THE KNOWLEDGE OF MEDIAL TIBIAL STRESS SYNDROME OF PARENTS AND COACHES OF ADOLESCENT ATHLETES

A THESIS

Submitted to the Faculty of the School of Graduate Studies and Research
of
California University of Pennsylvania in partial fulfillment of the requirements for the degree of

Master of Science

by
Joseph J. McShane

Research Advisor, Dr. Ellen J. West

California, Pennsylvania
2012

CALIFORNIA UNIVERSITY of PENNSYLVANIA
CALIFORNIA, PA

THESIS APPROVAL

Graduate Athletic Training Education

We hereby approve the Thesis of

Joseph J. McShane, ATC
Candidate for the degree of Master of Science

Date	Faculty
5/3/12	Ellen J. West, EdD, ATC, LAT (Chairperson)
5-3-12	Shelly DiCesaro, PhD, ATC
5.3.12	Jodi Dusi, PhD, PT

AKNOWLEDGEMENTS

I would like to recognize the following people who have significantly impacted my life. Without them, there wouldn't be even the slightest chance that I could've completed this. First, I would like to thank my advisor, Dr. Tom West, my thesis chair, Dr. Ellen West, and the members of my thesis committee: Dr. Shelly DiCesaro and Dr. Jodi Dusi and the rest of the faculty at Cal U for their help and guidance throughout the completion of my thesis and the master's program.

Next, I would like to thank Jamison Roth, Jamie Weary, and Miss Carolyn for their guidance, tremendous amounts of help and patience with me throughout this year while getting the Cal U Club Sports GA position up and running. I'd also like to thank all my athletes for putting up with all the changes I subjected them to this year. Please try to stay concussion free in the coming years.

At this point, I'd like to personally thank the permanent and honorary residents of Apartments 2 and 3 at 947 Cross Street: Mark Webber, Paul Rucci, Sean Rentler, and Ted Vandermeuse. Between the catfishing, visits to the local establishments, and adventures to the various cultural hotspots of southwestern Pennsylvania, you guys

either have managed to keep me sane or completely throw me off the deep end.

I would also like to acknowledge Curt Snyder's mustache, which brightened my day, reminded me to laugh, and allowed me to be a free spirit and an overall better person each and every day I set foot in the athletic training room.

To my Mom, Dad, Jen, Jason, Denny, and the rest of my family and friends, thank you for all you've done throughout this entire "education" thing that I've stumbled and staggered through over the past 20-odd years. Although I still haven't, nor do I intend to perfect the whole "growing up" thing, I'd like to thank you for at least attempting to get me to do so.

Last, but certainly not least, I'd like to thank my beautiful girlfriend, Abby, for dealing with my stress, keeping me grounded and putting up with all my crap (for lack of a better word) throughout the past year of being apart and being the most patient (saint-status-patience) and greatest person I've ever met.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

The purpose of the study is to examine the knowledge of parents and coaches with regard to medial tibial stress syndrome (MTSS). If we, as athletic trainers, are able to identify problem areas and gaps in knowledge bases to further educate those with this lack of knowledge, the overall care of the athletes suffering from medial tibial stress syndrome may be improved.

Medial tibial stress syndrome is a continuum of overuse trauma to the lower leg, more specifically, the sum of repetitive microtraumas to the medial tibia induced by activity which lead to pain and dysfunction in the lower extremity. The overall management of MTSS can be considerably more arduous for the sports medicine team (parents, coaches, athletes, athletic trainers and physicians), as it must deal with all aspects including prevention, management and treatment and must take a multifaceted approach when doing so. The athletic trainers and coaches are typically on the front lines of the prevention aspect in the adolescent athlete. These individuals are typically responsible for both the

conditioning prior to the season and training program throughout the season. The parents become much more involved when the athlete sustains MTSS as they must try to help their adolescent athlete manage the problem. Since the parents and coaches are such a large part in the prevention and management aspects of MTSS, their knowledge of the prevention and treatment must be adequate to prevent mismanagement or further injury to the athlete.

Understanding the incidence rates of MTSS in different populations is just as important as knowing how or why it occurs. Yates and White studied the incidence of MTSS among naval recruits.[1] In their literature review, they reference Murbarak et al's[2] characterization of MTSS, stated as "a symptom complex seen in athletes who complain of exercise induced pain along the posteriormedial border of the tibia."[5,7] Collating from several sources, Yates et al[5] expanded on this generic definition to both rule out older thought processes, such as MTSS as an inflammatory response process. This led the authors to create a more accurate and complete definition of "a bone stress reaction that becomes painful," citing metabolic changes in the bone due to exercise and increase osteoclastic activity on the posteriormedial border; often from compression of the bone. This increase in osteoclastic activity coupled with the

bone's inability to replace the broken down tissue fast enough, leads to increasingly porous bone tissue. As the bone is broken down more easily, the athlete begins to feel pain as the bone is subjected to microtraumas which can ultimately result in a stress fracture of the tibia. Though a good definition is crucial to its correct diagnosis, knowing its incidence among the active population is equally helpful in coming to the correct conclusion and identifying potential athletes who may be at risk.

Additionally, Yates and White[5] defined MTSS in their study based on each subject's pain history, location of pain and positive palpation of pain on the posterior-medial border of the tibia. The authors found forty of the recruits (35%) developed MTSS and female recruits were significantly more prone to developing MTSS (incidence rates of 53% and 28% for male and female recruits respectively). They concluded that controlling foot pronation and enabling male and female recruits to train separately could potentially decrease the incidence of MTSS in their sample. Furthermore, the authors stated that MTSS accounts for 13.2% to 17.3% of all running injuries.[5]

The main focus of Galbraith et al's[3] study was to delve into some conservative treatment approaches taken to

expedite the process of returning the athlete to play after he or she has been diagnosed with MTSS. The authors concluded that there are in fact several factors that can be classified as both prevention and rehabilitation. These factors that can also aid in the recovery process included relative rest, which can be defined as remaining physically active while still removing the activity which causes the unwanted stresses to the body, such as cross training or implementing low-impact exercises into the a modified training routine. Additionally, the use of cryotherapy and electrical stimulation with soft tissue mobilization and whirlpool baths were also indicated for both the acute and subacute phases.[3]

Though there is much literature on the rehabilitation methods for dealing with MTSS, The NATA issued a position statement, spearheaded by McLeod et al,[4] focusing on the prevention of overuse injuries in the pediatric population, including MTSS. The position statement highlights some of the profiles of both male and female athletes that may predispose athletes to overuse injuries such as tall stature, more explosive strength, large Q angles, increased muscle tightness and decreased muscle flexibility. The authors also stated that a decrease in the overall fitness level in the general population means that training

routines must be more gradually introduced to help prevent overuse injuries. They concluded that the athletic trainer must be able to identify risk factors associated with overuse injuries as well as taking the appropriate steps as to help prevent these injuries.

The evaluation, management and risk factors of MTSS should all be common knowledge among athletic trainers (who deal with several cases every year) in the high school setting; however, the coaches and parents of these athletes are not as well-versed on the subject, nor should they be expected to be. Several studies[5-7] have taken a look at the knowledge of coaches with regard to athletic injuries. Although this is a huge step, none of the studies surveyed looked at MTSS or overuse injuries in any form. Additionally, none of the literature surveyed dealt with the knowledge of parents of injuries in the adolescent athlete.

Therefore, this study will be significant, as it will provide feedback to the knowledge base of parents and coaches with regard to medial tibial stress syndrome. This can aid in the care of the athlete suffering from MTSS by having the athlete's parents and coaches be able to potentially identify signs and symptoms and refer their athlete to their athletic trainer or doctor, potentially

cutting down recovery time. With this knowledge, communication between the athletic trainer, parents and coaches will be made easier as all three will be greater informed. Additionally, the risk of MTSS being mismanaged in the adolescent athlete can be minimized as both the coaches would be less likely to have the athlete "walk it off," and, similarly, parents will be less likely to push their children through the pain.

METHODS

The primary purpose of this study was to examine the knowledge levels of parents and coaches with regard to medial tibial stress syndrome (MTSS) in the adolescent athlete. This section will include the following subsections: Research Design, Subjects, Instruments, Procedures, Hypotheses, and Data Analysis.

Research Design

This research was a descriptive study utilizing a research questionnaire. The independent variable was the group surveyed (either parents or coaches). The dependent variable was the subjects' score as measured by the MTSS knowledge survey, each question being worth one point. This overall score on the knowledge survey also had two subscores which were analyzed during hypothesis testing. The subscores were the prevention knowledge score and rehabilitation and treatment knowledge score. These three scores (prevention, rehabilitation and treatment, and overall score) were separated by the independent variable; either parent or coach.

Subjects

The subjects used for this study were parents and coaches of high school athletes in western Pennsylvania in PIAA districts 7 and 10. The survey was distributed to athletic directors who agreed to distribute it following contact with the primary researcher. The athletic directors then distributed the cover letter containing the link to the survey to the parents and coaches by sending home with the school's athletes. The surveys were then completed online using SurveyMonkey. Subjects were included if they were a coach or a parent of a high school athlete in western Pennsylvania. If a subject fit both categories of parent and coach, they were excluded from the main study; however, they were examined as independent data to see if the overlap showed a significant difference in the knowledge level.

Each subject was asked via an attached cover letter (Appendix C1) to participate in the study by completing an online survey to assess their knowledge of MTSS (Appendix C4). Subject participation was completely voluntary and consent was implied if they chose to complete the survey.

The study was approved by the Institutional Review Board (IRB) at California University of PA(Appendix C2) prior to any data collection. Surveys were completed anonymously and each participant's identity remained confidential.

Preliminary Research

A preliminary study was conducted with this research project. The survey was administered to a panel of experts in the field, four athletic trainers, for content validity evaluation. Additionally, nineteen subjects were given the MTSS knowledge survey to assess their knowledge of MTSS and aid the researcher by providing data on the difficulty level and reliability of the survey. Of the nineteen subjects, fourteen completed the survey twice; once upon reception of the survey and once one week later, in order to assess reliability. The survey was comprised of a set of questions derived from the literature outlined in the Literature Review (Appendix A). Comprised of questions ranging from "easy" to "hard," the survey tested the knowledge in each of the areas of MTSS knowledge including prevention, mechanism of injury, relative functional anatomy, treatment and management, as well as some of the diagnostic testing associated with the evaluation of MTSS.

Instruments

The Knowledge of Medial Tibial Stress Syndrome Survey (Appendix C1) was created by the researcher to assess the knowledge level of parents and coaches of adolescent athletes. The survey consisted of thirty questions testing different knowledge areas of MTSS. To support the management and prevention areas of the hypotheses, the sections of prevention and management were not only counted toward the overall knowledge score, but as an independent score as well. Although parents and coaches may not know anatomy and other risk factors, prevention and the management are the most critical areas they would need to recognize to provide the minimal level of care for MTSS. The areas tested included mechanism of injury, relative functional anatomy, prevention, treatment and management, and diagnostic testing used for the evaluation of MTSS. There were between three and five questions pertaining to demographic information, depending on whether the subject was a parent, coach or both, which assisted the researcher in classification of subjects.

Procedure

The researcher obtained Institutional Review Board (IRB) approval (Appendix C2) at California University of Pennsylvania before beginning any data collection or distribution of surveys. Approval to distribute the survey to parents and coaches was obtained though the athletic directors (AD's) of each high school surveyed. The athletic directors were contacted via email, found on the PIAA website. Once approval to distribute the surveys by the ADs was obtained, the AD's distributed the cover letters to the school's student-athletes to bring home to their parents. The cover letter (Appendix C3) explained the purpose of the study to each potential subject to be surveyed. Surveys were collected for a 4-week period following distribution from March 7 to April 4, 2012. The survey link was then deactivated and submissions could no longer be submitted. This timeframe was selected to allow for adequate time for both the subjects to complete the survey as well as the researcher to collect adequate data. The survey data was anonymous and all online submissions were kept confidential. The data was collected, entered into an electronic spreadsheet and analyzed and grouped according to the relevant demographic classification.

Hypotheses

The following hypotheses of the researcher were based on previous research and clinical assumptions.

1. Coaches will have a significantly greater knowledge of the prevention of MTSS than parents.
2. Coaches will have a significantly greater knowledge of the rehabilitation and treatment of MTSS than parents.
3. Coaches will have a significantly greater overall knowledge of MTSS than parents.

Data Analysis

All data was analyzed by SPSS version 18.0 for Windows at an alpha level of less than or equal to 0.05. The research hypotheses were analyzed using a T-test.

RESULTS

The following section is comprised of the information gathered through data collection and the analysis of the Knowledge of Medial Tibial Stress Syndrome Survey distributed to parents and coaches at six western Pennsylvania high schools. The results have been divided into these subsequent sections: (1) Reliability Testing, (2) Demographic Data, (3) Hypothesis Testing, and (4) Additional Findings.

Reliability Testing

The Knowledge of Medial Tibial Stress Syndrome Survey was distributed to a sample of convenience of parents and coaches of adolescent athletes. The survey was distributed to the same subjects one week later to determine its reliability, which was found by correlation testing to be $r = 0.374$; a low positive correlation. Nine of thirty questions had a very high correlation (above $r > 0.80$), six had a strong correlation ($0.60 \leq r \leq 0.80$), and seven had a moderate correlation ($0.40 \leq r \leq 0.60$) Eight of the thirty questions returned with a correlation value $r <$

±0.30 and were modified in an attempt to eliminate any unclear language and increase their reliability and the reliability of the survey overall.

Demographic Data

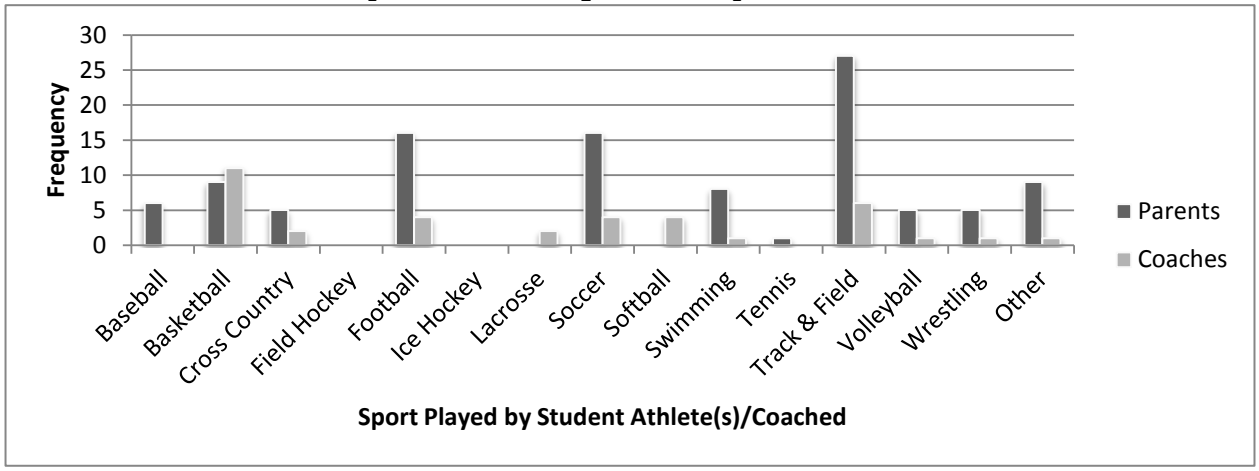
Of the 691 surveys handed out to the parents and coaches at the western Pennsylvania high schools, 91 responses were received for a 13.17% return rate. The sample consisted of 45 parents, 31 coaches, 13 parent/coaches (both) and 7 who did not fit either category. 61 of these subjects (40 parents and 21 coaches) completed the survey fully and were able to be analyzed during hypothesis testing (Table 1).

Table 1. Frequency Table of Demographic

Group	**Frequency (Completed)**	**Percent of Total Responses Received**
Parents	45 (40)	49.4%
Coaches	31 (21)	34.1%
Both	13 (11)	14.3%
Neither	7 (7)	7.7%

The study focused on parents and coaches in the western Pennsylvania region of the PIAA, specifically Districts 7 and 10. Figure 1 shows the collected responses with regard to what sport(s) each subject coached and/or their student athlete(s) played. Additionally, Table 2 reports the findings with regard to the number and frequency of the cover letter distribution for the six high schools surveyed within the two districts.

Figure 1. Frequency of Parents and Coaches With Regard to Student Athletes' Sport(s) Played or Sport Coached



Although additional demographic data were collected with regard to number and gender of student athletes for parents and coaching position and gender of athletes coached, the data were not utilized as there was an insufficient amount to examine for any additional findings.

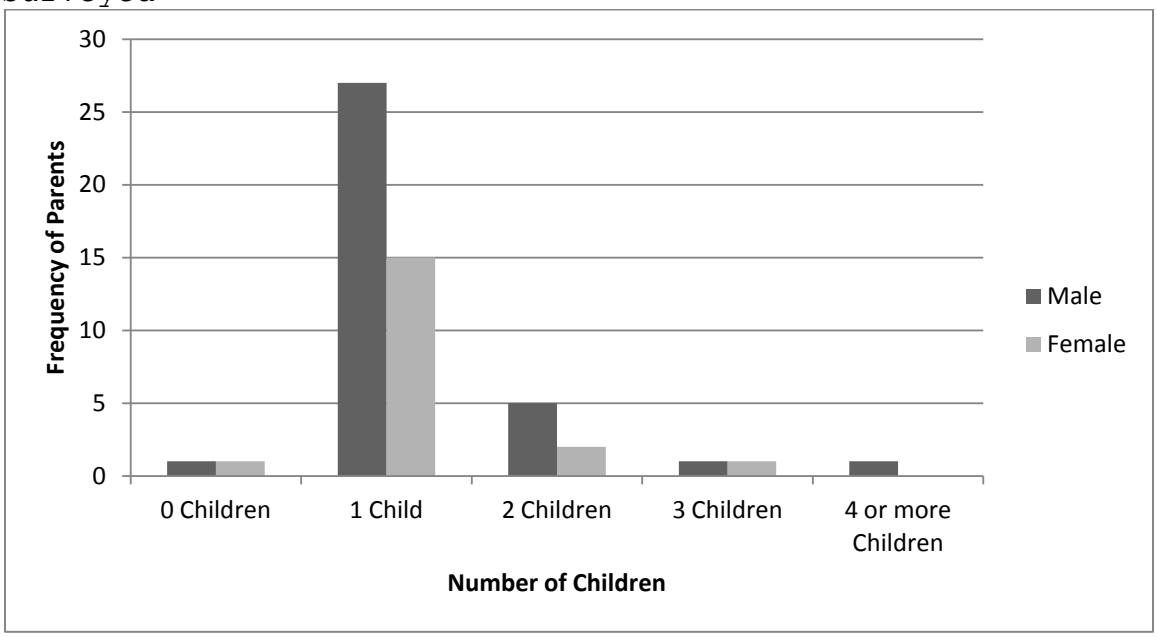
Table 2. Frequency Table of Number of Surveys Distributed by School District

School	District	Surveys Distributed	Percent
Brownsville	7	197	28.5%
Burgettstown	7	159	23.0%
California	7	103	14.9%
Cathedral Prep	10	27	3.9%
Iroquois	10	145	21.0%
McDowell	10	60	8.7%

Table 2 shows the distribution of surveys by school district. The surveys were primarily distributed by cover letter as well as by email, as per athletic directors' instruction.

Figure 2 shows the frequency of children by gender of parents surveyed, n=45. The subjects were able to choose if they had 0 to 4 or more children of each gender. Responses were recorded, but were not tethered to each subjects' responses to maintain confidentiality.

Figure 2. Frequency of Children by Gender of Parents Surveyed



Figures 3 and 4 show the responses of coaches by coaching position title and the gender of the athletes they coach respectively.

Figure 3. Frequency of Coaches by Coaching Position Title

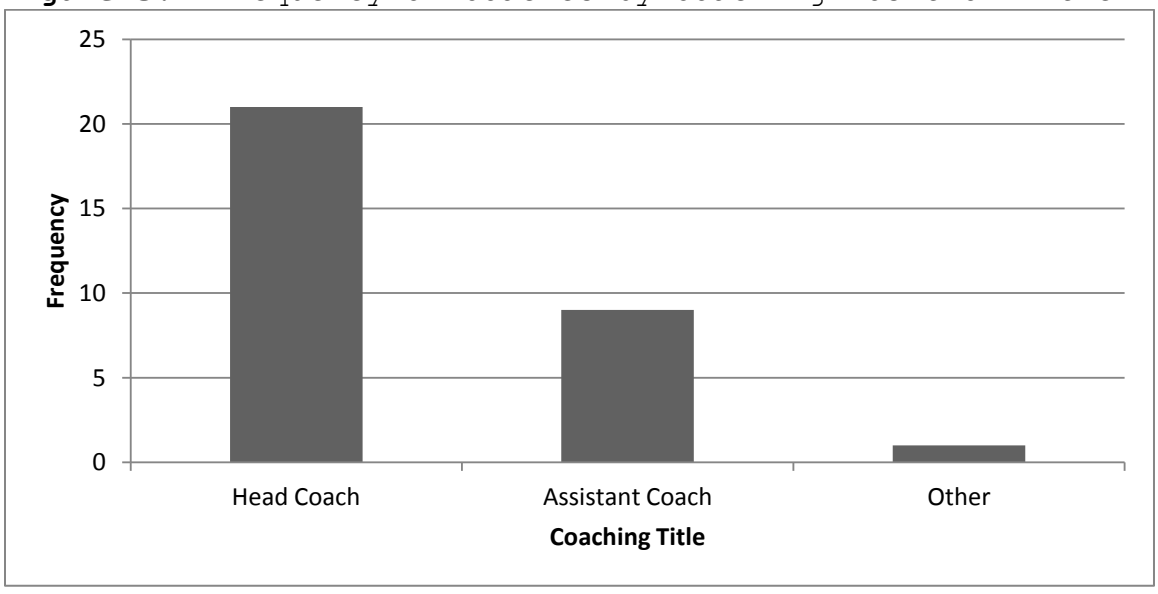
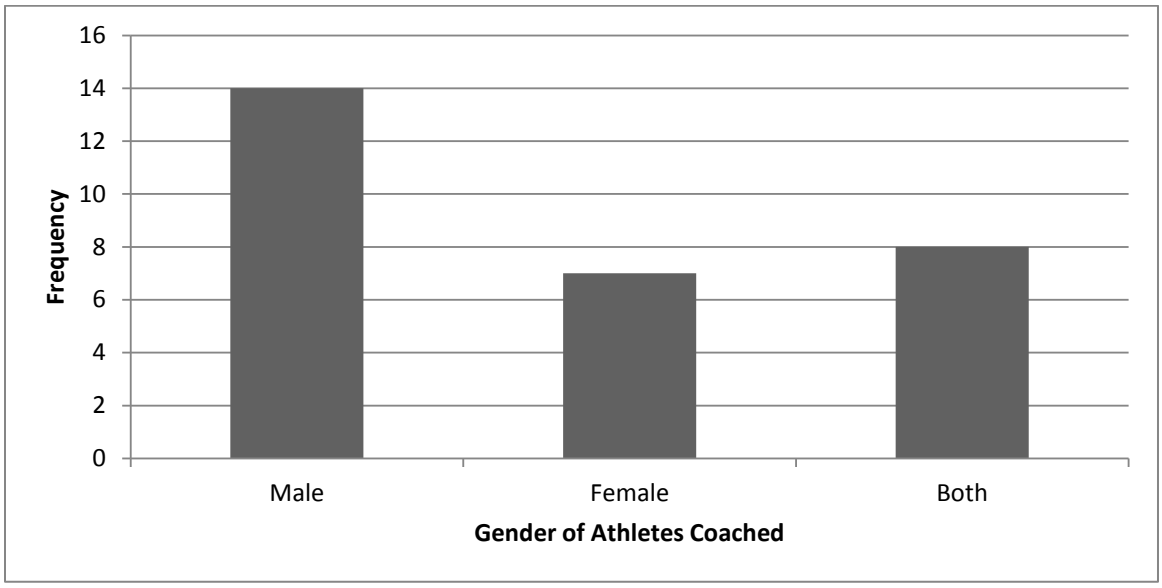


Figure 4. Frequency of Coaches by Gender of Athletes Coached



Additionally, 10 subjects who identified themselves as both a parent and a coach (parent-coaches) were asked the same demographic questions. The following figures (Figures5-9) display the "Both" category responses to the demographic questions both the parents and coaches were asked. The questions asked were the same questions asked of both the parents and the coaches.

Figure 5. Frequency of Parent-Coaches With Regard to Student Athletes' Sport(s) Played

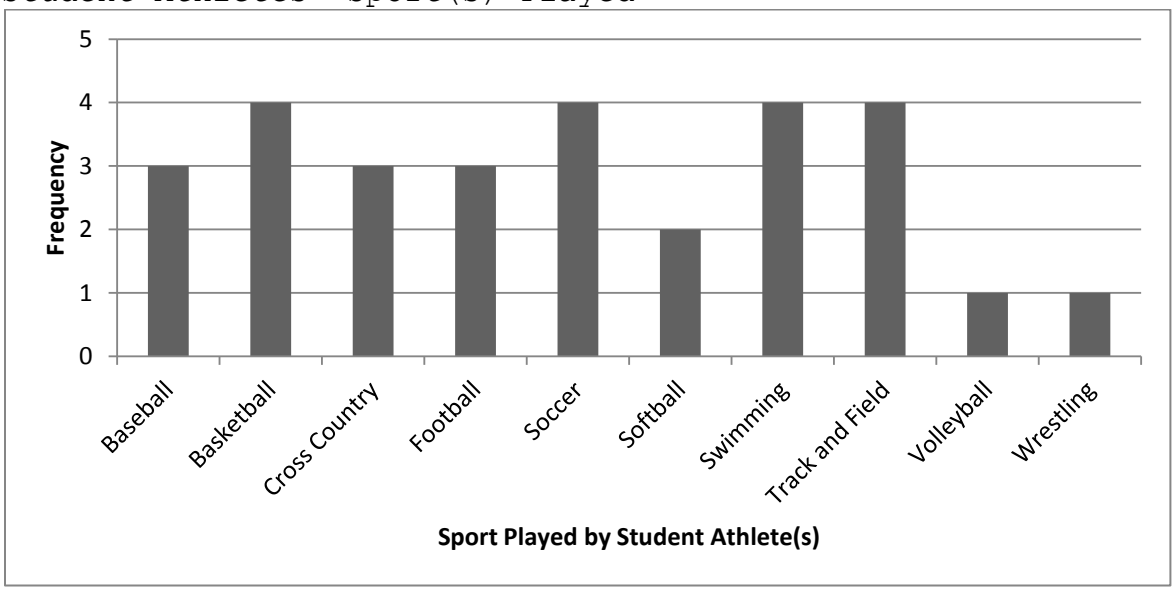


Figure 6. Frequency Sport(s) Played by Children by Gender of Parent-Coaches Surveyed

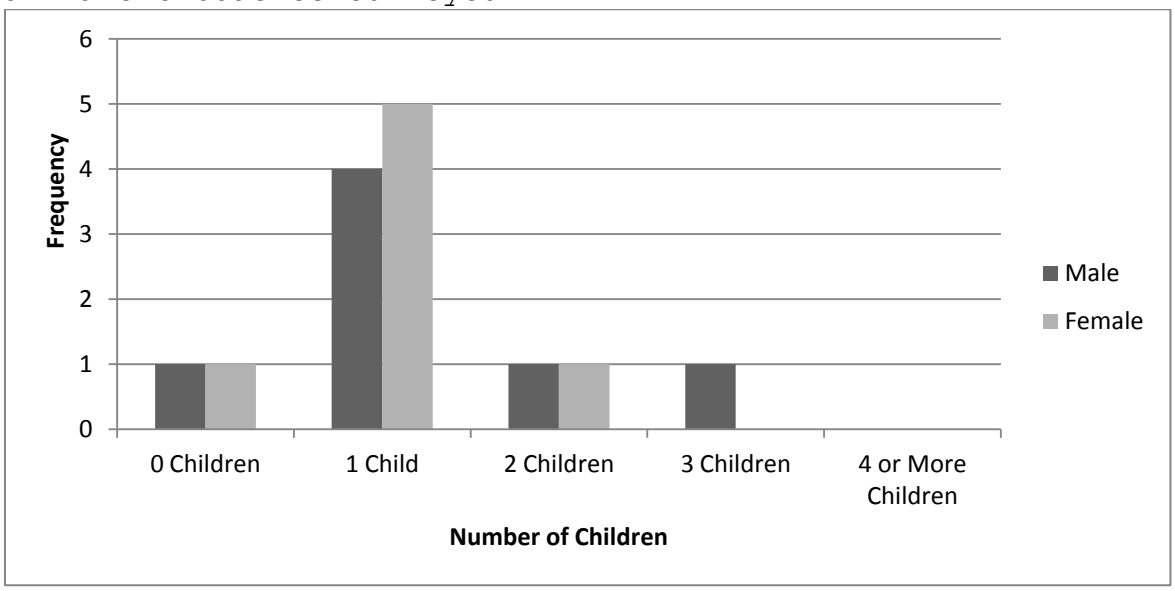


Figure 7. Frequency Sport(s) Coached by Parent-Coaches Surveyed

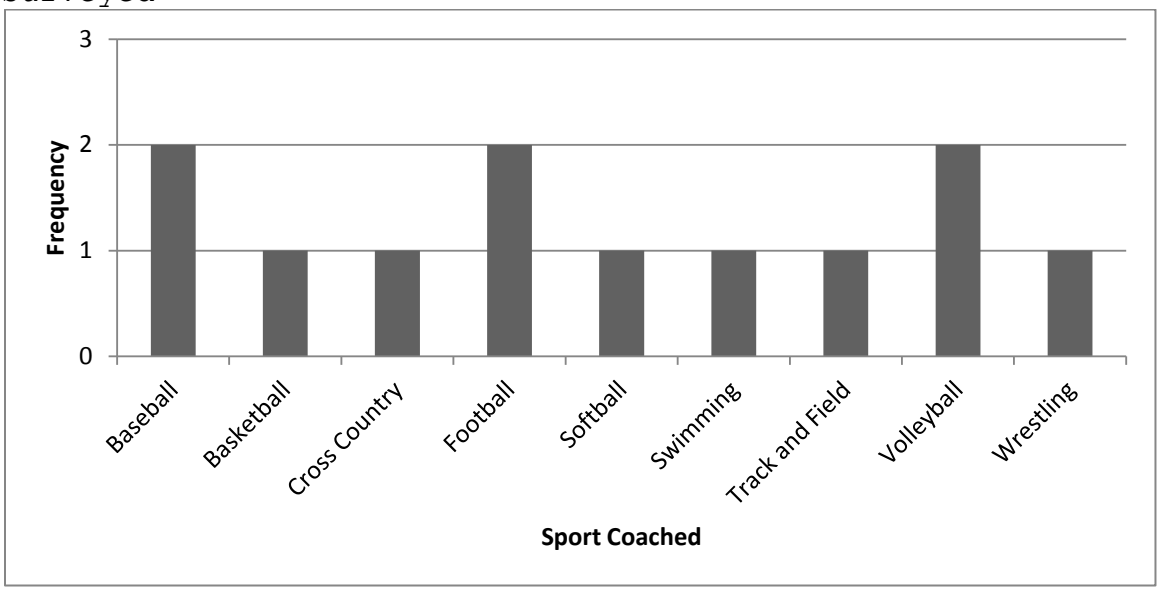


Figure 8. Frequency of Parent-Coaches by Coaching Position Title

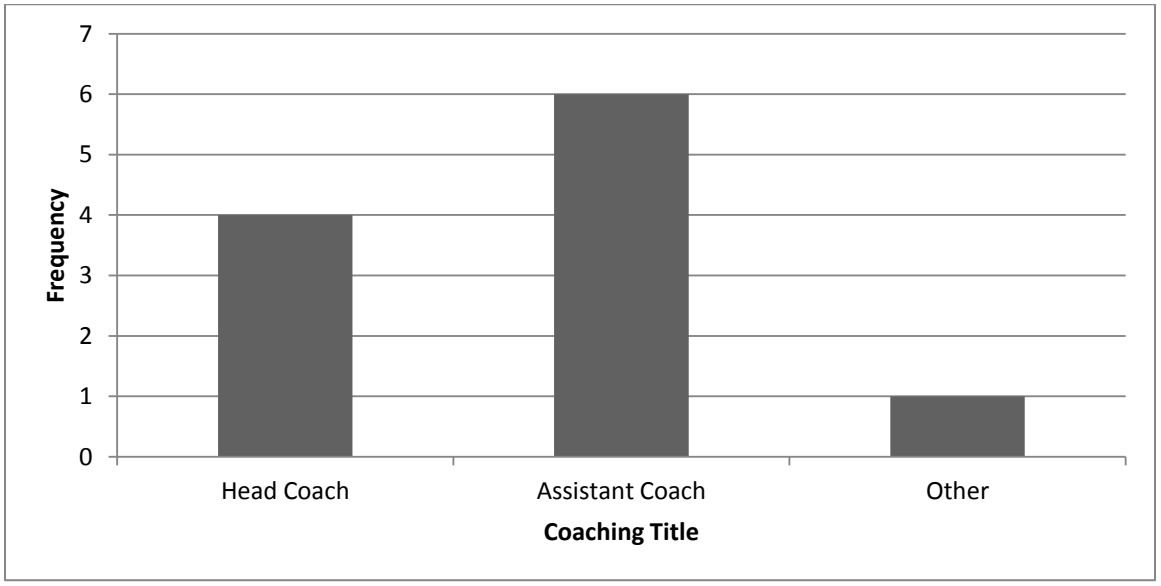
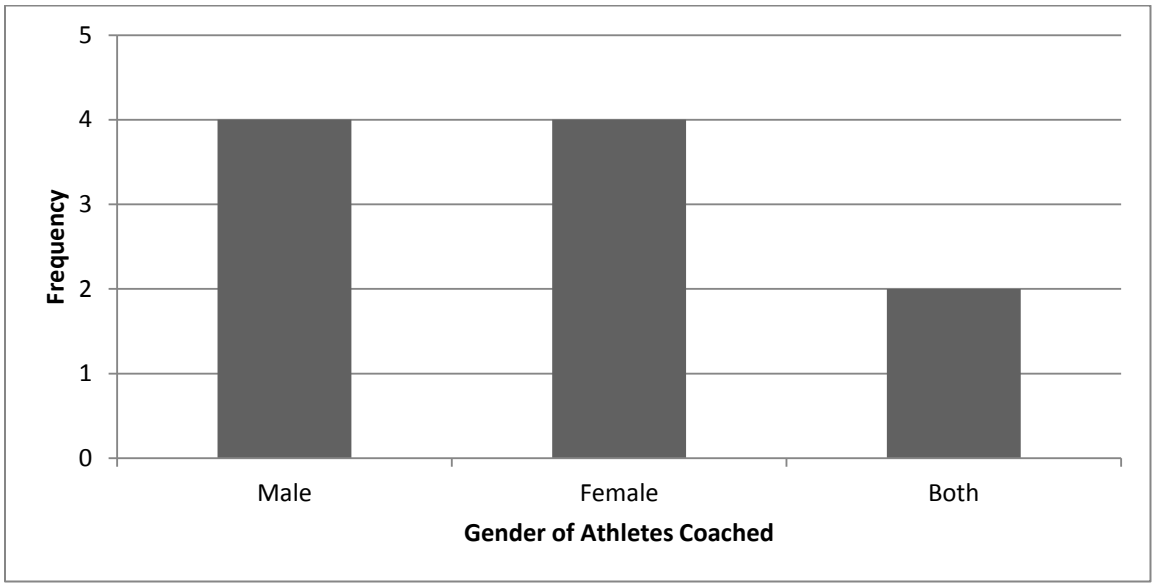


Figure 9. Frequency of Parent-Coaches by Gender of Athletes Coached



Hypothesis Testing

The following hypotheses were investigated by this study:

Hypothesis 1: Coaches will have a significantly greater knowledge of the prevention of MTSS than parents.

An independent sample t-test was used to compare the mean scores for each category used in hypothesis testing as well as the overall mean score and standard deviation of the scores with regard to parents and coaches. These results can be found below in Tables 3 and 4.

Results: An independent-samples T-test was conducted to compare the mean prevention knowledge score of

participants who identified themselves as parents (n = 40) to the mean prevention knowledge score of participants who identified themselves as coaches (n = 21). No significant difference was found ((t(59) = .200, p > 0.05)).

Conclusion: The mean prevention knowledge score of parents (*m* = 65.83, *sd* = 13.582) was not significantly different from the mean prevention knowledge score of coaches (*m* = 65.08, *sd* = 14.818).

Table 3. Mean and Standard Deviation for Knowledge Scores by Category

Category	Group	N	Mean	Standard Deviation
Prevention	Parents	40	65.83	13.582
	Coaches	21	65.08	14.818
Rehabilitation*	Parents	40	63.57	18.850
	Coaches	21	76.87	15.957
Overall*	Parents	40	60.33	7.874
	Coaches	21	65.87	9.939

*significant findings indicated for this category

Table 4. t-value, Degrees of Freedom and Significance for Knowledge Scores by Category

Category	t	df	Sig
Prevention	.200	59	.842
Rehabilitation	-2.754	59	.008
Overall	-2.382	59	.020

Hypothesis 2: Coaches will have a significantly greater knowledge of the rehabilitation and treatment of MTSS than parents.

An independent samples t-test was used to compare the mean scores for each category used in hypothesis testing as well as the overall mean score and standard deviation of the scores with regard to parents and coaches. These results can be found above in Tables 3 and 4.

Results: An independent samples T-test was conducted to compare the overall mean score of participants who identified themselves as parents (n = 40) to the overall mean score of participants who identified themselves as coaches (n = 21). The researcher found a significant difference between the means of the two groups

($t(59) = -2.754$, $p < 0.05$) with regard to the knowledge of the rehabilitation and treatment of MTSS.

Conclusion: The mean rehabilitation and treatment knowledge score of the parents was significantly lower (m = 63.57, sd = 18.850) than the mean score of the coaches (m = 76.87, sd = 15.957).

Hypothesis 3: Coaches will have a significantly greater overall knowledge of MTSS than parents.

An independent samples T-test was calculated to compare the mean scores for each category used in hypothesis testing as well as the overall mean score and standard deviation of the scores with regard to parents and coaches. These results can be found above in Tables 3 and 4.

Results: An independent samples T-test was conducted to compare the overall mean score of participants who identified themselves as parents (n = 40) to the overall mean score of participants who identified themselves as coaches (n = 21). A significant difference between the means of the two groups ($t(59) = -2.382$, $p < 0.05$) with regard to the overall knowledge score was found.

Conclusion: The mean overall knowledge score of the parents was significantly lower (m = 60.33, sd = 7.874) than the mean score of the coaches (m = 65.87, sd = 9.939).

Additional Findings

Several tests were conducted using the other areas examined in the The Knowledge of Medial Tibial Stress Syndrome Survey (Appendix C1) with the intent of discovering additional findings.

An independent samples T-test was used to compare the mean scores for each additional category which was not used in hypothesis testing as well as the overall mean score and standard deviation of the scores with regard to parents and coaches. These results can be found below in Tables 5 and 6.

Table 5. Mean and Standard Deviation for Additional Knowledge Scores by Category

Category	Group	N	Mean	Standard Deviation
Definition	Parents	40	68.13	21.917
	Coaches	21	66.67	26.615
Anatomy	Parents	40	59.17	18.852
	Coaches	21	62.70	19.653
Diagnostic Testing	Parents	40	48.93	17.388
	Coaches	21	57.82	20.935

Table 6. t-Value, Degrees of Freedom and Significance for Additional Knowledge Scores by Category

Category	t	df	Sig
Definition	.229	59	.820
Anatomy	-.685	59	.496
Diagnostic Testing	-1.768	59	.082

Results: An independent-samples T-test was calculated to compare the mean definition knowledge score of participants who identified themselves as parents to the mean prevention knowledge score of participants who

identified themselves as coaches. No significant difference was found ($t(59) = .229$, $p > 0.05$).

Conclusion: The mean definition knowledge score of parents ($m = 68.13$, $sd = 21.917$) was not significantly different from the mean prevention knowledge score of coaches ($m = 66.67$, $sd = 26.615$).

Another independent samples T-test was used to determine the mean scores for each additional category, including anatomy and risk factors, definition and incidence, and diagnostic testing, which were not used in hypothesis testing as well as the overall mean score and standard deviation of the scores with regard to parents and coaches. These results can be found above in Tables 5 and 6.

Results: An independent-samples T-test was conducted to compare the diagnostic testing knowledge score of participants who identified themselves as parents to the mean prevention knowledge score of participants who identified themselves as coaches. No significant difference was found ($t(59) = -1.768$, $p > 0.05$).

Conclusion: The mean diagnostic testing knowledge score of parents ($m = 48.93$, $sd = 17.388$) was not

significantly different from the mean prevention knowledge score of coaches (*m* = 57.82, *sd* = 20.935).

A one-way ANOVA was conducted to compare the mean knowledge scores between individuals who identified themselves as parents, as coaches, and individuals who identified themselves as both a parent and a coach. The results of the analysis between groups are shown below in Tables 7 and 8.

Table 7. Mean and Std. Deviation from One-way ANOVA for Parents, Coaches and Both on The Knowledge of Medial Tibial Stress Syndrome Survey

Category	Demographic	N	Mean	Std. Deviation
Definition	Parents	40	68.13	21.917
	Coaches	21	66.67	26.615
	Both	11	70.45	21.847
Prevention	Parents	40	65.83	13.582
	Coaches	21	65.08	14.818
	Both	11	60.61	11.237
Anatomy and Risk Factors	Parents	40	59.17	18.852
	Coaches	21	62.70	19.653
	Both	11	68.18	21.672
Diagnostic Testing	Parents	40	48.93	17.388
	Coaches	21	57.82	20.935
	Both	11	53.25	22.215
Rehabilitation*	Parents	40	63.57	18.850
	Coaches	21	76.87	15.957
	Both	11	74.03	21.013
Overall	Parents	40	60.33	7.874
	Coaches	21	65.87	9.939
	Both	11	64.85	11.388

*significant findings indicated for this category at .05 level

Table 8. One-way ANOVA Between Groups for Categories of Parents, Coaches and Both on The Knowledge of Medial Tibial Stress Syndrome for Sum of Squares, df, Mean Square, F-score and Significance

Category	Sum of Squares	df	Mean Square	F	Sig.
Definition	104.01	2	52.00	.095	.909
Prevention	237.82	2	118.91	.639	.531
Anatomy and Risk Factors	738.66	2	369.33	.970	.384
Diagnostic Testing	1104.13	2	552.07	1.494	.232
Rehabilitation*	2757.40	2	1378.70	4.071	.021
Overall	485.98	2	242.99	2.946	.059

*significant findings indicated for this category at .05 level

Results: A one-way ANOVA was conduced to compare the knowledge scores of participants who were either parents, coaches or both. A significant difference was found among the groups ($F(2,2) = 4.07$, $p < .05$) with regard to rehabilitation knowledge scores. Tukey's HSD was used to determine the nature of the differences (Table 9) between the demographics for rehabilitation scores. This analysis revealed that Parents scored lower ($m = 63.57$, sd 18.850) than Coaches ($m = 76.87$, $sd = 15.957$). Participants who

identified themselves as "both" (*m* = 74.03, *sd* = 21.013) were not significantly different than the other two groups.

Table 9. Post-Hoc Tukey comparing rehabilitation scores of parents, coaches and both for mean difference, std. error and sig.

Demographic 1 (D1)	Demographic 2 (D2)	Mean Difference (D1-D2)	Std. Error	Sig.
Parents	Coaches	-13.299*	4.959	.025
Both	Parents	10.455	6.265	.225
Both	Coaches	-2.845	6.849	.909

*significant findings indicated for this category at .05 level

Conclusion: Coaches will have a significantly higher knowledge of the rehabilitation of MTSS than subjects who identify themselves as parents or parent-coaches or "both."

No other statistically significant scores were found for parents, coaches or "both" in any other knowledge category or overall knowledge score for the one-way ANOVA between groups analysis.

DISCUSSION

The discussion section will be divided into four subsections: 1) Discussion of Results, 2) Implications to the Profession, 3) Recommendations for Future Research, and 4) Conclusions.

Discussion of Results

The purpose of this study was to examine the knowledge level of parents and coaches of adolescent athletes with regard to the management of medial tibial stress syndrome (MTSS). The researcher examined specific knowledge areas of MTSS such as definition and incidence, anatomy and risk factors, prevention, diagnostic imaging methods, and the rehabilitation and treatment protocols associated with MTSS. These areas were combined to make up the overall knowledge of MTSS.

Hypothesis 1 stated that coaches will have a significantly higher knowledge score with regard to the prevention of MTSS than parents. The researcher proposed this hypothesis on the assumption that since the subjects had an insignificant knowledge of both the rehabilitation and treatment as well as their overall knowledge, their

knowledge of prevention would also be lacking. Baron et al[5] examined the knowledge levels of mid-Michigan area coaches' knowledge of injury prevention in adolescent athletes by way of a paper survey with an attached demographic sheet; similar to this study's with the exception of the media by which it was delivered. The researchers found that only 15 of their 290 subjects, or about five percent, received a passing score on their survey. As this study by Baron et al[5] showed general injury prevention knowledge was lacking in the coaching population, the researcher observed similar results and found no significant findings with regard to prevention of medial tibial stress syndrome. Although the overall numerical score was not looked at for any of the categories, the researcher noted that the mean scores for the prevention section were only at 65%; a somewhat low percent correct.

Similar to Baron et al's[5] study, Iverson and Friden's[6] examined the knowledge of injury prevention of female high school basketball players; again by paper survey and informed consent. They reported no significant difference in knowledge scores in the female student athlete subjects whether they were subjected to a prevention program or place in a control group which not participate in a preventative exercise program.[6] The researcher's results,

like both of the previously mentioned studies examining prevention knowledge of athletic injuries, did not show a significant difference in the prevention knowledge levels of parents and coaches.

Hypothesis 2 stated that coaches will have a significantly higher knowledge of the rehabilitation and treatment of MTSS than parents. The researcher formed this hypothesis with respect to the O'Donoghue et al study[7], which cited "management" as the weakest area of knowledge with regard to sport-related concussions in the high school coaches population and to see if it could be applied to other athletic injuries as well.[7] A significant difference was found in the knowledge levels of coaches with regard to rehabilitation and treatment of MTSS compared to the parents surveyed.

Cross et al[8] examined the state of South Dakota's high school coaching population's knowledge of injury management. The population included 1050 coaches from 14 sports, finding that less than 50 percent of the coaches surveyed had current CPR or first aid certifications and, overall, the coaches' knowledge of the management of acute athletic injuries was lacking. Although this study was with regard to general first aid and CPR and did not examine the lower extremity specifically, it did look at

situations such as concussions, spinal cord injuries, neck injuries, and, most relevant to the current study and MTSS, fractures. The authors found that only 49.40% of their subjects felt they were prepared to handle fractures, providing insight that coaches' knowledge is lacking for injury management.[8]

Although the previous studies[5-9] looked at a specific knowledge score for one athletic injury or another, all of those reviewed by the researcher reached the same conclusion that there was an insufficient overall knowledge of all areas of athletic injuries with regard to sports medicine. The sports medicine team, in the adolescent athletic population typically involves the student athletes' athletic trainers, coaches and parents. This study showed a weakness in the area of the knowledge of rehabilitation and treatment of MTSS in parents even more than coaches as their score was significantly lower.

Hypothesis 3 stated coaches would have a significantly greater overall knowledge of MTSS than parents. The researcher hypothesized that regardless of what the overall score each subject received on the survey, the coaches' scores would be significantly higher than the scores of the parents. This was based on previous research which examined the knowledge levels of different populations with

regard to different areas of athletic training including knowledge of injuries and management of injuries.[5-9]

The results showed a significant difference between the two groups, stating the mean score for coaches was significantly higher than the mean score for parents. O'Donoghue et al[7] studied the knowledge of coaches with regard to sport-related concussions and found that their population of coaches displayed an overall moderate knowledge of the subject matter. Although this study did not compare populations (i.e. coaches to parents) it still showed that overall there was a gap in knowledge in the coaching population. When comparing this overall knowledge score on the survey to the areas that comprised it, this score may most closely relate to the rehabilitation and treatment knowledge score as it was the only individual category with a significant difference between parents and coaches. This difference, as identified above, shows that the parents may be the least knowledgeable as far as the care of the adolescent athlete suffering from medial tibial stress syndrome when compared to coaches.

In addition to hypothesis testing, several other statistical analyses were conducted in an attempt to find significant differences between the parents and coaches as

well as with subjects who identified themselves as both a parent and a coach.

The first additional findings examined the other areas of knowledge tested in the survey including definition and incidence, anatomy and risk factors, and diagnostic testing by way of independent samples t-tests. This was done to see if there were any significant findings similar to those found in the hypothesis testing with the rehabilitation and overall knowledge scores. The results showed no significant difference in knowledge levels of parents and coaches for any of the three categories. Although the researcher did not examine the knowledge of anatomy and risk factors or of diagnostic testing, O'Donoghue et al[7] found that their subjects' highest area of knowledge was in "recognition," a similar classification by their explanation as definition and incidence.[7] Even though the mean scores were similar to scores in other categories, no significant difference was found in the mean scores of parents and coaches in any of the additional categories tested.

The final additional findings examined the mean scores for each of the categories for subjects who identified themselves as parents, coaches or both by way of a one-way analysis of variance test between groups. A significant

difference was found between groups with regard to the knowledge of rehabilitation and treatment knowledge scores. Although a significant difference was found, post-hoc testing revealed it merely reinforced the findings from the hypothesis testing as the analysis between the "both" group when compared to the other two groups did not show significance. As stated before, this merely reinforced O'Donoghue et al's study showing that the knowledge of the management of injuries in different populations is lacking.[7]

Implications to the Profession

The findings of this research provide possible implications for the profession of athletic training. The research in this study shows that although many parents and coaches of high school athletes know about medial tibial stress syndrome, they may only be able to identify it as an injury and not through symptoms or know common proper prevention or rehabilitation practices. As many athletic trainers practice in the secondary school setting, two of the vital components of the sports medicine team in a high school are the coaches and parents. This lack of knowledge could be an area that athletic trainers attempt to increase

to allow their athletes suffering from MTSS to have a better overall management of their injury.

The sports medicine team in the secondary school setting consists professionally of the athletic trainer(s) and possibly a team physician who is assigned to the school; however, this physician may be contracted by a hospital or clinic and assigned to many schools. In the collegiate and professional settings where athletic trainers practice, there is almost always a team physician readily available as well as chiropractors, physical therapists and other allied health professionals to aid in the care of the athletes. This lack of personnel in the secondary school sports medicine team is one of many reasons that parents and coaches are often much more involved in the management of athletic injuries. The results of this study illustrated a lack of knowledge of medial tibial stress syndrome. Therefore, the overall knowledge level of how to manage athletes suffering from this injury is lacking. By educating parents and coaches, the athletes may be able to be given a higher level of care and the sports medicine team in the secondary school setting will be more effective and efficient in managing MTSS as proper management is closer to common knowledge among the parents and coaches involved. Additionally,

communication with a population of parents and coaches who have a higher knowledge of MTSS will be easier as the learning curve would start with more those more educated on MTSS.

Recommendations for Future Research

Based on the results of this study, the following suggestions for future research will be made. First, the researcher's study surveyed six western Pennsylvania high schools. Although these high schools represented a diverse group of parents and coaches, they may not be representative of other areas of the country's socioeconomic state, level of education, population diversity ratios and the size of individual school districts both in number of residents and geographically. This is both with regard to the type of schools that should be surveyed as well as the number of schools surveyed.

Second, future studies should consider using a different tool for examining knowledge levels of parents and coaches. This study compared coaches to parents and not the actual quantitative level that each group knows. Although the survey created was effective for this study, it may not be effective for studies testing a single

population as the researcher did not determine pass/fail scores which would need to be applied to a single population.

Third, future studies should include a more effective communication method to the parents than disseminating cover letters to athletic directors who distribute it to their coaches who hand it to their players who take it home to their parents. This may account for the low response rate. A more direct way of communicating with the parents and coaches may yield a larger sample size and an increased response rate.

Finally, future studies should examine the interaction between coaches, parents and the athletic trainer with regard to the management of injuries. Similarly, more studies should be performed to understand the level of parents and coaches with regard to more athletic injuries. By doing this, athletic trainers will generally know how knowledgeable the parents and coaches, with whom they are working, are with regard to the injuries the student athletes are sustaining.

Conclusions

The results of the study revealed the following major conclusions:

1. Coaches have an overall greater knowledge of medial tibial stress syndrome than parents of adolescent athletes.
2. Coaches have a greater knowledge of the rehabilitation and treatment of medial tibial stress syndrome than parents of adolescent athletes.
3. There is no significant difference in the knowledge levels of parents and coaches of adolescent athletes of medial tibial stress syndrome with regard to prevention, definition and incidence, anatomy and risk factors, and diagnostic testing.
4. There is no significant difference in the knowledge level in any of the tested categories for subjects who were both a parent and a coach of adolescent athletes.

REFERENCES

1. Yates B, White S. The incidence and risk factors in the development of medial tibial stress syndrome among naval recruits. *Am J Sports Med*. 2004;32(3):772-780.

2. Mubarak S, Gould R, Lee Y. The medial tibial stress syndrome. *Am J Sports Med*. 1988;10:201-205.

3. Galbraith RM, Lavallee ME. Medial tibial stress syndromes: conservative treatment options. *Curr Rev Musculoskelet Med*. 2009;2:127-133.

4. McLeod TCV, Decoster LC, Loud KJ, Micheli LJ, Parker JT, Sandrey MA, White C. National Athletic Trainers' Association Position Statement: prevention of pediatric overuse injuries. *J Athl Training*. 2011;46(2):206-220.

5. Baron MJ, Powell JW, Ewing ME, Nogle SE, Branta CF. First aid and injury prevention knowledge of youth basketball, football and soccer coaches. Intl J Coaching Science. 2009;3(1):55-67.

6. Iversen MD, Friden C. Pilot study of female high school basketball players' anterior cruciate ligament injury knowledge, attitudes and practices. *Scand J Med Sci Sports*. 2009;19:595-602.

7. O'Donoghue EM, Onate JA, Van Lunen B, Peterson CL. Assessment of high school coaches' knowledge of sport-related concussion. *Athletic Training and Sports Health Care Journal*. 2009;1(3):120-132.

8. Cross PS, Karges JR, Adamson AJ, Arnold MR, Meier CM, Hood JE. Assessing the need for knowledge on injury management among high school athletic coaches in South Dakota. *J South Dakota Medicine*. 2010: 241-245.

9. Ward CW. Teens' knowledge of risk factors for sports injuries. *J School Nursing*. 2004;20(4):216-220.

APPENDICES

APPENDIX A

Review of Literature

REVIEW OF LITERATURE

Medial tibial stress syndrome (MTSS), often referred to as "shin splints," is an overuse injury referred to as a continuum of injuries often associated with athletes participating in endurance sports at the high school, college, and professional levels.[1-4] Although the certified athletic trainers (ATCs) dealing with these injured athletes are familiar with MTSS, oftentimes the parents and coaches of the athletes experiencing it are uneducated on the subject. This lack of knowledge could potentially lead to improper management and possibly even make these athletes' symptoms worse.

The purpose of this review is to examine MTSS including current recommendations for best practices related to prevention, management and treatment. This review will have five separate sections: 1) The definition and incidence of MTSS, 2) The functional anatomy associated with MTSS found upon examination of the athlete with MTSS and associated risk factors, 3) Diagnostic testing used in conjunction to the evaluation of the injured athlete, 4) Management of MTSS, and finally, 5) The overall knowledge of parents and coaches of athletes of injuries sustained by

the adolescent athlete. A summary of the literature will be provided at the end of this literature review.

Definition and Incidence

Medial tibial stress syndrome (MTSS) is defined as the most common overuse injury seen in the running and active population.[5,6] Although it is very common, the definition is often inconsistent throughout the literature. Additionally, the incidence of MTSS throughout the literature is often inconsistent as well.

Definition

Yates and White studied the incidence of medial tibial stress syndrome among naval recruits.[5] In their literature review, they reference Murbarak et al's characterization of MTSS, stated as "a symptom complex seen in athletes who complain of exercise induced pain along the posteriormedial border of the tibia."[5,7] Drawing information from several sources, Yates et al[5] expanded on this generic definition to dismiss the previous assumptions that MTSS is merely an inflammatory response process. Instead, Yates and White presented that MTSS is a "a bone stress reaction that becomes painful," citing metabolic changes in the bone due

to exercise as well as an increase in osteoclastic activity on the posteriormedial border; often from compression of the bone. This increase in osteoclastic activity coupled with the bone's inability to replace the broken down tissue fast enough, leads to increasingly porous bone tissue. As the bone is able to be broken down more easily, the athlete begins to feel pain as the bone is subjected to microtraumas which can ultimately result in a stress fracture of the tibia. Though a good definition is crucial to its correct diagnosis, knowing its incidence among the active population is equally helpful in coming to the correct conclusion and identifying potential athletes who could be predisposed to MTSS and other overuse injuries.

Incidence

As previously referenced, Yates and White[5] examined the incidence of medial tibial stress syndrome in a population of 124 naval recruits, aged 17 to 35 with a mean age of 21.06 years (mean age=20.95 years in MTSS group), by way of entrance and exit interviews during their ten week training program. The authors began by taking a baseline history, anthropometric and biomechanical data on each subject and monitored the subjects throughout their training regime. They defined MTSS based on each subject's pain history,

location of pain and positive palpation of pain on the posterior-medial boarder of the tibia. They found that forty of the recruits, 35%, developed MTSS. The authors also reported that female recruits were significantly more prone to developing MTSS (52.9% of female recruits versus 28.2% of male recruits; p=0.012). They concluded that controlling foot pronation and enabling male and female recruits to train separately could potentially decrease the incidence of MTSS in their sample.[5]

Furthermore, Yates et al stated that MTSS accounts for anywhere between 13.2% to 17.3% of all running injuries.[5] Though this number is quite low, Orava et al's findings were quite different.[6]

Orava and Puranen[6] examined the overall occurrence and frequency of medial tibial stress syndrome, as well as several other overuse conditions in the lower leg, in 2750 athletes in Finland, 73% of their subjects falling within the 16 to 29 year old population. MTSS was the most common of the injuries, accounting for 60 percent of all the cases, and when combined with tibial stress fractures, it accounted for 75% of all injuries and the authors noted that both occurred typically at the same site with the same symptoms. The authors of this article also examined the

underlying causes of MTSS and noted that pain was most often elicited by exertional ischemia.

As Orava et al's study involving a sample size of over 2,000 individuals showed that incidence can be as high as 60 percent of injuries,[6] diagnosis of MTSS early is critical. Using an array of devices and methods during evaluation for diagnosis can give the clinician the edge against this syndrome and help catch it before it becomes severe.

Functional Anatomy and Risk Factors

The anatomy associated with medial tibial stress syndrome (MTSS) is typically consistent throughout the literature. Repetitive microtrauma and chronic overuse were outlined in the sources as the main causes of MTSS with secondary causes consisting of the culmination of several other injuries to the lower leg.[5,6] This section will examine; 1) the functional anatomy associated with MTSS as well as the examination and physical findings of MTSS, and 2) the risk factors often predisposing athletes to MTSS.

Functional Anatomy and Physical Findings

A study by Cosca et al[1] examined the causes of common overuse injuries including MTSS through an anatomy overview. The authors outlined basic causes, linking MTSS as being a part of a continuum of stress injuries and microtraumas to the posteriomedial tibia. The main cause noted was hyperpronation.[1] The authors additionally examined the common sign of "shin splints" with regard to pain patterns associated with the relative severity of MTSS. The occurrence of more anterior focal tenderness was more indicative of a stress fracture than more generalized tenderness showed.[1]

Similar to Cosca, Reinking et al[2] examined the anatomic and physiologic aspects of exercise related leg pain. Their study outlined concurrent issues often associated with MTSS such as chronic exertion compartment syndrome, tendinopathies of the lower extremity, tibial and peroneal nerve entrapment and stress fractures of the tibia and fibula. They further examined the anatomy associated with MTSS as well as the typical epidemiology and pathology behind it. More specifically, the authors noted that the cause of MTSS is typically more lateral than the pain presents with the anatomical sources of the medial leg pain associated with MTSS as the tibialis posterior muscle,

flexor digitorum longus, soleus, and the deep crural fascia of the shank. Reinking et al also noted that external risk factors such as training volume, surfaces and shoes contributed to MTSS. Additionally, it examined intrinsic factors such as fore-foot and rear-foot pronation and navicular drop as other key anatomic factors contributing to MTSS.[2]

A retrospective study performed by Lau et al[3] examined pediatric patients, mean age 11.5 years, diagnosed with overuse injuries. The authors studied 506 cases of overuse injuries in the pediatric population. Seventy-three percent of the patients in this study were male and findings stated that the knee and lower leg were the most common part of the body for an overuse injury to occur. The authors went on to examine the differences in functional anatomy between the adolescent and adult athlete citing open and closed epiphyseal plates as one the main difference. The authors concluded that there must be caution taken when diagnosing the pediatric patient as to not overlook issues only seen in adults, most commonly the higher occurrence of avulsions with muscular injuries in children.

Bates,[4] in similar methodology to Lau's retrospective study[3] of the pediatric patient, examined the signs and symptoms, incidence, pertinent anatomy and diagnostic

procedures behind MTSS in the form of a literature review. The symptoms included pain during walking and, in more severe cases, at rest as well as tenderness at the sight of pain, typically over the same anatomical landmarks as found by Reinking et al[2]. Additionally, the review stated that the athlete may present with compartment syndrome of the lower leg. The author found that "shin splints" accounted for up to 15% of all running injures and up to 60% of all lesions in the lower leg.[4] In the same vein, Stauch aimed to examine shin pain in the athletic population.

Strauch et al[8] provided an in-depth analysis on the evaluation methods of shin pain in the athletic patient, most specifically, the runner. They noted that palpation, especially along the medial boarder of the distal third of the fibula is key to the diagnosis of MTSS.

In an exploratory surgery case study by Percy,[9] the author presented a case study in which an adolescent male presents with persistent discomfort in the right lower leg, categorized as shin splints, with a metatarsal fracture in the ipsilateral foot. The patient's pain persisted for eight months without reduction in symptoms following treatment of rest and ice. The symptoms continued to persist and the author hypothesized that exploratory surgery to solve the problem. During the surgery, unlike

the previous studies[1-5], Percy found the athlete's lower leg musculature to be anomalous and continued to decompress the sheath around the muscle with a biopsy revealing a significant difference in muscle physiologic make-up than that of the un-injured leg. This difference showed atrophy on the injured side with increased fibrosis within the tissues, linking this early article to the more current diagnosis of MTSS.[6]

Though many of the studies reviewed have listed their own approach to diagnosing MTSS, Edwards et al[10] found a more standardized approach to diagnosing chronic leg pain in the athletic population. The conditions each case had to meet to be included under the blanket of "chronic leg pain" included medial tibial stress syndrome, stress fractures, chronic exertional compartment syndrome, nerve entrapment and popliteal artery entrapment syndrome. For each condition, the authors created an algorithm to be used in differential diagnosis these conditions and provided a short summary of any confounds between the diagnoses. The authors concluded that this could help differentiate between several of the chronic conditions in the event that the symptoms were masked or common between several overuse syndromes.

Identifying the anatomic structures involved is just one of the pieces to the puzzle of diagnosing and eventually treating MTSS. However, diagnosis can be simplified greatly if the ATC is able to identify certain factors putting their athletes at risk.

Risk Factors

In addition to anatomical and physical findings present in patients with MTSS, multiple risk factors were identified in several studies as contributors and the incidence of MTSS in the athletic population.[4-6,8]

In their review, Bates[4] examined the biomechanical risk factors, including running gait, with regard to foot rigidity in the supinated position during heel strike. The author stated rigidity during heel strike in conjunction with overpronation and/or tibial varum could influence the incidence of MTSS. They concluded that this was one of the underlying causes of MTSS.

Similar to Bates,[4] Rassi et al[11] looked at the relationship between alignment of the lower extremity and MTSS with regard to navicular drop, Q-angle, Achilles angle, tibial angle and intermalleolar and intercondylar distances in the non-professional athlete. Additionally, the subjects had their Body Mass Index (BMI) and history

taken prior and were observed over 17 weeks. Overall, the results showed that navicular drop was the only significant variable that could predict the occurrence of MTSS. However, regarding the authors additional findings (Q-angle, Achilles angle, tibial angle and intermalleolar and intercondylar distances), Rassi et al concluded that these did not apply to their population of non-professional athletes, as they were not statistically significant.[8]

As Bates[4] looked at static, measured risk factors, in a study examining ballet dancers, Gans[12] examined more dynamic risk factors in the ballet dancer. In their study, Gans looked at eight dancers with a history of previous MTSS and eight without with regard to heel contact during the ascent and descent of jumps and if it contributed to their developing MTSS. The author examined the dancers from the push-off to the landing phase of their jumps to determine any abnormalities contributing to MTSS. The author found no significant evidence in the single heel strike, however there was significance in the double heel strike. Though there were significant findings, Gans concluded that there could be confounding issues with Achilles tendon tightness, however they did note that heel strike could contribute to MTSS.

Similar to Rassi's lower leg study[11], Barnes et al[13] examined the association between foot type and medial tibial stress syndrome by way of systematic review of the literature. The foot types examined included pes cavus, pes planus and the "normal" arch. The authors concluded that there was no significant relationship between foot type and the incidence of medial tibial stress syndrome.

An accurate evaluation of the athlete and paying attention to important functional anatomy are key to correctly diagnosing MTSS. Though the evaluation of MTSS is critical, it is equally as important to know the definition and incidence of medial tibial stress syndrome to aid in the care of the athletic population.

Diagnostic Testing

Although a thorough evaluation of the associated anatomic structures of the patient experiencing symptoms is important, diagnostic testing is an important step in the diagnosis, prevention and treatment of MTSS. This section will outline and examine some of the diagnostic imaging procedures used in the diagnosis of MTSS.

Gaeta et al[14] examined the use of CT scans in on runners with MTSS. The purpose of their study was to

determine if runners who were asymptomatic would have abnormalities on CT scans of their tibias as well as determine how accurately the CT scan is in diagnosing medial tibial stress syndrome. They did this by performing CT scans on 20 asymptomatic runners and 21 runners who had either uni- or bilateral tibial pain. The study found that of the painful tibias, 14, all of them showed CT abnormalities and the testing's specificity, sensitivity, positive predictive value and negative predictive value were all very high as well and concluded that high resolution CT scanning is clinically accurate in indicating MTSS.

In a similar study by Holder et al[15], the authors examined scintigraphic patterns of MTSS in 10 patients. The patient population consisted of 5 male and 5 female athletes who were clinically diagnosed with "shin splints" or MTSS. The patients were subjected to three-phase scintigraphy to help diagnose medial tibial stress syndrome. The typical findings that the authors found were longitudinally oriented lesions on the posterior tibia, involving about one third of the bone. The authors concluded that this indicated soleus involvement and that these scintigraphic findings were significant in their

ability to help in the determining of medial tibial stress syndrome from stress fractures and reactions.

In another study examining bone scans and MTSS, Spencer et al[16] described the use of bone scan to determine abnormalities in patients with medial tibial stress syndrome, described in this article as "shin splints." The subjects, all young athletes, had previously had radiographs taken on their lower legs, all of which came back displaying no abnormalities. In each of the patients, there was a significantly noticeable lesion on both tibias and, in one case, on the tarsal bones. The author noted that this further supported the evidence that bone scans can be a very crucial step in the diagnosis of medial tibial stress syndrome.

Though the Holder et al and Spencer et al studies[15,16] showed the efficacy of bone scans, they can be very expensive. Samsi et al[17] chose to look at the more cost efficient x-ray imagining method as a means for diagnosing MTSS. The authors examined the efficacy of x-rays and bone scans in the diagnosis of medial tibial stress syndrome. The study used a total of twenty patients, the majority with tibial pain in the middle or lower 1/3 of the bone, however 3 patients had tenderness over their fibula. In the x-ray films, all the films appeared normal with the

exception of one patient with significant stress fractures, while the bone scan revealed an abnormality in twelve of the twenty patients. The authors concluded that bone scanning is indicated for the diagnosis of medial tibial stress syndrome because of its high sensitivity and specificity after x-rays were performed.

Similarly, Kijowski et al[18] found that x-rays were ineffective of diagnosing MTSS. However, in their study, the authors examined the correlation of x-ray/radiographic imaging with magnetic resonance imaging in patients who were previously diagnosed with medial tibial stress syndrome and were either currently receiving treatment or had just recently returned to participation in their given activity. Their 80 subjects each had underwent MRI and radiographic imaging. The study concluded that there was a strong association between the reaction on the radiographs at the site of the patients' symptoms and the MRI findings.

Although MRI and bone scan findings were found significant in diagnosing MTSS[14-18], Magnusson et al[19] looked at the bone mineral density to find a link. In their study, the authors examined the radiographic data from 14 adult male athletes who had been previously been diagnosed or were currently receiving treatment for medial tibial stress syndrome. The subjects' bone mineral density was

measured at a baseline and then between 4 and 8 years later to record the difference. The study found that in the regions where the pain was palpated, the bone mineral density was significantly lower in the baseline test and returned to normal at the final measurement. The authors concluded that although MTSS causes low bone mineral density while its symptoms are present, post-recovery, the athlete regains normal bone mineral density following an increased uptake.

Moen et al's[20] critical review examined the different methods of diagnosing medial tibial stress syndrome. Unlike previous studies, the authors found that x-ray absorptiometry was an effective imaging method for detecting MTSS. The authors concluded that though imaging techniques are useful in diagnosing MTSS, they must be used with caution.

Medial tibial stress syndrome, though somewhat of an enigma at times, can be easily diagnosed if the correct imagine procedure is utilized.[14-19] Though the use of X-rays has not been shown to have positive results,[17,18] the efficacy of MRI's, CT scans, bone scans and bone mineral density measurements have all been proven in the diagnosis of MTSS. [14-16,18-20]

Management of MTSS

Once an athlete has undergone an evaluation by their athletic trainer, physical therapist or orthopedic physician and have been formally diagnosed with MTSS, the next step is to get them back to competition pain-free. This involves not only a rehabilitation and management program, but also a separate program to help prevent MTSS from reoccurring. Yates and White[5] found a recurrence rate of 28%, with a relative risk of 1.52, showing statistical significance that an athlete will be more prone to developing MTSS if he/she has been previously diagnosed. Statistical significance in perspective, this section will examine the management approaches with regard to rehabilitation of the athlete with MTSS as well as the prevention strategies implemented in the literature for preventing MTSS in the future.

Rehabilitation and Treatment

The athlete suffering from MTSS may or may not undergo rehabilitation. Though this may seem like an inappropriate management strategy to some, much of the literature emphasizes rest as the main tool for helping recover from MTSS.[13,20-25]

Orava and Puranen's[6] study mentioned earlier in the definition and incidence section[5,6] went further to state that the only treatment examined which was noted to decrease symptoms in both the fascial compartment as well as at the site of MTSS was rest. The authors concluded that if rest was ineffective, a surgical intervention in the form of a fasciotomy is recommended to alleviate symptoms.[6]

Galbraith et al[21] also examined the management of MTSS by way of a systematic review. Their review reinforced several factors already mentioned by the authors in the Functional Anatomy and Risk Factors section that contribute to MTSS such as navicular drop, footwear, running distance and intensity. The main focus; however, was to delve into some conservative treatment approaches taken to expedite the process of returning the athlete to play after they have been diagnosed with MTSS. The authors concluded that there are in fact several factors that can be classified as both prevention and rehabilitation. These factors, which can also aid in the recovery process, included relative rest such as cross training or implementing low-impact exercises into the a modified training routine. Additionally, the use of cryotherapy and electrical stimulation with soft tissue mobilization and whirlpool

baths were also indicated for both the acute and subacute phases.

In a case study using a less traditional approach than that of Galbraith et al,[21] Krenner[22] examined a chiropractic approach to managing medial tibial stress syndrome. The treatment consisted of breaking up of adhesions via muscle stripping and massage. Acupuncture was also utilized and additionally, chiropractic manual adjustive techniques to help restore normal biomechanical function bilaterally. This continued 5 times over 10 days until the symptoms were alleviated. Additionally, patient's activity was sharply decreased. Krenner concluded that treatment of MTSS must be a multi-faceted process that not only alleviates pain but also restores biomechanical function.

Strauch and Slomiany[23] took a more traditional approach to their study and examined the causes, treatments and rehabilitation for patients with medial tibial stress syndrome. In the treatment phase of management, the authors identified rest as the main treatment method utilized; however, they noted that pool workouts were effective in maintaining the athlete's level of fitness. Acute treatment for pain modulation consisted of NSAIDS, ice massage, iontophoresis and compression to the area by way of a neoprene sleeve worn on the lower leg.

Similar to the other authors,[20-23] in an article from the Journal of Athletic Training, Shaffer[24] provided an in depth look into the prevention and treatment of stress fractures. This article was an update to a previous article by the same authors. They updated their findings from their initial study to include that pneumatic bracing of the tibia, which used in conjunction with immobilization and rest, aided in reducing the recovery period in the athlete with stress reactions, stress fractures and MTSS.

Though there are many articles concerned with the treatment of MTSS, very few of the articles surveyed implement these methods into a high quality study testing a larger sample size. In a randomized controlled trial however, Johnston et al[25] examined the treatment of medial tibial stress syndrome in 2700 navy recruits, which was finally narrowed down to 25 subjects in their experimental group following the exclusion of subjects who progressed to stress fractures or concurrent lower extremity pathologies. Their two treatment methods consisted of traditional conservative treatment involving typical cyrotherapy methods, a stretching and strengthening program, NSAIDs for pain modulation, modification of training routines and relative rest with the other group received pneumatic leg brace orthoses. Though the orthoses did aid in the

soldiers' recovery, the authors weren't able to draw any conclusions from their findings and stated that more research would be needed to verify if the orthoses are effective in the prevention and treatment of medial tibial stress syndrome.

Although many of the authors suggested different methods such as leg orthoses,[23,25] and traditional modality use for pain modulation,[21,22] the one thing that remained consistent was the need of rest for the injury. Whether it was termed "relative" or "modified," rest was the one true generally accepted treatment option for the athlete suffering from MTSS.[6,20-23,25] However, once the athlete who was suffering from MTSS is returned to participation, the focus must now be changed from treating the syndrome to preventing it.

Prevention

Once the athlete has completed resting and their rehabilitation program for MTSS and has returned to competition, the focus must shift from treating MTSS to preventing it from occurring again.

Strauch and Slomiany[23] noted that prevention can be made considerably easier with the implementation of a strength and conditioning program, even after the athlete

has fully recovered. The program, the authors suggested, should include flexibility exercises as well as strengthening exercises, emphasizing the calves, hamstrings and quadriceps.

Adverse to Strauch and Slomiany,[23] Shaffer's[24] review also examined two studies which integrated only a stretching program to aid, but found that both were ineffective in preventing MTSS. The authors concluded that evidence for preventing MTSS and tibial stress fractures is generally lacking concrete strategies for effective prevention. Essentially, the prevention of MTSS must be a multifaceted approach.

Examining MTSS on a larger scale, Rome et al[26] created a Cochran review examining the common techniques for preventing stress fractures and reactions in young athletes. The authors went on to review 13 trials of military recruits enrolled in MTSS prevention programs and 3 trials of treatment programs. In the 10 trials involving orthoses, data suggested that the interventions did significantly prevent MTSS when compared to the non-orthoses groups. Two trials concluded that muscle stretching did not help prevent injuries when performed prior to exercises, much like Shaffer.[24]

Similarly, a review by Craig[27] examined the literature on the prevention of MTSS. The author examined studies in which there was a controlled trial of an evidence based prevention method for MTSS including insoles, stretching programs, footwear and graduated running programs. However, like previous literature,[23,24] Craig concluded that none of the studies of MTSS prevention had statistically significant evidence that their respective prevention method was effective, however, there was promise for shock absorbing insoles from one of the studies reviewed.[25]

An NATA position statement by McLeod et al[28] examined the prevention of overuse injuries in the pediatric population, including MTSS. The statement highlights some of the profiles of both male and female athletes that may predispose athletes to overuse injuries such as tall stature, more explosive strength, large Q angles, increased muscle tightness and decreased muscle flexibility. The authors also stated that a decrease in the overall fitness level in the general population means that training routines must be more gradually introduced to help prevent overuse injuries. They concluded that the athletic trainer must be able to identify risk factors associated with overuse injuries as well as taking the appropriate steps as to help prevent these injuries.

Similar to previous articles,[23-25] A prospective controlled study was conducted by Gardner et al[29] to examine the effect of shock absorbent insoles in the prevention of stress fractures and other overuse injuries. The authors studied a group of 3,025 marine recruits over a period of 12 weeks and systematically issued elastic polymer insoles to even and odd numbered platoons. After a period of time, the authors found that the insoles did not prevent stress reactions in the tibias. They also included a control group of those recruits who were wearing running sneakers as opposed to boots during their workouts for about an hour and a half a day, examining the age of the shoe relative to the incidence of shin pain. They found that though there was a trend that the age of the shoe had somewhat an effect, it was not large enough to be significant in preventing stress reactions. They concluded that neither the shock absorbent insoles nor the age of sneakers of the control group was significant in preventing lower extremity stress reactions their subject pool.

Tolbert and Brinkley[30] examined several articles on the incidence of MTSS in athletics and created a program to help counteract the underlying causes they found in a review of the literature. Including a warm up for 5 to 10 minutes greatly increased the efficacy of the program. The

program also included hamstring stretching, soleus stretching, gastrocnemius stretching and ice massage for pain modulation. The authors concluded that though rest is the only treatment, by integrating a stretching and strengthening program such as this, the athletic training and strengthening and conditioning staff can greatly reduce the incidence of MTSS.

Similar to Shaffer[24] and Craig[27] however, Brushoj et al's[31] randomized controlled trial examined an exercise program to aid in the prevention of MTSS and other overuse injuries of the lower extremity. The subjects were either given an prevention program consisting of squats, lunges, hip abduction and external rotation exercises, forefoot lifts, coordination drills and quadriceps stretching or a placebo program of abdominal curls, back extensions, biceps and triceps towel curls and pectoral stretches. The authors found that the program did not help prevent the incidence of MTSS in the recruits; however, it did increase the recruits' 12-minute maximal running test distance when compared to the placebo group. The authors concluded that this may be caused by the lack of knowledge of all the risk factors behind overuse injuries.

Though very few of the authors found any significant evidence on the effective prevention of MTSS, making sure

to only gradually increase activity was shown to help prevent MTSS. Additionally, the integration of a warm-up into a training routine can also decrease the incidence of MTSS.

Knowledge of Athletic Injuries

Prevention, assessment and management of the athlete with MTSS is built into the proficiency assessment of athletic trainers as they complete their undergraduate or entry-level masters' programs. On the other end of the spectrum, however, the same cannot be said for the parents and coaches of these athletes as they are not as versed in these areas. Injuries, generally, are easily recognized by coaches, parents and other athletes, who typically possess a basic understanding of the care and prevention aspects. Several recent studies have been conducted looking at the knowledge level of these three populations that are the frontline in dealing with athletic injuries.

O'Donoghue et al[32] conducted a study in the form of a survey examining the knowledge of high school coaches with regard to sport-related concussions. Looking at their subjects' knowledge, the authors split their survey into prevention, management and recognition sections.

Additionally, the subjects were split into groups according to sex and whether or not they had attended a concussion workshop or not. The authors found that overall, the coaches' scored best in the area of recognition and worst in management and that male coaches, regardless of the sex of their athletes or their sport, were more knowledgeable than females.

In a more focalized study by Cross et al,[33] the authors examined only the state of South Dakota's high school coaching population's knowledge of injury management. The population included 1050 coaches from 14 sports, the majority of which indicated that they were in charge of the initial evaluation of athletic injuries for their athletes. The study found that less than 50 percent of the coaches surveyed had current CPR or first aid certifications and, overall, the coaches' knowledge of the management of acute athletic injuries was lacking.

Similar to O'Donoghue et al's[32] study, Baron et al[34] conducted a smaller, but similar survey-based study with regard to injury prevention and first aid knowledge of high school coaches in the mid-Michigan area. The results, however; unlike O'Donoghue's[32] study, showed that only fifteen out of the 290 coaches earned a passing score on the Revised First-Aid Assessment Survey, suggesting that

overall, the population who was surveyed had insufficient knowledge in the realm of first aid and injury prevention.

While many of these studies have examined the knowledge of coaches,[32-34] Iversen and Friden[35] examined the knowledge of female high school basketball players' knowledge of anterior cruciate ligament injures with regard to knowledge attitudes and practices associated with ACL injuries. The authors examined 113 players and 12 coaches in these knowledge areas with 86 (74 players, 12 coaches) completing the study. The authors concluded that even after the trial, there were no significant findings with regard to any of the areas beings assessed.

Very much in the same context of Iversen and Friden's study,[35] Ward[36] also examined teens' knowledge of the risk factors associated with common sports injuries in the area of prevention of athletic injuries. In their study, the author administered a survey during a physical education class to students testing the subjects' knowledge of athletic injury prevention. Ward concluded that the subjects not only had a high level of athletic participation, but they concurrently had a high level of knowledge with regard to common injury prevention practices and the equipment often utilized.

Although coaches are often the first responders to their athletes when an acute trauma occurs, they are not always as knowledgeable as many would like them to be.[32-34] Although two of the studies surveyed looked at the knowledge of athletes of injury prevention and management,[35,36] the athlete who is injured will not be the first responder to their own ankle sprain, torn labrum or other trauma, nor should they be expected to be. Additionally, few studies have examined the knowledge level of the parents of the athletes who are suffering these injuries. Because of this lack of knowledge, the athletes can often be at risk and this can create a problem.

Summary

Medial tibial stress syndrome is a continuum of lower leg traumas associated with overuse in athletics and other physical activity.[5-7] Though the evaluation of the functional anatomy and risk factors associated with it are very well defined, and all but set in stone,[1-10] the diagnostic testing for MTSS has been somewhat controversial and, as far as the literature is concerned, very indeterminate.[14-19,24]

The athletic trainer must recognize these risk factors and be able to integrate prevention programs and educate their athletes on the proper prevention techniques to help them avoid MTSS and keep them in the game.[22-29] Additionally, when an adolescent athlete does end up with MTSS, rest and a proper rehabilitation and management program is critical in the athlete's return to play.[5,6,20-25]

Although the athletic trainer is often very knowledgeable on MTSS, the integration of these prevention and management strategies can be difficult if the parents, coaches and athletes they are working with are ignorant on the subject. As shown in the literature, coaches and athletes are oftentimes well below the adequate knowledge level in regard to athletic injury management and prevention in general and the literature of the knowledge of parents is all but non-existent.[32-36] This can create an issue for the Athletic Trainer during the management of the athlete with MTSS.

APPENDIX B

The Problem

STATEMENT OF THE PROBLEM

The purpose of the study was to examine the knowledge of parents and coaches with regard to medial tibial stress syndrome. If we, as athletic trainers, are able to identify problem areas and gaps in knowledge bases and educate those with this lack of knowledge, the overall care of the athlete suffering from medial tibial stress syndrome may be better. As MTSS is a continuum of overuse trauma to the lower leg, the overall management of it can be considerably difficult as everyone involved in the prevention, management and treatment must take a multifaceted approach. The athletic trainer and coaches are typically on the front lines of the prevention aspect in the adolescent athlete. These are the individuals typically responsible for the conditioning prior to the season and training program throughout the season. The parents become much more involved when the athlete sustains MTSS as they must try to help their children manage the problem. Since the parents and coaches are such a large part in the prevention and management aspects of MTSS, their knowledge of the prevention and treatment must be to a certain level as to not mismanage or further injure the athlete.

Definition of Terms

The following definitions of terms were defined for this study:

1) Medial tibial stress syndrome (MTSS) - A continuum of overuse injuries to the lower leg resulting in a loss of function.
2) Adolescent Athlete- Any high school-aged person competing in high school athletics.

Basic Assumptions

The following are basic assumptions of this study:

1) The subjects will be honest when they complete their demographic sheets.
2) The subjects will answer the survey to the best of their ability.
3) Subjects will be representative of high school coaches and parents in their knowledge of MTSS.

Limitations of the Study

The following are possible limitations of the study:

1) The knowledge of MTSS in the populations being surveyed may be skewed by overall education of the community surveyed.

2) Coaches and Parents may provide inconsistent responses.
3) The validity of the survey has not been established.
4) There is no current research specifically regarding this topic.
5) The distribution method to both the parents and coaches was indirect, which could account for the low response rate.

Significance of the Study

This study will be significant as it will provide feedback to the knowledge base of parents and coaches with regard to medial tibial stress syndrome. This can aid in the care of the athlete suffering from MTSS by having the athlete's parents and coaches be able to potentially identify signs and symptoms and refer their athlete to their athletic trainer or doctor, potentially decreasing recovery time. With this knowledge, communication between the athletic trainer, parents and coaches will be made easier as all three will be greater informed. Additionally, the risk of MTSS being mismanaged in the adolescent athlete can be minimized as both the coaches would be less likely to have the athlete "walk it off,"

and, similarly, parents will be less likely to push their children through the pain.

APPENDIX C

Additional Methods

APPENDIX C1

MTSS Knowledge Survey

Medial Tibial Stress Syndrome Knowledge Survey

Dear Parent or Coach,

My name is Joseph McShane and I am currently a master's degree candidate at California University of Pennsylvania Graduate Athletic Training Education Program. In order to complete part of my degree requirements, I am requesting your participation in my research thesis. I am conducting survey research to examine the knowledge of parents and coaches of high school athletes of athletic injuries with regard to the realms of Athletic Training. The results of this study (excluding individual and demographic information) may be published in medical journals for the benefit of the medical community.

Parents and Coaches of high school athletes are being asked to participate in this research; however, your participation is voluntary and you have the right to choose not to participate or to discontinue participation at any time by exiting the survey. The California University of Pennsylvania Institutional Review Board has reviewed and approved this project. The approval is effective 2/21/2012 and expires 2/19/2013.

The survey, entitled Medial Tibial Stress Syndrome Knowledge Survey, consists of 3 to 5 demographic questions and 30 knowledge questions, and will take about 15 to 20 minutes to complete. Minimal risk is posed by participating in this study as confidentiality will be maintained.

All survey responses are anonymous and upon submission, neither your name nor any other demographic information will be attached to the answers you provide. Informed consent to use the data collected will be assumed upon submission of the survey to the researcher. Survey responses collected will only be accessible to the primary researcher and the Graduate Athletic Training Education Program (GATEP) Chair. Upon completion of the study, all individual survey results will be deleted.

Please take this survey at at your earliest convenience. If you have any questions regarding this project, please feel free to contact the primary researcher, Joseph McShane at mcs4257@calu.edu. You can also contact the faculty advisor for this research, Ellen West, EdD, ATC at west_e@calu.edu.

Please click next to complete the survey. Thank you in advance for your participation. I greatly appreciate your time and effort.

Sincerely,
Joseph McShane, ATC
Primary Researcher
California University of Pennsylvania
250 University Ave, California PA 15419
mcs4257@calu.edu

Medial Tibial Stress Syndrome Knowledge Survey

*1. What is your relationship to your student athlete(s)?

- [ ] Parent
- [ ] Coach
- [ ] Both
- [ ] Neither

Medial Tibial Stress Syndrome Knowledge Survey

***2. What sport(s) does your student athlete(s) play? (choose all that apply)**

- ☐ Baseball
- ☐ Basketball
- ☐ Cross Country
- ☐ Field Hockey
- ☐ Football
- ☐ Ice Hockey
- ☐ Lacrosse
- ☐ Soccer
- ☐ Softball
- ☐ Swimming
- ☐ Tennis
- ☐ Track & Field
- ☐ Volleyball
- ☐ Wrestling

Other (please specify)

***3. Gender of children currently participating in high school sports**

	0 Children	1 Child	2 Children	3 Children	4 or More Children
Male	☐	☐	☐	☐	☐
Female	☐	☐	☐	☐	☐

Medial Tibial Stress Syndrome Knowledge Survey

***4. What sport do you coach? (choose all that apply)**

- ☐ Baseball
- ☐ Basketball
- ☐ Cross Country
- ☐ Field Hockey
- ☐ Football
- ☐ Ice Hockey
- ☐ Lacrosse
- ☐ Soccer
- ☐ Softball
- ☐ Swimming
- ☐ Tennis
- ☐ Track & Field
- ☐ Volleyball
- ☐ Wrestling

Other (please specify)

***5. What is your coaching title?**

- ☐ Head Coach
- ☐ Assistant Coach

Other (please specify)

***6. What gender are your athletes?**

- ◯ Male
- ◯ Female
- ◯ Both

Medial Tibial Stress Syndrome Knowledge Survey

***7. What sport(s) does your student athlete(s) play?**

- [ ] Baseball
- [ ] Basketball
- [ ] Cross Country
- [ ] Field Hockey
- [ ] Football
- [ ] Ice Hockey
- [ ] Lacrosse
- [ ] Soccer
- [ ] Softball
- [ ] Swimming
- [ ] Tennis
- [ ] Track & Field
- [ ] Volleyball
- [ ] Wrestling

Other (please specify)

***8. Gender of children currently participating in high school sports**

	0 Children	1 Child	2 Children	3 Children	4 or More Children
Male	☐	☐	☐	☐	☐
Female	☐	☐	☐	☐	☐

Medial Tibial Stress Syndrome Knowledge Survey

***9. What sport do you coach?**

- [ ] Baseball
- [ ] Basketball
- [ ] Cross Country
- [ ] Field Hockey
- [ ] Football
- [ ] Ice Hockey
- [ ] Lacrosse
- [ ] Soccer
- [ ] Softball
- [ ] Swimming
- [ ] Tennis
- [ ] Track & Field
- [ ] Volleyball
- [ ] Wrestling

Other (please specify)

***10. What is your coaching title?**

- ◯ Head Coach
- ◯ Assistant Coach

Other (please specify)

***11. What gender are your athletes?**

- ◯ Male
- ◯ Female
- ◯ Both

Medial Tibial Stress Syndrome Knowledge Survey

***12. Of the four injuries listed, which is the most reported "overuse" injury seen in the active population?**

	Medial Tibial Stress Syndrome (MTSS)/ "Shin Splints"	Iliotibial Band (IT Band) Friction Syndrome	Patella-Femoral Pain Syndrome (PFPS)	Plantar Fasciitis
Choose the best answer:	◯	◯	◯	◯

***13. Where is the most common location for pain associated with Medial Tibial Stress Syndrome(MTSS)?**

	Top of your foot	Inside of your knee	Front/inside of your shin bone	Outside of your ankle
Choose the best answer:	◯	◯	◯	◯

***14. Which gender is more prone to developing Medial Tibial Stress Syndrome (MTSS)?**

	Male	Female
Choose the best answer:	◯	◯

***15. MTSS can occur as frequently as ___% in the athletic population.**

	10%	30%	60%	90%
Choose the best answer:	◯	◯	◯	◯

***16. The following muscle group should be the focus of a stretching and strengthening program for the prevention of MTSS:**

	Calf muscles	Quadriceps (Front Thigh muscles)	Hamstrings (Back Thigh muscles)	All of the Above
Choose the best answer:	◯	◯	◯	◯

***17. Orthopedic devices (orthotics) which have been designed to prevent MTSS have been proven effective in doing so.**

	True	False
Choose the best answer:	◯	◯

***18. Which of the following is the most effective in preventing MTSS?**

	Shock absorbing shoe insoles	Stretching/Strengthening Program	Proper Footwear	Graduated Running Programs
Choose the best answer:	◯	◯	◯	◯

***19. The sports medicine team can help prevent MTSS by doing which of the following:**

	Identify risk factors	Identify differences in the athletes' bodies	Utilize a graduated training routine	All of the Above
Choose the best answer:	◯	◯	◯	◯

Medial Tibial Stress Syndrome Knowledge Survey

***20. A 5 to 10 minute warm up can help prevent MTSS**

	True	False
Choose the best answer:	◯	◯

***21. Beginning a program at a higher level will help the athlete to peak at the correct time and prevent MTSS from occurring.**

	True	False
Choose the best answer:	◯	◯

***22. Which group of muscles is typically most at fault for pain associated with MTSS?**

	Calf and Front-Shin Muscles; "The Lower Leg"	Back-Thigh muscles	Front-Thigh muscles	Hip Muscles
Choose the best answer:	◯	◯	◯	◯

***23. Where is the most common site for pain associated with overuse injuries to occur?**

	Knee and hip	Knee and shin	Ankle and knee	Shoulder and elbow
Choose the best answer:	◯	◯	◯	◯

***24. Which of the following injuries/conditions is NOT typically seen along with MTSS?**

	Compartment Syndrome	Stress Fractures	Nerve Damage	Ankle Sprains
Choose the best answer:	◯	◯	◯	◯

***25. Which of the following is NOT a risk factor associated with MTSS?**

	Amount of Training	Weather	Surface Type (grass, concrete, asphalt, running track)	Athletic Footwear
Choose the best answer:	◯	◯	◯	◯

***26. A _____ foot, while running, can contribute to MTSS**

	Rigid	Non-rigid	Relaxed	Sprained
Choose the best answer:	◯	◯	◯	◯

***27. Which of the following does NOT make an athlete more susceptible to MTSS?**

	Tall stature	Tight hamstring muscles	Short stature	Tight calf muscles
Choose the best answer:	◯	◯	◯	◯

***28. The most effective imaging method for diagnosing MTSS is Computerized Tomography (CT Scans)**

	True	False
Choose the best answer:	◯	◯

***29. Which of the following diagnostic imaging methods is NOT effective in helping diagnose MTSS specifically, but may aid in the diagnosis in the long run?**

	CT Scans	Scintigraphy	Bone Scans	X-Rays
Choose the best answer:	◯	◯	◯	◯

Medial Tibial Stress Syndrome Knowledge Survey

***30. MTSS will show up on diagnostic images (x-rays, bone scans, etc.).**

	True	False
Choose the best answer:	◯	◯

***31. This is the least expensive diagnostic imaging method often used as a tool in diagnosing MTSS:**

	Bone Scans	X-Rays	MRI's	CT Scans
Choose the best answer:	◯	◯	◯	◯

***32. An athlete's predisposition to MTSS can be determined by how dense their shin bones are.**

	True	False
Choose the best answer:	◯	◯

***33. Bone density returns to normal following a full recovery from MTSS.**

	True	False
Choose the best answer:	◯	◯

***34. When MTSS is seen on x-rays, it has typically progressed to a stress fracture.**

	True	False
Choose the best answer:	◯	◯

***35. What is the MOST important treatment following diagnosis of MTSS?**

	Change their shoes often	Limit running on grass	Rest	Ignore it
Choose the best answer:	◯	◯	◯	◯

***36. Which of the following is helpful in the rehabilitation of an athlete suffering from MTSS?**

	Implementing pool workouts	Relative Rest	Biking rather than running	All of the Above
Choose the best answer:	◯	◯	◯	◯

***37. Which of the following treatment methods are NOT used for the management of MTSS symptoms immediately after diagnosis?**

	Electrical Stimulation	Ice Bags	Hot Water Whirlpool	Cold Water Whirlpool
Choose the best answer:	◯	◯	◯	◯

***38. Which of the following is the most appropriate for maintaining an athlete's level of fitness throughout an MTSS rehabilitation program?**

	Plyometrics and Jump Training Exercises	Pool workouts	Lower Body Weight Training	None of the Above
Choose the best answer:	◯	◯	◯	◯

Medial Tibial Stress Syndrome Knowledge Survey

***39. The management of MTSS is almost exactly the same as the management of _____.**

	Stress Fractures	Pulled Hamstrings	Ankle Sprains	Torn ACL's
Choose the best answer:	◯	◯	◯	◯

***40. A research-based conservative treatment program for MTSS would consist of all of the following EXCEPT:**

	Compression sleeves for the shin or other orthopedic devices	NSAID's for controlling pain (Advil, Aleve, etc)	Relative Rest with a Stretching/Strengthening Routine	Icing the injury
Choose the best answer:	◯	◯	◯	◯

***41. Resting the involved limb, specifically from activities that produce pain is defined as:**

	Active Assistance	Relative Rest	Cross Training	None of the Above
Choose the best answer:	◯	◯	◯	◯

Medial Tibial Stress Syndrome Knowledge Survey

Thank you for your participation in this survey.

APPENDIX C2

Institutional Review Board –

California University of Pennsylvania

California University of Pennsylvania

Proposal Number
Date Received

PROTOCOL for Research Involving Human Subjects

Institutional Review Board (IRB) approval is required before beginning any research and/or data collection involving human subjects

(Reference IRB Policies and Procedures for clarification)

Project Title *Knowledge of Medial Tibial Stress Syndrome of Parents and Coaches of Adolescent Athletes*

Researcher/Project Director *Joseph McShane, ATC*

Phone # *814-403-8266* ***E-mail Address*** *mcs4257@calu.edu*

Faculty Sponsor (if required) *Ellen J West, EdD, ATC*

Department *Health Science*

Project Dates *January 1, 2012* ***to*** *December 31, 2012*

Sponsoring Agent (if applicable) *n/a*

Project to be Conducted at *California University of Pennsylvania*

Project Purpose: ☒ ***Thesis*** ☐ ***Research*** ☐ ***Class Project*** ☐ ***Other***

Keep a copy of this form for your records.

Approved, September 12, 2005 / (updated 02-09-09)

Please attach a typed, detailed summary of your project AND complete items 2 through 6.

1. *Provide an overview of your project-proposal describing what you plan to do and how you will go about doing it. Include any hypothesis(ses)or research questions that might be involved and explain how the information you gather will be analyzed. For a complete list of what should be included in your summary, please refer to Appendix B of the IRB Policies and Procedures Manual.*

   The purpose of the study is to examine the knowledge of parents and coaches with regard to medial tibial stress syndrome (MTSS). The research to be conducted will be descriptive in design. The dependent variable will be the knowledge of medial tibial stress syndrome measured by the subjects' score on the survey they are to be given. The independent variable will be the if the participant is a parent or a coach. The subjects of the survey will be parents and coaches of adolescent athletes in central and western Pennsylvania. The researcher will utilize athletic directors (AD's) at high schools to distribute a pen and paper survey at random to the parents and coaches at their respective schools. The AD's will be given a cover letter asking permission and explaining the significance of the study as well as instructions on distribution to the parents and coaches.

   Once the AD has distributed the survey, the subjects will be given a cover letter with the survey explaining the purpose. Informed consent will be implied by the completion and returning of the survey to the researcher. Surveys will be returned by mail in self addressed, stamped envelopes. Results will be kept secure in the Graduate Athletic Training Program Director's office in a locked cabinet until the data is to be analyzed. The following hypotheses were based on the researcher's review of the literature and the researcher's intuition. The hypotheses will be tested utilizing appropriate statistical techniques.

   1. Coaches will have a significantly greater overall knowledge of MTSS than parent.
   2. Coaches will have a significantly greater knowledge of the treatment of MTSS than parents.
   3. Coaches will have a significantly greater knowledge of the prevention of MTSS than parents.

2. *Section 46.11 of the Federal Regulations state that research proposals involving human subjects must satisfy certain requirements before the IRB can grant approval. You should describe in detail how the following requirements will be satisfied. Be sure to address each area separately.*

   a. *How will you insure that any risks to subjects are minimized? If there are potential risks, describe what will be done to minimize these risks. If there are risks, describe why the risks to participants are reasonable in relation to the anticipated benefits.*

      Risks to subjects will be minimal. The survey to be administered will contain question testing coaches' and parents' knowledge of medial tibial stress syndrome as well as some demographic questions. To minimize risks further, the subjects will be informed that the demographic information that is to be collected will be kept anonymous and confidential.

   b. *How will you insure that the selection of subjects is equitable? Take into account your purpose(s). Be sure you address research problems involving vulnerable populations such as children, prisoners, pregnant women, mentally disabled persons, and economically or educationally disadvantaged persons. If this is an in-class project describe how you will minimize the possibility that students will feel coerced.*

      Subjects will be selected based on the criteria that they are either a parent or coach of an adolescent athlete without discrimiation or specialized selection methods. This study will not be surveying a vulnerable population and participation is completely voluntary. All subjects will be parents or coaches of adolescent athletes in western and central Pennsylvania.

c. *How will you obtain informed consent from each participant or the subject's legally authorized representative and ensure that all consent forms are appropriately documented? Be sure to attach a copy of your consent form to the project summary.*

As the study has minimal risk, participating in the survey will be completely voluntary and their consent will be implied when they complete the survey. In the case that the survey is completed by a parent or coach that has not reached 18 years of age, the survey will be discarded.

d. *Show that the research plan makes provisions to monitor the data collected to insure the safety of all subjects. This includes the privacy of subjects' responses and provisions for maintaining the security and confidentiality of the data.*

Subjects' names will not be included in the survey in any way. Additionally, the responses received via mail will be stored in a secure cabinet on campus in the Graduate Athletic Training Program Director's office under lock and key.

3. *Check the appropriate box(es) that describe the subjects you plan to use.*

☒ *Adult volunteers*	☐ *Mentally Disabled People*
☐ *CAL University Students*	☐ *Economically Disadvantaged People*
☐ *Other Students*	☐ *Educationally Disadvantaged People*
☐ *Prisoners*	☐ *Fetuses or fetal material*
☐ *Pregnant Women*	☐ *Children Under 18*
☐ *Physically Handicapped People*	☐ *Neonates*

4. *Is remuneration involved in your project?* ☐ *Yes or* ☒ *No. If yes, Explain here.*

5. *Is this project part of a grant?* ☐ *Yes or* ☒ *No If yes, provide the following information:*

   Title of the Grant Proposal _____

   Name of the Funding Agency _____

   Dates of the Project Period _____

6. *Does your project involve the debriefing of those who participated?* ☐ *Yes or* ☒ *No*

   If Yes, explain the debriefing process here.

7. *If your project involves a questionnaire interview, ensure that it meets the requirements of Appendix___in the Policies and Procedures Manual.*

California University of Pennsylvania Institutional Review Board
Survey/Interview/Questionnaire Consent Checklist (v021209)

This form MUST accompany all IRB review requests

Does your research involve ONLY a survey, interview or questionnaire?
☒ **YES**—Complete this form
☐ **NO**—You MUST complete the "Informed Consent Checklist"—skip the remainder of this form

Does your survey/interview/questionnaire cover letter or explanatory statement include:

☒ (1) Statement about the general nature of the survey and how the data will be used?

☒ (2) Statement as to who the primary researcher is, including name, phone, and email address?

☒ (3) FOR ALL STUDENTS: Is the faculty advisor's name and contact information provided?

☒ (4) Statement that participation is voluntary?

☒ (5) Statement that participation may be discontinued at any time without penalty and all data discarded?

☒ (6) Statement that the results are confidential?

☒ (7) Statement that results are anonymous?

☒ (8) Statement as to level of risk anticipated or that minimal risk is anticipated? (NOTE: If more than minimal risk is anticipated, a full consent form is required—and the Informed Consent Checklist must be completed)

☒ (9) Statement that returning the survey is an indication of consent to use the data?

☒ (10) Who to contact regarding the project and how to contact this person?

☒ (11) Statement as to where the results will be housed and how maintained? (unless otherwise approved by the IRB, must be a secure location on University premises)

☒ (12) Is there text equivalent to: "Approved by the California University of Pennsylvania Institutional Review Board. This approval is effective nn/nn/nn and expires mm/mm/mm"? (the actual dates will be specified in the approval notice from the IRB)?

☐ (13) FOR ELECTRONIC/WEBSITE SURVEYS: Does the text of the cover letter or explanatory statement appear before any data is requested from the participant?

☐ (14) FOR ELECTONIC/WEBSITE SURVEYS: Can the participant discontinue participation at any point in the process and all data is immediately discarded?

California University of Pennsylvania Institutional Review Board
Informed Consent Checklist (v021209)

This form MUST accompany all IRB review requests

Does your research involve ONLY a survey, interview, or questionnaire?
☒ **YES**—DO NOT complete this form. You MUST complete the "Survey/Interview/Questionnaire Consent Checklist" instead.
☐ **NO**—Complete the remainder of this form.

1. **Introduction** (check each)
   - ☐ (1.1) Is there a statement that the study involves research?
   - ☐ (1.2) Is there an explanation of the purpose of the research?

2. **Is the participant.** (check each)
   - ☐ (2.1) Given an invitation to participate?
   - ☐ (2.2) Told why he/she was selected.
   - ☐ (2.3) Told the expected duration of the participation.
   - ☐ (2.4) Informed that participation is voluntary?
   - ☐ (2.5) Informed that all records are confidential?
   - ☐ (2.6) Told that he/she may withdraw from the research at any time without penalty or loss of benefits?
   - ☐ (2.7) 18 years of age or older? (if not, see Section #9, Special Considerations below)

3. **Procedures** (check each).
   - ☐ (3.1) Are the procedures identified and explained?
   - ☐ (3.2) Are the procedures that are being investigated clearly identified?
   - ☐ (3.3) Are treatment conditions identified?

4. **Risks and discomforts**. (check each)
   - ☐ (4.1) Are foreseeable risks or discomforts identified?
   - ☐ (4.2) Is the likelihood of any risks or discomforts identified?
   - ☐ (4.3) Is there a description of the steps that will be taken to minimize any risks or discomforts?
   - ☐ (4.4) Is there an acknowledgement of potentially unforeseeable risks?
   - ☐ (4.5) Is the participant informed about what treatment or follow up courses of action are available should there be some physical, emotional, or psychological harm?
   - ☐ (4.6) Is there a description of the benefits, if any, to the participant or to others that may be reasonably expected from the research and an estimate of the likelihood of these benefits?
   - ☐ (4.7) Is there a disclosure of any appropriate alternative procedures or courses of treatment that might be advantageous to the participant?

5. **Records and documentation**. (check each)
   - ☐ (5.1) Is there a statement describing how records will be kept confidential?
   - ☐ (5.2) Is there a statement as to where the records will be kept and that this is a secure location?
   - ☐ (5.3) Is there a statement as to who will have access to the records?

6. For research involving more than minimal risk (check each),

☐ (6.1) Is there an explanation and description of any compensation and other medical or counseling treatments that are available if the participants are injured through participation?

☐ (6.2) Is there a statement where further information can be obtained regarding the treatments?

☐ (6.3) Is there information regarding who to contact in the event of research-related injury?

7. Contacts.(check each)

☐ (7.1) Is the participant given a list of contacts for answers to questions about the research and the participant's rights?

☐ (7.2) Is the principal researcher identified with name and phone number and email address?

☐ (7.3) FOR ALL STUDENTS: Is the faculty advisor's name and contact information provided?

8. General Considerations (check each)

☐ (8.1) Is there a statement indicating that the participant is making a decision whether or not to participate, and that his/her signature indicates that he/she has decided to participate having read and discussed the information in the informed consent?

☐ (8.2) Are all technical terms fully explained to the participant?

☐ (8.3) Is the informed consent written at a level that the participant can understand?

☐ (8.4) Is there text equivalent to: "Approved by the California University of Pennsylvania Institutional Review Board. This approval is effective nn/nn/nn and expires mm/mm/mm"? (the actual dates will be specified in the approval notice from the IRB)

9. Specific Considerations (check as appropriate)

☐ (9.1) If the participant is or may become pregnant is there a statement that the particular treatment or procedure may involve risks, foreseeable or currently unforeseeable, to the participant or to the embryo or fetus?

☐ (9.2) Is there a statement specifying the circumstances in which the participation may be terminated by the investigator without the participant's consent?

☐ (9.3) Are any costs to the participant clearly spelled out?

☐ (9.4) If the participant desires to withdraw from the research, are procedures for orderly termination spelled out?

☐ (9.5) Is there a statement that the Principal Investigator will inform the participant or any significant new findings developed during the research that may affect them and influence their willingness to continue participation?

☐ (9.6) Is the participant is less than 18 years of age? If so, a parent or guardian must sign the consent form and assent must be obtained from the child

- ☐ Is the consent form written in such a manner that it is clear that the parent/guardian is giving permission for their child to participate?
- ☐ Is a child assent form being used?
- ☐ Does the assent form (if used) clearly indicate that the child can freely refuse to participate or discontinue participation at any time without penalty or coercion?

☐ (9.7) Are all consent and assent forms written at a level that the intended participant can understand? (generally, 8th grade level for adults, age-appropriate for children)

California University of Pennsylvania Institutional Review Board
Review Request Checklist (v021209)

This form MUST accompany all IRB review requests.
Unless otherwise specified, ALL items must be present in your review request.

Have you:

☒ (1.0) FOR ALL STUDIES: Completed ALL items on the Review Request Form?
Pay particular attention to:

- ☒ (1.1) Names and email addresses of all investigators
  - ☒ (1.1.1) FOR ALL STUDENTS: use only your CalU email address)
  - ☒ (1.1.2) FOR ALL STUDENTS: Name and email address of your faculty research advisor
- ☒ (1.2) Project dates (must be in the future—no studies will be approved which have already begun or scheduled to begin before final IRB approval—NO EXCEPTIONS)
- ☒ (1.3) Answered completely and in detail, the questions in items 2a through 2d?
  - ☒2a: NOTE: No studies can have zero risk, the lowest risk is "minimal risk". If more than minimal risk is involved you MUST:
    - ☐ i. Delineate all anticipated risks in detail;
    - ☐ ii. Explain in detail how these risks will be minimized;
    - ☐ iii. Detail the procedures for dealing with adverse outcomes due to these risks.
    - ☐ iv. Cite peer reviewed references in support of your explanation.
  - ☒ 2b. Complete all items.
  - ☒ 2c. Describe informed consent procedures in detail.
  - ☒ 2d. NOTE: to maintain security and confidentiality of data, all study records must be housed in a secure (locked) location ON UNIVERSITY PREMISES. The actual location (department, office, etc.) must be specified in your explanation and be listed on any consent forms or cover letters.
- ☒ (1.4) Checked all appropriate boxes in Section 3? If participants under the age of 18 years are to be included (regardless of what the study involves) you MUST:
  - ☐ (1.4.1) Obtain informed consent from the parent or guardian—consent forms must be written so that it is clear that the parent/guardian is giving permission for their child to participate.
  - ☐ (1.4.2) Document how you will obtain assent from the child—This must be done in an age-appropriate manner. Regardless of whether the parent/guardian has given permission, a child is completely free to refuse to participate, so the investigator must document how the child indicated agreement to participate ("assent").
- ☒ (1.5) Included all grant information in section 5?
- ☒ (1.6) Included ALL signatures?

☐ (2.0) FOR STUDIES INVOLVING MORE THAN JUST SURVEYS, INTERVIEWS, OR QUESTIONNAIRES:

- ☐ (2.1) Attached a copy of all consent form(s)?
- ☐ (2.2) FOR STUDIES INVOLVING INDIVIDUALS LESS THAN 18 YEARS OF AGE: attached a copy of all assent forms (if such a form is used)?
- ☐ (2.3) Completed and attached a copy of the Consent Form Checklist? (as appropriate—see that checklist for instructions)

☒ (3.0) FOR STUDIES INVOLVING ONLY SURVEYS, INTERVIEWS, OR QUESTIONNAIRES:

- ☒ (3.1) Attached a copy of the cover letter/information sheet?
- ☒ (3.2) Completed and attached a copy of the Survey/Interview/Questionnaire Consent Checklist? (see that checklist for instructions)
- ☒ (3.3) Attached a copy of the actual survey, interview, or questionnaire questions in their final form?

☒ (4.0) FOR ALL STUDENTS: Has your faculty research advisor:

- ☒ (4.1) Thoroughly reviewed and approved your study?
- ☒ (4.2) Thoroughly reviewed and approved your IRB paperwork? including:
  - ☒ (4.2.1) Review request form,
  - ☐ (4.2.2) All consent forms, (if used)
  - ☐ (4.2.3) All assent forms (if used)
  - ☒ (4.2.4) All Survey/Interview/Questionnaire cover letters (if used)
  - ☒ (4.2.5) All checklists
- ☒ (4.3) IMPORTANT NOTE: Your advisor's signature on the review request form indicates that they have thoroughly reviewed your proposal and verified that it meets all IRB and University requirements.

☒ (5.0) Have you retained a copy of all submitted documentation for your records?

9

Project Director's Certification
Program Involving HUMAN SUBJECTS

The proposed investigation involves the use of human subjects and I am submitting the complete application form and project description to the Institutional Review Board for Research Involving Human Subjects.

I understand that Institutional Review Board (IRB) approval is required before beginning any research and/or data collection involving human subjects. If the Board grants approval of this application, I agree to:

1. Abide by any conditions or changes in the project required by the Board.
2. Report to the Board any change in the research plan that affects the method of using human subjects before such change is instituted.
3. Report to the Board any problems that arise in connection with the use of human subjects.
4. Seek advice of the Board whenever I believe such advice is necessary or would be helpful.
5. Secure the informed, written consent of all human subjects participating in the project.
6. Cooperate with the Board in its effort to provide a continuing review after investigations have been initiated.

I have reviewed the Federal and State regulations concerning the use of human subjects in research and training programs and the guidelines. I agree to abide by the regulations and guidelines aforementioned and will adhere to policies and procedures described in my application. I understand that changes to the research must be approved by the IRB before they are implemented.

Professional Research

Project Director's Signature

Department Chairperson's Signature

Student or Class Research

Student Researcher's Signature

Supervising Faculty Member's Signature if required

Department Chairperson's Signature

ACTION OF REVIEW BOARD (IRB use only)

The Institutional Review Board for Research Involving Human Subjects has reviewed this application to ascertain whether or not the proposed project:

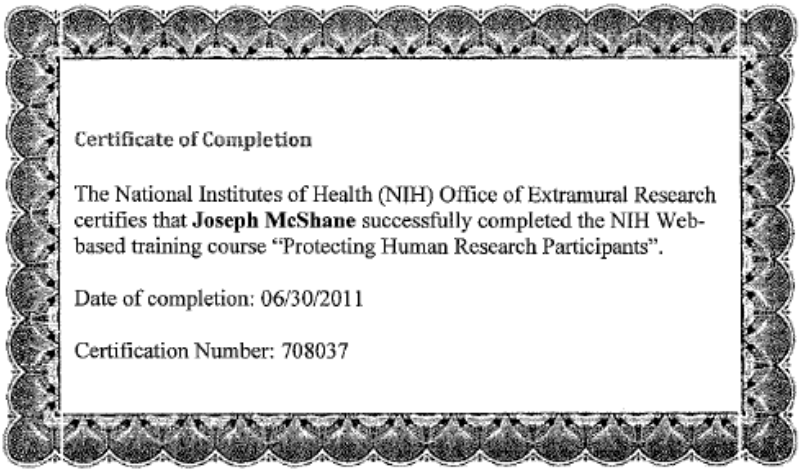
1. provides adequate safeguards of the rights and welfare of human subjects involved in the investigations;
2. uses appropriate methods to obtain informed, written consent;
3. indicates that the potential benefits of the investigation substantially outweigh the risk involved.
4. provides adequate debriefing of human participants.
5. provides adequate follow-up services to participants who may have incurred physical, mental, or emotional harm.

☐ Approved[_____] ☐ Disapproved

Chairperson, Institutional Review Board

Date

Approved, September 12, 2005 / (updated 02-09-09)



Certificate of Completion

The National Institutes of Health (NIH) Office of Extramural Research certifies that **Joseph McShane** successfully completed the NIH Web-based training course "Protecting Human Research Participants".

Date of completion: 06/30/2011

Certification Number: 708037

11-036 Approval
instreviewboard
Sent: Monday, February 20, 2012 1:10 PM
To: MCS4257 - MCSHANE, JOSEPH JEFFREY
Cc: West, Ellen

Institutional Review Board
California University of Pennsylvania
Morgan Hall, Room 310
250 University Avenue
California, PA 15419
instreviewboard@calu.edu
Robert Skwarecki, Ph.D., CCC-SLP,Chair

Dear Joseph McShane:

Please consider this email as official notification that your proposal titled "Knowledge of Medial Tibial Stress Syndrome of Parents and Coaches of Adolescent Athletes" (Proposal #11-036) has been approved by the California University of Pennsylvania Institutional Review Board as amended.

The effective date of the approval is 2-20-2012 and the expiration date is 2-19-2013. These dates must appear on the consent form .
Please note that Federal Policy requires that you notify the IRB promptly regarding any of the following:

(1) Any additions or changes in procedures you might wish for your study (additions or changes must be approved by the IRB before they are implemented)

(2) Any events that affect the safety or well-being of subjects

(3) Any modifications of your study or other responses that are necessitated by any events reported in (2).

(4) To continue your research beyond the approval expiration date of 2-19-2013 you must file additional information to be considered for continuing review. Please contact instreviewboard@calu.edu

Please notify the Board when data collection is complete.

Regards,

Robert Skwarecki, Ph.D., CCC-SLP
Chair, Institutional Review Board

The following changes were submitted to the IRB and accepted. They can be found in this email approval from the IRB:

Institutional Review Board
California University of Pennsylvania
Morgan Hall, Room 310
250 University Avenue
California, PA 15419
instreviewboard@calu.edu
Robert Skwarecki, Ph.D., CCC-SLP,Chair

Dear Joseph McShane:

Please consider this email as official notification that the modifications (listed below) to your previously-approved study (#11-036 "Knowledge of Medial Tibial Stress Syndrome of Parents and Coaches of Adolescent Athletes") have been approved by the California University of Pennsylvania Institutional Review Board.

-Modify methods to include online survey distribution (e.g. SurveyMonkey) in addition to the pen and paper method already in place
NOTE: the cover letter/consent form must appear on the online site prior to any survey questions.

-Addition of McDowell High School as a data collection site

This modification is effective 2-21-2012. The expiration date is the same as for the original approval (2-19-2013). These dates must appear on the consent form.
Please note that Federal Policy requires that you notify the IRB promptly regarding any of the following:

(1) Any additions or changes in procedures you might wish for your study (additions or changes must be approved by the IRB before they are implemented)
(2) Any events that affect the safety or well-being of subjects
(3) Any modifications of your study or other responses that are necessitated by any events reported in (2).
(4) To continue your research beyond the approval expiration date of 2-19-2013 you must file additional information to be considered for continuing review. Please contact instreviewboard@calu.edu

Please notify the Board when data collection is complete.
Regards,
Robert Skwarecki, Ph.D., CCC-SLP
Chair, Institutional Review Board

APPENDIX C3

Letter to Panel of Experts

California University of Pennsylvania

November 28, 2011

Dear Athletic Training Colleague,

I am a graduate student at California University of Pennsylvania pursing a Master of Science Degree in Athletic Training. I am conducting survey research to add to the bank of knowledge within the Athletic Training profession. The objective of my study is to test the knowledge level of my subjects with regard to medial tibial stress syndrome. The subjects for this study will include parents and coaches of high school athletes. The participants will be contacted by their children's athletic directors and all information will be kept confidential.

I am the primary researcher and have developed the questionnaire to be used in this study. You have been chosen to be an expert on this panel to assist in the validation of my study, due to your expertise and experience. Your feedback is very important to the success of this study and I greatly appreciate any suggestions you have. Any comments or suggestions you submit will be used to revise and make the questionnaire more valid for use in this study.

Any additional comments about the survey would be appreciated. Please note this survey will be delivered to the subjects via paper survey and not as a word document. I have given you the word document version in order that you may make comments. Please return this document to me with any comments you may have by December 1, 2011. If you have any questions do not hesitate to contact me via email or phone at mcs4257@calu.edu or (814) 403-8266.

After completing and reviewing the survey, please answer the following questions:
1) Are the questions direct and understandable?
2) Are there any questions that are not coherent or should be excluded from the research?
3) Are there any questions that should be added to questionnaire that would aid in the research?

Thank you in advance for your time, efforts, and consideration in helping me with my research.

Sincerely,

Joseph McShane, ATC
California University of PA

APPDENDIX C4

Cover Letter for Survey

CALIFORNIA UNIVERSITY OF PENNSYLVANIA
ATHLETIC TRAINING

March 8, 2012

Dear Parent or Coach,

My name is Joseph McShane and I am currently a master's degree candidate at California University of Pennsylvania Graduate Athletic Training Education Program. In order to complete part of my degree requirements, I am requesting your participation in my research thesis. I am conducting survey research to examine the knowledge of parents and coaches of high school athletes of athletic injuries with regard to the realms of Athletic Training. The results of this study (excluding individual and demographic information) may be published in medical journals for the benefit of the medical community.

Parents and Coaches of high school athletes are being asked to participate in this research; however, your participation is voluntary and you have the right to choose not to participate or to discontinue participation at any time by exiting the survey. The California University of Pennsylvania Institutional Review Board has reviewed and approved this project. The approval is effective 2/21/2012 and expires 2/19/2013.

The survey, entitled *Medial Tibial Stress Syndrome Knowledge Survey*, consists of 3 to 5 demographic questions and 30 knowledge questions, and will take about 15 minutes to complete. Minimal risk is posed by participating in this study as confidentiality will be maintained.

All survey responses are anonymous and upon submission, neither your name nor any other demographic information will be attached to the answers you provide. Informed consent to use the data collected will be assumed upon submission of the survey to the researcher. Survey responses collected will only be accessible to the primary researcher and the Graduate Athletic Training Education Program (GATEP) Chair. Upon completion of the study, all individual survey results will be deleted.

Please take this survey at **www.surveymonkey.com/s/caluMTSS** at your earliest convenience. The survey will be available starting March 7, 2012 and continue through March 30, 2012. If you have any questions regarding this project, please feel free to contact the primary researcher, Joseph McShane at *mcs4257@calu.edu*. You can also contact the faculty advisor for this research, Ellen West, EdD, ATC at *west_e@calu.edu*.

Thank you in advance for your participation. I greatly appreciate your time and effort.

Sincerely,

Joseph McShane, ATC
Primary Researcher
California University of Pennsylvania
250 University Ave, California PA 15419
mcs4257@calu.edu

APPENDIX C5

Letter to Athletic Directors

California University of Pennsylvania

February 8, 2012

Dear Athletic Director:

My name is Joseph McShane and I am a Graduate Athletic Trainer at California University of Pennsylvania seeking my Masters of Science degree in Athletic Training. A requirement for this degree is the completion of a research based thesis project; my study's title is "The Knowledge of Medial Tibial Stress Syndrome (Shin Splints) of Parents and Coaches of Adolescent Athletes."

Students participating in high school athletics are subjected to the rigors of not only training, but competition as well. As their training regimes grow ever more intense to compete at a higher level and beat their competition, the risk for injuries increases. Although many coaches and parents think of an athletic injury consisting of a sprained ankle or a separated shoulder, many are unaware of the injuries caused by overtraining and overuse; termed "overuse injuries." Medial tibial stress syndrome (MTSS), often referred to as "Shin Splints," is one of these injuries often seen in the pediatric population. Though its incidence is quite common, its management for the children who are without the supervision of an athletic trainer at their high school is often left up to their parents and coaches. A lack of knowledge of the proper management of this injury can lead to more serious injuries such as stress fractures or neural damage from compartment syndrome of the lower leg. My study is aiming to test the knowledge level of these parents and coaches to see how knowledgeable they really are.

I am asking that the parents of athletes and coaches fill out a survey on their own time. This survey will ask 30 questions regarding medial tibial stress syndrome and take about twenty minutes. In addition to the knowledge questions, the subjects will be asked demographic questions such as "are you a parent or a coach" and "what sport does your child participate in?" Once the surveys are completed, they will be returned by each subject in a provided postage paid envelope.

I am writing to seek your approval to use your High School athletes' parents and coaches for participation in my study.

In conclusion, I would like to thank you for your time, cooperation, and consideration with this matter.

Sincerely,

Joseph McShane
California University of Pennsylvania
Graduate Assistant Athletic Trainer

REFERENCES

1. Cosca DD, Navazio F. Common problems in endurance athletes. *Am Family Phys.* 2007;76(2):237-244.

2. Reinking MF. Literature Review: Exercise Related Leg Pain (ERLP): A Review of the Literature. *North American Journal of Sports Physical Therapy*. 2007; 2(3):170-181.

3. Lau LL, Mahadev A, Hui JHP. Common lower limb sports-related overuse injuries in young athletes. *Ann Acad Med Signapore*. 2008;37(4):315-319.

4. Bates P. Shin splints- a literature review. *Brit J Sports Med*. 1985;19(3):132-137.

5. Yates B, White S. The incidence and risk factors in the development of medial tibial stress syndrome among naval recruits. *Am J Sports Med*. 2004; 32(3):772-780.

6. Orava S, Puranen J. Athletes' leg pains. *Brit J Sports Med*. 1979;13:92-97.

7. Mubarak S, Gould R, Lee Y. The medial tibial stress syndrome. *Am J Sports Med*. 1988;10:201-205.

8. Strauch WB, Slomiany WP. Evaluating shin pain in active patients. *J Musculoskeletal Medicine*. 2008;25(3):138-140,144-146,148.

9. Percy ECC. Case report: an epiphyseal stress fracture of the foot and shin splint in an anomalous calf muscle in a runner. *Brit J Sports Med*. 1980;14(2,3):110-113.

10. Edwards PH, Wright ML, Hartman JF. A practical approach for the differential diagnosis of chronic leg pain in the athlete. *Am J Sports Med*. 2005;33(8):1241-1249.

11. Raissi GRD, Cherati ADS, Mansoori KD, Razi MD. The relationship between lower extremity alignment and medial tibial stress syndrome among non-professional athletes. *Sports Medicine, Arthroscopy, Rehabilitation, Therapy and Technology*. 2009(1:11).

12. Gans A. The relationship of heel contact in asscent and descent from jumps to the incidence of shin splints in ballet dancers. *Physical Therapy*. 1985;65(8):1192-1196.

13. Barnes A, Wheat J, Milner C. Association between foot type and tibial stress injuries: a systematic review. *Br J Sports Med*. 2008;42:93-98.

14. Gaeta M, Minutoli F, Vinci S, Salamone I, D'Andrea L, Bitto L, Magaudda L, Alfredo B. High-Resolution CT grading of tibial stress reactions in distance runners. *Am J Roentgen*. 2006;187: 789-793.

15. Holder LE, Michael RH. The specific scintigraphic pattern of "shin splints in the lower leg": concise communication. *J Nucl Med*. 1984;25:865-869.

16. Spencer RP, Levinson ED, Baldwin RD, Sziklas JJ, Witek JT, Rosenberg R. Diverse bone scan abnormalities in "shin splints." *J Nucl Med.* 1979;20:1271-1272.

17. Samsi AB, Tilve GH, Shikare S. Bone imaging in sports medicine. *J Postgraduate Medicine*. 1997;43(3):71-72.

18. Kijowski R, Choi J, Mukharjee R. Significance of radiographic abnomalities in patients with tibial stress injuries: correlation with magnetic resonance imaging. *Skeletal Radiol*. 2007;36:633-640.

19. Magnusson HI, Ahlborg HG, Karlsson C, Nyquist F, Karlsson MK. Low regional tibial bone density in athletes with medial tibial stress syndrome normalizes after recovery from symptoms. *Am J Sports Med*. 2003;31:596-600.

20. Moen MH, Tol JL, Weir A, Steunebrink M, De Winter TC. Medial tibial stress syndrome: A critical review. *J Sports Med.* 2009;39(7):523-546.

21. Galbraith RM, Lavallee ME. Medial tibial stress syndroms: conservative treatment options. *Curr Rev Musculoskelet Med.* 2009;2:127-133.

22. Krenner BJ. Case report: comprehensive management of medial tibial stress syndrome. *J Chiropractic Medicine.* 2002;3(1):122-124.

23. Strauch WB, Slomiany WP. Shin pain treatments get active patients back on track. *Biomechanics*. 2008;15(4):31-38.

24. Shaffer SW, Uhl TL. Preventing and treating lower extremity stress reactions and fractures in adults. *J Athletic Training*. 2006;41(4):466-469.

25. Johnston E, Flynn T, Bean M, Breton M, Scherer M, Dreltzler G, Thomas D. A randomized controlled trial of a leg orthosis versus traditional treatment for soldiers with shin splints: a pilot study. *Military Medicine*. 2006;171(1):40-44.

26. Rome K, Handoll HHG, Ashford RL. Interventions for preventing and treating stress fractures and stress reactions of bone of the lower limbs in young adults (Review). *The Cochrane Library*. 2009(1).

27. Craig DI. Medial tibial stress syndrome: Evidence-based prevention. *J Athl Training*. 2008;43(3):316-318.

28. McLeod TCV, Decoster LC, Loud KJ, Micheli LJ, Parker JT, Sandrey MA, White C. National athletic trainers' association position statement: prevention of pediatric overuse injuries. *J Athletic Training*. 2011;46(2):206-220.

29. Gardner LI. Dziados JE, Jones BH, Brundage JF, Harris JM, Sullivan R, Gill P. Prevention of lower extremity stress fractures: a controlled trial of a shock absorbent insole. *APJH*. 1988;78(12):1563-1568.

30. Tolbert TA, Binkley HM. Treatment and prevention of shin splints. *Strength and Conditioning Journal*. 2009;31(5):69-72.

31. Brushoj C, Larsen K, Albrecht-Beste E, Nielsen MB, Loye F, Holmich P. Prevention of overuse injuries by a concurrent exercise program in subjects exposed to an increase in training load: a randomized controlled trial of 1020 army recruits. *Am J Sports Med*. 2008;36(4):663-670.

32. O'Donoghue EM, Onate JA, Van Lunen B, Peterson CL. Assessment of high school coaches' knowledge of sport-related concussion. *Athletic Training and Sports Health Care Journal*. 2009;1(3): 120-132.

33. Cross PS, Karges JR, Adamson AJ, Arnold MR, Meier CM, Hood JE. Assessing the need for knowledge on injury management among high school athletic coaches in South Dakota. *J South Dakota Medicine*. June 2010; 241-245.

34. Baron MJ, Powell JW, Ewing ME, Nogle SE, Branta CF. First aid and injury prevention knowledge of youth basketball, football and soccer coaches. *Intl J Coaching Science.* 2009;3(1):55-67.

35. Iversen MD, Friden C. Pilot study of female high school basketball players' anterior cruciate ligament injury knowledge, attitudes and practices. *Scand J Med Sci Sports.* 2009;19: 595-602.

36. Ward CW. Teens' knowledge of risk factors for sports injuries. *J School Nursing*. 2004;20(4): 216-220.

ABSTRACT

Title: THE KNOWLEDGE OF MEDIAL TIBIAL STRESS SYNDROME OF PARENTS AND COACHES OF ADOLESCENT ATHLETES

Researcher: Joseph J. McShane

Advisor: Dr. Ellen J. West

Date: May 2012

Research Type: Master's Thesis

Context: This study evaluated the knowledge of parents and coaches of adolescent athletes of medial tibial stress syndrome with regard to different areas of knowledge associated with athletic injuries within the scope of practice of athletic trainers.

Objective: The purpose of this study was to examine the knowledge of parents and coaches of medial tibial stress syndrome in the adolescent athlete.

Design: Descriptive research study

Setting: The researcher distributed a cover letter containing a link to the Internet based survey to athletic directors at the high schools to be surveyed. The athletic directors then distributed the letter to the parents and coaches at their respective schools.

Subjects: Parents and coaches of the six western Pennsylvania high schools' athletes surveyed.

Interventions: The independent variables in the study were the subjects tested (either parents or coaches). The dependent variable was the subjects' score as measured by the MTSS knowledge survey ($r = 0.374$), each question being worth one point. The survey was created by the researcher and administered

via a cover letter given to the athletic directors at the high schools to be surveyed who then distributed the cover letter to the parents and coaches at their school. The data was analyzed using SPSS at a significance level at $\alpha \leq 0.05$.

Measurements: All data analyzed at a significance level at $\alpha \leq 0.05$ for all hypotheses. H1: an independent samples t-test was used to compare mean prevention knowledge scores between parents and coaches. H2: an independent samples t-test was used to compare mean rehabilitation and treatment knowledge scores between parents and coaches. H3: an independent samples t-test was used to compare mean overall knowledge scores between parents and coaches.

Results: Hypothesis 1 had findings that were not significant. H1: ($t(59) = .200$, $p > 0.05$). Hypotheses 2 and 3 had findings that were significant. H2: ($t(59) = -2.754$, $p < 0.05$). H3: ($t(59) = -2.382$, $p < 0.05$).

Conclusion: The study revealed that coaches of adolescent athletes have a significantly greater level of knowledge of the rehabilitation and treatment of medial tibial stress syndrome than parents of adolescent athletes. Coaches also have a significantly greater overall level of knowledge of medial tibial stress syndrome.