Mental Toughness: Effect on Factors Associated with Injury and Illness in Adolescent Athletes

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This thesis titled
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Athletes

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Abstract

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Mental Toughness: Effect on Factors Associated with Injury and Illness in Adolescent Athletes

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Background: High school sports participation has increased in the past decade, notably in multiple sport participation and sport specialization by adolescent athletes. Stressful circumstances during training and competition can predispose athletes to overtraining syndrome and athlete burnout. Others have used a mental toughness training program to determine how athletes handle stressors during training and competition, and whether the training positively affects factors associated with illness and injury.

Objective: This study is an extension of previous research on mental toughness. This study measured the effect of a mental toughness intervention on mental toughness, somatic manifestation, athlete burnout, stress recognition, stress response, coping aptitude, and athletic performance. Participants: Six Caucasian male varsity track athletes from a rural public high school participated in this study. Methods: The participants completed instruments assessing mental toughness, athlete burnout, somatic manifestations, stress recognition, and stress response prior to, during, and at the conclusion of a 4-wk mental toughness intervention. The Mental, Emotional, and Bodily Toughness Inventory (MeBTough) was used for assessing mental toughness. Spearman rho correlation coefficients (r) assessed the relationships between mental toughness, athlete burnout, somatic manifestations, stress response, stress recognition, and coping
aptitude. A related sample Wilcoxon signed rank test was used to determine if the MeBTough, Athlete Burnout Questionnaire (ABQ), Cohen-Hoberman Inventory of Physical Symptoms (CHIPS), Stress Response Scale for Adolescents (SRSA), Brief Cope Inventory (BriefCOPE) and Perceived Stress Scale (PSS) scores after the intervention were significantly different than baseline scores. **Results:** At baseline, mental toughness displayed a negative relationship with athlete burnout \( r = -0.07 \), somatic manifestations \( r = -0.46 \), and stress recognition \( r = -0.17 \). There was a decrease in somatic manifestations \( P = 0.04 \) and athlete burnout \( P = 0.04 \) following the intervention. Active coping \( P = 0.04 \), use of emotional support \( P = 0.04 \), and planning \( P = 0.04 \) subscale scores of the BriefCOPE increased from pre- to postintervention. No significant change in mental toughness \( P = 0.17 \), stress recognition \( P = 0.34 \), or stress response \( P = 0.71 \) from pre- to postintervention was observed. Increases in mental toughness resulted in enhanced performance, most noticeably by a decrease in the team’s 4 x 800 m event time by 1 min. **Conclusion:** Though mental toughness was inversely related to athlete burnout and somatic manifestations in these 6 rural high school track athletes, a 4-wk mental toughness intervention did not improve their mental toughness. Future studies, including a longer intervention in a larger sample of a variety of athletes, are needed to assess the true impact of the online intervention on mental toughness scores and the factors associated with overtraining injury and illness.
Dedication

I dedicate this to Linda Suis Baker. Rest in peace. 04/07/1946-05/15/2014

“It’s something unpredictable, but in the end is right. I hope you had the time of your

life.” Billy Joe Armstrong
Acknowledgments

I would like to acknowledge Dr. Brian Ragan, for allowing me to use the Mental, Emotional, and Behavioral Toughness Inventory (MeBTough). I greatly appreciate the generous funding from the College of Health Sciences and Professions Student Research Grant that promoted the successful completion of my project. Finally, I would like to show my utmost appreciation to my thesis committee: Dr. Chad Starkey, Dr. Cheryl Howe, and Dr. Sheri Huckleberry.
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Chapter 1: Introduction

The following study is an extension of previous research on the effects of mental toughness on injury and illness. The participation of adolescents in sports has tremendously increased over the last decade. Koebler revealed that more than 7 million high school students (55.5% of all high school students) participated in sports in 2011; in 2013, high school participation reached 8 million. Participation by high school athletes is characterized by playing multiple sports during one sport season, specializing in only one sport throughout an entire school year. In either case, overtraining and athlete burnout risks have dramatically surged, increasing the consequences of injury or cessation of sports participation. Multiple state high school athletic associations in the United States, including North Carolina, West Virginia, and Ohio have implemented a mandatory rest period between sport seasons. However, many adolescent athletes play on competitive recreational or travel sports teams that do not follow the same regulations as high school associated sports.

With the increase in sport participation and specialization, paired with inadequate rest, OTS and athlete burnout is becoming more prominent. Limited research has revealed the benefits of a 6-wk online mental toughness intervention program on mental toughness in college athletes and its effect on injury and illness. However, little to no research has investigated the effect of a 4-wk online mental toughness intervention program on illness and injury, nor the effect of mental toughness training in adolescent athletes. Finally, no research has evaluated the relationship between a 4-wk mental toughness intervention and enhancement in athletic performance.
Injury and Specialization of Sport in Adolescent Athletes

With an increase of overtraining and decreased adequate rest, the risk of adolescent athletes being injured multiplies.\textsuperscript{5-8} Goldberg and colleagues\textsuperscript{7} reported that at least 3 million adolescent athletes are injured annually and seek medical care, either in the emergency department or physicians’ offices. In 2009, adolescent athletes (ages 15-17) visited the emergency department more often than any other age group as a direct result of athletic injury.\textsuperscript{8}

Mental Toughness, Overtraining, and Athlete Burnout

Loehr\textsuperscript{9} referred to mental toughness as “the ability to consistently maintain an ideal performance state during the most stressful situations.” (p10) Visram\textsuperscript{1} reported that mental toughness is related to factors associated with injury and illness. However, there is limited research that accesses adolescent athlete’s mental toughness and how it affects illness and injury. Adolescent athletes experience different stressors during competition and daily life as compared to other populations, which may result in this demographic responding differently to mental toughness training.

Athletes who are exposed to high levels of sport participation without adequate rest are at greater risk of overtraining injuries and illnesses.\textsuperscript{5,6,10,11} Overtraining Syndrome (OTS) is the body’s inability to recover from a high volume of training due to inadequate rest.\textsuperscript{10,11} Adolescent athletes who suffer from OTS may display signs of athlete burnout if adequate rest is not initiated. Athlete burnout is an emotional and/or physical condition that may affect performance.\textsuperscript{12,13} A factor that many experts believe may positively impact athlete burnout is mental toughness.\textsuperscript{1-3}
Mental Toughness and Athletic Performance

Coaches may ponder the question, whether an athlete’s performance is influenced more by physical or mental ability. Research has demonstrated that athletes who perform at an elite level display increased levels of mental toughness.\textsuperscript{1-3} Drees and Mack\textsuperscript{3} emphasized that athletes who scored higher on a mental toughness assessment were more successful during a wrestling season. Similar findings were revealed in national handball players, in which athletes with higher mental toughness levels were superior at shooting and coping with stressful situations.\textsuperscript{14}

Purpose

Based on previous studies, the following research project sought to evaluate athlete burnout, coping aptitude, somatic manifestations, stress recognition, stress response, and mental toughness in adolescent high school athletes.\textsuperscript{1-3} This study implemented a 4-wk online mental toughness training program (MeBTough), to determine its impact on mental toughness scores. Mental toughness scores and the association between athlete burnout, coping aptitude, somatic manifestations, stress response, and stress recognition before, during, and after the intervention were examined.

Professional Significance

The adolescent athlete has a variety of factors that could potentially affect their performance during competition. Stressors that adolescent athletes experience may enhance the risk of OTS and athlete burnout, which can affect the athletes’ performance and be detrimental to their longevity with their sport. Research has revealed that improved mental toughness may decrease the risk of OTS and athlete burnout.\textsuperscript{1}
Specific Aims

1. Assess the association among mental toughness and athlete burnout, somatic manifestation, coping aptitude, stress response, and stress recognition.

2. Assess the effect of an individualized, online intervention program (MeBTough) on mental toughness in adolescent athletes.

3. Assess the changes in mental toughness scores and factors associated with illness and injury in adolescent athletes.

4. Assess the impact of mental toughness on race times for adolescent track athletes.

Hypotheses

1. Mental toughness scores will be inversely associated with athlete burnout, somatic manifestation, stress recognition, and stress response; mental toughness scores will be directly associated with coping aptitude.

2. A 4-wk individualized online intervention program will increase mental toughness scores.

3. Increased mental toughness scores will positively impact athlete burnout, somatic manifestations, stress response, coping aptitude and stress recognition.

4. Increased mental toughness scores will enhance athletic performance on 4 x 800 m races.
Chapter 2: Literature Review

This chapter will provide information regarding the importance of this research as it pertains to injury and illness in adolescent athletes: (a) what is OTS, its signs and symptoms and how it is treated; (b) what is athlete burnout, its signs and symptoms and how it is treated; (c) stress and how it affects injury, illness, and athletic performance; and (d) coping with stressors, and assessment of mental toughness and mental toughness training.

Sport Injury

The number of high school athletes jumped 919% from 1971-72 to 2005-06, and continues to increase every year. A 2011 survey by the Nation Federation of State High School Association (NFHS) revealed 55.5% of all high school students participate in sports. The NFHS also reported that more than 7 million high schoolers participated in athletics during the 2010-2011 academic year. With the increase in high school students playing sports year after year, it is plausible there will be a related increase in the number of injuries occurring each year.

Injuries suffered by an adolescent athlete can be detrimental for the athlete, his/her parents, and his/her coaches. During the 2011-2012 through 2013-2014 school years, 47,014 injuries occurred, including 82.45% (38,765) non-time loss injuries and 17.55% (8,249) time loss injuries, by high school athletes. Goldberg and colleagues reported that at least 2 ½ million adolescent athletes are injured and seek medical care, either from the emergency department or physicians’ offices. In 2009, adolescent athletes ages 15-17 visited the emergency department more often than any other age
group secondary to athletic injury. The literature suggests that factors associated with OTS, athlete burnout, and/or stress affects performance level and enthusiasm for sport participation.

**Predictors of Sport Injury and Illness**

**Overtraining syndrome.** OTS is defined as the body’s inability to recover due to a high volume of training and lack of adequate recovery. This maladaptive response can persist for weeks to months, depending on the extent of physical activity. There are 85 different signs and symptoms that have been associated with overtrained athletes in the literature.

Participation in multiple sports or training for multiple seasons (multisport/season dilemma) is a key factor that can result in OTS in adolescent individuals. Rural high schools have fewer athletes, resulting in athletes participating in multiple sports to allow the school to field multiple teams. Of students enrolled in high schools with less than 800 students, 57% participated in multiple sports in one season. In high schools with an enrollment of more than 1,200 students, 28% participated in multiple sports in one season. Larger schools, which have enough student athletes to field multiple teams, do not have to recruit student athletes who are participating in other sports during a season.

Participating in multiple sports in one season and/or specializing in a single sport may deny the individual a true off-season and adequate rest. One study determined that out of 272 adolescent athletes, 41% reported a loss in motivation for training when participating in multiple sports at the same time. Mostafavifar et al. hypothesized that early sports specialization “hinders young athletes overall comprehensive motor skill
development and predisposes them to future injury, specifically musculoskeletal overuse injuries.

**Recommended treatment of overtraining syndrome.** The same methods may be used to prevent and to treat OTS. The incidence of OTS can be reduced by progressively increasing intensity of exercises over 6-12 wk. Time off between seasons is another strategy. For example, many states including NC, WV, and OH require 1 wk off between seasons for high school athletes participating in consecutive sports, while Bybee emphasizes high school athletes require at least a 2-mo rest period to prevent OTS from occurring. The Children’s Hospital of Colorado (CHC) states that each athlete should have at least 1 mo of rest between every 3 mo of competition. The CHC also recommends that adolescent athletes participate in only one sport per season. For athletes who have been diagnosed as having OTS should rest for several weeks with the resumption of training in short, low intensity bouts. Participation in stress management activities, including behavioral therapy and counseling, are effective in treating OTS. Total termination of training is not necessary.

**Athlete Burnout**

As previously stated, athlete burnout is an emotional and/or physical condition that may affect performance. Burnout negatively affects performance and is associated with becoming extremely fatigued due to the demands placed on individuals’ potential energy and physical strength. Athlete burnout is represented in adolescent individuals by two key symptoms: decreased emotional and physical attraction to training, and depreciation of one’s accomplishments and involvement in sports. Other
potential signs and symptoms include acute/chronic musculoskeletal pain and unexplained weight loss. Risk factors that may attribute to athlete burnout include: participating in more than one sport during a single season, increase in training, increased nervousness, and decreased confidence. If athlete burnout is not treated, it may result in cessation of sport participation.

**Recommended treatment for athlete burnout.** Rest is the effective treatment for athlete burnout. The time required for each individual adolescent varies from athlete to athlete. Research has suggested that short intervals of low intensity aerobic exercise that is not related to the sport the athlete plays is beneficial during the athletes off season.

**Overtraining effects on the human body.** Overload is an element of physical training required for enhanced athletic performance. Cellular responses occur within the body as a response to stress adaptation to physical training. Training regimens should allow for an adequate healing period to transpire, which will result in physical gains. Spending several hours training can be effective, but can also result in a decline in performance and increased fatigue. While overload is an important aspect of adaptation, inadequate time between training sessions may result in an abnormal recovery process. Inadequate rest time affects the musculoskeletal and pulmonary systems, potentially resulting in stress fractures and/or chronic destruction of muscular tissue.

**Stress’s effects on illness and injury.** The literature is inconclusive regarding the relationship between illness and stress in adolescent individuals. While some literature supports the idea that there is no relationship between stress and illness, there is
evidence that a relationship exists.\textsuperscript{1,12,16,29} Elevated stress levels have been observed to increase the risk of upper respiratory tract infections.\textsuperscript{31,32} Important games and practices that are psychologically demanding can result in injury if athletes perceive stressful situations as intimidating or scary.\textsuperscript{1,29} When athletes view a game situation as threatening, an increase in anxiety levels occurs, which can result in altered muscle tension and/or affect an athletes’ attention span.\textsuperscript{1,29} If athletes are distracted, they may be predisposed to otherwise preventable injuries during play.\textsuperscript{1,29-32} Studies have also revealed that socioeconomic status affects the amount of stress exposure that athletes experience, thereby increasing the likelihood of illness.\textsuperscript{37,38}

\textbf{Stress, burnout, and coping}. Higher burnout scores have a correlation with an increase in stress and decreased ability to cope in athletes.\textsuperscript{1,33} The management strategy employed can influence the affiliation amongst coping and athlete burnout in adolescent competitors during stressful situations.\textsuperscript{34,35} Mitigating factors that cause an adolescent athlete to portray an event as “threatening” may alleviate the stress response.\textsuperscript{33-36}

\textbf{Mental Toughness}

Loehr\textsuperscript{9} stated that mental toughness is, “the ability to consistently maintain an ideal performance state during the most stressful situations, which includes mental, physical, and emotional attributes.” (p26) In essence, athletes with higher mental toughness scores have the ability to overcome stressors, pressures, and challenges seen in athletic competition.\textsuperscript{1-3,14}

\textbf{Psychological (cognitive) aspect of mental toughness}. The psychological or cognitive aspects of athletic performance can affect the outcome of a competition.
English Channel swimmers stated that they used cognitive orientation, or positive self-talk, to enhance their performance, and finish strong.\textsuperscript{39} Individuals who possess higher levels of mental toughness are able to dismiss negative information that interferes with current goals and perform at a higher rate in school.\textsuperscript{40} Mental toughness has been noted to have an association with perception of injury. Visram\textsuperscript{1} reported that “Athletes with higher levels of mental toughness were found to report fewer injuries than their less mentally tough counterparts.” (p29) Athletes with more mental toughness also perceive their injuries to be less threatening.\textsuperscript{1-3,41-44}

**Physical aspect of mental toughness.** Being psychologically tough is a major factor in athletes’ success, but how does it affect the way athletes perform? Increases in performance resulting from an increase in mental toughness was found in 12-17-y-old national level table tennis players.\textsuperscript{40} Mentally tough individuals performed better when receiving negative and positive feedback on how they performed a task.\textsuperscript{42}

**Assessment of Mental Toughness**

**Mental Toughness 48 and Sports Mental Toughness Questionnaire.** The Mental Toughness 48 and Sports Mental Toughness Questionnaire are two instruments used to estimate mental toughness. Kobus “model of hardiness” influenced the creation of the Mental Toughness 48.\textsuperscript{45} However, Visram\textsuperscript{1} claims that “there are limited data on its psychometric properties, and a lack of the association between mental toughness and hardiness on which the scale is based, and thus, it lacks relevance to the construct of mental toughness.” (p27)
The Sports Mental Toughness Questionnaire was created as a result of copious amounts of mental toughness “fads” in previous research articles.\(^1\)\(^-\)\(^3\) This measurement tool has been observed to be a valid and reliable tool.\(^46\) However, researchers report the Sports Mental Toughness Questionnaire lacks a “theoretical framework.”\(^1\) (p27)

**Mental, Emotional, and Bodily Toughness Inventory (MeBTough).** The 43-item questionnaire calculates mental, physical, and emotional aspects of mental toughness.\(^1\)\(^-\)\(^3\) The physical dimension consists of being adequately equipped and acting tough, while the emotional aspect has four markers: flexibility, responsiveness, strength, and resiliency.\(^1\)\(^,\)\(^2\) Mental toughness is evaluated using three elements: managing stress, creating a positive psychological state, and accessing emotions.\(^1\)\(^-\)\(^3\)

**Mental Toughness Intervention Program**

The intervention program, MeBTough, was developed by Measuremental, LLC.\(^1\)\(^-\)\(^3\)\(^,\)\(^44\) The program provides mental toughness training based on athletes’ initial MeBTough score.\(^1\)\(^-\)\(^3\)\(^,\)\(^44\) Athletes’ actual scores are compared with expected scores to reveal their strengths and weaknesses.\(^1\) Athletes’ strengths and weaknesses are based on their individual scores compared to the expected MeBTough average scores (averages of other individuals who have completed this assessment). A personalized intervention program is created by assessing the mental toughness score and principal strengths and weaknesses (see Figure 1); specific exercises based upon strengths and weaknesses are provided to the athletes.
The mental toughness profile created from the MeBTough assessment is unique to each athlete. Previous studies have shown that 2 athletes can have similar scores, but have differing mental toughness profiles.1–3 Similarly, 2 athletes can have similar weaknesses but have different total scores.

**Effect of mental toughness on performance and factors of illness and injury.**

Mental toughness is an essential factor necessary for athletes to perform at a high level. Drees and Mack3 revealed that mental toughness, age, and seasons winning percentage were positively related. MeBTough score differences were observed between lower and upper classman and season records. However, mental toughness was not found to be positively related to experience or practice time.3 Researchers have also revealed that a mental toughness intervention significantly decreases athlete burnout (see Figure 2),
somatic manifestations (see Figure 3), stress recognition (see Figure 4), and enhances
winning percentage in collegiate women tennis players (see Figure 5).\textsuperscript{1,43}

\textbf{Figure 2.} Cohen-Hoberman Inventory of Physical Symptoms (CHIPS) scores at baseline, after weeks 2 and 4, and postintervention in Division III Field Hockey and Soccer teams. Figure 3 is reproduced with permission from Ragan B. Measuremental [Website]. Measuremental LLC; 2013. Copyright Brian Ragan.

\textbf{Figure 3.} Athlete Burnout Scale (ABQ) scores at baseline, after weeks 2 and 4, and postintervention in Division III field hockey and soccer teams.\textsuperscript{11,41} Figure 4 is reproduced with permission from Ragan B. Measuremental [Website]. Measuremental LLC; 2013. Copyright Brian Ragan.
Figure 4. Perceived Stress Scale (PSS) scores at baseline, after weeks 2 and 4, and post intervention in Division III field hockey and soccer Teams.\textsuperscript{11,41} Figure 5 is reproduced with permission from Ragan B. Measuremental [Website]. Measuremental LLC; 2013. Copyright Brian Ragan.

Figure 5: Comparison of college women tennis team winning percentage before and after the intervention.\textsuperscript{41} Figure 6 is reproduced with permission from Ragan B. Measuremental [Website]. Measuremental LLC; 2013. Copyright Brian Ragan.

Summary

High school sport participation and specialization is increasing annually, causing an increase in training levels without adequate rest, resulting in OTS and athlete burnout.
Stressors combined with prolonged exercise and minimal to no recovery time increases the likelihood of illness and/or injury.\textsuperscript{1,5,6,10,11} Adolescent athletes deal with a variety of stressors daily, occurring at home, school and athletic practices and competitions. Few investigations on how mental toughness affects stress and other factors associated with injury and illness have been initiated.

Loehr\textsuperscript{9} believed that mental toughness is “the ability to perform at the highest level of one’s ability regardless of the outside factors, and impacts how athletes respond to stress.” (p12) Visram\textsuperscript{1} agrees with Loehr’s principles of mental toughness, stating that “mental toughness is an adjuster of cognitive appraisal, and therefore, should enhance athletes’ abilities to handle mental, emotional, and bodily stress.” (p80) From previous investigations on this topic, one would think that increasing an athlete’s mental toughness would result in increased ability to cope with stressors, thus resulting in a decrease in OTS and athlete burnout.\textsuperscript{1-3} This study will further evaluate the effectiveness of mental toughness as a modifier of factors of injury and illness in adolescent athletes.


Chapter 3: Methods

Design

This research study used a pretest-posttest design that builds on a previous study conducted by Visram, who studied mental toughness in college athletes over a 6-wk period.¹ The present study evaluated the effects of the MeBTough program over a 4-wk period on physical and psychological factors of illness and injury in adolescent athletes.

Participants

A total of 13 athletes were recruited from one varsity track team at a rural high school in West Virginia. Data collection began at the beginning of March 2014 and concluded at the end of April 2014. The team began preseason practices in the end of February 2014, and participated in 12 meets. Of the 13 recruited athletes, 6 athletes completed the 4-wk mental toughness intervention following baseline measures and were therefore included in the analysis. The other 7 athletes dropped out of the study prior to the intervention program and baseline data collection.

Inclusion and exclusion criteria. Athletes were screened and selected for enrollment into the study based on the following criteria: (a) age 14 to 18 y; (b) participated in varsity track at the identified rural high school. Athletes who volunteered to complete the screening process and met all criteria were officially enrolled in the study. All participating athletes under 18 y had a legal guardian sign a parent/legal guardian informed consent form, and the student signed the informed assent form approved by the Ohio University Institutional Review Board (see Appendix B, C, and D).
**Sociodemographic information.** All participants completed a brief demographics questionnaire (see Appendix E). All athletes' parents/legal guardians completed a sociodemographic questionnaire (see Appendix F). This information allowed researchers to compare mental toughness and socioeconomic status.

**Sports medicine injury reports.** Illnesses and injuries that occurred during this study were evaluated by the athletic trainer and were documented on the Sports Medicine Injury Report Form (see Appendix G).

**Questionnaires**

This study incorporated six questionnaires. These questionnaires included topics regarding mental toughness, somatic manifestation, athlete burnout, stress response, stress recognition, and coping inventories.

**Mental, Emotional, and Bodily Toughness Inventory (MeBTough).** The Mental, Emotional, and Bodily Toughness Inventory (MeBTough) is a 43-item mental toughness measurement tool designed to evaluate 9 components of mental toughness. Each subject indicated on a 7-point scale (1 = almost never, 4 = sometimes, 7 = almost always) how exposed he was to the example provided in the statement. Measuremental scored 11 of the items by reverse order to decrease the possibility of athletes picking the top possible score. Athletes who had an elevated level of mental toughness displayed higher total scores. Possible scores range from 200-800, with lower scores representing relatively less mental toughness. The MeBTough is both valid and reliable in regards to quantifying mental toughness within the athletic realm.¹,⁴³,⁴⁴
**Athlete Burnout Questionnaire (ABQ).** The Athlete Burnout Questionnaire (ABQ) is a multidimensional inventory that contains 15-items that assess three subscales of sport burnout. Answers range from 1 = almost never to 5 = most of the time. All answers are indicated on a 5-point scale. The ABQ scale has been observed as a valid and reliable measure.\(^{47}\)

**Stress Response Scale for Adolescents (SRSA).** The Stress Response Scale for Adolescents (SRSA) measures how much situations in one’s life are considered to be stressful. Thirty-four stress response items show how random and overwhelming adolescent individuals find their lives. SRSA is a valid and reliable tool for measuring stress response in adolescent individuals.\(^{48}\)

**Cohen-Hoberman Inventory of Physical Symptoms (CHIPS).** The Cohen-Hoberman Inventory of Physical Symptoms (CHIPS) assessed 33 somatic manifestations that a participant may have felt within the last 2 wk. Answers range from 0 = not bothered by it, to 4 = extremely bothered by it. Lower scores indicated that individuals were less concerned by somatic manifestations. All answers are indicated on a 5-point scale. CHIPS is a reliable and valid tool for adolescent individuals.\(^{49}\)

**Brief Cope Inventory (BriefCOPE).** The Brief Cope Inventory (BriefCOPE) is a 28-item inventory that includes 14 subscales with 2 items each. The inventory uses a 4-point Likert scale with answer possibilities ranging from 1 = I haven’t been doing this at all, to 4 = I’ve been doing this a lot. Global scores are not calculated for this instrument. Each subscale was scored individually, displaying how the patient uses each strategy. This measure is a valid and reliable tool.\(^{50}\)
Perceived Stress Scale (PSS). The Perceived Stress Scale (PSS) is a 10-item tool that measures perception of stressful situations within the past month. A response interval of 2 wk was implemented for this study, secondary to the length of the training program (see Table 1). A 5-point Likert scale is used for this measure. Answers range from 1 = never to 5 = very often. Higher scores indicate elevated levels of stress recognition. The PSS is a valid and reliable measure of stress recognition.\textsuperscript{1,51}

Study Protocol

Phase 1: Recruitment. Adolescent athletes received flyers (see Appendix A), the address to the study’s website, and information about the recruitment visit by the primary researcher. Recruitment visits allowed the athletes to receive more information and ask questions about the study. Interested athletes were asked to attend the screening and baseline testing sessions (Phase 2).

Phase 2: Screening and baseline testing. At this time, the athletes were asked to complete a written demographic questionnaire, ABQ, SRSA, CHIPS, BriefCOPE, and PSS. The parents/legal guardians of the athletes were asked to complete a sociodemographic questionnaire. Participants registered for the mental toughness intervention program and completed the MeBTough inventory online at Measuremental LCC’s website: http://www.measuremental.com/services.html. Baseline testing was completed in a computer lab, where students were allowed privacy in completing the required questionnaires.

Phase 3: Implementation of the MeBTough program. Following baseline measures, athletes were assigned login information for the 4-wk online mental toughness
The intervention was created by Measuremental LLC (Indianapolis, IN) and was administered via Measuremental’s online training website. Subjects were provided an account and became Measuremental clients. Throughout the intervention, athletes received training exercises electronically from the Measuremental team. The athletes were offered the freedom to complete all of the daily assignments or only those they wished to complete. Each day, the exercise and its theoretical basis were provided via their MeBTough online account, as well as a summary of assigned tasks. In addition to recapping the main points, this task list allowed clients to take ownership of the activities that empowered them to develop mental toughness. Users were often asked to implement action steps over the course of several days to reinforce the benefits and to encourage them to continue to focus on their mental toughness goals. Samples of exercises that were included in the intervention are provided in Appendix H.

**Phase 4: Midintervention testing.** Over the course of the 4-wk intervention, all athletes were administered the Brief Cope, CHIPS, and PSS instruments at the conclusion of weeks 2 and 4 of the intervention. At each time point, data was collected before daily practices, and at least one day before or after a day of track meet in hardcopy format. This phase was based on previous research.¹

**Phase 5: Postintervention testing.** At the conclusion of the 4-wk intervention, all athletes were administered the MeBTough, ABQ, SRSA, Brief Cope, CHIPS, and PSS to reassess the scores. Postintervention measures were completed 2 to 4 days succeeding the conclusion of the 4-wk intervention. The testing took place at the high school where the athletes attended.
Phase 6: Follow-up testing. Two weeks after the completion of the intervention, all athletes completed the MeBTough Inventory one last time to compare pre- and postintervention results. This phase was based on previous research.1

Potential Harm

The potential harm linked with this study was marginal. Athletes had the potential to feel slight mental fatigue while finishing questionnaires.

Table 1: Implementation of Assessments: Timeline of Study

<table>
<thead>
<tr>
<th></th>
<th>Week 0</th>
<th>Week 1</th>
<th>Week 2</th>
<th>Week 3</th>
<th>Week 4</th>
<th>Week 5</th>
<th>Week 6</th>
<th>Week 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>MeBTough</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>ABQ</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BriefCOPE</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>PSS</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>SRSA</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>CHIPS</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Time Commitment</td>
<td>45</td>
<td>15</td>
<td>45</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Min)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Week 0: Baseline testing. Weeks 1-4: Intervention. Week 5: Posttesting. Week 7: Follow-up testing.

Data Analysis

Statistical Package for the Social Sciences (SPSS) 21.0 was used for analysis of data. Data were inspected to reveal if variables had normal distributions, and descriptive
statistics for the output measures were expressed as mean ± standard deviation. Significance level for all analyses was set at \( P \leq 0.05 \).

All baseline data were combined for analyses. Spearman rho correlation coefficients (\( r \)) were used to assess the associations between mental toughness, athlete burnout, somatic manifestations, stress response, stress recognitions, and coping aptitude. The efficacy of the intervention was investigated using baseline and posttesting MeBTough data. A related sample Wilcoxon signed rank test was used to determine if the MeBTough, ABQ, CHIPS, SRSA, BriefCOPE and PSS scores after the intervention were significantly different than baseline scores.
Chapter 4: Results

This chapter presents the findings for all the specific aims. All 6 athletes participated in baseline, midintervention, postintervention, and follow-up data collection.

Baseline

**Athlete characteristics.** All 6 male (17.3 ± 0.8 y) athletes competed in high school track at the time of this study. All participants were Caucasian. In this sample, 4 (66.7%) of the athletes competed in track for more than 5 y. A majority of the athletes (83.3%) participated in multiple sports during the spring sports season. All athletes denied a history of diagnosed psychological conditions. Half of the athletes were from families whose incomes were $50,000 to $89,999. All other athletes were from families whose incomes were < $50,000. One athlete (0.16%) qualified for a free lunch program.

**Baseline scores.** ABQ (29.50 ± 2.10), CHIPS (13.20 ± 3.90), and PSS (18.00 ± 1.50) total scores were inversely correlated with the MeB Tough total scores (see Table 2). MeB Tough total scores and BriefCOPE subscales Denial ($r = -0.83$, $P \leq 0.05$) and Use of Emotional Support ($r = -0.96$, $P \leq 0.01$) revealed negative relationships. A majority of the athletes’ (83.3%) strengths indicated by the MeB Tough questionnaire was “Acting Tough.” The other 2 athletes displayed strengths in “Emotional Toughness” (empowering emotions and emotional flexibility). The biggest weakness for 4 of the athletes was “Emotional Toughness” (empowering emotion, emotional responsiveness, and emotional resiliency). “Optimal State” and “Being Well Prepared” were also weaknesses of the group at baseline.
Table 2: Spearman rho Correlation Coefficients Among Baseline Total Scores

<table>
<thead>
<tr>
<th></th>
<th>MeBTtotal</th>
<th>ABQtotal</th>
<th>CHIPStotal</th>
<th>PSStotal</th>
<th>SRSAtotal</th>
</tr>
</thead>
<tbody>
<tr>
<td>MeBTtotal</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABQtotal</td>
<td>-0.07</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHIPStotal</td>
<td>-0.46</td>
<td>0.38</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PSStotal</td>
<td>-0.17</td>
<td>0.44</td>
<td>0.66</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>SRSAtotal</td>
<td>0.08</td>
<td>0.27</td>
<td>0.75*</td>
<td>0.75*</td>
<td></td>
</tr>
</tbody>
</table>

MeBTtotal = Mental, Emotional, and Bodily Toughness Inventory total score, ABQtotal = Athlete Burnout Questionnaire total, CHIPStotal = Cohen-Hoberman Inventory of Physical Symptoms total, PSStotal = Perceived Stress Scale total, SRSAtotal = Stress Response Scale for Adolescents total.

*P ≤ 0.05 denotes a statistical significance.

Change in Total Scores

MeBTough scores from baseline, postintervention, and follow-up are presented in Table 3. MeBTough scores increased by approximately 7 points from baseline to postintervention, and by approximately 25 points from postintervention to follow-up testing (see Figure 6). CHIPS (P = 0.04) and ABQ (P = 0.04) postintervention scores decreased. BriefCOPE active coping (P = 0.04), use of emotional support (P = 0.04), and planning (P = 0.04) subscale scores increased from pre- to postintervention. PSS (P = 0.34) and SRSA (P = 0.71) postintervention scores did not display a significant change.

“Emotional Flexibility,” “Emotional Responsiveness,” and “Well Preparedness” were strengths found after the intervention. “Emotional Responsiveness” and “Optimal State” were determined to be the biggest weaknesses after the program.
Table 3. Numerical Results from Questionnaires from Baseline to Follow-up

<table>
<thead>
<tr>
<th>Time Point</th>
<th>MeBTough</th>
<th>ABQ</th>
<th>CHIPS</th>
<th>PSS</th>
<th>SRSA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>Baseline</td>
<td>Baseline</td>
<td>Baseline</td>
<td>Baseline</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>After Week 2</td>
<td>After Week 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Post</td>
<td>Post</td>
</tr>
<tr>
<td>Mean</td>
<td>459.17</td>
<td>29.50</td>
<td>13.20</td>
<td>18.00</td>
<td>52.83</td>
</tr>
<tr>
<td>SD</td>
<td>21.10</td>
<td>2.10</td>
<td>3.90</td>
<td>1.50</td>
<td>3.50</td>
</tr>
<tr>
<td>Range</td>
<td>366-515</td>
<td>25-38</td>
<td>0-25</td>
<td>16-25</td>
<td>43-65</td>
</tr>
<tr>
<td>P values</td>
<td>0.17</td>
<td>0.04*</td>
<td>0.04*</td>
<td>0.34</td>
<td>0.71</td>
</tr>
</tbody>
</table>

*P \leq 0.05 denotes a statistically significant difference.

**Injury and illness data.** No injuries and one illness were reported during the study period. The ill athlete did not miss any practices or competitions during the intervention.
Mental Toughness and Athletic Ability

After completing a questionnaire about the intervention, all athletes stated that the intervention enhanced their ability to perform. One athlete stated, “When we started the training program, I was only able to run fast during the beginning of my meets. Now, I perform at a high level at the beginning, during, and end of my meets.” Another athlete wrote in a journal entry that he had decreased his time by 8 s since the previous meet. A relationship was revealed between MeBTough scores and 4 x 800 m times ($r = -0.95$, $P \leq 0.01$). All members of the team participating in the 4 x 800 m dash displayed faster times throughout the study, decreasing times by approximately 1 min to break a school record. Figure 7 displays the changes in the 4 x 800 m team times before, during, and after the intervention. In addition to performing better, the athletes felt more mentally prepared for practices and competition. In a sport that involves a strong mental component, having a proper mindset may result in better performance outcomes.

**Figure 6.** Changes in mean MeBTough scores throughout the duration of the study.
**Exercises and Journal Entries**

Athlete 1 completed all exercises and journal entries during the intervention. The athlete stated, “I tied the school record in high jump. This program has made me more collected and mellow; that helps me strategize while running.” At the end of the intervention, the athlete denoted, “I am mentally tougher because I am performing at a higher level and it will make me state bound this year.” This athlete scored the highest score on the MeBTough (532/800) and increased his score by 45 points throughout the program.

![Times (Minutes)]

**Figure 7.** Changes in 4 x 800 m times before, during, and after the intervention indicating improved performance.

Of 28 journal entries, athlete 2 completed 26 and completed all the exercises. Initially, the athlete identified, “I’m looking to better myself as an athlete mentally and physically. I tend to become lazy at practices at times, which causes me not to focus during practice and competition.” At the conclusion of the intervention, the athlete indicated, “I have the ability to reach my goals. Dedication and the will to win has helped
me accomplish my goals.” This athlete scored 461 on the MeBTough following the intervention, a 27-point increase from baseline.

All 28 exercises and journal entries were completed by athlete 3. At the beginning of the program, athlete 3 explained, “before a competition, if I begin to get discouraged, I use my affirmation statement to build myself up and counter any negative thoughts that come my way.” Following the mental toughness program, the athlete noted, “My friends have noticed me having more confidence and that I run faster. I also believe that this is true and is helping me keep an overall better mindset.” This athlete scored 434 on the MeBTough at baseline, and increased his score by 28 points following the intervention.

Athlete 4 completed all exercises and five journal entries during the intervention. The athlete explained that saying the phrases in his affirmation statement helped him perform at a higher level. At the conclusion of the program, the athlete stated, “I never could get under 5 minutes, but I want to keep trying.” This athlete’s MeBTough score decreased during the program, from 515 to 493, a decrease of 22 points.

Athlete 5 completed all exercises, but no journal entries. This athlete recorded the lowest MeBTough score at baseline (366/800). This individual athlete’s score decreased at the conclusions of the program by 32 points (334). This decreased score may be attributed to the noncompliance seen throughout the program.

Athlete 6 completed all exercises and journal entries. The athlete indicated, “I had a meet on Saturday, and when I was running I kept repeating my statement in my head and I stayed motivated.” At the conclusion of the study, the athlete recognized, “this program has boosted my confidence and I run harder and prepare better.” Athlete 6’s
MeBTough score increased from 461 to 509, the largest increase seen in this sample of athletes completing the program.

All athletes that revealed increases in mental toughness stated that their confidence increased. The aforementioned athletes also indicated that the affirmation statement from an exercise helped them remain calm during stressful situations. A lack of compliance during the study may have resulted in decreases in mental toughness from pre- to postintervention in 2 of the 6 athletes.
Chapter 5: Discussion

This thesis was an extension of prior studies designed to assess the relationship between mental toughness and somatic manifestations, athlete burnout, stress recognition, coping aptitude, and stress response.\textsuperscript{1,3} This study also evaluated the effect of mental toughness training on these same factors related to injury and illness, as well as athletic performance in adolescents. The study revealed that greater MeBTough total scores were related to lower ABQ, CHIP, and PSS total scores. Visram\textsuperscript{1} also revealed a relationship between greater mental toughness scores and lower athlete burnout and PSS scores. Common strengths of the 6 high school track athletes included “Acting Tough,” “Emotional Flexibility,” and “Empowering Emotions.” Common weaknesses included “Emotional Resiliency” and “Emotional Responsiveness.” A 4-wk online intervention resulted in statistically significant changes in somatic manifestations, athlete burnout, and coping aptitude, but not in mental toughness, stress recognition, or stress response. However, emotional toughness was strengthened following the intervention in the 6 athletes. Finally, though mental toughness did not significantly increase following the online intervention, the athletes attributed their improved run performance to their completion of the 4-wk intervention.

Previous research demonstrated that mentally tough individuals have the ability to cope more efficiently with adverse factors of daily life.\textsuperscript{1,3} However, it has also been found that lower socioeconomic status is related to higher PSS scores.\textsuperscript{52} In the current study, the athletes whose parents earned less than $50,000 annually, had higher PSS scores, regardless of their mental toughness scores.
The overall mental toughness scores of the athletes consistently increased throughout the program, but not at statistically significant levels. These results were not similar to those of prior studies that revealed an increase in mental toughness scores as a result of the intervention. The lack of statistical significance may be an indication that a 6-wk mental toughness intervention cannot be condensed into 4 wk and/or small sample size.

The intervention revealed a statistically significant impact on somatic manifestations, coping aptitude, and athlete burnout, decreasing CHIPS and ABQ scores from pre- to postintervention, and increasing positive coping strategies (active coping, use of emotional support, and planning) from pre- to postintervention. A decrease in somatic manifestations and athlete burnout may reduce the likelihood of athletes developing OTS. Increasing coping aptitude may enhance the athlete’s ability to overcome stressful situations and, therefore, reducing the risks of OTS and athlete burnout. Furthermore, athletes stated that they felt more energized and enthusiastic about competing. Previous research evaluating mental toughness displayed a significant impact on athlete burnout, coping aptitude, stress recognition, mood state, and depression.

Both PSS and SRSA results were inconclusive. The PSS scores increased from baseline to midintervention and then decreased at the end of the program. This variable response over time could be attributed to increased demands of their sport midseason, followed by improved stress management as the intervention progressed. The SRSA remained numerically unchanged throughout the study, suggesting the level of stress that the athletes were facing did not change. However, the responses to the stressful situations
were more positive (eg, full of pep, lively) compared to negative responses (eg, tense, angry, discouraged). This would suggest that the intervention did not decrease the amount of stress, but potentially changed distress to eustress, resulting in athletes’ ability to better overcome stressful situations.

Completion of exercises and journal entries appeared to help athletes increase their mental toughness scores. These findings are similar to previous research.\textsuperscript{1,3} The affirmation statement that was created by the athletes during the intervention appeared to assist the athletes in keeping calm and overcoming stressful situations. Athletes who completed five or fewer journal entries displayed decreases in mental toughness scores from baseline to posttest.

**Limitations**

**Low sample size.** It was difficult to recruit athletes who remained compliant throughout the study. This may be because the athletes did not fully understand the intervention.

**Length of intervention.** This study questioned whether a 6-wk intervention could be condensed to 4-wk. Prior research using a 6-wk intervention revealed a larger increase in mental toughness and decrease in stress recognition.

**Mood dependent measures.** Some instruments asked how the athlete felt at the exact moment, which could skew the data, because answers were not limited to feelings directly related to sports. Instruments could also be affected if the athlete felt ill or had a traumatic experience during the previous 2 wk. Furthermore, there was no way to calculate how compliant the athlete is when completing the instruments.
Future Research

Future research related to mental toughness should include follow-up studies years after completion of the intervention to determine the duration of the effects. Athletes in this study completed a follow-up examination 2 wk after the completion of the intervention. The changes between posttest and follow-up totals were considerably larger than changes between pretest and posttest totals. Follow-up measures months to years later would allow researchers to determine if effects were maintained, or if they were lost or decreased with time.

Another aspect of this study that should be further evaluated is the use of a control (no treatment) group for comparison to the group receiving the intervention created by Measuremental LLC. Having a control group may allow researchers to see the true effectiveness of this intervention on adolescent athletes. Additionally, comparing male and female athletes would allow researchers to determine if one sex is more receptive or responsive than the other. Using team sports, such as football and basketball, as opposed to an independent sport such as track and field could also display different results. Finally, it would be useful to compare mental toughness in rural high school athletes who participate in multiple sports in a single season with urban high school athletes who participate in one sport.

The measures used with the intervention could be changed in future research. Previous research has revealed a cross-sectional relationship with mental toughness, mood state, and depression in collegiate athletes, but no research has shown a relationship among these variables in adolescent athletes.¹
Finally, grade point average of the athletes should be evaluated during future research to determine if an increase in mental toughness is related to higher grade point averages. This may allow researchers to reveal if mental toughness can affect not only what an athlete does in a respective sport, but also in other facets of life.

**Conclusion**

Adolescent athletes who participate in multiple sports in a single season experience increased training volume and decreased amounts of adequate rest. Long-term occurrences of imbalances between demands and resources can result in illness and injury. Mental toughness positively modifies cognitive appraisal of stressful situations, reducing the risk of psychological and physical injury and illness.

In this study, 6 high school track athletes were studied to determine the relationship between mental toughness and factors associated with injury and illness and whether a 4-wk online intervention can enhance mental toughness and thus reduce the risk of injury and illness. It was found that elevated mental toughness scores were connected with decreased athlete burnout and somatic manifestations and increased coping aptitude in adolescent athletes. The 4-wk intervention decreased somatic manifestation and athlete burnout scores in all of the athletes and resulted in enhanced performance. However, the 4-wk intervention did not produce statistically significant increases in mental toughness levels or decreases in stress recognition. Therefore, mental toughness training may potentially decrease somatic manifestations and athlete burnout, increase coping aptitude, and enhance athletic performance in adolescent athletes.
References


52. Adler NE, Boyce T, Chesney MA, et al. Socioeconomic status and health: the
Appendix A: Recruiting Flyer

MENTAL TOUGHNESS TRAINING PROGRAM

- Are you a male high school basketball player between the ages of 14-18 years old?
- Would you like to be a part of a research study at Ohio University?

If you answered yes to these questions, you may be eligible to participate in this study!

Participate in Mental Toughness Training Program and answer questionnaires

Earn a chance to win up to 3 $50 gift cards

Free Mental Toughness Training Program

Please leave your contact information or email the research team!

OHIO UNIVERSITY
Frank Baker, AT, EMT-B
fb607512@ohio.edu
http://fb607512.wix.com/mentough-inventory
Appendix B: Consent Form

OHIO UNIVERSITY CONSENT FORM

**Title of Research:** Impact of a Mental Toughness Training Program on the Psychological and Physical Predictors of Illness and Injury in Adolescent Athletes  
**Researchers:** Frank Baker, AT and Cheryl Howe, Ph.D.

You are being asked to participate in a research project. For you to be able to decide whether you want to participate in this project, you should understand what the project is about as well as the possible risks and benefits in order to make an informed decision. This process is known as informed consent. This form describes the purpose, procedures, possible benefits, and risks. It also explains how your personal information will be used and protected. Once you have read this form and your questions about the study are answered, and you agree to participate, you will be asked to sign it. You should receive a copy of this document to take with you.

**Explanation of Study**

The purposes of this study are to determine if there are associations between mental toughness levels and mood disturbances, such as athlete burnout, stress, coping ability, and physical symptoms experienced. This study will also identify the effectiveness of a Mental Toughness Training Program at increasing mental toughness levels in adolescent athletes. If you agree to participate, you will receive an e-mail from the Mental Toughness Training Program website and will be asked to fill out a daily journal over a 6-week period. To measure the program’s effectiveness, you will be asked to complete several questionnaires about demographic information, mental toughness, athlete burnout, perceived stress, coping ability, and physical symptoms at several time points before, during and after the program. You should not participate in this study if you are not between the ages of 14-18 years old and are not a high school athlete who participates in varsity athletics. All study visits will take place at your high school and are outlined below.

**Visit 1.** During visit 1, you will be asked to complete 8 different questionnaires: demographic questionnaire, the Mental, Emotional, Bodily Toughness Inventory (MeBTough), Athlete Burnout Questionnaire (ABQ), Stress Response Scale for Adolescents (SRSA), Cohen-Hoberman Inventory of Physical Symptoms (CHIPS), Brief Cope Inventory (BriefCOPE), and the Perceived Stress Scale (PSS). Your parent/legal guardian will be asked to fill out a Sociodemographic questionnaire. You will also receive directions on how to fill out your journal entries on the MeBTough website. During this visit, you will be allowed to ask any questions about the study. This meeting will take place during pre-season and will take 45 minutes to 1 hour.

**Visit 2 & 3.** This meeting will take place before one of your practices during weeks 2 and 4. During these visits, you will be asked to fill out the BriefCOPE, PSS, and CHIPS questionnaires. While completing these questionnaires, you will be allowed to ask any questions of the research team. This visit will take 15-30 minutes.

**Visit 4.** This visit will take place before the beginning of a practice at your high school following the 6th week of the program. You will again be asked to complete the seven questionnaires (MeBTough, ABQ, BriefCOPE, PSS, SRSA, and CHIPS) that you completed during the first visit. This visit should take 45 minutes.
Visit 5. Two weeks after the program is over, you will once again be asked to complete the MeBTough inventory during this final meeting. This should take 10-15 minutes.

Possible Risk and Discomforts
There are minimal risks associated with being involved in this study. You may experience negative feelings when filling out questionnaires asking you to evaluate different aspects about yourself, but those feeling should be temporary.

Benefits
You may not benefit from participation in this study. Participation could result in an increase in mental toughness, which may result in enhanced athletic ability or reduction of injury or illness.

Confidentiality and Records
Your information will be treated as privileged and confidential. You will not be personally identified if the results are published. All data collected will be numerically coded for data analysis, thereby assuring anonymity for all individuals. No individual data will be identifiable in any publication resulting from this research. Your study information will be kept confidential by keeping all personal information in a cabinet until the study is over. After the study has been published, all personal information will be destroyed and only numerically-coded data will be maintained.

Compensation
Participants that complete at least 80% all the required testing materials, including the questionnaires and the daily journal entries, will be entered into three separate drawings for a $50 gift card from either Wal-Mart, Target, or Dunham’s following weeks 3, 6, and 10.

Request for Additional Information
You are encouraged to ask questions about the study. The researchers will attempt to answer all your questions to the best of their knowledge. The researchers fully intend to conduct the study with your best interest, safety, and comfort in mind. Should you have any questions about your treatment or any other matter relative to your involvement in the project, or if you experience research related issues at any time during this study, you may contact Frank Baker at (740) 856-8435 (fb607512@ohio.edu) or Dr. Cheryl Howe at (740) 593-2388 (howec@ohio.edu) at any time. If you have any questions regarding your rights as a research participant, please contact Jo Ellen Sherow, Director of Research Compliance, Ohio University, (740)593-0664.

By signing this consent form, you are agreeing that:
- You have read this consent form (or it has been read to you) and have given the opportunity to ask questions and have them answered.
- You have been informed of potential risks to you and have been explained to your satisfaction.
- You understand Ohio University has no funds set aside for any injuries you might receive as a result of participating in this study.
- You are 18 years of age or older.
- You participation in this research is completely voluntary.
- You may leave the study at any time. If you decide to stop participating in the study, there will be no penalty to you and you will not lose any benefits to which you are otherwise entitled.

Print your name

Date

Signature

Please do not write in this box:

<table>
<thead>
<tr>
<th>Study Representative Statement:</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have explained the purpose of the research, the study procedure, the possible risks and discomforts, the possible benefits, and have answered any questions to the best of my ability.</td>
</tr>
</tbody>
</table>

Study Representative Name (print or type)

Signature

Date
Appendix C: Parental Consent Form

OHIO UNIVERSITY PARENTAL CONSENT FORM

Title of Research: Impact of a Mental Toughness Training Program on the Psychological and Physical Predictors of Illness and Injury in Adolescent Athletes

Researchers: Frank Baker, AT and Cheryl Howe, Ph.D.

Your child is being asked to participate in a research project. For you to be able to decide whether you want your child to participate in this project, you should understand what the project is about as well as the possible risks and benefits in order to make an informed decision. This process is known as informed consent. This form describes the purpose, procedures, possible benefits, and risks. It also explains how your child’s personal information will be used and protected. Once you have read this form and your questions about the study are answered, and you agree to participate, you will be asked to sign it. You should receive a copy of this document to take with you.

Explanation of Study

The purposes of this study are to determine if there are associations between mental toughness levels and mood disturbances, such as athlete burnout, stress, coping ability, and physical symptoms experienced. This study will also identify the effectiveness of a Mental Toughness Training Program at increasing mental toughness levels in adolescent athletes. If you agree to allow your child to participate, your child will receive an e-mail from the Mental Toughness Training Program website and will be asked to fill out a daily journal over a 6-week period. To measure the program’s effectiveness, your child will be asked to complete several questionnaires about demographic information, mental toughness, athlete burnout, perceived stress, coping ability, and physical symptoms at several time points before, during and after the program. Your child should not participate in this study if he is not between the ages of 14-18 years old and is not a high school athlete who participates in varsity athletics. All study visits will take place at your high school and are outlined below.

Visit 1. During visit 1, your child will be asked to complete 8 different questionnaires: demographic questionnaire, the Mental, Emotional, Bodily Toughness Inventory (MeBTough), Athlete Burnout Questionnaire (ABQ), Stress Response Scale for Adolescents (SRSA), Cohen-Hoberman Inventory of Physical Symptoms (CHIPS), Brief Cope Inventory (BriefCOPE), and the Perceived Stress Scale (PSS). Your will be asked to fill out the Sociodemographic questionnaire. Your child will also receive directions on how to fill out their journal entries on the MeBTough website. During this visit, you and your child will be allowed to ask any questions about the study. This meeting will take place during pre-season and will take 45 minutes to 1 hour.

Visit 2 & 3. This meeting will take place before one of your child’s practices during weeks 2 and 4. During these visits, your child will be asked to fill out the BriefCOPE, PSS, and CHIPS questionnaires. While completing these questionnaires, your child will be allowed to ask any questions of the research team. This visit will take 15-30 minutes.

Visit 4. This visit will take place before the beginning of a practice at your child’s high school following the 6th week of the program. Your child will again be asked to complete the seven questionnaires (MeBTough, ABQ, BriefCOPE, PSS, SRSA, and CHIPS) that he completed during the first visit. This visit should take 45 minutes.

Visit 5. Two week after the program is over, your child will once again be asked to
complete only the MeBTough inventory during this final meeting. This should take 10-15 minutes.

**Possible Risk and Discomforts**
There are minimal risks associated with being involved in this study. Your child may experience negative feelings when filling out questionnaires asking him to evaluate different aspects about himself, but those feeling should be temporary.

**Benefits**
Your child may not benefit from participation in this study. Participation could result in an increase in mental toughness, which may result in enhanced athletic ability or reduction of injury or illness.

**Confidentiality and Records**
Your child’s information will be treated as privileged and confidential. Your child will not be personally identified if the results are published. All data collected will be numerically coded for data analysis, thereby assuring anonymity for all individuals. No individual data will be identifiable in any publication resulting from this research. Your child’s study information will be kept confidential by keeping all personal information in a cabinet until the study is over. After the study has been published, all personal information will be destroyed and only numerically-coded data will be maintained for 3 years.

**Compensation**
Participants that complete at least 80% all the required testing materials, including the questionnaires and the daily journal entries, will be entered into three separate drawings for a $50 gift card from either Wal-Mart, Target, or Dunham’s following weeks 3, 6, and 10.

**Request for Additional Information**
You and your child are encouraged to ask questions about the study. The researchers will attempt to answer all your questions to the best of their knowledge. The researchers fully intend to conduct the study with your child’s best interest, safety, and comfort in mind. Should you have any questions about your child’s treatment or any other matter relative to your involvement in the project, or if your child experience research related issues at any time during this study, you may contact Frank Baker at (740) 856-8435 (fb607512@ohio.edu) or Dr. Cheryl Howe at (740) 593-2388 (howec@ohio.edu) at any time. If you have any questions regarding your rights as a research participant, please contact Jo Ellen Sherow, Director of Research Compliance, Ohio University, (740)593-0664.

By signing this consent form, you are agreeing that:
- You have read this consent form (or it has been read to you) and have given the opportunity to ask questions and have them answered.
- You have been informed of potential risks to you and have been explained to your satisfaction.
- You understand Ohio University has no funds set aside for any injuries you might receive as a result of participating in this study.
- You are 18 years of age or older and are the legal parent or guardian of the child.
- Your participation in this research is completely voluntary.
- Your child may leave the study at any time. If you or they decide to stop participating in the study, there will be no penalty to either of you and you or your child will not lose any benefits to which you are otherwise entitled.

Print your name ____________________________ Date ____________________

Signature

Please do not write in this box:

**Study Representative Statement:**
I have explained the purpose of the research, the study procedure, the possible risks and discomforts, the possible benefits, and have answered any questions to the best of my ability.

Study Representative Name (print or type) ____________________________

Signature ____________________________ Date ____________________
Appendix D: Assent Form

OHIO UNIVERSITY ASSENT FORM

Title of Research: Impact of Mental Toughness Training on Predictors of Psychological and Physical Predictors of Illness and Injury in Adolescent Athletes

Researchers: Frank Baker, AT, EMT-B & Cheryl Howe, Ph.D.

We are doing a research project about how mental toughness effects the way you feel and play sports. A research study is a way to learn more about people. If you decide that you want to be a part of this study, you will be asked to fill out several forms and write in a diary on the internet. This will take 30-45 minutes to fill out all the forms. You will also fill out forms three more times, two times in the middle of the study and one time when the study is finished. The two done in the middle will take 15-30 minutes and the last time will take 10-15 minutes.

There are some things about this study you should know. You may be selected to participate in a Mental Toughness Training Program for six weeks. If you are selected, you will use this program over the internet. You will also be writing in a journal on the internet. Each journal entry will take at least 10-15 minutes to do. You will be able to write in your journal at any time during the day.

After the six-week program is complete, you will fill out the forms that you read about in the first paragraph. Four weeks after the program, you will be asked to fill out one more form. There is a small chance that you will feel some discomfort from filling out the forms stated above, but this will go away quickly. Discomfort meaning that you may feel upset or sad after reading the forms.

Everyone will have a chance to receive benefits from this program. A benefit means that something good happens to you. This study may enhance the way you play in sports and decrease the chance of you being injured. When we finished this study we will write a report about what was learned. The report will not include your name or that you were in the study. You do not have to be in this study if you do not want to be. If you decide to stop after you begin, that’s okay too. For being in this study and finishing 80% of the forms during each submission, your name will be put in a drawing where you could win one of three $50 gift cards from a store of your choice (Wal-Mart, Dunham’s, or Target).

You are encouraged to ask questions about the study. The researchers will attempt to answer all your questions to the best of their knowledge. The researchers fully intend to conduct the study with your best interest, safety, and comfort in mind. Should you have any questions about your treatment or any other matter relative to your involvement in the project, or if you experience research related issues at any time during this study, you may contact Frank Baker at (740) 856-8435 (fb607512@ohio.edu) or Dr. Cheryl Howe at (740) 593-2388 (howec@ohio.edu) at any time. If you have any questions regarding your rights as a research participant, please contact Jo Ellen Sherow, Director of Research Compliance, Ohio University, (740)593-0664.

No, I do not want to be in this research project.

Yes, I do want to be in this study.

I ______________________, want to be in this research project. (Print your name here) ______________________ (Sign your name here) (Date)
Appendix E: Demographic Questionnaire

1. Date of Birth _______________  
   2. Age ____________

3. Have you ever participated in sports? ________________

4. If so, when was the last time you participated in a sport? ________________

   What sport season? (Please circle) Fall  Winter  Spring  Summer

5. How long have you participated in sports? ________________

6. Are you currently participating in any other sports besides track? (Please Circle) Yes or No

7. Grade Level ________________

8. Have you suffered any injuries in the past? (circle one) Yes  No

   If yes, please list
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________

9. Do you have any chronic health conditions? (circle one) Yes  No

   If yes, please list
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________

10. Do you have a history of suffering from depression or any other psychological conditions? (circle one) Yes  No

    If yes, please list
    __________________________________________________________
    __________________________________________________________
    __________________________________________________________

11. Do you take any medications regularly?  
    (circle one) Yes  No

    If yes, please list
    __________________________________________________________
Appendix F: Parent Sociodemographic Questionnaire

Parent Sociodemographic Questionnaire

Dear Parent,

Thank you for allowing your child to participate in the Mental Toughness Training Program being conducted at your school by researchers from Ohio University. As part of the evaluation of the program, we would like you to answer some questions that ask about your child and your family and the neighborhood where you live. These questions should be answered only about the child in your family who is participating in the Mental Toughness Training Program at his school.

This questionnaire should only be completed by child’s parent or legal guardian. There are no right or wrong answers to these questions. Completing this survey is completely voluntary and you may refuse to answer any specific question at any time. Your responses to these questions are completely confidential and will only be seen by research staff. Your name and your child’s name will not be linked to these individual responses and the results from this questionnaire will only be presented in research publications in a summary form without names.

QUESTIONS

1. What is your Child’s date of birth? 
   
   ___ ___ / ___  ___ / ___ ___ ___ ___
   M    M      D      D      Y     Y    Y     Y

2. What is your Child’s gender? (Circle one)
   
   Male………………………………………….1
   Female…………………………………………2

3. What is your Child’s race? (Circle all that apply)
   
   Caucasian……………………………………. 1
   Black / African American………………….. 2
   Asian………………………………………… 3
   American Indian /Alaskan native…………. 4
   Native Hawaiian/Other Pacific Islander….. 5
   Other, specify _____________________ 6
   I do not know………………………………… -8

4. What is your Child’s ethnicity (Circle one):
Hispanic.................................................. 1
Non-Hispanic........................................... 2
I do not know........................................... -8

5. What is the highest level of education that your child’s mother or female legal guardian(s) has completed?

<table>
<thead>
<tr>
<th>Education Level</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than High School</td>
<td>1</td>
</tr>
<tr>
<td>Some High School</td>
<td>2</td>
</tr>
<tr>
<td>High School graduate or GED</td>
<td>3</td>
</tr>
<tr>
<td>Trade School</td>
<td>4</td>
</tr>
<tr>
<td>Some college</td>
<td>5</td>
</tr>
<tr>
<td>College graduate</td>
<td>6</td>
</tr>
<tr>
<td>Post graduate degree</td>
<td>7</td>
</tr>
<tr>
<td>I DO NOT KNOW</td>
<td>-8</td>
</tr>
<tr>
<td>NOT APPLICABLE</td>
<td>-1</td>
</tr>
</tbody>
</table>

6. What is the highest level of education that your child’s father or male legal guardian(s) has completed?

<table>
<thead>
<tr>
<th>Education Level</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than High School</td>
<td>1</td>
</tr>
<tr>
<td>Some High School</td>
<td>2</td>
</tr>
<tr>
<td>High School graduate or GED</td>
<td>3</td>
</tr>
<tr>
<td>Trade School</td>
<td>4</td>
</tr>
<tr>
<td>Some college</td>
<td>5</td>
</tr>
<tr>
<td>College graduate</td>
<td>6</td>
</tr>
<tr>
<td>Post graduate degree</td>
<td>7</td>
</tr>
<tr>
<td>I DO NOT KNOW</td>
<td>-8</td>
</tr>
<tr>
<td>NOT APPLICABLE</td>
<td>-1</td>
</tr>
</tbody>
</table>
7. What is your **total household income** for one year and from all sources? (Please circle one)

   Below $20,000........................................................1
   $20,000 –$29,999 2
   $30,000 –$39,999 3
   $40,000 –$49,999 4
   $50,000 –$59,999 5
   $60,000 –$69,999 6
   $70,000 –$79,999 7
   $80,000 –$89,999 8
   $90,000 –$99,999 9
   Above $100,000 10
   I DO NOT KNOW ..............................................11

8. Does your child participate in the free or reduced lunch program? (Circle one)

   NO.................................................................1
   YES...............................................................2

9. What is your relationship to this child?

   Mother............................................................1
   Father.............................................................2
   Legal Guardian-related.........................................3
   Legal Guardian-unrelated.....................................4
   Other, specify ________________________________ 5

10. Occupation

    Place: ________________________________

    Title: _________________________________

Home Address (please include city and zip code):

_____________________________________________________________________

_____________________________________________________________________

Home Phone: __________________ Work Phone: ________________________

THANK YOU FOR COMPLETING THIS FORM
Appendix G: Sports Medicine Injury Report Form

Illness and Injury Form

Athletes Name: ___________________  Grade: ________  Team: ________________

Most Likely cause of injury: ________________________________________________

Referral Plan: (Please circle one)

Not at this time  Plain Radiographs/MRI/CT Scan  Emergency Room

Other: ____________________________________________________________________

Immediate Treatment: (Please report all treatments used for the subject on the lines below)

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Participation/Restriction _____________________________

____ If your symptoms do not improve significantly by ________________, return for re-evaluation

____ Return for re-evaluation and/or further treatment on ________________________.

Recommendation Provided by: ___________________________  Date: _____________

Time: ______

Feel free to contact me if you have any questions. I can be reached at:
________________________________________________________________________
Appendix H: Mental Toughness Training Program Example Exercise

 Emotional Resiliency – Example Exercise

The following example is for individuals with below average overall mental toughness whose primary strength is emotional resiliency.

To take the proverbial emotional “punch” and bounce back quickly, individuals must be able to control their focus of attention. Over five days, these individuals are asked to select from the following action steps:

1. Focus on the present – To avoid the fear associated with focusing on the future and the frustration that often accompanies dwelling on the past, it is critical to focus on the present during times of stress or when facing adversity.
2. Focus on performance cues – By focusing on specific mechanisms (e.g., the ideal start position, the balancing of weight in a particular stance), individuals can direct their attention appropriately to target actions while avoiding negative emotions.

Additionally, these individuals develop a routine to let go of negative emotions (e.g., physically pushing aside the mistake) so they can stay focused on the goals at hand.

The individuals then implement these actions during their normal training and in competition, and they have the option of summarizing their progress in their performance journals. Along with the specific tasks given in the example above, individuals practice certain actions (e.g., repeating an affirmation statement they created for themselves) throughout the training program. A summary of action steps for the above example is as follows:

Summary: Today I will

• Repeat my affirmation statement at least twice today.
• Develop a new list of action steps to be completed.
• Complete the first activity on my list.

 Creating an Optimal State – Example Exercise

Like the emotional resiliency example, the following is for individuals with below average overall mental toughness, but creating an optimal state is the primary strength for these individuals.

To perform at their peaks, individuals must be able to achieve an ideal state of physiological and psychological arousal. Over five days, these individuals are asked to select action steps to deliberately change their readiness and get into an optimal performance zone.
To calm down, individuals can choose from a variety of strategies, such as the following:
1. Use cue words – Repeat a calming word before performing;
2. Breathe deeply – Exhale a deep breath to a count of 4 to relax the body and mind;
   or
3. Slow down – Deliberately slow movements in competition or preparation to avoid rushing under pressure.

To psych up, individuals can choose from a variety of strategies, such as the following:
1. Use cue words – Repeat an exciting or motivating word before performing;
2. Breathe quickly – Breathe more rapidly while harnessing positive thoughts; or
3. Listen to music – Listen to music with a fast beat to increase arousal.

Again, these individuals implement these actions during their normal training and in competition and have the option of summarizing their progress in their performance journals. Along with the specific tasks given in the example above, individuals practice certain actions (e.g., repeating an affirmation statement they created for themselves) throughout the training program. A summary of action steps for the above example is as follows:

Summary: Today I will

• Repeat my affirmation statement at least twice today.
• Develop a new list of action steps to be completed.
• Complete the first activity on my list.