

A multi-group test of equivalence was done using the results of model 3. In testing for configural invariance in which no equality constraints were imposed, the model produced good fit,  $DF=6$ ;  $\chi^2=20.90$ ;  $CMIN/DF=3.48$ ;  $CFI=.95$ ,  $RMSEA=.069$ ,  $LO\ 90=.038$ ,  $HI\ 90=0.103$ ,  $PCLOSE=.139$ ;  $TLI=.75$ ,  $SRMR=.04$ . Based on standard regression weights, there were slight variations on significant paths for males and females, specifically with hardiness-Control (In Appendix B, Table 20 provides fit statistics for gender invariance while Table 21 provides all estimates for both males and females on these paths). In order to test for structural invariance, equality constraints were placed on all regression weights. This constrained model yielded excellent fit,  $DF=17$ ;  $\chi^2=27.12$ ;  $CMIN/DF=1.60$ ;  $CFI=.97$ ,  $RMSEA=.03$ ,  $LO\ 90=.00$ ,  $HI\ 90=0.06$ ,  $PCLOSE=.86$ ;  $TLI=.94$ ,  $SRMR=.05$ . According to the Chi-Square difference test,  $\chi^2_D(11)=6.38$ , the value did not exceed the cut off of 19.68. Thus, males and females are not different at structure or regression weights of the paths in the model. In order to examine the scalar invariance of the model, the variances of each construct was constrained to be equal across males and females.

## CHAPTER V

### DISCUSSION

The following four aims were addressed in the current study. The first aim assessed the internal consistency, factor structure and gender variance of the MTS, while the second aim examined the validity of the MTS. This study revealed that the MTS is a valid tool for assessing mental toughness though its unidimensionality, evidence of gender invariance, and correlations among related measures of hardiness, optimism and grit, and low negative relation to competitive anxiety. The third aim assessed relationships of mental toughness and related constructs of hardiness and optimism to coping behavior. The final structural model resulted in a poor fit. Thus results of the third aim are interpreted with caution, the model revealed that mental toughness is a better predictor of problem- and emotion-focused coping than hardiness or optimism. Additionally, hardiness and optimism do not mediate the relationship between mental toughness and these approach styles of coping. The fourth aim explored gender differences on the variables of the study as well as relationships among these variables. There were no gender differences on the main variables of this study (i.e., mental toughness, hardiness, optimism) and genders did not differ on the final model on the relationship of mental toughness to coping.

### **Factor Structure of the MTS**

The first aim was to examine the internal consistency and factor structure of the MTS. Results confirmed good reliability and that the one-factor model for the MTS showed an adequate fit with all 11 items loaded onto a single factor. These items had relatively high factor loadings, ranging from .58-.74, and minimally satisfactory fit statistics, CFI=.92, RMSEA=.08, TLI=.90. According to Tabachnick and Fidell (2007) a factor loading of .60 indicates an acceptable criterion for item retention. This finding is consistent with previous work on the MTS that has shown a moderate fit with CFI>.94, RMSEA<.06 (Madrigal, Hamill, & Gill, 2013). One major problem in the literature on mental toughness measures is the lack of psychometric properties on the existing scales.

The Psychological Performance Inventory (PPI), one of the first known measures, was once considered a valid measure of mental toughness, but when psychometric properties were assessed, the factorial structure of the PPI was not supported and reliability of the scale did not hold (Middleton et al., 2004). Recent work on another popular mental toughness scale, the Mental Toughness Questionnaire-48, has also found problems with the original hypothesized factor structure of the measure. Although Clough, Earle, and Sewell (2002) found initial evidence for the MTQ-48's reliability and validity, factorial investigation of the model had not been done until recently. Gucciardi, Hanton, and Mallett (2012) found that the hypothesized 4-factor model of the MTQ-48 did not fit the data well in the athlete or workplace populations assessed.

To date, the MTS is the only mental toughness measure that has undergone repeated confirmation factor analyses that continue to support its unidimensionality and items. The MTS is a brief and efficient measure of mental toughness in collegiate athletes.

In further support of the MTS as a reliable measure, the mental toughness scale was found to be invariant across gender in factor structure, factor loadings, and residual variance. Thus, the MTS is not gender-biased and can be used to determine true differences on mental toughness regardless of participant gender. Testing for measurement invariance has not been done on many mental toughness scales. Gao, Mack, and Ragan (2013) found gender differential item functioning at the scale level on the Mental, Emotional, and Bodily Toughness Inventory. When a scale is found to be non-invariant, individual's membership (e.g., being male or female) affects their response to a specific item in that scale, implying that the item (or scale) may be potentially biased against a group. Thus conclusions regarding gender differences in mental toughness should be made with caution when using total Mental, Emotional, and Bodily Toughness Inventory scores. However, the MTS is gender invariant and does not appear to be gender-biased.

### **Measuring Optimism, Hardiness, and Coping**

Prior to the path analysis for the main model, confirmatory factor analyses were performed on scales assessing optimism (LOT-R), hardiness (DRS-15), and coping (CFQ). Most scales had minimal model fit, specifically the DRS-15 was most problematic. The LOT-R measure of optimism had an acceptable fitting model with

moderate reliability which is in line with previous work on the LOT-R demonstrating adequate internal consistency, test-retest reliability, and constructive, predictive validity (Majer, Jason, & Olson, 2004; Richardson & Ratner, 2005), and one-factor structure (Segerstrom, Evans, & Eisenlour-Moul, 2011).

The coping function questionnaire had minimal model fit, but some items cross-loaded onto other factors, suggesting room for improvement in the CFA model. Further work might be needed on this scale to ensure quality measurement. Kowalski and Crocker (2001) found the three-factor coping function model was a significant improvement over the one-factor model. However, in examining their original model fit, the authors stated the model could have been improved (Kowalski & Crocker, 2001).

In testing the original three-factor (i.e., Challenge, Commitment, Control) hardiness model, the CFA produced a poor fit. Similarly, a one-factor model (i.e., total hardiness score) did not improve the fit. In an attempt to resolve the poor fit, each factor was analyzed separately in a CFA. Challenge and Control had acceptable model fits, while Commitment did not statistically fit in the model of hardiness. One item from the Challenge factor was still problematic and was dropped, resulting in a 9-item hardiness measure that consisted of a 4-item Challenge subscale and 5-item Control subscale. Previous work on the DRS-15 has found good reliability and validity (Bartone, 2007). Sinclair and Tetrick (2002) confirmed a three-factor structure of Commitment, Control, and Challenge, however this analysis was done using the full 45-item version of the DRS. Reliability on the subscales of hardiness (both original and revised) was relatively low compared to the 15-item version. Previous literature has found higher alphas (.68-.82) for

the subscales and total scores of the DRS-15 (Bartone, 1999). In a review on hardiness theory, the DRS was supported as being both conceptually and psychometrically, the most sound hardiness measure available (Funk, 1992). However, no factor structure analyses have been done on the 15-item version of the DRS. Clough, Earle, Perry, and Crust (2012) indicate that scales failing to meet CFA model fit is a problem in personality literature. Hopwood and Donnellan (2010) carried out CFAs on many of the most-used personality questionnaires (e.g., 16PF, NEO) and could not meet CFA criteria. Regardless, the current study found the DRS-15 to be questionable and thus results should be viewed with caution.

### **Validity of the MTS**

The second aim examined the convergent and discriminant validity of the MTS. Convergent validity support was demonstrated for the MTS by positive relationships with hardiness (revised and original measure), optimism and grit, while discriminant support was established through a low negative relationship to competitive trait anxiety. Previous work has demonstrated relationships between the MTS with similar positive constructs such as: flow, self-esteem, and self-efficacy (Madrigal, Hamill, & Gill, 2013). Based on previous research, we expected to find correlations between mental toughness, optimism, and hardiness. Sheard and Golby (2006a) found moderate relationships between mental toughness and hardiness. While Nicholls et al. (2008) found moderate positive relationships among mental toughness with both hardiness, and optimism.

Based on previous research, it was anticipated that mental toughness would be correlated with hardiness. However, the MTS did not correlate with all the subscales of

hardiness, specifically not correlating with the revised Challenge subscale. When examining relationships of the original hardiness subscales with the MTS, there were significant positive correlations with commitment and control, but no association with the challenge subscale. There have been debates that mental toughness is just an extension of hardiness (Gucciardi, Hanton, & Mallett, 2013). However, research also states that hardiness may be a contributing factor, but not the defining feature of mental toughness (Clough, Earle, Perry, & Crust, 2012). Hardiness and mental toughness are separate constructs and it appears that the MTS is more a measure of control and regulating emotions, whereas the abbreviated DRS (i.e., DRS-15) may be more a measure of control and viewing stress as a challenge.

Another related construct is grit, which has received increased attention in the academic setting. Grit, which is a personality characteristic embodying perseverance for long-range goals, has been associated with higher educational attainment and higher college GPAs (Duckworth et al., 2007). GRIT is composed of two subscales (i.e., persistence of effort, consistency of interest). Most work on GRIT has been done using total scores, however studies that have looked at subscales have found persistence of effort being more predictive of GPA and extracurricular activities, while consistency of interest was a better predictor for making fewer career changes during adulthood (Duckworth & Quinn, 2009). In a recent study, grit predicted higher levels of exercise (Reed, Pritschet, & Cutton, 2012). Thus grit may serve as a predictor of consistent exercise behavior. In the current study grit was more strongly correlated with mental toughness than hardiness or optimism. Specifically, mental toughness correlated strongest

with the Persistence of effort subscale. Persistence of effort reflects commitment and effort toward one's goals (Duckworth et al., 2007), thus it seems relevant that mental toughness would have high associations with this positive characteristic.

In earlier research, support for discriminant validity on the MTS was found through low correlations with shyness, social responsibility, and GPA (Madrigal, Hamill, & Gill, 2013). Support for discriminant validity in the present study was supported through low negative associations with competitive anxiety (SCAT). Results clearly supported the discriminant and convergent validity of the MTS.

### **The Relationships among Mental Toughness, Hardiness, Optimism and Coping**

While the third aim was to examine the relationship of mental toughness to coping behavior in college athletes, no model produced good fit statistics. Thus results should only be interpreted as possible indications of future modeling attempts. The best fitting model revealed significant paths in which mental toughness predicted optimism, hardiness-control, problem-focused coping and emotion-focused coping. As hypothesized, mental toughness predicted both optimism and hardiness-control, but neither optimism nor hardiness-control mediated the relationship between mental toughness and coping. In fact, mental toughness was a stronger predictor of problem- and emotion-focused coping than optimism or hardiness-control. This final model suggests that mental toughness is unique and superior when predicting coping behavior of college athletes. As a whole, the model indicates the benefits of mental toughness in predicting positive characteristics of hardiness-control and optimism, as well as positive coping



behaviors. However, more work is needed to support this model, possibly through using other measurement assessments for hardiness and coping.

Previous literature supports that mental toughness, optimism, and hardiness are all positively related with each other (Eschleman, Bowling, & Alarcon, 2010; Nicholls et al., 2008; Sheard, 2009). Additionally, there is support that mental toughness, hardiness, and optimism all are related to approach styles of coping (i.e., problem- and emotion-focused coping). Nicholls et al. (2008) found higher levels of mental toughness were associated with the use of more problem and approach coping behavior and less use of avoidance coping. Similarly, hardiness has been found to be related to problem-focused coping but negatively related to emotion-focused coping and not to avoidant styles of coping (Eschleman, Bowling, & Alarcon, 2010). Hanton, Neil, Mellalieu, and Fletcher (2008) found that current-elite athletes used more problem- and emotion-focused coping strategies than past-elite athletes, which were interpreted as more effective coping strategies. Perhaps these positive characteristics are related to approach coping styles due to the broadened mindsets that can be elicited through positive emotions. According to the broaden-and-build theory of positive emotions, various discrete positive-emotions (e.g., joy, contentment, interest) broaden one's thought-action repertoire, expanding the range of cognitions and behaviors that come to mind. In contrast, negative emotions narrow one's thought-action repertoire by preparing one to behave in a specific way (e.g., attack when angry, escape when afraid). These broadened mindsets, in turn, build an individual's physical, intellectual, and social resources (Fredrickson, 2001). Based on the broaden-and-build theory of positive emotions, those who experience positive emotions

in the midst of stress are able to benefit from the broadened mindset and better regulate negative emotions. Although mental toughness, hardiness, and optimism are not emotions, their positive effects could be due to broadening the mindset and allowing for resources to be used in other areas.

Studies have supported that mentally tough individuals tend to prefer problem-focused coping (Nicholls et al., 2009). Mental toughness had a stronger relationship to emotion-focused coping than problem-focused coping in the final model. In examining items of the MTS, most appear to reflect controlling one's emotions or mental state in challenging situations. In essence, both problem-and emotion-focused coping share the characteristic of remaining in the stressful situation to cope with the event.

In the final model, hardiness-control and hardiness-challenge were used to assess hardiness, rather than the total score of the original hardiness scale and neither hardiness subscale predicted emotion-focused coping. This may be due to challenge and control being more related to coping methods that focus on resolving the problem rather than controlling one's emotions. Additionally, hardiness-control was a stronger predictor of problem-focused coping than hardiness-challenge. Perhaps control plays a larger role when coping with stress (i.e., injury, training for one's sport, competition situations, lack of playing time) than viewing the situation as a challenge.

The final model revealed that neither hardiness nor optimism partially mediated the relationship between mental toughness and coping strategies. However, as a whole the model was a poor fit and individual results should not be over interpreted. This model of hardiness and optimism not partially mediating the relationship between mental

toughness and coping should be tested using other another measure of hardiness. Tugade and Fredrickson (2004) found that positive emotions contributed to the ability for resilient individuals to physiologically recover from negative emotional arousal. Perhaps mental toughness mediates the relationship between stress and coping, which suggests stress needs to be in the model. Mentally tough individuals may utilize coping strategies that reduce the potential effects of stress. For example, injury may become a very stressful experience if improper coping strategies are in place. In the present study, mental toughness predicted approach styles of coping (i.e., problem-and emotion-focused coping). The next step would be to examine a model with mental toughness mediating the relationship between perceived stress and coping.

### **Gender Differences**

The fourth aim was to explore differences between male and female athletes in mental toughness and related constructs of hardiness, optimism, and coping behaviors. No gender differences were predicted, and gender did not influence the main variables or model in this study. There were no gender differences on mental toughness, optimism, GRIT-consistency, problem-focused, or avoidant coping. Additionally the final model with mental toughness being the best predictor of problem and emotion focused coping, and neither hardiness or optimism mediating this relationship, did not differ by gender. The only gender differences were on hardiness-challenge, emotion-focused coping, GRIT-effort, and competitive-trait anxiety.

Other researchers have found gender differences for hardiness, however results have been inconsistent (Klag & Bradley, 2004; Rosen, Wright, Marlowe, Bartone, &

Gifford, 1999). In examining gender equivalence on the hardiness measure (DRS) (Hystad, (2012) found the relationship between the control scale and total hardiness scale was not equivalent across gender. In the current study, there were no gender differences for the control subscale, but only for the challenge subscale. Females reported higher scores on the challenge subscale than males. Challenge is viewed as seeing stress as normal and as an opportunity to learn more (Kobasa, 1979). Based on this perception of stress as a key factor in defining challenge, it appears the female athletes in this study had an alternative view of stress.

In this study, female athletes reported using more emotion-focused coping strategies than males. Previous studies have shown that males and females appraise events differently, suggesting that they may utilize different coping strategies (Kaiseler, Polman, & Nicholls, 2013; Tamres, Janicki, & Helgeson, 2002). Kowalski and Crocker (1990) found that adolescent girls used more emotion-focused coping than adolescent males, however the specific stressor participants were coping with was not mentioned. According to the situational hypothesis (Rosario, Schinn, Morch, & Huckabee, 1988), gender differences disappear when males and females experience the same stressor under similar conditions (Sigmon, Stanton, & Snyder, 1995). Perhaps no differences were found for problem-focused or avoidant coping because both genders reported similar stressors in regards to injury, training, and game situations.

Females also reported having higher GRIT-effort and competitive-trait anxiety than males. Although no work has been done on gender differences with GRIT, research has indicated gender differences on competitive trait anxiety, and that research confirms

that male athletes tend to report lower levels of anxiety than women (Nicholls, Polman, Levy, & Backhouse, 2009). In general, women have tended to report higher levels of competitive anxiety and lower levels of confidence than men (Jones et al., 1991; Martens et al., 1990; Woodman & Hardy, 2003). The current results further supports this in that females report higher levels of competitive anxiety than males.

These differences on competitive anxiety may be the reflection of gender-based cultural norms (Moritz & Feltz, 2000). In essence, females may not be experiencing greater anxiety than males, they may just be more willing to reveal undesired traits. Research has indicated that self-presentation concerns can lead to reporting socially desirable information (Baird & Ozler, 2012).

There were no gender differences for mental toughness or optimism. Previous research on gender differences for optimism have found mixed results. Boman, Smith, and Curtis (2003) found no differences between gender on optimism, whereas, Puskar, Bernardo, Ren, Haley, Tark, Switala, and Siemon (2010) found female adolescents to have lower optimism scores than their male counterparts. In athletic populations, no gender differences were found on optimism (Czech, Burke, Hardy, & Joyner, 2002). The lack of gender difference in optimism is consistent with the lack of gender difference in mental toughness. However, few studies have examined gender differences in mental toughness. Male athletes from various levels of competition have been found to have higher scores of mental toughness (using the MTQ-48) and control than their female counterparts (Nicholls, Polman, Levy, & Backhouse, 2009). But previous work with the MTS has similarly found no difference between male and female athletes on mental

toughness (Madrigan, Hamill, & Gill, 2013). At the collegiate level, it appears that mental toughness does not differ based on gender. More research is needed on the development of mental toughness to examine if gender differences are apparent at earlier levels of competition. In the current study, this lack of gender differences was confirmed in the final model tested. Mental toughness was the best predictor for problem and emotion focused coping, while hardiness or optimism did not mediate this relationship, for both men and women.

### **Limitations**

Several limitations of this study should be noted. First, the scales used to assess coping and hardiness were problematic. Specifically, these multiple factor scales failed to demonstrate good confirmatory factor analyses. Additionally, the reliability for the hardiness scale was very low which could have added to the scale's misfit. In structural equation modeling, scales with poor confirmatory factor analyses make interpreting results problematic. Modifications were made to the hardiness scale to improve model fit. Without modifications or with unacceptable model fits at the scale level, interpretations of the final structural model may be inaccurate (Kline, 2010). That is to say, if there was a poor model fit for hardiness predicting emotion-focused coping, it is unclear whether the path was bad or if the measure of hardiness is problematic. Furthermore, when modifications are made to scales, it is unclear if the construct intended for measurement is what is really being assessed. Although hardiness is conceptualized as being composed of control, commitment, and challenge, only two of those factors remained in the revised hardiness scale. While the original hardiness scale in the study (i.e., DRS-15) is an

abbreviated version of a validated measure of hardiness, confirmatory factor analyses that have been performed on this brief version have indicated problems with scale (Hystad, Eid, Johnsen, Laberg, & Bartone, 2010; Kardum, Hudek-Knezevic, & Krapic, 2012). However, analyses were performed with both the original 15-item DRS scale and revised 9-item DRS and produced similar results. Mental toughness was still positively correlated with both measures of hardiness and both measures predicted problem-focused coping.

Another limitation to note was the listwise deletion of 45 cases. The majority of these cases did not complete at least 2 full scales from the entire survey, information about those that were removed from the survey could have added insight into the scales they did complete. The influence of the coach may have also impacted the way in which athletes responded to items. While coaches were initially contacted or knew of the benefits of receiving general findings, the manner in which they urged their players to complete the survey (i.e., online or hard copy) may have influenced responses. In anticipation of these effects, coaches were reminded that they would not receive their team's score of mental toughness but rather general findings in regards to relationships between mental toughness and coping. Additionally, players were reminded of the anonymity of their responses via the consent form for online participants and verbal message from the PI during collection from those that completed the hard copy surveys.

Another limitation was how coping was assessed. Athletes reflected back to a time during their season that was most stressful, then responded how they coped with that stress. Although this was an attempt to gain general coping behavior with sport-related

stress, the responses to coping were not in real-time. Most athletes reported that their stressors occurred between 1-3 months ago, but again, the coping behavior was not in relation to an immediate stress currently being addressed.

A further consideration for this study is the nature of the sample. In an attempt to generalize results across sports, both male and female participants were sampled across a range of sports. Although there were more females, the difference in male participants was not extreme. It should also be noted that most sports were team-based, thus more work is needed in populations of individual sports. In relation to influences that may have existed due to the presence of the coach, the setting in which the surveys were completed may have influenced responses. The majority of responses were completed via hard copy in group settings consisting of team locker rooms, team meeting rooms, or places where the team held practice. Online responses may have been done individually or in a group as well. In an effort to minimize group influence, the PI was present during group administrations and enforced no talking and anonymity while participants completed the survey, however in some cases the coaching staff was also present in the room.

### **Future Directions**

Future studies examining specific stresses in sport may clarify the role of mental toughness in specific coping behaviors of athletes. The present study did not focus on specific sources of stress (e.g., injury or performance) and perceived stress was not included in the model. Future studies can look at specific stresses (e.g., injury) and examine the relationship of mental toughness to coping to see if similar patterns emerge. Additionally, future work should examine the development of mental toughness.



Specifically, how it is fostered and promoted through various sources within sport. Researchers can then have a better understanding of when interventions might be appropriate to enhance mental toughness.

Future work should also address the buffering effects of mental toughness on the stress-coping relationship. We know that mental toughness is related to approach styles of coping, but the relationship between mental toughness and stress is unclear. In the present study stress was not a primary variable and the one-item stress thermometer is not an established measure of stress. Perhaps mentally tough individuals do not perceive sport situations as stressful because they are using effective ways to cope with the situation before it manifests into more stress. More work is needed on this, specifically by examining whether perceived stress mediates the relationship between mental toughness and approach styles of coping (i.e., problem-, emotion-focused coping).

### **Conclusions**

Research on mental toughness is still in its infancy, due in part to a lack of a psychometrically-sound measure. Results from this study support the reliability and validity of the MTS as a unidimensional and gender invariant measure of mental toughness. Additionally, this study revealed the superiority of mental toughness as a predictor of approach styles of coping (i.e., problem-, emotion-focused coping) with sport-related stress. Specifically, hardiness and optimism did not mediate the relationship between mental toughness and coping, suggesting that mental toughness is distinct, and better than these related positive constructs in predicting coping. More work is needed on the possible stress-buffering effects of mental toughness. Future work can then determine

how mental toughness can be developed and in what populations (e.g., injured) and situations mental toughness may have the greatest benefits.

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(circle one)

< 1 day                      2-7 days                      1 week to 3 months                      +3 months

6. This season, have you ever played in a practice or competition while injured?  Yes  No

***Part 2: Views on Athletics and Life***

**Life Orientation**

**The following statements refer to some general attitudes and behaviors. Please rate each of the following statements as it applies to you, using the scale below. Be as honest as you can throughout, and try not to let your responses to one question influence your response to other questions. There are no right or wrong answers.**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
	<b>Strongly Disagree</b>	<b>Moderately Disagree</b>	<b>Neither Agree nor Disagree</b>	<b>Moderately Agree</b>	<b>Strongly Agree</b>
___ 1					
	In uncertain times, I usually expect the best.				
___ 2					
	It's easy for me to relax.				
___ 3					
	If something can go wrong for me, it will.				
___ 4					
	I'm always optimistic about my future.				
___ 5					
	I enjoy my friends a lot.				
___ 6					
	It's important for me to keep busy.				
___ 7					
	I hardly every expect things to go my way.				
___ 8					
	I don't get upset too easily.				
___ 9					
	I rarely count on good things happening to me.				
___ 10					
	Overall, I expect more good things to happen to me than bad.				

**Views on being an Athlete**

**Listed below are a series of statements regarding your views on being an athlete. Please think about how you usually feel and rate each of the statements using the scale below.**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
	<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Neither Agree Nor Disagree</b>	<b>Agree</b>	<b>Strongly Agree</b>
1.					
	I have an inner arrogance that makes me believe I can achieve anything I set my mind to.			1 2 3 4 5	
2.					
	I know when to celebrate success but also know when to stop and focus on the next challenge.			1 2 3 4 5	

3.	I have a killer instinct to capitalize on the moment when I know I can win.	1	2	3	4	5
4.	I know what needs to be done in order to achieve the level of performance required to win.	1	2	3	4	5
5.	I have the patience and discipline to control my efforts to achieve each goal along the ladder of success.	1	2	3	4	5
6.	Even though I am tired, I continue to train to achieve my goal.	1	2	3	4	5
	<b>1</b> <b>Strongly Disagree</b>	<b>2</b> <b>Disagree</b>	<b>3</b> <b>Neither Agree Nor Disagree</b>	<b>4</b> <b>Agree</b>	<b>5</b> <b>Strongly Agree</b>	
7.	I use all aspects of a very difficult training environment to my advantage.	1	2	3	4	5
8.	I am able to increase my effort if it is required to win.	1	2	3	4	5
9.	When an obstacle is in my way I find a way to overcome it.	1	2	3	4	5
10.	I accept, embrace, and even welcome the elements of training that are considered painful.	1	2	3	4	5
11.	I have total commitment to my performance goal until every possible opportunity of success has passed.	1	2	3	4	5

### Views About Life

**Below are statements about life that people often feel differently about. Please show how much you think each one is true about you. There are no right or wrong answers; just give your own honest opinions.**

	<b>0</b> <b>Not at all true</b>	<b>1</b> <b>A little True</b>	<b>2</b> <b>Quite True</b>	<b>3</b> <b>Completely True</b>	
1.	Most of my life gets spent doing things that are meaningful.	0	1	2	3
2.	By working hard you can nearly always achieve your goals.	0	1	2	3
3.	I don't like to make changes in my regular activities.	0	1	2	3
4.	I feel that my life is somewhat empty of meaning.	0	1	2	3
5.	Changes in routine are interesting to me.	0	1	2	3
6.	How things go in my life depends on my own actions	0	1	2	3

7.	I really look forward to my work activities.	0	1	2	3
8.	I don't think there is much I can do to influence my own future.	0	1	2	3
9.	I enjoy the challenge when I have to do more than one thing at a time.	0	1	2	3
10.	Most days, life is really interesting and exciting for me.	0	1	2	3
11.	It bothers me when my daily routines get interrupted.	0	1	2	3
12.	It is up to me to decide how the rest of my life will be.	0	1	2	3
13.	Life in general is boring for me.	0	1	2	3
14.	I like having a daily schedule that doesn't change very much.	0	1	2	3
15.	My choices make a real difference in how things turn out in the end.	0	1	2	3

### Views on Coping with Stress

1. Describe the most stressful sport situation you have faced in the last 12 months

---

2. How long did the stressful situation last: (circle one)

< 1 week      1-4 weeks      1-3 months      >3 months

3. When did the stressful situation occur? (check one)

- The past week
- >1 week ago but < 1 month ago
- >1 month ago but less than 3 months ago
- > 3 months ago but < 12 months ago
- > 12 months ago

4. Please indicate the amount of stress that you experienced by marking an "X" on the scale below

0      10      20      30      40      50      60      70      80      90      100  
 No stress at all      Intolerable stress

5. What was it about this situation that made it most stressful?

---

**Below are statements about ways people cope with stress. Please indicate how much you've used each of the following methods to cope with stressful situations.**

**Refer to the same stressful situation as in the previous question when responding to the items below**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
	<b>Not at all</b>	<b>A little</b>	<b>Some what</b>	<b>Quite a bit</b>	<b>Very Much</b>
1. I tried to find a way to change the situation.	1	2	3	4	5
2. I stayed in the situation and tried to control my emotions to better deal with the situation.	1	2	3	4	5
3. I worked harder to try to change the situation.	1	2	3	4	5
4. I tried to change how I thought about the situation so it didn't seem so stressful.	1	2	3	4	5
5. I tried to get out of the situation as soon as I could to reduce the stress.	1	2	3	4	5
6. I used strategies to change the situation in order to deal with the stress.	1	2	3	4	5
7. I tried to view the situation in a way that made it seem less stressful.	1	2	3	4	5
8. I tried to leave or avoid the situation to get away from the problem or reduce the stress.	1	2	3	4	5
9. I did my best to change the situation.	1	2	3	4	5
10. I tried to use different strategies that would help me control my emotions.	1	2	3	4	5
11. I looked for ways to solve the problem or change the situation.	1	2	3	4	5
12. I tried to get out of the situation to get away from the stress.	1	2	3	4	5
13. I stayed in the situation and tried to change it.	1	2	3	4	5
14. I worked through my emotions in order to feel better.	1	2	3	4	5
15. I tried to get away from the situation to reduce the stress.	1	2	3	4	5
16. I tried to find ways to control my emotions.	1	2	3	4	5
17. I tried to relax so that I could keep my emotions under control.	1	2	3	4	5

18. In order to reduce the stress I tried to get myself out of the situation. 1 2 3 4 5

### General attitudes & beliefs

Listed below are a series of statements regarding your general attitudes and beliefs. Please think about how you usually feel and rate each of the statements using the scale below.

	1	2	3	4	5
Not at all like me	Somewhat like me			Very Much like me	
1. I often set a goal but later choose to pursue a different one.	1	2	3	4	5
2. New ideas and projects sometimes distract me from previous ones.	1	2	3	4	5
3. I have been obsessed with a certain idea or project for a short time but later lost interest.	1	2	3	4	5
4. I have difficulty maintaining my focus on projects that take more than a few months to complete.	1	2	3	4	5
5. I finish whatever I begin.	1	2	3	4	5
6. Setbacks don't discourage me.	1	2	3	4	5
7. I am a hard worker.	1	2	3	4	5
8. I am diligent.	1	2	3	4	5

### Competition Questionnaire

Following are some statements about how people feel when they compete in sports and games. Read each statement and decide if you hardly ever, sometimes, or often feel this way when you compete in sports and games. If your choice is *hardly ever*, circle the A, if your choice is *sometimes*, circle the B, and if your choice is *often*, circle the C. There is no right or wrong answer. Do not spend too much time on any one question. Remember to choose the word that describes how you *usually* feel when competing in sports and games.

Hardly Ever	Sometimes	Often
A	B	C

- |   |   |   |   |
|---|---|---|---|
| 1. Competing against other People/Teams is socially enjoyable | A | B | C |
| 2. Before I compete, I feel uneasy                            | A | B | C |

- |  |   |   |   |
|--|---|---|---|
| 3. Before I compete, I worry about not performing well               | A | B | C |
| 4. I am a good sportsman when I compete                              | A | B | C |
| 5. When I compete, I worry about making mistakes                     | A | B | C |
| 6. Before I compete, I am calm                                       | A | B | C |
| 7. Setting a goal is important when competing                        | A | B | C |
| 8. Before I compete, I get a queasy feeling in my stomach            | A | B | C |
| 9. Just before competing, I notice my heart beats faster than usual  | A | B | C |
| 10. I like to compete in games that demands a lot of physical energy | A | B | C |
| 11. Before I compete, I feel relaxed                                 | A | B | C |
| 12. Before I compete, I am nervous                                   | A | B | C |
| 13. Team sports are more exciting than individual sports             | A | B | C |
| 14. I get nervous wanting to start the game                          | A | B | C |
| 15. Before I compete, I usually get uptight                          | A | B | C |

**THANK YOU VERY MUCH FOR YOUR PARTICIPATION AND INSIGHTS!!**

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\*IF YOU WOULD LIKE TO BE ENTERED IN THE DRAWING TO WIN ONE OF FIVE \$20 GIFT

CARDS TO AMAZON.COM

Please write your name \_\_\_\_\_

And email\_\_\_\_\_



APPENDIX B  
STATISTICAL TABLES

*Table 8*

*Summary Variable Descriptive Statistics*

	Males (n=201)		Females (n=247)		Total (n=525)		$\alpha$
	M	SD	M	SD	M	SD	
Stress Therm. Scale (range 0-100)	58.00	22.17	59.63	20.87	59.13	21.30	----
MTS (range 11-55)	45.76	6.21	46.12	5.43	45.97	5.74	.87
Optimism (range 6-24)	22.88	3.84	22.39	3.68	22.55	3.74	.73
Hardiness-Original (total) (15-60)	43.66	4.45	43.75	3.77	43.69	4.05	.69
Hardiness-Revised (total) (range 9-36)	18.39	3.26	19.23	3.29	18.90	3.31	.60
Hardiness- Challenge (4-16)	4.80	1.52	5.14	1.70	5.01	1.64	.69
Hardiness-Control (5-20)	16.20	1.86	16.31	1.66	16.26	1.74	.67
GRIT (total) (range 5-40)	26.64	3.70	27.32	3.72	29.54	5.09	.76
GRIT-Consistency (1-20)	10.63	3.54	10.77	3.52	13.21	3.53	.78
GRIT-Effort (1-20)	16.02	2.73	16.54	2.61	16.33	2.66	.72
CFQ Scale (total) (range 16-80)	54.67	10.10	54.63	10.46	54.64	10.29	.85
Problem-focused Coping (4-20)	21.83	4.55	21.14	5.63	21.40	5.25	.83
Emotion-focused Coping (7-35)	26.14	4.76	27.14	5.09	26.75	5.00	.83
Avoidance coping (5-25)	13.63	5.83	13.11	6.16	13.30	6.06	.90
SCAT (range 0-30)	18.26	4.45	19.74	4.79	19.20	4.72	.86

Table 9

*Optimism (LOT-R) Factor Loading Estimates (Standard Errors)*

	Unstandardized	SE	Standardized	R <sup>2</sup>
lot_1	1.000	-----	-----	-----
lot_4	1.295	.205	.500	.250
rlot_7	2.054	.293	.734	.539
rlot_9	1.679	.251	.591	.350
lot_10	1.454	.218	.587	.344
rlot_3	1.492	.225	.568	.322

\*indicates significant at  $p < .05$

Note: Fit statistics for LOT-R: DF=9;  $\chi^2=46.88$ ; CMIN/DF=5.21; CFI=.93, RMSEA=.090, LO 90=.065, HI 90=0.116, PCLOSE=.005, TLI=.89.

Table 10

*Original Hardiness (Dispositional Resiliency Scale-15; DRS) Factor Loading Estimates & Squared Multiple Correlations*

	Control			Challenge			Commitment			R <sup>2</sup>
	Unst	SE	Stand	Unst	SE	Stand	Unst	SE	Stand	SMC
drs_2	1.000									
drs_6	1.125	.125	.563*							.32
drs_12	1.143	.118	.652*							.43
drs_15	1.228	.125	.668*							.45
rdrs_8	.575	.102	.305*							.09
drs_5				1.000						
drs_9				.285	.104	.143				.02
rdrs_3				1.138	.134	.655*				.43
rdrs_11				1.010	.126	.569*				.32
rdrs_14				1.339	.155	.753*				.57
drs_1							1.000			
drs_7							.682	.159	.258*	.07
drs_10							1.401	.214	.500*	.25
rdrs_4							1.300	.187	.588*	.35
DRS 13							1.189	.173	.571*	.33

\*indicates significant at p<.05

Table 11

*Maximum Likelihood Estimates of DRS-Original Subscales*

Parameter	Unstandardized	SE	Standardized
Control<->Challenge	-.005	.008	-.04
Commitment<->Challenge	.017	.007	.16
Control<->Commitment	.054	.009	.59

\*indicates significant at p<.05

Table 12

*Fit Statistics for DRS Variations*

	DF	$\chi^2$	CMIN /DF	CFI	RMSEA (CI)	PCLOSE	TLI
DRS-original	87	508.23	5.85	.71	.10 (.09-.10)	.000	.67
DRS-Revised	26	77.69	2.99	.94	.06 (.05-.08)	.105	.91
Control-only	5	18.70	3.74	.97	.07 (.04-.11)	.122	.93
Commitment- only	5	80.44	16.09	.75	.17(.14-.20)	.000	.50
Challenge- only	5	25.24	5.05	.95	.09 (.06-.12)	.028	.90

Table 13

*Coping Function Questionnaire (CFQ) Factor Loading Estimates*

	Problem-Focused			Emotion-Focused			Avoidance Focused			R <sup>2</sup>
	Unst	SE	Stand	Unst	SE	Stand	Unst	SE	Stand	
CFQ1	1.000									
CFQ3	.924*	.065	.693							.481
CFQ6	.772*	.065	.577							.333
CFQ9	1.195*	.076	.778							.605
CFQ11	.962*	.063	.751							.564
CFQ13	.803*	.067	.581							.338
CFQ2				1.000						
CFQ4				1.499*	.174	.588				.346
CFQ7				1.637*	.182	.642				.412
CFQ10				1.744*	.186	.721				.519
CFQ14				1.690*	.179	.727				.529
CFQ16				1.779*	.185	.774				.599
CFQ17				1.422*	.158	.643				.414
CFQ5							1.000			
CFQ8							1.144*	.073	.758	.574
CFQ12							1.354*	.075	.905	.818
CFQ15							1.252*	.073	.843	.711
CFQ18							1.344*	.076	.880	.774

\*indicates significant at p<.05

Table 14

*Maximum Likelihood Estimates for CFQ*

Parameter	Unstandardized	SE	Standardized
Problem<->Emotion	.145*	.024	.403
Avoidance<->Emotion	.048	.020	.119
Avoidance<->Problem	.285*	.045	.353

\*indicates significant at p<.05

Note: Fit statistics for CFQ: DF=132;  $\chi^2=585.60$ ; CMIN/DF=4.44; CFI=.90, RMSEA=.082, LO 90=.076, HI 90=0.089, PCLOSE=.000, TLI=.88.

Table 15

Multi-Group Analysis on MTS by Gender

Item	Males			Females		
	Unstand	SE	Stand Est	Unstand	SE	Stand Est
1	1.000			1.000		
2	1.054	.155	.715	.872	.141	.536
3	1.070	.166	.646	1.069	.173	.532
4	.982	.152	.649	1.039	.158	.615
5	1.192	.179	.687	1.208	.181	.640
6	1.146	.167	.729	1.260	.183	.698
7	1.039	.156	.687	1.278	.190	.656
8	.846	.136	.609	1.119	.166	.659
9	.912	.136	.698	1.120	.163	.699
10	1.180	.181	.661	1.256	.192	.611
11	1.218	.174	.758	1.349	.194	.724

Table 16

Maximum Likelihood Estimates for Model 1

			Estimate	S.E.	Standard.
lot_scale	<---	MTS_scale	.222	.027	.341*
DRS_co	<---	MTS_scale	.079	.013	.261*
DRS_ch	<---	MTS_scale	.029	.016	.078
CFQ_Emotion	<---	lot_scale	.169	.057	.127*
CFQ_Problem	<---	MTS_scale	.185	.042	.203*
CFQ_Emotion	<---	MTS_scale	.251	.039	.289*
CFQ_Problem	<---	lot_scale	.062	.062	.044
CFQ_avoidance	<---	lot_scale	-.160	.075	-.099*
CFQ_avoidance	<---	MTS_scale	.035	.050	.033
CFQ_Problem	<---	DRS_co	.409	.130	.135*
CFQ_Emotion	<---	DRS_co	.179	.120	.062
CFQ_avoidance	<---	DRS_co	.096	.157	.027
CFQ_Problem	<---	DRS_ch	.254	.104	.102*
CFQ_Emotion	<---	DRS_ch	.172	.096	.072
CFQ_avoidance	<---	DRS_ch	-.160	.126	-.055

\*indicates significant at p<.05

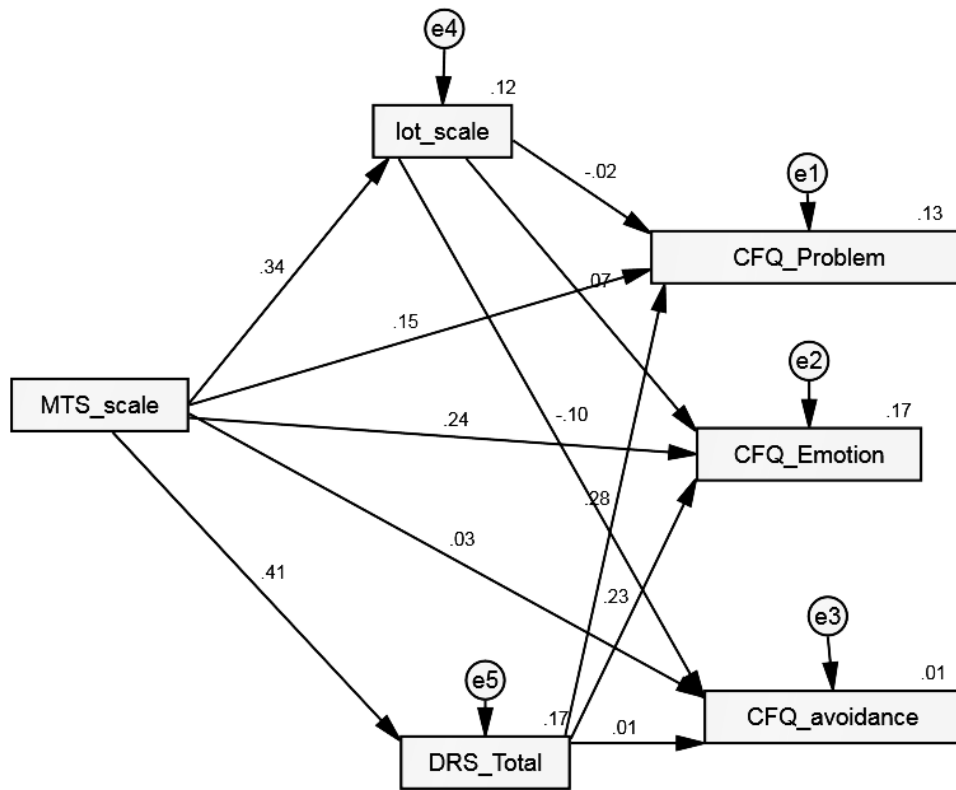


Figure 4. Path Diagram for Model 2. Fit statistics for model:  $DF=4$ ;  $\chi^2=169.09$ ;  $CMIN/DF=42.27$ ;  $CFI=.67$ ;  $RMSEA=.281$  (.25-.32);  $PCLOSE=.000$ ;  $TLI=-.24$

Table 17

*Maximum Likelihood Estimates for Model 2*

			Estimate	S.E.	Stand Estimates.
lot_scale	<---	MTS_scale	.222	.027	.341*
DRS_Total	<---	MTS_scale	.317	.030	.414*
CFQ_Problem	<---	MTS_scale	.138	.043	.151*
CFQ_Emotion	<---	MTS_scale	.205	.040	.237*
CFQ_avoidance	<---	MTS_scale	.033	.053	.032
CFQ_Problem	<---	lot_scale	-.022	.061	-.016
CFQ_Emotion	<---	lot_scale	.089	.056	.067
CFQ_avoidance	<---	lot_scale	-.166	.075	-.102*
CFQ_Problem	<---	DRS_Total	.332	.053	.278*
CFQ_Emotion	<---	DRS_Total	.260	.049	.230*
CFQ_avoidance	<---	DRS_Total	.019	.066	.014

\*indicates significant at  $p < .05$



Table 18

Maximum Likelihood Estimates for Model 3

			Estimate	S.E.	Stand Est.	P
lot_scale	<---	MTS_scale	.222	.027	.341	***
DRS_ch	<---	MTS_scale	.029	.016	.078	.072
DRS_co	<---	MTS_scale	.079	.013	.261	***
CFQ_Problem	<---	MTS_scale	.185	.042	.203	***
CFQ_Emotion	<---	MTS_scale	.251	.039	.289	***
CFQ_Problem	<---	lot_scale	.062	.062	.044	.319
CFQ_Emotion	<---	lot_scale	.169	.057	.127	.003
CFQ_Problem	<---	DRS_ch	.254	.104	.102	.014
CFQ_Emotion	<---	DRS_ch	.172	.096	.072	.074
CFQ_Problem	<---	DRS_co	.409	.130	.135	.002
CFQ_Emotion	<---	DRS_co	.179	.120	.062	.136

Table 19

Squared Multiple Correlations for Variables in Model 3

	R <sup>2</sup>
Emotion-Focused Coping	.148
Optimism	.116
Problem-Focused Coping	.097
DRS_control	.068
DRS_challenge	.006

Table 20

Fit Statistics for Gender Invariance

	DF	$\chi^2$	CMIN /DF	CFI	RMSEA (CI)	PCLOSE
Configural model	6	20.90	3.48	.95	.069 (.04-.10)	.14
Structural model	17	27.28	1.60	.97	.034 (.00-.06)	.86
Chi-Square Difference	$\chi^2_{D(11)}=6.38$					

Table 21

Maximum Likelihood Estimates for Gender Invariance on Model 3

	Males		Females			
	Estimate	S.E.	Estimate.	Estimate	S.E.	Estimate.
LOT-R←MTS	.234	.041	.379*	.212	.036	.313*
DRS_ch←MTS	-.010	.021	-.034	-.043	.018	-.128
DRS_co←MTS	.089	.020	.298*	.069	.017	.227*
CFQ_Problem←MTS	.033	.009	.269*	.033	.010	.192*
CFQ_Emotion←MTS	.177	.057	.231*	.306	.052	.327*
CFQ_Problem←LOT-R	.007	.014	.036	.012	.014	.047
CFQ_Emotion←LOT-R	.226	.089	.182*	.165	.075	.119*
CFQ_Problem←DRS_ch	.023	.165	.009	.053	.168	.017
CFQ_Emotion←DRS_ch	-.103	1.72	-.040	.050	.145	.018
CFQ_Problem←DRS_co	.053	.028	.131	.075	.031	.133*
CFQ_Emotion←DRS_co	.132	.177	.052	.177	.161	.058

\*indicates significant at  $p < .05$