

Education and Screening of the Female Athlete Triad in the Adolescent Population

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Approved May 2020

Abstract

The Female Athlete Triad was first identified in 1992, yet the majority of primary care providers are unaware of the signs and symptoms and proper screening for the syndrome. The purpose of this study was to implement screening for symptoms of the female athlete triad with female adolescent athletes. The primary measured outcome was the diagnosis of the female athlete triad using the Female Athlete Screening Tool. Secondary measures included provider satisfaction of understanding and diagnosing the triad, body mass index, injury history, Tanner staging, and diet. Also, pre and post education was provided to primary care providers on the diagnosis of the female athlete triad. The providers answered questions from the Provider's Satisfaction Scale. The quasi-experimental study included 11 participants between the ages of 13-18 at a Midwest pediatric primary care practice during Fall 2019 and Spring 2020. One participant was found to be at high risk for developing the female athlete triad and two others were at risk. Six providers from the pediatric practice participated in education on the female athlete triad and a two percent increase in knowledge was discovered at post testing. The evidence and findings indicate that providers should screen for the female athlete triad with their female athlete patients. Recognition of the syndrome early could mitigate both short and long term consequences. Short-term consequences include disordered eating that can lead to anorexia and long-term consequences include amenorrhea that can lead to osteoporosis.

Keywords: primary care providers, female athlete triad, FAST, education, screening

Education and Screening of the Female Athlete Triad in the Female Adolescent Population

The female athlete triad is a constellation of symptoms that plagues many female athletes who desire to excel in their sport (Nazem & Ackerman, 2012). The Task Force on Women's Issues of the American College of Sport's Medicine (ACSM) first identified the phenomena in 1992. At that time, they labeled the symptoms of disordered eating, amenorrhea, and osteoporosis that health care providers were observing in the female adolescent athlete population. Diagnosis required that all three elements of the triad be present simultaneously for the diagnosis to be made, which caused many athletes to go undiagnosed (Kelly & Hecht, 2016). In 2007, the ACSM changed the diagnostic criteria. The female athlete triad is now identified as a continuum of irregularities ranging from healthy to disease related to energy availability, menstrual function, and bone mineral density (BMD). The female adolescent athlete does not need to be affected by all three elements of the triad to be officially diagnosed. The adolescent female can have one, two, or three of the symptoms in order to be diagnosed with the female athlete triad (Matzkin, Curry & Whitlock, 2015). Since the change in diagnostic criteria, diagnosing the triad has increased (Kelly & Hecht, 2016).

Several health consequences are associated with eating disorders that are linked to high mortality rates. Premature death is six to nine times more likely in women with an eating disorder (Joy, Kussman, & Nattiv, 2016). Athletes are aware that initial weight loss may lead to better competition outcomes and success. However, achieving weight loss can create a domino effect leading to nutritional deficiencies, immune system suppression, and chronic fatigue (de Oliveira Coelho et al., 2014). It is common for this disorder to be overlooked until the female athlete begins to experience serious side effects such as exhaustion, electrolyte imbalance, and

multiple stress fractures (Thralls et al., 2016). Bone weakening and energy depletion are also key characteristics of the female athlete triad (Pantano, 2016). If the female continues to play in college, the cycle continues and often worsens (Nazem & Ackerman, 2012).

Local Issue

Attention needs to be focused on acknowledging that the female athlete is at risk for the triad. Many adolescent athletes go undiagnosed because their primary care provider (PCP) is not aware of the signs and symptoms that make up the female athlete triad (Thralls et al., 2016). The major issue identified is the underreported health issues related to the female athlete triad. In addition, the sports pre-participation exam (PPE) includes questions regarding weight, diet, and any history of eating disorders. Providers are not aware that if an athlete answers “yes” to any of the diet, weight, or history of eating disorder questions that the Female Athlete Triad Coalition recommends the PCP ask additional questions specific to the female athlete triad (McNulty, Adams, Anderson & Affenito, 2014).

Specific to the Kansas City area, a Varsity high school softball coach reported that although she was unaware of the diagnoses of the female athlete triad, she had noted several of the symptoms in her players over time such as weakness, stress fractures, weight loss, and excessive exercise (T. Carroll, personal communication, March 21, 2019).

The PCPs at the project site are the main providers for many of the female adolescent athletes at surrounding high schools. The Midwest Pediatric Clinic serves approximately twelve different high schools and is the primary site for many female sports PPE. Female adolescent athletes are seen from all sports, including volleyball, track, cross-country, soccer, basketball, softball, soccer, swimming, and cheerleading. Aside from school-based sports many female adolescent athletes are involved in competitive activities including competitive dance,

gymnastics, and ice-skating. The project site sees a variety of different races for each sport, but Caucasian is the predominate race. The female athlete triad can affect all cultures, races, ethnicities, and socio-economic statuses.

Diversity Considerations

Past studies have demonstrated that eating disorders do not discriminate and impact individuals of all ages, racial and ethnic backgrounds, socioeconomic status, and gender (Bould et al., 2016). Female adolescent athletes compete in an array of sports including track, cross-country, swimming, gymnastics, ice-skating, soccer, and volleyball. Though the female athlete triad may arise in any physical activity, athletes engaging in sports dedicated to endurance, artistic, weight bound behaviors, or sports that highlight staying thin pose a more significant threat (McNulty, Adams, Anderson & Affenito, 2014; Thralls et al., 2016).

Researchers found that female African Americans and Latino high school athletes have a lower risk of disordered eating, stress fractures, and menstrual dysfunction compared to Caucasians (Mountjoy et al., 2018). A study assessing nutritional understanding, physical activity habits, and beliefs across sex, race and ethnicity, and socioeconomic status in female adolescent athletes was lower among Latinos compared to African Americans and Caucasians (Manore, Patton-Lopez, Meng, & Wong, 2017).

The project was conducted in a busy Midwest pediatric practice. The census of the town is around 76,000, with 20,000 being 18 years of age and younger. The racial demographics of the community include Caucasian 87%, African American 6.4%, and Hispanic 7%. The most popular foreign languages spoken are Spanish, Creole, African dialects, and Arabic (Data Gov, 2018). The poverty rate is around 19% and exceeds the national average. The median annual income for households is about \$46,000, which is lower than the median annual income of

\$60,000 for the Untied States (Census, 2017). The practice serves many of the pediatric population of the project site, but it is also the closest pediatric clinic for multiple surrounding rural towns. The practice accepts all types of insurance including private, Medicaid, Medicare, and self-pay. Approximately 89% of the population has insurance coverage, with 46% on employee based plans, 16% on Medicaid, 11% on Medicare, 13% on non-specified plans, and 3% covered by military plans (Data Gov, 2018).

Problem Statement

Many PCPs are unaware of the diagnosis of the female athlete triad. Researchers estimate 15%-54% of female adolescent athletes suffer from one, two, or three of the symptoms that form the constellation of the triad (Barrack et al., 2014). Although it is a recognized medical diagnosis, the education of health care providers is necessary to understand the incidence and impact the disease has on the present and future healthcare needs of the female adolescent athlete. Healthy People 2020 Objectives are aimed at improving the development, health, safety, and well-being of adolescents and young adults. Identifying and treating the female athlete triad early can mitigate long-term sequelae such as osteoporosis, cardiovascular disease, and poor reproductive health.

Intended Improvement with Purpose

The primary purpose of the project was to educate PCPs on the signs and symptoms of the female athlete triad and the use of the Female Athlete Screening Tool (FAST). The intended improvement included that PCPs would become more knowledgeable of the signs and symptoms of the triad and the short and long-term consequences to the female adolescent athletes health. The goal was to improve the diagnosis of the female athlete triad in a pediatric

primary care clinic. Triggers for change were due to the increased prevalence of the female athlete triad and the potential long-term health consequences if untreated.

Facilitators and Barriers

Content experts and professional consultants facilitated successful outcomes for this project. The chosen site included four pediatricians, two PNPs, and eight nurses. All providers were aware of the project and showed interest in participating in the study. Between these healthcare providers, they average 65,000 visits a year from newborn to eighteen years of age. The providers see a large number of female adolescent athletes every year for their annual sports PPE. The state of Missouri mandates that all adolescent athletes must have sports PPE prior to participation in school-based athletics. The female athlete triad is a timely topic and significantly impacts female adolescent athletes. As there are both short and long term side effects of this disease, the sustainability of studying the issues of the disease process and developing interventions to treat are continuous.

Barriers included the vulnerable nature of the adolescent population and their reliance on adult guardians. Consent was completed by the parent or guardian. This can be challenging if the female adolescent comes to the appointment by herself and cannot give consent. Parents or guardians may be leery of participating in the study or may not understand the significance of the female athlete triad on both short and long term health of their adolescent. Another key barrier was the amount of time required by the PCPs to complete the multi-layered study protocol. Because this site has seven PCPs and eight nurses, protocol drift could occur and threaten the integrity of the study.

Inquiry

Among primary care providers, does education on the FAST compared to no education and screening tool, increase diagnosis of the female athlete triad over six-months?

Search Strategies

Over thirty published articles and studies were found that relate to the female athlete triad and the health belief model. Five electronic databases for articles published from 2014 to 2019 were searched to identify studies that have investigated the female athlete triad. These databases included PubMed, EMBASE, MEDLINE, CINAHL, and Cochrane. Key search words included female athlete triad, female adolescent athletes, disordered eating, reproductive health, and primary care provider (Appendix A).

Inclusion criteria included female, ages 13-18, and engaged in at least one physical activity. Exclusion criteria included males, non-athletes years, and younger than 13 and older than 18 years of age. The identified studies consisted of ten quantitative studies, fourteen qualitative studies, five systematic reviews, and one evidence based practice guideline. Based on Melnyk & Fineout-Overholt (2019) three of the studies were Level I evidence, two studies were Level II, five studies were Level III, three studies were a Level IV, eight studies were Level V, and four studies were a Level VI. The student investigator also evaluated one Evidence Based Practice Guideline published by the Female Athlete Triad Coalition. These studies have directly provided evidence and guidance for the evidence-based practice project.

Evidence by Themes

The themes of female adolescent athletes, female athlete triad, education of PCPs, and utilizing the FAST were evident in the synthesis of evidence for the topic of this inquiry. Six articles supported female adolescent athletes, three articles supported the female athlete triad, nine articles supported education of PCPs, and four articles supported the FAST (Appendix B).

Female Adolescent Athletes

Female adolescent athletes express a competitive edge and desire to win no matter the cost. Female adolescent athletes range from 13-18 years of age. A surge of female adolescent athletes occurred after the passing of Title IX legislation, which protects the rights of female athletes and their participation with the hopes of future participation in college athletics (Matzkin, Curry & Whitlock, 2015; Mehta, Thompson, & Kling, 2018). Consequently, a greater number of adolescents have had the opportunity to engage with the health and well-being aspects of sports. While sports participation can be positive, it does bring increased risks including the female athlete triad (Kelly & Hecht, 2016). Curry et al. (2015) discussed how female athletes are often more vulnerable to developing the symptoms of the triad as they not only struggle with poor body image, but a desire to be lighter and leaner in order to improve performance. Participation in athletics, however has been empowering and valuable for female adolescent athletes by increasing self-esteem and reducing risky behaviors, such as drug abuse and teen pregnancy (Kelly & Hecht, 2016; Matzkin, Curry & Whitlock, 2015).

Researchers have found that the female athlete is determined to be leaner to enhance her sport's performance. This expectation can lead the athlete to strict dieting and extreme exercise (Curry et al., 2015; de Oliveira Coelho et al., 2014). Female adolescent athletes compete in an array of sports. Though the female athlete triad may arise in any physical activity, athletes engaging in sports dedicated to endurance, artistic, or weight bound behaviors or sports that highlight staying thin pose a more significant threat (McNulty, Adams, Anderson & Affenito, 2014; Thralls et al., 2016). These sports demand a substantial amount of dedication and performance from the growing and developing female adolescents. During this time, the adolescent experiences the onset of menses, with rapid growth, so the triad can be specifically

destructive. Additional risk factors for the female athlete triad include beginning competitive sports at an early age, calorie restriction, violence, and family tension (Curry et al., 2015).

Female Athlete Triad

The female athlete triad is a multifactorial disease. This theme encompasses symptoms and precursors to development of later complications and more complex diagnoses. Without treatment of the triad, female adolescent athletes diagnosed are at risk for developing long-term sequelae (Curry et al., 2015; Thralls et al., 2016). The triad originally consisted of disordered eating, amenorrhea, and osteoporosis. In 2007 the ACSM broadened the definition of the female athlete triad. The original criteria have expanded, and the three elements are now understood to be on a continuum, which ranges from health to disease. Along with the three original characteristics of the triad, the adolescent athlete may also experience low energy availability with or without disordered eating, menstrual dysfunction, and low BMD (Kelly & Hecht, 2016; Ranson, Patterson, & Colvin, 2018). This criterion adds to the clinical presentation giving the athlete a more definitive diagnosis. This improved definition highlights the range of the illness. Adolescents may exhibit any of the three elements, which may not occur concurrently to impart negative health consequences. Females presenting with one element of the triad have an increased risk of developing symptoms of the other triad elements (Brown, Dewoolkar, Baker, & Dodich, 2017; Joy, Kussman, & Nattiv, 2016; Kelly & Hecht, 2016).

Disordered eating

One element of the female athlete triad is disordered eating which is directly related to low energy availability in the female adolescent athlete (Adams, Anderson & Affenito, 2014). Originally labeled disordered eating, this component of the triad is now defined as a continuum of energy availability, specified as energy consumption minus energy spent. Females engaged in

competitive sports may share personal characteristics such as perfectionism and determination that makes them outstanding competitors. By taking on the demand to excel at their sport, they may ultimately increase the risk for disordered eating (Curry et al., 2015; McNulty, Adams, Anderson & Affenito, 2014). Researchers found that continued periods of frequent weight changes, limited caloric intake, injuries, and negative remarks directed at the female's weight and size were the most shared causes given by athletes for the development of negative changes in eating habits (Brown, Dewoolkar, Baker, & Dodich, 2017). Primary care providers can assist athletes, families, and coaches to be mindful of the impact of disparaging comments, or suggestions made to female adolescents concerning body image, which can increase the risk of disordered eating (Curry et al., 2015).

Amenorrhea

Female adolescent athletes with the female athlete triad can experience a range of menstrual irregularities. These include primary or secondary amenorrhea, oligomenorrhea, and problems with ovulation (Brown, Dewoolkar, Baker, & Dodich, 2017). It can be challenging to accurately differentiate menstrual anomalies in the adolescent population because their hormones are still developing. The American Academy of Pediatrics (AAP) advocates screening for the female athlete triad, and any other health concerns, in any athlete with a total of six months of amenorrhea or oligomenorrhea (AAP, 2018). Implementing a wholesome diet and monitoring exercise can lead to reappearance of menses (Thralls et al., 2016).

Osteoporosis

The slowed rate of bone growth that is related with the female athlete triad is troubling since bone growth and maturation in childhood and adolescence are vital for the success of bone mass accumulation and the avoidance of musculoskeletal injuries in adulthood (Pantano, 2016;

(Thralls et al., 2016). Peak bone growth in females appears between the ages of 10 and 14 years, and most often reached in early adulthood. Towards the end of puberty, almost 90% of adult bone accumulation has been acquired. Family history, involvement in weight training activities, and nutrition all affect bone growth in children and adolescents. Optimal nutrition and weight-training exercise can positively affect healthy bone growth during childhood and adolescence (Brown, Dewoolkar, Baker, & Dodich, 2017; Kelly & Hecht, 2016). With improved energy availability and continuation of menses, minimal bone growth is achievable in athletes with the triad, although, some will have consistently lower BMD than those not affected by the triad.

Education of Primary Care Providers

The overarching theme is to increase providers' awareness of the female athlete triad and teach them how to screen for the diagnosis. This phenomenon is found in the female athlete population and is of interest to coaches, institutions, and players. Adolescent athletes are required by state regulation to have an annual sport PPE prior to the upcoming athletic season (FAT, 2017; Ranson, Patterson, & Colvin, 2018). Screening is especially necessary if a female athlete exhibits warning signs that increase her chance for developing the female athlete triad. These athletes who warrant further screening include athletes with a record of multiple stress fractures, several pathologic fractures, injuries related to overuse, and menstrual abnormalities (Barrack et al., 2014; Brown et al., 2017; Kelly & Hecht, 2016).

The healthcare provider through risk factor assessment and screening can accomplish early recognition of the female athlete triad. Collective involvement among student athletes, parents, coaches, athletic trainers, and primary care providers is optimum for the identification and prevention of the female athlete triad (Brown et al., 2017; Pantano, 2016; Thralls et al., 2016). Researchers found that only 20% of primary care providers were able to correctly

recognize all three elements of the triad (Kelly & Hecht, 2016). Improved education of athletes, coaches, and parents of the health risks of the female athlete triad can avert serious long-term complications. Attention needs to be focused on acknowledging that the female athlete is at risk for the triad.

Many athletes are unaware of the signs and symptoms that make up the triad and do not even realize they are experiencing an illness (de Oliveira Coelho et al., 2014; Kelly & Hecht, 2016). The female athlete triad is treatable, but can take years for the triad to be resolved (Brown et al., 2017; Curry et al., 2015; Pantano, 2016). Timely involvement during the adolescent years may enhance maximum bone growth, a vital measure of postmenopausal osteoporosis, possibly stopping minimal BMD, postmenopausal osteoporosis, and musculoskeletal complications in adulthood (Kelly & Hecht, 2016; Thralls et al., 2016). Health promotion activities are primary protection in preventing the development of the triad, and the female adolescent athlete can take charge of her health by practicing self-care and intentional learning.

Female Athlete Screening Tool

The FAST was developed exclusively for use in female athletes. It is a standardized patient administered questionnaire that takes approximately 15 minutes to complete. The original study of the FAST questionnaire was a cross-sectional quantitative design developed in 2001 by McNulty, a dietitian. The FAST is a 33-item measure that incorporates two different four-item Likert scales, three ranked items, and one dichotomous item (Appendix C). A score of 79-94 indicates subclinical disordered eating and greater than 94 indicates a clinical eating disorder.

Female athletes with known eating disorders also scored higher on the FAST than females not involved in athletics. This indicated a measurable difference affected by elite athletic status (Knapp & Anderson, 2014). A correlational analysis demonstrated the FAST was strongly

correlated with the Eating Disorder Examination Questionnaire (EDE-Q) and the Eating Disorder Inventory (EDI-3). Content validity was demonstrated by correlation with the EDE-Q (0.60, $p < .05$) and the EDI-3 (0.89, $p < 0.01$). With the use of the FAST, primary care providers can quickly identify female adolescent athletes who are engaging in harmful behaviors with the use of a validated screening tool. Early detection is specifically vital with eating disorders and the growing adolescent, so that effective medical, dietary, and psychological care can be provided to the individual (Hinken, 2018; McNulty, Adams, Anderson, & Affenito, 2014).

Theory Related to Identified Project Concepts

The student investigator chose the middle range theory of The Health Belief Model (HBM) to assist in the framing of the female athlete triad study. The HBM focuses on changing health behaviors in individuals and six concepts are found in the HBM (Akey, Rintamaki, & Kane, 2013). These include perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy.

For change to occur, the female athlete must perceive that they are susceptible to disordered eating, amenorrhea, and osteoporosis. The female athlete must believe that the triad is unhealthy and can lead to lifelong health consequences. Therefore, the female athlete will understand that this is a threat to their health and well-being. The athlete will voice their determination to change, which will then lead to a transformation in their overall behavior. Cues to action include being educated on the risks of developing the triad. Also, support from the coach and parents could decrease the susceptibility of the female athlete to the triad (Appendix D).

Methods

IRB Approval

The Institutional Review Board (IRB) at the study site approved the research study. The primary study site is an affiliate of the local hospital system and granted permissions to conduct the study at the site.

Ethical Issues

The PCPs and nurses maintained privacy when the data was collected with the female adolescent in the exam room. The data was collected and stored in a locked file cabinet located in a locked office at the main collection site. The student investigator and identified professionals maintained confidentiality. There were no conflicts of interest between the student investigator and the collection site. Because the chosen population is 13-18 years of age and considered a vulnerable population, parental consent was obtained prior to administering the FAST to the participants.

Funding

Minimal cost was associated with the project. Some costs included paper, copying resources for the FAST, and clinical staff time during the sports PPE. Implementation of the project was in addition to an already scheduled sport PPE (Appendix E) and no additional funding was necessary. Patients completed the FAST, demographic, and injury questionnaires while waiting to be seen by the PCP. Twenty minutes were allotted for each sport PPE that allowed the PCP to review the questionnaires and complete a thorough physical examination. The FAST can be found in the public domain with no cost associated to the student investigator. The FAST was in the supplementary files in the *Journal of the Academy of Nutrition and Dietetics* and can be used free of charge. Likewise, the other data collected was also free and included the demographic data, the biometric measures, and the history and physical exam findings. The sports PPE form was free to students and healthcare providers.

Setting and Participants

The project took place in a pediatric primary care clinic located in the Midwest. There were four pediatricians, two PNPs, and eight nurses at the practice. The adolescent participants included all female adolescent athletes ranging from 13-18 years of age. Inclusion criteria included the participants were female, ages 13-18, and engaged in at least one sport. Exclusion criteria included males, non-athletes, younger than 13 and older than 18 years of age.

Convenience sampling of adolescents was used as patients were seen for their annual sports PPE.

EBP Intervention

Prior to involvement with the adolescent participants, a scheduled time with the providers of the clinic was established to receive the education related to the signs and symptoms and short and long term negative health outcomes of the female athlete triad. Prior to the education, the providers completed a satisfaction survey. Participants were recruited based on their need for an annual sport PPE (Appendix F). Prior to arriving to the clinic, the potential participant's chart was flagged for involvement in the study due to meeting the inclusion criteria. Informed consent was obtained, including assent from the adolescent and consent from the parent or guardian. The guardian and the adolescent could have refused to participate in the study without fear of reprisal related to their medical care. The nurse obtained the biometric measurements once the participant was escorted to the exam room. Biometrics included vital signs with height, and weight for BMI calculation (Appendix G). Next, the nurse administered the paper and pencil measures. This consisted of the demographic questionnaire (Appendix H), history of sports related injuries questionnaire (Appendix I), and the FAST. The PCP then reviewed the history and asked further questions regarding the female athlete triad if the participant had answered yes to any of the questions involving weight, diet, and history of eating disorders. The PCP then conducted a

thorough sports PPE, including Tanner Staging as per the standard practice in the clinic. If the PCP believed the female adolescent athlete had positive signs and symptoms of the female athlete triad, they might have referred the participant for lab work, nutritional counseling, and mental health assessment (Appendix J). At the end of the project, the satisfaction of the PCPs was measured by using a satisfaction scale.

Change Process

Lewin's Change Model of unfreezing, movement, and refreezing can help primary care providers guide female adolescent athletes diagnosed with the triad through the change process of healthy diet and physical activity and identify readiness to change. This model encourages new knowledge, and requires prior learning to be rejected and replaced (Manchester et al., 2014). Lewin's Change Model has three steps: driving forces, restraining forces, and equilibrium. The first step is to unfreeze. This means producing motivation for change in the practice and why the practice needs to change. The second step is change and the last step is to refreeze. Refreezing occurs when change has become a habit and daily practice. The force field analysis allows the primary care provider to identify those forces that will assist in change and those forces that will resist change. Both elements are important to develop equilibrium.

Evidence Based Practice Model

The HBM is based on the idea that individuals will take action to prevent illness if they identify themselves to be prone to the condition. In addition, the individual believes the incidence of the condition has serious consequences, and their choices will decrease outcomes of illness. Finally, the individual embraces the benefits of taking control of their health outweigh the consequences (Jones et al., 2015). The concepts in this model include planned change, change agent, and change process (Skinner, Tiro, & Champion, 2015). Theoretical relationships

demonstrate that there are three major categories of concepts. The first category of concepts is modifying factors that include age, gender, ethnicity, personality, socioeconomic status, and knowledge. The second category is individual beliefs. This includes perceived susceptibility to disease, perceived benefits, perceived barriers, perceived self-efficacy, and perceived threat. This leads to the third category, which includes action. This category consists of cues to action that leads to change in individual behaviors (Glanz, Rimer, & Viswanath, 2008).

Study Design

The design was a quasi-experimental study, one cohort adolescents and providers. A pre-and post-test design represented the study design with the providers. A post-only design was used with the adolescents. With a PCP educational intervention focused on the female athlete triad, an increase in PCP awareness and diagnosing of the triad was fostered in the study.

Internal Validity

The student investigator decreased the threat of selection by specific and targeted inclusion criteria. In order to reduce the threat of history, the student investigator was aware of variables or issues that may alter the delivery of education to the PCP or the collection of data from the athletes. The next issue of maturation was not a problem because the student investigator completed a quasi-experimental study. Testing was not a problem due to the study design not being a pre and posttest design. Instrumentation could have been challenging because there were multiple data collectors involved besides the student investigator. To decrease this problem, the student investigator had an in-service involving the PCPs and nurses with a written protocol of how to collect the data. Finally the threat of mortality was not an issue for this chosen project because the student investigator was not following subjects over time. Hence the issue of losing subjects does not pertain to this particular study design.

External Validity

External validity threats included pretest sensitization, which was not an issue because the student investigator was not administering a pre and post-test. Interaction of selection and experimental treatment was not an issue because the student investigator was not engaging in an experimental treatment. The issue of interaction of selection was minimized because of the design of the study being a cross-sectional snap shot of the participant's health. Reactive effects of experimental arrangement were not applicable because this was not an experimental design study. However, the participants were representative of a real world situation by participating in organized sports. Next is multiple treatment interference. This was not applicable because the student investigator was not offering multiple treatment modalities. The threat of irrelevant responsiveness of measures was decreased in this study because the FAST demonstrated good validity and reliability in past studies. Finally the issue of irrelevant replicability of treatments was not applicable because the student investigator was not offering intervention treatments due to the quasi-experimental design. Therefore, the ability for the results to be generalized to other female adolescent athletes was meaningful.

Outcomes to be Measured

The outcome of physician satisfaction verified that PCPs are comfortable and willing to screen their female adolescent athletes thoroughly for the female athlete triad. The outcome of improved female athlete triad diagnosis by PCPs confirmed the effectiveness of the education training in identifying the triad. Other outcomes included body mass index, injury history, Tanner staging, and diet. In addition the student investigator examined correlations between the FAST and other measures including biometric measures, and history and physical exam results (Appendix L).

Measurement Instruments

The Physician Satisfaction Scale was used at the end of the intervention to assess the PCPs satisfaction with assessing and diagnosing the female athlete triad (Appendix K). This measure was a five point Likert Scale containing 16 items with two dimensions. These included understanding the patient's illness, and effective communication between the provider and the patient (Légaré et. al., 2007). This scale was selected to assess if the PCPs were effectively gathering appropriate data from the female adolescents history and physical to accurately diagnose for the female athlete triad. Reliability demonstrated that Cronbachs Alpha was at 0.90 (Shore & Franks, 1986).

The FAST was developed exclusively for use in female athletes. The measure maybe accessed via public domain found on the Internet. The FAST was a paper pencil measure that takes approximately 15 minutes to complete. The measure included 33-items that incorporated two different four-item Likert scales, three ranked items, and one dichotomous item (Appendix C). Discriminatory validity was recognized and showed the FAST could distinguish between athletes with eating disorders and athletes partaking in actions pointed to improve competition (Hinken, 2018; McNulty, Adams, Anderson, & Affenito, 2014).

Reliability demonstrated that Cronbachs Alpha was 0.87 (McNulty, Adams, Anderson, & Affenito, 2014). Female athletes with known eating disorders also scored higher on the FAST than females not involved in athletics. This indicated a measurable difference affected by elite athletic status (Knapp & Anderson, 2014). Athletes with eating disorders scored higher on the FAST than did non-athletes with eating disorders, indicating a measurable difference affected by athlete status. Correlation analysis demonstrated high concurrent validity between the FAST and the EDI-2 and EDE-Q, two other tools measuring eating disorders. The FAST distinguished the

specific characteristic of the female athlete with disordered eating pathology and successfully recognized those at risk.

The procedures for collecting data included biometrics which were collected followed by obtaining demographic information, history of injuries, and administration of the FAST paper pencil measure. The student investigator or trained staff member provided instructions on the FAST. The participants were encouraged to answer all of the questions of the FAST. Finally, information related to the history and physical exam was obtained by the PCP.

Quality of Data

Power was determined by previous research using the FAST measure. In two previous studies the sample size was approximately 40. Power was calculated with an effect size of 0.4, Alpha of 0.05, and a power of 0.8. This calculation revealed a sample size of 34 female participants using the G*Power software.

Quality of data is dependent on consistency of the staff administering the FAST and obtaining biometric measures. Primarily the student investigator was relying on other health care members at the pediatric practice to collect data. The FAST showed consistent reliability and validity was established with the initial publication of the measure. Study participants' biometric measures were obtained using one sphygmomanometer and the same scale and height measurement tool. This study is not a pre and posttest design; therefore measurement of change was not calculated. The student investigator compared results of the study to the previously published study by McNulty from 2014.

Analysis Plan

The data was entered into IBM SPSS. Descriptive statistics were analyzed and included measures of central tendency and measure of variability for the Physician Satisfaction Survey.

Correlations between the FAST, biometric measures, injury history, and diet was conducted to examine relationships.

Results

Settings and Participants

Four Physicians and two PNPs completed the Provider Survey (n=6). Participants were from a pediatric primary care clinic located in the Midwest. Participants completed the FAST and descriptive questions of the patient population. Convenience sampling was used to obtain a sample of 11 adolescents. The staff collected the participant's height and weight to calculate BMI. The student investigator collected chart data such as tanner score, and pulse.

Intervention Course

Physicians and PNPs received a sixty-minute educational in-service on the female athlete triad. This included signs and symptoms, who to screen, diagnose, and treatment. The healthcare providers answered questions before a thirty-minute educational intervention was given. Six months later the healthcare providers were given the same questions to see if a change occurred when comparing results to the first data collection.

Providers identified participants of the study when they scheduled a clinic visit for their annual sports PPE. No intervention, other than the screening, was given to the participants. Only a convenience sample of female adolescent athletes was measured using the FAST.

Outcome Data by Subtopic

Data was analyzed using SPSS. Three variables from the FAST were reversed coded. These included questions 15, 28, and 32 (Appendix C). Individual items of the FAST were examined for normalcy using the Kolmogorov-Smirnov test, which revealed a value of <0.05 indicating the data was not normal. In addition, inter-item correlations revealed a mean of 0.26,

which indicates that data was not normal. Reliability testing of the FAST found that Cronbach's Alpha was at 0.923. Non-parametric correlations, using Spearman-Rho, were analyzed with the sum total of the FAST and descriptive data of the adolescent participants. Significant correlations at $p < 0.01$ included estimated family income, weight, BMI, type of injury, and number of injuries. Weight and BMI correlated positively and estimated family income, type of injury, and number of injuries correlated negatively (Appendix T).

The time between collecting data for healthcare providers using pre and post testing was six months. Data analyzed included sum totals for each period of pre and post-test. A One-sample sign test and a Wilcoxon test showed no significant differences between the two time frames. However, the mean score, although not significant, did indicate a move towards significance for the post-test results. There was no missing data between the two time frames.

Discussion

Successes

The FAST measure had a high reliability result for this study with a Cronbach's Alpha of 0.923. The study results demonstrated the total of the FAST correlated with several descriptive variables. One of the outcomes demonstrated an inverse relationship between the total and family income. This indicated that the higher the FAST score, which reveals pathology, the higher the household income. Other correlations indicated that the higher the FAST score, the lower the BMI, weight, number of injuries, and types of injuries.

Study Strengths

The site was located at a pediatric primary care clinic located in the Midwest. The pediatric clinic had a significant female adolescent athlete following. The organizational culture was supportive of the research. The providers consisted of four physicians and two PNPs who

identified eligible participants and made sure the data sets were completed without missing data. The main project facilitator stayed in contact regularly with the student investigator. She acted as a liaison between the providers and student investigator. The degree of success with the educational intervention given to the providers did not show statistical significance. However, the means differences increased with the post-test results.

In the small sample size, the study results indicated significant correlations, revealing that in adolescents with high FAST scores, >94, the athletes had increased weight and BMI scores. Negative correlations indicated that higher FAST scores meant these female adolescent athletes had lower types of injuries and number of injuries. Also, higher FAST scores indicated participants had higher socioeconomic status. This may be due to participation in sports, which is financially expensive.

Results vs. Literature Evidence

The original Physician Satisfaction Survey was developed using a Likert scale. Changing the measurement of the questions to nominal may have contributed to findings of no significance. Researchers have found in other studies using the FAST that Cronbach's alpha was 0.87 and 0.96 (Knapp & Anderson, 2014; McNulty, Adams, Anderson, & Affenito, 2014). In this study, Cronbach's alpha was 0.92. McNulty, Adams, Anderson, & Affenito (2014) had forty-one participants and Knapp & Anderson (2014) had thirty-six participants. Both published research studies suggested that they needed a larger sample size to find statistical significance. This study had eleven participants. In the two studies the sample population focused on endurance athletes such as, track and cross-country. In this study, there was a range of athletes including gymnastics, dance team, ice skating, track, cross country, volleyball, soccer, softball, and basketball.

In the study by Kelly and Hecht (2016) researchers compared the FAST to other measures including the Eating Disorder Examination (EDE-Q), Bulimia Test Revised (BUILT-R), and the Eating Disorder Inventory-2 (EDI-2). These comparisons were made to establish different types of validity including discriminant and concurrent validity. In the study by Knapp and Anderson (2014) researchers compared the FAST to other measures including the Athletic Milieu Direct Questionnaire (AMDQ) and the Low Energy Availability Questionnaire (LEAF-Q). Only discriminant validity was examined. This study did not compare different measures to establish validity. However, the developer of the FAST did establish content validity in the development of the measure.

Limitations

Internal Validity Effects

Within the clinic, two doctors and one nurse practitioner decided to leave the practice and establish their practice beginning May 1, 2020. These providers had the largest patient caseload in the practice. Post data was collected after the providers were made aware of the significant changes that would occur in the clinic with the loss of two physicians and one PNP. In addition, the project facilitator was one of the providers leaving the practice. Being in the clinic, the student investigator was aware of the intense friction between providers who were staying and leaving. This provider change was a threat to internal validity.

Providers could have increased their knowledge by reading on the topic of the female athlete triad. In the female athlete adolescent population, testing was not a threat. However, with the provider population post-testing was possibly a threat since they would be exposed to the same questions twice. Selection was a threat to internal validity because this study was not randomized and providers identified participants when they scheduled their sport PPE.

Instrumentation was not a threat to internal validity because the measurement instrument did not change during the study. Attrition was not an immediate threat in the study because the same six participants in the provider population also completed the post-test. With the female athlete adolescent population, data was only collected at one point in time.

External Validity Effects

Threats to external validity include reactivity, novelty, participant effect, interaction of selection and intervention, interaction of setting and intervention, and interaction of history and intervention (DeMarco, & Healey-Walsh, 2019). Reactivity was a possible threat to external validity because the adolescent participants knew the study was about participating in sports the day they received their sports PPE. Novelty was a threat to external validity with the providers because the providers should have been knowledgeable regarding the female athlete triad and probably were not. There was only a two percent difference between pre and post-test findings. Participant effect probably did not occur, but the participants were adolescents completing the forms and it is doubtful they had preconceived expectations regarding the female athlete triad phenomena. Interaction of selection and intervention was a possible threat because of some of the sports played and level of competition was less than participants who played more physically intense sports in other studies involving the FAST. Interaction of setting and intervention was not a threat to external validity because the providers were comfortable in their work setting and the adolescent participants were eager to complete their sport PPE so they could compete in sports. Interaction of history and intervention was possibly a threat to external validity because of the instability of the practice towards the end of data collection and could have influenced the results and decreased the generalizability of the findings. This specifically pertains to the provider participants.

Sustainability of Effects and Plans to Maintain Effects

Sustainability of effects and plans to maintain effects could be measured at one and five years to measure if the providers take into consideration the possibility of the female athlete triad affecting their patient population. One method of sustaining effects is to provide ongoing education to the providers who completed the study.

Efforts to Minimize the Study Limitations

Limitations of the study include a small sample size and the need to identify those athletes who play at the elite level from those who play only recreational or high school level sports. The small sample size lessens the validity of the results. In future studies the sports criteria need to be focused more on endurance or high intensity sports such as track, cross country, soccer, basketball, and volleyball. To minimize the potential of limitations to this study the student investigator used an established measure with good reliability. The student investigator used questions from the Physician Satisfaction Survey with the providers. However, this was a limitation because the questions were changed from a Likert scale to nominal data and more information could have been obtained if the student investigator used a Likert scale.

Interpretation**Expected and Actual Outcomes**

The student investigator expected that more data sets would have been collected during the six months. Opportunities were missed because data collection did not begin earlier in the summer when female adolescent athletes were receiving their sports PPE for fall athletics. The student investigator was aware that significant findings would be lacking due to the small sample set. The reliability statistics demonstrated that the FAST was a good measure to use with regards to the female athlete triad although the validity is threatened by the small sample size. The

student investigator expected a greater difference in scores with the provider population because literature shows that most providers are unfamiliar with the female athlete triad.

Intervention Effectiveness

The intervention effectiveness could have increased with using other healthcare sites, as the project site did not see all potential female adolescent athletes in the Midwest area. Although a small percentage was noted in the increased understanding of the female athlete triad, only a two percent increase in knowledge occurred in the provider population over a six-months.

Intervention Revision

Intervention revision would include using more sites and starting data collection earlier in the summer months prior to the beginning of fall sports. In the previous two studies, researchers had 36 and 41 participants and they both acknowledged the need for more participants in their studies. Regarding the provider data the student investigator would revise the questions asked of the providers from nominal data to a Likert scale. This would provide more depth of understanding of the data.

Expected and Actual Impact to Health System, Costs, and Policy

Both short and long-term consequences exist, including not treating females diagnosed with the female athlete triad. Several health consequences are associated with eating disorders that are linked to high mortality rates (Joy, Kussman, & Nattiv, 2016). The female athlete triad is an emerging phenomenon and the costs associated with it are unknown. According to the FAST measure one participant scored greater than 94 which indicated she had a clinical eating disorder and two participants who scored between 79 and 94. This indicated a subclinical disordered eating problem. The remaining participants scored below 79, which indicated they did not have elements of the female athlete triad. The literature reveals that females diagnosed with the female

athlete triad have an increased risk for developing anorexia or bulimia leading to hospitalizations, which could cost up to \$50,000 for in-patient treatment (Nilsen et al., 2019). One long-term consequence of prolonged amenorrhea is the development of osteoporosis later in life. Osteoporosis can lead to cervical spine fractures that are unpredictable and painful to live with (Kelly & Hecht, 2016).

The cost of this study was minimal. Costs included paper, copying resources for the FAST, and clinical staff time during the sports PPE. Implementation of the project was in addition to an already scheduled sport PPE (Appendix E) and no additional funding was necessary. As this was a low cost intervention a webinar could be created with the education material and placed on a viewing platform, so other healthcare providers have access to the information. Funding resources for future projects related to the female athlete triad could include the Sports Medicine Department at Children's Mercy Hospital, Female Athlete Triad Coalition, or the National Institute of Health.

Conclusion

The research topic of the female athlete triad is timely and relevant to today's female adolescent athletes and to the providers who care for them. With the passing of Title IX legislation a greater number of female adolescents have had the opportunity to engage in a wide variety of sports. With the increase in participation, females are at risk for both short and long term negative health outcomes. With the use of the FAST, primary care providers can quickly identify female adolescent athletes who are engaging in harmful behaviors with the use of a validated screening tool.

Most of the research conducted to date involves older adolescent females, ages 16-21. Limited research has been done on female adolescent athletes under the age of 16 years (Melin,

2016). Researchers may have limited access to the patient population due to their young age. Having a robust sample size that could lead to significant findings is lacking. To date, the published research on the female athlete triad is limited to descriptive studies and lack intervention based methodologies. Quick and exact measures are lacking to assess adequate energy consumption and expenditure in female athletes (Stein, Ackerman, & Stracciolini, 2016). Further research should be conducted to recognize if a biomarker could act as a benchmark to measure criterion validity of the FAST since amenorrhea and body mass index are insensitive markers in the female athlete adolescent age group (Kelly & Hecht, 2016).

The plan for dissemination originally included presenting at the Advanced Pediatric Summit in Boston, Massachusetts. This conference was postponed and rescheduled for November of 2020. Due to the worldwide pandemic of COVID-19, dissemination occurred via a video presentation through the University of Missouri Kansas City. In addition, a manuscript of the study will be submitted to *The Journal of Pediatric and Adolescent Gynecology*.

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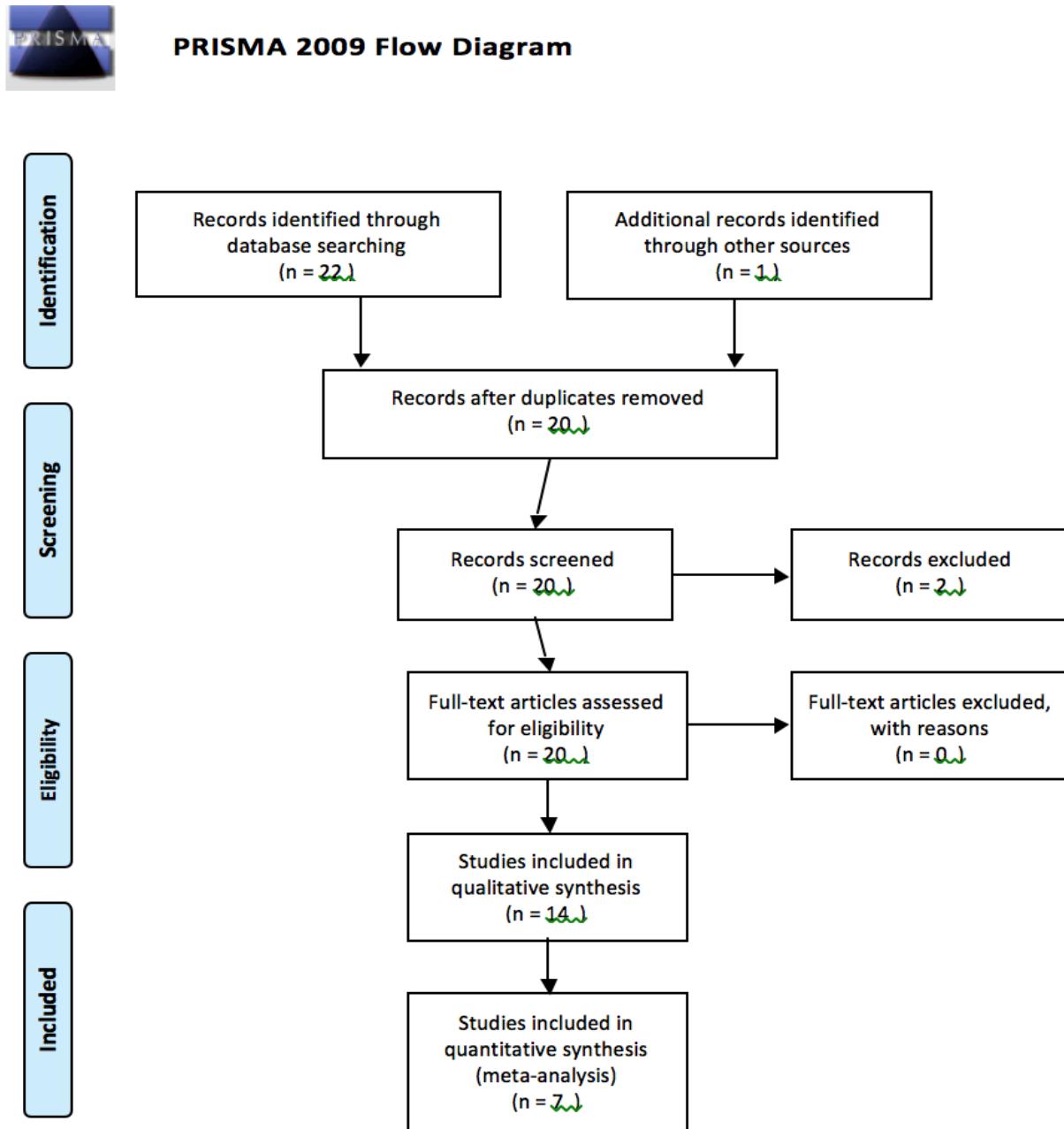
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Appendix A



Appendix B

Review of Evidence Table

PICOT: Among primary care providers will the use of the FAST compared to no screening increase diagnostic accuracy of the female athlete triad over a six-month period of time?

First author, Year, Title, Journal	Purpose	Research Design ¹ , Evidence Level ² & Variables	Sample & Sampling, Setting	Measures & Reliability (if reported)	Results & Analysis Used	Limitations & Usefulness
Introduction of the Female Athlete Triad (FAST)						
Hinken (2018). Correlation Between Female Athlete Screening Tool (FAST) Scores and Biomarkers to Identify Female Athlete Triad. Journal of Sports Medicine.	To determine if the FAST is a valid indicator of the three physical components of FAT- malnutrition, amenorrhea, and low bone mineral density, and if administration of the FAST can be used as a time- and cost-effective way to	Quantitative, non-experimental , Level VI descriptive. IV- three biomarkers of FAT, including malnutrition, which was measured via plasma levels of Prealbumin; amenorrhea, which was measured via	A total of 40 female college students, who either participate in varsity intercollegiate athletics (n = 20, 50%) or voluntarily engage in habitual exercise (n = 20, 50%), participated in this study.	Female Athlete Screening Tool (FAST). Reliability analysis revealed high internal consistency (Cronbach's $\alpha = .87$)	Results indicated not significant differences between total FAST scores of participants in each of the groups for any of the three biomarkers The results of a One-Way Analysis of Variance, which examined FAST scores based on the type of eating for a manipulation check, indicated	Some limitations of the current study were identified. The sample size was relatively small, and the presence of the three biomarkers was extremely limited among the sample, Too few participants met criteria for the diagnostic groups, limited

	identify FAT	self-reported menstrual history; and low BMD DV- value of participants' FAST scores; a score of 79 or higher is considered above-threshold and suggests the occurrence of disordered eating patterns.			that there were differences among the groups, $F(2, 38) = 58.90, p < .001$.	the statistical power.
McNulty (2014). Development and Validation of a screening tool to identify eating disorders in female athletes. Journal of the American Dietetic Association	To develop and validate a screening tool to identify eating pathology in female athletes	Quantitative, non-experimental , Level VI descriptive. FAST, and 3 other psychometric measures	Sample size of 41. The athletes screened for eating disorders by sports medicine team.	FAST used. Reliability indicated a high internal consistency of the FAST (Cronbach's Alpha= 0.87).	Reliability indicated a high internal consistency of the FAST (Cronbach's Alpha= 0.87). ANOVA used. Athletes with eating disorders showed significantly higher scored on the FAST as compared with	Small sample size and focused on more competitive sports. Further investigations need to identify biomarkers that serve as a gold standard to measure criteria validity.

					athletes without eating disorders ($p<0.001$). Correlation analysis showed the FAST was strongly correlated with the Eating Disorder Questionnaire (0.60, $P<0.05$) and Eating Disorder Inventory (0.89, $P<0.001$)	
Comparing/Contrasting the FAST vs. validated measures						
Kearney. (2016). Relative Energy Deficiency in Female College Track and Field Athletes. Journal of Nutrition.	To examine the prevalence of RED-S in female collegiate track and field athletes.	Level VI Descriptive cross-sectional study, obtaining data through the use of a questionnaire and a relative energy	12 Female Collegiate track and field athletes	Data obtained through the use of a LEAFQ questionnaire, a three-day food and exercise recall, and body composition analysis.	Spearman's rho analysis found a significant inverse correlation between Day 1 hours spent in optimal energy balance (± 400 kcal) and body fat percent ($p=0.024$, $rs= -0.643$), and	Study highlights the misleading effect of averaging multiple days of dietary recall on energy balance. The findings from the LEAF-Q show that 58% of participants

		expenditure index		significant positive correlation between Day 1 hours spent in optimal energy Balance (± 400 kcal) and fat free mass percentage ($p=0.03$, $rs=0.625$). Spearman's rho analysis also found an inverse correlation between Day 1 hours spent in an energy deficit (<-400 kcals) and fat free mass percentage ($p=0.03$ $rs= -0.626$), and a positive correlation between Day 1 hours spent in an energy deficit and body fat percentage ($p=0.026$, $rs=0.636$). Seven out of twelve participants scored ≥ 8 on the LEAF-Q putting them at risk for RED-S.	were at risk for RED-S, and half of all participants had or were experiencing menstrual dysfunction.
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Melin. (2014). The LEAF Questionnaire: a screening tool for the identification of female athletes at risk for the female athlete triad. Journal of Sports Medicine	Develop/test a screening tool designed to identify female athletes at risk for the Triad.	Quantitative, non-experimental , Level VI descriptive. EA, menstrual function, bon health DV- the value of participants' LEAF-Q scores	84 female athletes who trained >5 times/week	LEAF-Q. Reliability and internal consistency were evaluated in a subsample of female dancers and endurance athletes (n=37). Discriminant as well as concurrent validity was evaluated by testing self-reported data against measured current EA, menstrual function and bone health in endurance athletes from sports such as long distance running and triathlon (n=45). The 3 variables had values of Cronbach's alpha ≥ 0.71	The 25-item LEAF-Q produced an acceptable sensitivity (78%) and specificity (90%) in order to correctly classify current EA and/or reproductive function and/or bone health.	LEAF-Q only validated within certain endurance athlete groups. LEAF-Q needs to be tested in other aesthetic groups and sports that require weight categories for competition.
Female athlete triad (FAT)						
Matzkin (2015). Female athlete	Reviewing the new definition	Level III, no variables	Comparing and Contrasting	N/A	Any athlete who falls under the so-	Further research is needed to

triad: past, present, and future. JAAOS-Journal of the American Academy of Orthopedic Surgeons,	of the FAT and impact of Title IX	notes	current and past definition of the FAT		called umbrella of the triad should be questioned and educated regarding all of the components and potential health risks of this condition.	determine the true prevalence of the triad and identify which females are at risk. Awareness levels among athletes, coaches, and healthcare professionals should be assessed to determine where education is needed most.
Rauh. (2014). Associations Between the Female Athlete Triad and Injury Among High School Runners. The International Journal of Sports Physical Therapy.	To determine the association between Triad and risk of lower extremity musculoskeletal injury among adolescent runners	RCT. Level II. Data collected-daily injury reports, EDE-Q, menstrual history questionnaire, anthropometric data.	89 female adolescent runners who competed in cross country and track from six high schools in CA.	Data collected included daily injury reports, EDE-Q, menstrual history questionnaire, a dual-energy BMD scan, and body composition.	In the BMD Z-score ≤ -1 SD adjusted model, low BMD relative to age (BMD Z-score of ≤ -1 SD) was significantly associated Odds Ratio = 4.6, 95% CI: 1.5-13.3) with an increased occurrence of musculoskeletal injury during the sport season. In the BMD Z-score ≤ -2 SDs adjusted model, a history of	Data was collected before the revised ACSM position stand was published. Self-reported menstrual status data was used instead of laboratory measures. The accuracy of coaches' reports on injury type (e.g., sprain, strain, stress reaction) was

					oligo/amenorrhea was significantly associated ($OR=4.1$, 95% CI: 1.2-13.5) with increased musculoskeletal injury occurrence.	less certain without a clinician's diagnosis to confirm them.
Tenforfe (2017). Association of the Female Athlete Triad Risk Assessment Stratification to the Development of Bone Stress Injuries in Collegiate Athletes. American Journal of Sports Medicine.	This study aimed to (1) classify athletes from a collegiate population of 16 sports into low-, moderate-, and high-risk categories using the Female Athlete Triad Cumulative Risk Assessment score and (2) evaluate the predictive value of the risk categories for subsequent BSIs.	Cohort study; Level III	A total of 323 athletes completed both electronic preparticipation physical examination and dual-energy x-ray absorptiometry scans.	239 athletes with known oligomenorrhea/a menorrhea status were assigned to a low-, moderate-, or high-risk category. Chart review was used to identify athletes who sustained a subsequent BSI during collegiate sports participation; the injury required a physician diagnosis and imaging confirmation.	Of 239 athletes, 61 (25.5%) were classified into moderate-risk and 9 (3.8%) into high-risk categories. Sports with the highest proportion of athletes assigned to the moderate- and high-risk categories included gymnastics (56.3%), lacrosse (50%), cross-country (48.9%), swimming/diving (42.9%), sailing (33%), and volleyball (33%). When examining the 6 individual components of the	Using published guidelines, 29% of female collegiate athletes in this study were classified into moderate- or high-risk categories using the Female Athlete Triad Cumulative Risk Assessment Score. Moderate- and high-risk athletes were more likely to subsequently sustain a BSI; cross-country runners sustained most BSIs.

					triad risk assessment score, both the oligomenorrhea/a menorrhea score ($P = .0069$) and the prior stress fracture/reaction score ($P = .0315$) were identified as independent predictors for subsequent BSIs	
Education of Primary Care Providers						
Brown. (2017). The female athlete triad: special considerations for adolescent female athletes. <i>Translational Pediatrics</i> .	Discussion on the number of adolescent female athletes has continued to grow, there has been further research and investigation into this field and the triad has evolved in definition.	Literature Review. Level V.	Female adolescent athletes who have been diagnosed with the FAT or identified as being at risk for FAT.	No Reliability. N/A	N/A	Health care providers and professionals working with adolescent athletes have an opportunity to provide education regarding the female athlete triad and contribute to preventive strategies for youth athletes at risk.

Thein-Nissenbaum (2017). Treatment strategies for the FAT: current perspectives	Provide the reader with the latest terms used to define the FAT	Narrative Review of Meta-Analysis and Review of Clinical Guidelines, Level I SR.	Keywords- FAT, adolescent female athlete, disordered eating, eating disorder, low energy availability, relative energy deficit, anorexia, bulimia, menstrual dysfunction, amenorrhea, oligomenorrhea, bone mineral density, osteopenia, osteoporosis, stress fracture, and stress reaction, were utilized to search for relevant articles.	N/A	Coaches, parents, health care professionals, and fellow teammates should be aware of any of these signs and symptoms and discuss any concerns with the athlete privately. Screening for the Triad should occur during the preparticipation examination or any time components of the Triad are suspected.	Testing for the FAT needs to be consistent.

Pantano. (2016). Knowledge, Attitude, and Skill of High School Coaches with Regard to the Female Athlete Triad. North American Society for Pediatric and Adolescent Gynecology	The purpose of this study was to investigate knowledge high school coaches have about the female athlete triad and to determine if gender differences in knowledge, attitudes, and behaviors exist.	Cross sectional design (Observational), Level IV Descriptive statistics (means, SD, frequency) and gender differences in response to triad knowledge, attitude, and behavior questions.	Two hundred currently employed high school coaches.	Participants completed a 30-question survey used to assess knowledge, attitudes, and behaviors coaches had about the female athlete triad.	One hundred twenty-three high school coaches completed the survey.. Twenty-four percent reported "having heard of the triad" and 14% (17 of 123) were able to correctly name all of its components. There were no significant differences between gender and the coach's ability to correctly name the 3-triad components ($t = 1.47$, $P = .14$). There was no correlation between coach gender ($r = 0.13$, $P = .07$), age ($r = 0.07$, $P = .42$), number of years of coaching ($r = 0.014$, $P = .88$), and coach's knowledge of	Female athletes might be at risk for developing the female athlete triad and high school coaches can be instrumental in identifying athletes who are at risk. This study showed that gaps in knowledge about the triad exist and that educating coaches about the condition could serve as an important means of prevention for the condition.
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					the triad components, respectively.	
Goolsby. (2016). Bone Health in Athletes: The Role of Exercise, Nutrition, and Hormones. <i>The Journal of Primary Care</i> .	To understand the benefits of exercise on bone health requires knowledge of bone composition, formation, and adaptation.	Clinical Review. Articles reviewed ranged from Level I to Level IV.	PubMed articles dating from 1986 to 2016 were used for the review. Relevant terms such as keywords and section titles of the article were searched and articles identified were reviewed for relevance to this article.	No Reliability. N/A	Evidence shows that exercise benefits bone health at every age and is a critical factor in osteoporosis prevention and treatment. Early recognition and appropriate treatment of the FAT and other stress fracture risk factors are vital to preventing long-term bone health problems.	To optimize bone health, adequate nutrition, appropriate weight bearing exercise, strength training, and adequate calcium and vitamin D are necessary throughout life.
Kroshus. (2015). Assessing the awareness and behaviors of US high school nurses with respect to the female athlete triad. <i>The Journal of School Nursing</i> .	This study assessed knowledge, attitudes, communication, and referral behaviors of U.S. high school nurses about the Female Athlete	Literature Review. Level V.	Participants were a random sample of 370 U.S. high school nurses	One thousand U.S. high school nurses who are members of the National Association of School Nurses (NASNs) were randomly selected from the NASN database and contacted by e-mail and invited to	The results indicated that only 19% of the nurses were able to identify the three components of the Triad and only 25% reported that they work proactively with coaches to help prevent health	Response biases in the results and consequently limits its generalizability. The number of athletes referred to school nurses on an annual basis was calculated as a raw value rather

				participate in an online survey about student health.	issues among their female athletes	than relative to the enrollment of students at the school or the number of female athletes at the school.
Curry. (2015). Female Athlete Triad Awareness among Multispecialty Physicians. Journal of Sports Medicine.	To determine the percentage of physicians across multiple specialties who had heard of the phrase FAT and determine the percentage who can properly diagnose or have a high comfort level appropriately referring these patients.	Quantitative, non-experimental Level V, descriptive Via electronic survey, researchers recruited medical staff, residents, and fellows at three large academic institutions across specialties to answer an eight-item test on Triad awareness and knowledge.	931 physicians participants Convenience Sample 40 % Male 60 % Female 23 % Residents 12 % Fellows 65 % Attending	Electronic survey Univariate analyses, independent <i>t</i> tests were used to test statistical significance when comparing two groups; ANOVA methods were used for multiple group comparisons.	37 % had heard of the Triad. Fellows heard of the Triad was 1.8 times than the Attending group ($p < 0.006$), while the likelihood of a resident having heard of it was 1.6 times that of an attending ($p < 0.003$). Residents and fellows were significantly better at properly identifying the three components of Triad compared to attending physicians ($p < 0.007$).	Findings show that approximately one third of the physicians surveyed have heard of the Triad. Approximately one half of physicians were comfortable treating or referring a patient with the Triad. Increased awareness through education to properly identify and manage the Triad is essential for all

						physicians.
House. (2017). Female Athlete Triad for Primary Care. American Academy of Pediatrics	Discuss the definition and prevalence of the FAT and prevention, detection, and treatment strategies	Literature Review. Level V	Female adolescent athletes who have been diagnosed with the FAT or identified as being at risk for FAT.	No Reliability	N/A	Education aimed at athletes, coaches, trainers, nurses, PCPs to allow early identification and intervention
Melin. (2014). Energy availability and the female athlete triad in elite endurance athletes. Medicine and Science of Sports.	The aims of this study were to examine associations between EA/MD and energy metabolism and the prevalence of Triad-associated conditions in endurance athletes.	Quantitative, Quasi-Experimental, Level III	Forty women [26.2 ± 5.5 years, body mass index (BMI) 20.6 ± 2.0 kg/m ² , body fat 20.0 ± 3.0%], exercising 11.4 ± 4.5 h/week, were recruited from national teams and competitive clubs	Reliability not reported	Subjects with low/reduced EA had lower resting metabolic rate (compared with those with optimal EA [28.4 ± 2.0 kcal/kg fat-free mass (FFM)/day vs. 30.5 ± 2.2 kcal/kg FFM/day, P < 0.01], as did subjects with MD compared with eumenorrheic subjects (28.6 ± 2.4 kcal/kg FFM/day vs. 30.2 ± 1.8 kcal/kg FFM/ day, P <	Athletes with low/reduced EA and/or MD had lowered RMR. Triad-associated conditions were common in this group of athletes, despite a normal BMI range. The high prevalence of ED, MD, and impaired bone health emphasizes the importance of prevention, early detection, and treatment of energy

					0.05). 63% had low/reduced EA, 25% ED, 60% MD, 45% impaired bone health, and 23% had all three Triad conditions. 53% had low RMR, 25% hypercholesterolemia, and 38% hypoglycemia.	deficiency This observational study does not document the effect of induction of low or reduced EA on metabolic adaptations or endocrine alterations, and cannot demonstrate a causative effect
Joy. (2016). Update on eating disorders in female athletes. Journal of Sports Medicine.	Reviewing ways to prevent eating disorders aimed at athletes, coaches, parents and athletic administrators, and focused on expanding knowledge of healthy nutrition in support of sport performance and health.	Narrative Review of Meta-Analysis and Review of Clinical Guidelines, Level I SR.	Keywords- FAT, adolescent female athlete, disordered eating, eating disorder, low energy availability, relative energy deficit, anorexia, bulimia, menstrual dysfunction, amenorrhea, oligomenorrhea, bone mineral	Comparing studies investigate the prevalence of eating disorders in female athletes.	Screening for disordered eating behaviors, eating disorders and for related health consequences should be a standard component of preparticipation examinations, and team physicians should be knowledgeable of the updated diagnostic criteria	Sports medicine physicians play a key role in evaluation, diagnosis and treatment, including clearance and return to play. Utilizing established recommendations that guide clearance and return to play decision-making

			density, osteopenia, osteoporosis, stress fracture, and stress reaction, were utilized to search for relevant articles		for eating disorders in the Diagnostic and Statistical Manual-V	can ease difficult decisions, and promote transparency and accountability in support of a healthy athlete.
Female Adolescent Athletes						
Knapp. (2014). Eating Disorders in Female Athletes: Use of Screening Tools. American College of Sports Medicine.	Analyzing the use of different screening tools in ED.	Literature Review. Level V	5 tools were analyzed	No Reliability. N/A	The AMDQ, BEDA-Q, and FAST tools have been validated for female athletes, and all are promising for use as a screen for clinical eating disorders. The FAST is the only tool that additionally can identify subclinical eating disorders.	Potential for future research would include validation of athlete-specific screening tools in an earlier age group, such as high school female athletes
Kelly. (2016). The Female Athlete Triad. American Academy of	Report outlines the current state of knowledge on the epidemiology,	Literature Review. Level V	Analyzed provider knowledge on the three different	N/A	The well-child visit or PPE provides time for the provider to screen for and	More awareness and education is needed regarding topic of the triad

Pediatrics	diagnosis, and treatment of the triad conditions.		components of the triad		provide education and guidance regarding the components of the female athlete triad and the risks of inadequate EA for athletes	
Hasdemir. (2016). Evaluation of female athlete triad and gynecological complaints in young female athletes. Journal of Clinical Gynecology	Aim of this study was to determine the prevalence and clinical characteristics of FAT and its relationship with gynecologic complaints of young Turkish female athletes.	Cross sectional design (Observational), Level IV	87 female athletes involved in a variety of sports and 85 sedentary female students	Questionnaire was completed consisting of 32 separate questions assessing eating behavior, menstrual status, gynecologic and systemic complaints, psychological problems, and sexual history	The age of menarche was found to be significantly lower in the sedentary group ($p = 0.00$). Late menstruation and oligomenorrhea were notable complaints among the athletes, and body mass index (BMI) was found to be statistically lower in the athletic group ($p = 0.00$). Cold hands and hair loss were seen more often in the sedentary group compared to the athletic group ($p < 0.05$). According to a	Excessive sports activity can be hazardous in young female population. Lower BMI might be related to menstrual irregularity. Young female population should be informed about this relationship, especially athletes who are particularly at risk. Certain precautions should be taken into consideration in this population in order to get benefits of sports

					logistic regression analysis, independent variables (BMI, menstrual status, and bone fractures) were found to be statistically insignificant ($p > 0.05$).	activity.
House. (2017). Female Athlete Triad for Primary Care. American Academy of Pediatrics	Discuss the definition and prevalence of the FAT and prevention, detection, and treatment strategies	Literature Review. Level V	Female adolescent athletes who have been diagnosed with the FAT or identified as being at risk for FAT.	No Reliability	N/A	Education aimed at athletes, coaches, trainers, nurses, PCPs to allow early identification and intervention
Yi. (2016). Triathlete Risk of Pelvic Floor Disorders, Pelvic Girdle Pain, and Female Athlete Triad. Female Pelvic Medicine & Reconstructive Surgery	Our primary objective was to describe the prevalence of PFD, PGP, and the FAT in a female triathlete population. We also evaluated for an association between these conditions.	Quantitative, non-experimental Level V, descriptive	Online survey given to 311 women who self-identified as female triathletes.	Online survey given to women who self-identified as female triathletes. Using validated questionnaires, Epidemiology of Prolapse and Incontinence Questionnaire and Pelvic Girdle Questionnaire, along with the	Three hundred eleven female triathletes responded to the Internet survey. There was a significant prevalence of PFDs with stress urinary incontinence and anal incontinence symptoms being most common	Pelvic floor disorders are common and bothersome in female triathletes. Pelvic girdle pain, while present, does not limit these athletes from their training. These female triathletes may be at risk

				<p>female athlete triad questionnaire, we identified the prevalence of PFDs, PGP, and female athlete triad in this specific population. Demographic and exercise intensity were also queried to characterize these female triathletes.</p>	<p>(37.4% and 28%, respectively). Urgency urinary incontinence and pelvic organ prolapse were less common (16% and 5%, respectively). Stress urinary incontinence and pelvic organ prolapse were more common in triathletes ($P = 0.001$, $P = 0.05$). Pelvic girdle pain was noted in 18% of these triathletes but was not disabling. Twenty-four percent of participants screened positive for at least 1 arm of the female athlete triad. No association was found between the female athlete triad and PFDs.</p>	<p>for the female athlete triad. Female triathletes may be at risk for both metabolic and PFDs and should be screened when identified.</p>
Tenforfe (2017). Association of the Female	This study aimed to (1) classify athletes	Cohort study; Level of evidence	A total of 323 athletes completed both	239 athletes with known oligomenorrhea/a	Of 239 athletes, 61 (25.5%) were classified into	Using published guidelines, 29% of female

Athlete Triad Risk Assessment Stratification to the Development of Bone Stress Injuries in Collegiate Athletes. American Journal of Sports Medicine.	from a collegiate population of 16 sports into low-, moderate-, and high-risk categories using the Female Athlete Triad Cumulative Risk Assessment score and (2) evaluate the predictive value of the risk categories for subsequent BSIs.	III	electronic preparticipation physical examination and dual-energy x-ray absorptiometry scans.	menorrhrea status were assigned to a low-, moderate-, or high-risk category. Chart review was used to identify athletes who sustained a subsequent BSI during collegiate sports participation; the injury required a physician diagnosis and imaging confirmation.	moderate-risk and 9 (3.8%) into high-risk categories. Sports with the highest proportion of athletes assigned to the moderate- and high-risk categories included gymnastics (56.3%), lacrosse (50%), cross-country (48.9%), swimming/diving (42.9%), sailing (33%), and volleyball (33%). Twenty-five athletes (10.5%). When examining the 6 individual components of the triad risk assessment score, both the oligomenorrhea/a menorrhrea score ($P = .0069$) and the prior stress fracture/reaction score ($P = .0315$) were identified as	collegiate athletes in this study were classified into moderate- or high-risk categories using the Female Athlete Triad Cumulative Risk Assessment Score. Moderate- and high-risk athletes were more likely to subsequently sustain a BSI; cross-country runners sustained most BSIs.
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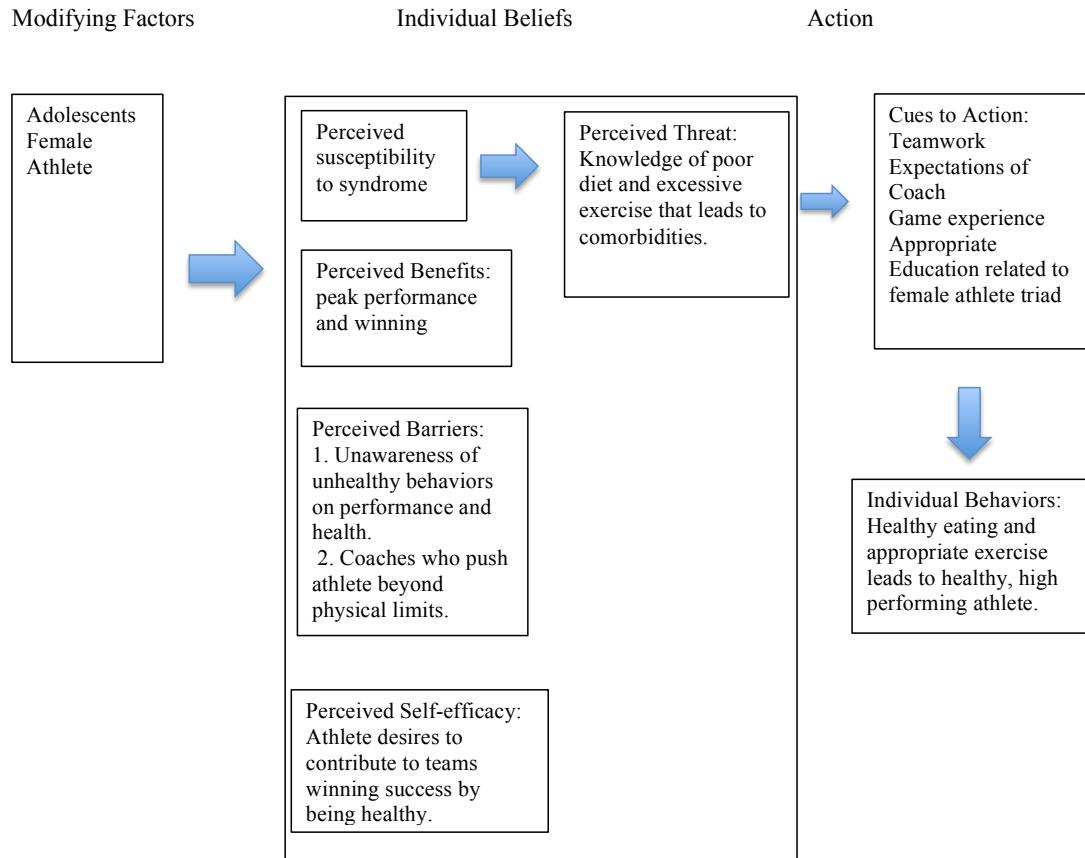
					independent predictors for subsequent BSIs	
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Appendix C

Permission obtained to use the Female Athlete Screening Tool

Appendix D

Theory Application Diagram



Appendix E

Female Athlete Triad EBP Project Budget Table

Item	Item Description	Quantity	Unit Cost	Anticipated Cost
Print materials	1. Female Athlete Screening Tool 2. Questionnaire related to any sports related injuries 3. Consent Form 4. Demographics Survey 5. Education handouts for Providers	30 15	FAST and Questionnaires \$0.05 per sheet with black and white printing. Provider education \$0.05 per sheet with black and white printing.	\$4.50 for all three forms (30 copies of each). \$1.50 for two sheets of handouts.
Equipment	<ul style="list-style-type: none"> • Thermometer • Stethoscope • Scale 	1 of each item	Part of standard office equipment	N/A
Miscellaneous	<ul style="list-style-type: none"> • Stapler with staples to assemble packets 	1 stapler 30 staples	\$3.50 for one stapler \$1.25 for one pack of staples	\$3.75 for both items.

Provider Education	<ul style="list-style-type: none"> • Presentation with ppt handout (20 minutes) • Quick Reference sheet for PCPs 	5 Pediatricians 2 PNP 8 Nurses	No cost-Standard provider day. Will do education while on their lunch break	N/A
Collection Time	<p>While waiting for PCP, nurses will administer and obtain the following:</p> <ul style="list-style-type: none"> • Paper and pencil surveys (6-7 minutes) • Biometric assessment (5 minutes) • Established sports PPE visit with PCP (H&P 20 minutes) 			
Total				\$15.75

Appendix F

Recruitment Flyer



- **Invitation to participate in a research study involving female adolescent athletes between the ages of 13-18 years old who need their annual school sports physical**
- **The study focuses on the overall health of female adolescent athletes**
- **The study will be part of the annual sports physical examination**
- **Ask your Primary Care Provider for more information or contact Emily Moe BSN, RN at enmqr8@mail.umkc.edu**

Appendix G

Physical Examination

Pulse _____

Height _____

Weight _____

BMI

- Less than 18.5
- 18.5-25
- Other

Tanner Staging _____

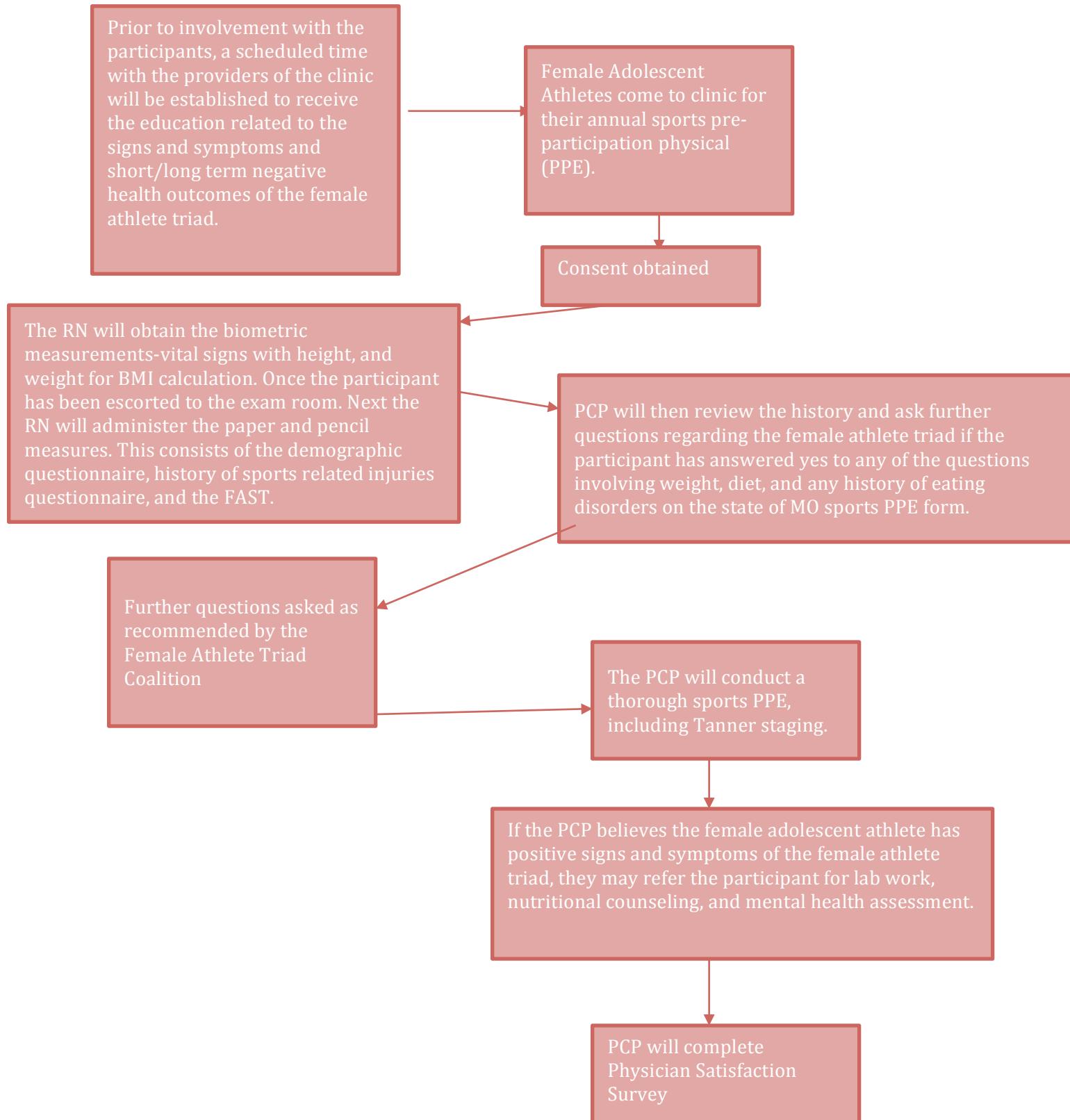
Appendix H**Demographics**

1. Age _____
2. Grade in School _____
3. Race/Ethnicity
 - a. African American
 - b. Asian American
 - c. White, non-Hispanic
 - d. White, Hispanic
 - e. Middle Eastern
 - f. Other: _____
4. Estimated total Family Income
 - a. Less than \$20,000
 - b. \$20,000-\$34,999
 - c. \$35,000- \$49,999
 - d. \$50,000- \$74,999
 - e. \$75,000-\$99,999
 - f. Over \$100,000
5. Type of Sport
 - a. Gymnastics
 - b. Dance team
 - c. Ice skating
 - d. Track/cross-country
 - e. Volleyball
 - f. Soccer
 - g. Softball
 - h. Basketball
6. Number of Sports played
 - a. 1
 - b. 2
 - c. 3
 - d. 4
7. Number of years of sports participation
 - a. 0-2 years
 - b. 3-5 years
 - c. 6-8 years
 - d. 9-11 years
 - e. 12-14 years

Appendix I

Injuries and Menses History

1. Number of sports injuries
 - a. 0 injuries
 - b. 1 injury
 - c. 2 injuries
 - d. 3 injuries
 - e. 4 injuries
2. Type of injury
 - a. Sprain
 - b. Fracture
 - c. Loss of consciousness due to exhaustion
 - d. Other
3. Regularity of menses
 - a. None
 - b. Monthly
 - c. Every other month
 - d. Other

Appendix J**EBP Flow Diagram**

Appendix K

SHORE AND FRANKS

MEDICAL CARE

Appendix Physician Satisfaction Scale

Please answer all of the questions. Circle the item on the scale from 1 to 5 that best reflects your feelings, where 1 = strongly agree and 5 = strongly disagree.

Interpersonal

- Q1. This patient was able to explain his or her problems in terms I could understand.
- Q4. This patient was not very friendly.
- Q8. The patient seemed satisfied with how things went. (1)
- Q10. This patient understood what I said.
- Q12. This patient was able to be very open with me. (4)
- Q14. This patient basically disagreed with my explanations and plans.
- Q20. Aspects of caring for this patient were physically unpleasant.
- Q22. I don't believe this patient appreciated my efforts at all. (8)
- Q24. This patient gave me a clear idea of how today's problems affected his or her life.
- Q38. This patient asked too many questions.
- Q39. Overall rapport with this patient was very high. (13)

Professional

- Q2. I think I really understood why this patient came here today.
- Q5. I helped this patient today.
- Q6. I spent too much time with the patient.
- Q11. There was little of educational value for me in this patient encounter.
- Q25. After this encounter, I think I have a good understanding of what is going on. (11)
- Q28. I believe I can be of help to this patient.
- Q30. This encounter made me realize how little I really know.
- Q31. I enjoyed the challenge of seeing this patient.
- Q32. I did not use my time with the patient very effectively today.
- Q34. Truthfully, I would rather have been spending my time with patients whose problems are more serious.
- Q36. This patient did not require my skills.
- Q37. This patient's problem was one I feel competent to handle.

Personal

- Q3. I learned little from this encounter.
- Q9. Emotionally, I was very comfortable during this visit.
- Q16. This visit made me feel good about being a doctor. (6)
- Q19. I had not been looking forward to seeing this patient.
- Q23. I felt frustrated by this encounter. (3)
- Q35. I felt good about myself after this encounter.

- Q41. I was disappointed with how things went. (15)
Q43. Overall, I was satisfied with this patient encounter. (16)

Contextual

- Q7. I am having a terrible day. (10)
Q13. Other things were on my mind during this encounter. (5)
Q15. During this visit, I was physically uncomfortable (hot, cold, sick, tired, etc.).
Q18. My previous patient encounter went very well. (9)
Q26. I did not get very much sleep last night.
Q27. I felt pressed by other commitments during this visit. (12)
Q40. I was too busy today to spend enough time with this patient. (7)
Q42. Things have been going smoothly for me today with nurses, secretaries, and other physicians. (14)

Additional Questions From Weinberger et al.¹⁸

- Q17. I was very active in this encounter.
Q21. I believe this patient is generally compliant.
Q29. I needed to make many facilitative remarks in this encounter.
Q33. Humor was used during this encounter.

Notes

1. Questions here are grouped by the four hypothesized domains. The four questions from Weinberger et al.¹⁸ did not fit these categories.
2. Question numbers refer to sequence in the original questionnaire.
3. Numbers in parentheses after questions refer to sequence in 16-question version of questionnaire.

Appendix L

Outcome Analysis Table

	State	Measurement Instrument Name	Tool validity and reliability	Permission Need	Statistical Analysis
Primary Outcome	Screening for female athlete triad	FAST	Cronbachs Alpha was 0.87. Discriminatory/Concurrent validity. Researchers found significance between groups at p<0.05.	Public Domain	Cronbachs Alpha, tests for normality, correlation
Secondary Outcome	Body mass index, Tanner staging, physician satisfaction survey	Biometric measurements	N/A	N/A	Tests for normality, correlation
	Injury history, diet	Qualitative	N/A	N/A	Tests for normality, correlation
Demographics	Age of athlete, ethnicity, grade level, number of sports involved in, and how long they have been playing chosen sport, club/school participation.	Not applicable	Not applicable	Not Applicable	Descriptive for each group. Comparison statistics if two independent groups.
Participant Completion of the Measurement Tool (Procedure): After informed consent has been obtained, then biometrics will be collected followed by obtaining demographic information, history of injuries, and administration of the FAST paper pencil measure. Finally, information related to the history and physical exam will be obtained by the PCP. The student investigator or trained staff member will give instruction on the measure. The participants will be encouraged to answer all of the questions on the FAST.					

Appendix M					
Logic Model for DNP Project					
Student: Emily Moe					
Inquiry, PICOTS: Among primary care providers will the use of the FAST compared to no screening increase diagnostic accuracy of the female athlete triad over a six-month period of time?					
Evidence, sub-topics 1. Female Adolescent Athletes 2. Female Athlete Triad 3. Education of primary care providers 4. Introduction of the Female Athlete Screening Tool (FAST) Major Facilitators or Contributors 1. Project Facilitators include Dr. Barber and Dana	Intervention(s) <i>Activities</i>		Outcomes -- Impact <i>Short</i> <i>Medium</i> <i>Long</i>		
	EBP intervention which is supported by the evidence in the Input column (brief phrase) Educate the primary care providers on the use of the FAST and how to screen for the female athlete triad. Major steps of the intervention (brief phrases) Educate providers and nurses on: 1. The female athlete triad 2. The use of the FAST Data collection would consist of: 3. Administering the paper and pencil FAST 4. Biometric measurements including: • Vital signs • Height, Weight		Outputs <i>Participation</i> The participants (subjects) Pediatric Primary Care Providers Site Lakeside Pediatrics Time Frame September-March Consent or assent Needed Consent		

<p>Kapp</p> <p>2. Access to Pediatric providers</p> <p>3. Public access to measure</p> <p>4. Timely topic that has minimal research</p> <p>5. Mandated Sport PPE prior to school based athletics</p> <p>Major Barriers or Challenges</p> <p>1. Pediatric population</p> <p>2. Providers Time</p> <p>3. Delays by the IRB</p> <p>4. Obtaining consent</p>	<p>for BMI calculation</p> <p>5. History of sports related injuries such as stress fractures, sprains, and pulled muscles.</p> <p>6. The signs and symptoms of eating disorders (PE by provider)</p> <p>7. Tanner Staging (PE by provider)</p>	<p>Other person(s) collecting data (yes/no)</p> <p>Yes</p> <p>Others directly involved in consent or data collection</p> <p>Yes</p>	<p>used</p> <p>1. SPSS</p> <p>2. Correlations between measures</p> <p>3. Descriptive statistics</p>	
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Appendix N

Project Timeline Flow Graphic



Appendix O

Definition of Terms

- Adolescence- defines the years between ages 13 and 19 and is considered the transitional stage from childhood to adulthood.
- Biometric measures- the measurement of physical characteristics including height, weight, body mass index, and Tanner stages.
- Demographic measures- data related to the population and particular groups within
- FAST- Female Athlete Screening Tool (FAST).
- Female athlete triad- Female athlete triad is a combination of three conditions: disordered eating, amenorrhea, and osteoporosis. A female athlete can have one, two, or all three parts of the triad.
- Health Belief Model- The HBM focuses on changing health behaviors in individuals.
- Pediatric Primary care provider- focused on the physical, mental, and social health of children from birth to young adulthood. Pediatric care involves a wide variety of health services ranging from preventive health care to the diagnosis and treatment of acute and chronic diseases.
- Sports pre-participation exam (PPE)- The sports PPE provides the medical background on which physical activity decisions will be made by the individual athlete's physician or the team physician and associated medical staff. Athletes are required to have an annual sport PPE. The goal in performing is to promote the health and safety of the athlete in training and competition.
- Tanner Staging- a scale of physical development in children, adolescents and adults. The scale defines physical measurements of development based on external primary and

secondary sex characteristics, such as the size of the breasts, genitals, testicular volume and development of pubic hair.

Appendix P

Statistics Table

Subject Characteristics	Minimum	Maximum	Mean	Standard Deviation
Age				
Weight (kg)				
Height (cm)				
BMI				

Variable	Fast Scores	P value
Age		
BMI		
Menses		
Types of Injuries		
Type of Sport		
Years of Sports participation		
Number of Sports		
Race/Ethnicity		
Family Income		

Appendix Q

Statistics Data Set

CodeBook.sav [DataSet1] - IBM SPSS Statistics Data Editor

	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure	Role
1	addphyac	Numeric	8	2	participate in a...	{1.00, Frequ...	None	8	Right	Unknown	Input
2	cantexwor	Numeric	8	2	can't exercise w...	{1.00, Frequ...	None	8	Right	Unknown	Input
3	beleatdis	Numeric	8	2	believe female ...	{1.00, stron...	None	8	Right	Unknown	Input
4	trainconfatcal	Numeric	8	2	during training ...	{1.00, frequ...	None	8	Right	Unknown	Input
5	nofoodmo3fat	Numeric	8	2	do not eat more...	{1.00, stron...	None	8	Right	Unknown	Input
6	perimitflowe	Numeric	8	2	performance im... scale tomorrow...	{1.00, frequ...	None	8	Right	Unknown	Input
7	scatomgn2lbs	Numeric	8	2	I weigh myself	{1.00, daily}...	None	8	Right	Unknown	Input
8	weighmy	Numeric	8	2	chose to exerci...	{1.00, 2 or ...	None	8	Right	Unknown	Input
9	choexdaycom	Numeric	8	2	consume ETO...	{1.00, frequ...	None	8	Right	Unknown	Input
10	conETObev	Numeric	8	2	guilty with frie...	{1.00, frequ...	None	8	Right	Unknown	Input
11	guifriedfood	Numeric	8	2	injured still exer...	{1.00, stron...	None	8	Right	Unknown	Input
12	injurandexer	Numeric	8	2	consume diatar...	{1.00, frequ...	None	8	Right	Unknown	Input
13	dietherbsupp	Numeric	8	2	concerned abo...	{1.00, frequ...	None	8	Right	Unknown	Input
14	conbodyfat	Numeric	8	2	conscious abou...	{1.00, frequ...	None	8	Right	Unknown	Input
15	athconadcams	Numeric	8	2	friends tell me t...	{1.00, frequ...	None	8	Right	Unknown	Input
16	worrgainwt	Numeric	8	2	feel uncomfor...	{1.00, frequ...	None	8	Right	Unknown	Input
17	thiniswinn	Numeric	8	2	lose wt to pleas...	{1.00, frequ...	None	8	Right	Unknown	Input
18	trainintens	Numeric	8	2	limit amount of ...	{1.00, frequ...	None	8	Right	Unknown	Input
19	durseaexdao	Numeric	8	2	train intensely	{1.00, frequ...	None	8	Right	Unknown	Input
20	frietellme	Numeric	8	2	during season ...	{1.00, frequ...	None	8	Right	Unknown	Input
21	feeluncommeat	Numeric	8	2	strive for perfect...	{1.00, stron...	None	8	Right	Unknown	Input
22	limamofcarb	Numeric	8	2	Avoid eating meat	{1.00, stron...	None	8	Right	Unknown	Input
23	trylosweiple	Numeric	8	2	done things to ...	{1.00, frequ...	None	8	Right	Unknown	Input
24	uncomp	Numeric	8	2	feel uncomfortable	{1.00, yes}...	None	8	Right	Unknown	Input
25	injnoexnocal	Numeric	8	2	regularity of m...	{1.00, none}...	None	8	Right	Unknown	Input
26	past2ymocom	Numeric	8	2	past 2 years un...	{1.00, 7 or ...	None	8	Right	Unknown	Input
27	pratoconc	Numeric	8	2	race and ethnicity	{1.00, Africa...	None	8	Right	Unknown	Input
28	lotsgoqual	Numeric	8	2	grade level in s...	{1.00, 7th gr...	None	8	Right	Unknown	Input
29	nogoodatall	Numeric	8	2	type of sports i...	{1.00, gymna...	None	8	Right	Unknown	Input
30	striveperf	Numeric	8	2	number of sport...	{1.00, 1}...	None	8	Right	Unknown	Input
31	avodeatme	Numeric	8	2	years of sports ...	{1.00, 0-2 y...	None	8	Right	Unknown	Input
32	hapweight	Numeric	8	2	Number of spor...	{1.00, 0 inju...	None	8	Right	Unknown	Input
33	kpwtdown	Numeric	8	2	Type of injury	{1.00, sprai...	None	8	Right	Unknown	Input
34	VAR00001	Numeric	8	2	Regularity of m...	{1.00, none}...	None	8	Right	Unknown	Input
35	VAR00002	Numeric	8	2	Regularly	{an 18.5}...	None	8	Right	Unknown	Input
36	VAR00003	Numeric	8	2	Irregularly	{an 18.5}...	None	8	Right	Unknown	Input
37	VAR00004	Numeric	8	2	Never	{an 18.5}...	None	8	Right	Unknown	Input
38	age	Numeric	8	2	age	None	None	8	Right	Unknown	Input
39	raceethnicity	Numeric	8	2	race and ethnicity	{1.00, Africa...	None	8	Right	Unknown	Input
40	grade	Numeric	8	2	grade level in s...	{1.00, 7th gr...	None	8	Right	Unknown	Input
41	estimatedfa...	Numeric	8	2	estimated famil...	{1.00, less t...	None	8	Right	Unknown	Input
42	sport	Numeric	8	2	type of sports i...	{1.00, gymna...	None	8	Right	Unknown	Input
43	numbersports	Numeric	8	2	number of sport...	{1.00, 1}...	None	8	Right	Unknown	Input
44	yearsofsport	Numeric	8	2	years of sports ...	{1.00, 0-2 y...	None	8	Right	Unknown	Input
45	numberspor...	Numeric	8	2	Number of spor...	{1.00, 0 inju...	None	8	Right	Unknown	Input
46	typesinjury	Numeric	8	2	Type of injury	{1.00, sprai...	None	8	Right	Unknown	Input
47	menses	Numeric	8	2	Regularity of m...	{1.00, none}...	None	8	Right	Unknown	Input
48	BMI	Numeric	8	2	BMI	an 18.5}...	None	8	Right	Unknown	Input

Appendix R

Faculty DNP Project Letter



June 21, 2019

DNP Project Approval
UMKC DNP Student

This letter serves to provide documentation regarding Emily Moe's Doctor of Nursing Practice (DNP) Project proposal. Ms. Moe obtained approval for her project proposal, *Provider Education and Screening of the Female Athlete Triad in the Adolescent Population*, from the School of Nursing and Health Studies DNP faculty on June 21, 2019.

If we can provide further information, please feel free to contact us.

Sincerely,

A handwritten signature in black ink that reads "Lyla Lindholm".

Cheri Barber, DNP, RN, PPCNP-BC, FAANP
Clinical Assistant Professor
DNP Program Director
UMKC School of Nursing and Health Studies
barberch@umkc.edu

Lyla Lindholm, DNP, ACNS-BC
UMKC MSN-DNP Program Coordinator
Clinical Assistant Professor
DNP Faculty

Appendix S

IRB Approval Letter

Mosaic Life Care at St. Joseph
Institutional Review Board

5325 Faraon St.
St. Joseph, MO 64506
816.271.6070 phone 816.271.6533 fax
mvMosaicLifeCare.org



more than health care ... life care

June 26, 2019

Heartland Regional Medical Center
Institutional Review Board
FWA00000816
Approval Date 6/26/19 JRC

Emily Moe, BSN RN
University of Missouri-Kansas City
2464 Charlotte
Kansas City, MO 64108

Dear Emily:

RE: Provider Education and Screening of the Female Athlete Triad in the Adolescent Population

The Heartland Regional Medical Center Institutional Review Board (IRB) reviewed your proposed study as referenced above. The study was found to have minimal degree of risk to the research participants. The board approved the study based on criteria specified under 45 CFR 46.111.

Federal regulations require that investigators report any unanticipated problems involving risks to human subjects or others. Heartland's IRB procedures may be found in Standard RI0105.

Sincerely,

A handwritten signature in black ink, appearing to read "M. Biria".

Mazda Biria, M.D.
Chairman, Institutional Review Board

Appendix T

Statistical Analysis

Descriptives

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
rcsum	11	48.00	102.00	74.1818	13.96294
age	11	13.00	18.00	15.1818	2.04050
race and ethnicity	11	3.00	3.00	3.0000	.00000
grade level in school	11	1.00	6.00	3.8182	1.72152
estimated family income	11	4.00	6.00	4.7273	.78625
type of sports involvement	11	1.00	8.00	5.4545	2.58316
number of sports played	11	1.00	3.00	1.4545	.82020
years of sports activity	11	1.00	5.00	3.1818	1.66242
Number of sports injuries	11	1.00	5.00	3.3636	1.12006
Type of injury	11	1.00	2.00	1.4545	.52223
Regularity of menses	11	2.00	3.00	2.2727	.46710
BMI	11	1.00	3.00	2.0000	.63246
Pulse	11	60.00	103.00	86.0909	11.36182
Height	11	158.00	173.00	166.0909	3.96118
Weight	11	41.00	103.00	62.5455	16.82477
Tanner	11	4.00	5.00	4.4545	.52223
Valid N (listwise)	11				

Reliability

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	11	100.0
	Excluded ^a	0	.0
	Total	11	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.923	.921	33

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Inter-Item Correlations	.260	-.821	.922	1.743	-1.123	.121	33

Sign Test

Frequencies

		N
PostSumDoc - PreSumDoc	Negative Differences ^a	1
	Positive Differences ^b	2
	Ties ^c	3
	Total	6

- a. PostSumDoc < PreSumDoc
- b. PostSumDoc > PreSumDoc
- c. PostSumDoc = PreSumDoc

Test Statistics^a

PostSumDoc - PreSumDoc	
Exact Sig. (2-tailed)	1.000 ^b

- a. Sign Test
- b. Binomial distribution used.

Wilcoxon Signed Ranks Test

Ranks

		N	Mean Rank	Sum of Ranks
PostSumDoc - PreSumDoc	Negative Ranks	1 ^a	1.50	1.50
	Positive Ranks	2 ^b	2.25	4.50
	Ties	3 ^c		
	Total	6		

a. PostSumDoc < PreSumDoc

b. PostSumDoc > PreSumDoc

c. PostSumDoc = PreSumDoc

Test Statistics^a

PostSumDoc - PreSumDoc	
Z	-.816 ^b
Asymp. Sig. (2-tailed)	.414

a. Wilcoxon Signed Ranks Test

b. Based on negative ranks.

Descriptives	Sum FAST Score
Age	.806
Family Income	-.759**
Grade	.907
Sport Type	.845
Injury Type	-.810**
Number of Injuries	-.819**
Number of Sport's played	-.401
Years in Sport	-.595

Descriptives	Mean
Age	15 years
Race	Caucasian
Family Income	\$50,000-\$74,999
Grade	9 th grade
Sport Type	Volleyball
Injury Type	Sprain
Number of Injuries	Two Injuries
Number of Sports Played	One sport
Years in Sport	6-8 years

Biometrics	Sum FAST Score
BMI	.765**
Height	.744**
Weight	.651

**Significant at the .01 level

*Significant at the .05 level