Spring 2021

PERCEPTIONS OF CARDIAC SCREENING OF HIGH SCHOOL ATHLETES AMONG ATHLETIC TRAINERS AND HIGH SCHOOL COACHES

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PERCEPTIONS OF CARDIAC SCREENING OF HIGH SCHOOL ATHLETES AMONG ATHLETIC TRAINERS AND HIGH SCHOOL COACHES

By

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A doctoral dissertation submitted to the
College of Education
in partial fulfillment of the requirements
for the degree Doctor of Education
in Organizational Leadership

Southeastern University
March, 2021

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DEDICATION

First and foremost, I would like to dedicate this work to my parents and to thank them for their love and support throughout my life. Thank you both for giving me strength to reach for the stars and chase my dreams. Especially to my mother who no longer walks this earth, I know you are looking down on me smiling with pride in heaven. You both taught me to be strong in what I believe in, trust and have faith in God, and to lead a life I can be proud to call my own. For that I thank you.

Secondly, I want to thank my loving and supportive husband, Chad. Without your push to always better myself and the many countless ways of believing in me, I think most certainly that you believed in me more than I believed in myself. I literally do not think I could have done this without you. You have supported me throughout the entirety of my doctoral process, even in my anxiety driven moments, you knew how to keep me calm, listen, and support me. You supported me every step of the way with patience, great insight, humor, and above all, love. I appreciate and love you more than words can express.

Lastly, to my big brother, Vince, little sister, Viviana, and my dearest niece, Olivia. Vince, thank you for everything you do and have done for me. I am greatly thankful to you and for all the support and love you have shown me. Your friendship and guidance have always made me feel stronger and more grounded. Vivi, I am beyond lucky to have been gifted a sister like you. The bond we share is special, and you, my dear, are worth more than gold, and I am very blessed to have you. Thank you so much, sister, for your support, encouragement, and love. Little Olive (Olivia), you, I think, have been one of my biggest supporters and for that I am thankful. This journey of mine has been mostly to show you that you can reach for the stars, and that you can

accomplish anything you set your mind to! Always remember, you are kind, you are smart, and you are important! I love you so much, sweet girl.

ACKNOWLEDGMENTS

When I decided to start this journey and when searching for a doctoral program, I honestly did not think that I would be accepted into one, and then Southeastern University came along and took a chance on me. From my acceptance letter, to the very first day my Cohort met, I knew that SEU was exactly where I was meant to be.

I want to thank my dissertation committee members, Dr. Kevin Weaver, Dr. Tom Gollery, and Dr. Kasey Mueller. This process could not have been completed without each of you. To my dissertation chair, Dr. Weaver, I am beyond grateful and appreciative of your time, energy, and constructive feedback throughout this entire process. Every time I emailed you when I thought I was sinking, you managed to pull me back up and encourage me. Your insight and direction allowed me to turn my study into a valuable one, one that I am very passionate about, and your excitement for it made it all that much better. Dr. Gollery, thank you so much for your passion and drive in quantitative research. From the very first moment we spoke about my study, your excitement and willingness to dive in deep gave me the extra added push to want to complete this process. Our conversations over quantitative research made me more appreciative of your work. Dr. Mueller, thank you so much for seeing my study for what it is, the importance of the health and well-being of athletes, and health education awareness. Your guidance and enthusiasm are greatly appreciated.

I also want to thank my study participants, among them are friends, colleagues, and mentors. To my athletic training colleagues and mentors, thank you for your continued support. Your knowledge and insight have been invaluable throughout this process.

Lastly, to my Cohort G Family! Without each and every one of you this process would have been so much harder. All of you proved to be great colleagues, extremely supportive, and, above all, amazing friends. There are two beautiful individuals I would like to thank specifically, because without each of your phone calls, texts, and encouragement, this process would not have been possible. To Erin Newberry & Tori Hersey, ladies, you have shown me the true meaning of friendship. We have laughed together, cried together, and picked each other up when we needed it the most. You both bring so much joy into my life, thank you so much for being my friends through it all! Always remember, one fire at a time!

Abstract

Regular participation in competitive exercise is associated with cardiac anomalies that can exist in a high school athletes' heart. The purpose of this quantitative, non-experimental study was to determine the perceptions of athletic trainers and high school coaches on cardiac screening high school athletes prior to athletic participation. The study also examined seven barriers that are present with the implementation of cardiac screening. The current study was carried out with 104 participants composed of two categories: athletic trainers, and high school coaches. Study participants perceptions were assessed using a 5-point Likert scale survey consisting of 12 questions. Although studies have shown collegiate and professional sports implementation of cardiac screening prior to athletic participation is beneficial to the athlete's overall health and well-being, the findings from this study indicate the implementation of cardiac screening at the high school level are also beneficial for the high school athlete's overall health and well-being. School districts should be encouraged to explore the option to implement and administer cardiac screening to their athletes prior to athletic participation.

Keywords: Cardiac screening; high school athletes, perceptions of cardiac screening, recommendations for cardiac screening, athletic trainers', high school coaches, young athletes, detection of cardiac disease, electrocardiogram

TABLE OF CONTENTS

Dedication iii

Acknowledgments v

Abstract vii

Table of Contents viii

List of Tables xi

List of Figures xii

I. INTRODUCTION 1

Background of the Study 2

Incidence Rate and Occurrence 2

Governing Bodies on Cardiac Screening 3

Conceptual Framework 4

Theoretical Foundation 7

Problem Statement 8

Purpose Statement 8

Overview of Methodology 9

Research Questions 9

Research Hypotheses 10

Overview of Analyses 11

Preliminary Analysis 11

Data Analysis by Research Questions 12

Limitations 12

Definition of Key Terms 13

Significance 14

II. REVIEW OF LITERATURE 16

Anatomy of the Heart 16

SCD in Young Athletes 18

Incidence of Sudden Cardiac Death 20
Cardiac Screening 22
Cost Effectiveness of Cardiac Screening 25
Governing Cardiac Guidelines for Athletes 26
Awareness and Education of Cardiac Screening 29
Impact of Cardiac Screening 30
Current Implementation of Cardiac Screening 32
Summary 34
III. METHODOLOGY 36
Description of Methodology 36
Research Design 36
Sample Selection 37
Statistical Power Analysis 37
Instrumentation 38
Procedures 39
Data Analysis 39
Preliminary Analysis 39
Research Question 1 40
Research Question 2 40
Research Question 3 40
Research Question 4 41
Analyses by Research Questions 41
Summary 42
IV. RESULTS 43
Methods of Data Collection 43
Finding for Foundational Analyses 44
Data Analysis by Research Question 47
Research Question 1 47
Hypothesis 47
Analysis 48
Findings 48

Research Question 2 48
Hypothesis 49
Analysis 49
Findings 50
Research Question 3 50
Hypothesis 51
Analysis 51
Findings 51
Research Question 4 52
Hypothesis 53
Analysis 53
Findings 53
Summary 54
V. DISCUSSION 56
Statement of Problem 56
Review of Methodology 57
Discussion by Research Question 59
Research Question 1 59
Research Question 2 60
Research Question 3 61
Research Question 4 62
Study Limitations 63
Implications for Future Practice 63
Recommendations for Future Research 65
Conclusion 66
References 68

LIST OF TABLES

Table Page

Table 1: Internal Reliability: Overall and by Category of Study Participants 45

Table 2: Preliminary Analyses Responses to Survey Items on the Research Instrument 46

Table 3: Comparison on Perceptions: Requirement of Cardiac Screening.....48

Table 4: Comparison on Perceptions: Cardiac Screening for Overall Health.....50

Table 5: Comparison on Perceptions: CPR/First Aid Knowledge of Cardiac Screening 51

Table 6: Perceptions of Barrier Effect upon Pursuit of Cardiac Screening 52

Table 7: Perceptions of Barrier Effect Pursuit of Cardiac Screening by Professional Role ...54

LIST OF FIGURES

Figure Page

Figure 1: The Conceptual Framework for the Health Belief Model.....6

I. INTRODUCTION

The health benefits of physical education and exercise are well known. Athletes are generally perceived as some of the healthiest individuals in society (Hedrich et al., 2006). High school athletes in most cases are in their prime or peak health; however, a devastating few of the millions of high school athletes participating in athletics across the nation will die from sudden cardiac death (SCD) (Shaw, 2008). Very few avenues exist to educate athletes, coaches, and parents on the options available for preventing SCD. Cardiac screening is one of the few opportunities available to high school athletes for the potential prevention and proper implementation of SCD. In most instances, these options are not utilized due to the lack of education, funding, and resources.

Implementation of cardiac screening is a significant issue in society because no requirement exists for a high school athlete to utilize cardiac screening before athletic participation. Oliva et al. (2017) stated, "Healthy-appearing competitive athletes may harbor unsuspected cardiovascular disease with the potential to cause sudden death" (p. 394). Several heart anomalies can arise within the high school athlete's age range that could cause a catastrophic event, which could potentially be prevented if cardiac screening was required for high school athletes. Witnessing young athletes die on the court or field is painful to watch, whereas the simple implementation of a test potentially could have prevented a devasting event.

Background of the Study

SCD often can be the very first symptom of underlying genetic heart disease in an athlete. Due to the occurrence of SCD, several types of screening processes have been used to rule out cardiac anomalies that may be present in an athlete's heart. Because of this development, numerous proposals for pre-participation screening programs are available (Semsarian et al., 2015). Semsarian et al. (2015) pointed out, "The main argument in support of screening is clear – the potential to prevent SCD and reduce mortality through detection of cardiovascular abnormalities, initiation of effective disease-specific treatments, and possible disqualification from competitive sports if necessary" (p. 1019).

The first step an athlete must take to participate in sports is to get a pre-participation physical exam that includes an in-depth medical and family history. Sanders et al. (2013) claimed, "With the increase in participation comes the need for specific health care related to the demands of the athlete. The first component of the health care process for athletes starts with the PPE" (p. 182). The Pre-participation Examination (PPE), pre-participation screening, medical evaluation, or sports screenings are synonymous terms used for the process of tests athletes should have completed before participation in any type of sport, competition, or training (Sanders et al., 2013). All 50 states require the completion of some form of pre-participation evaluation before an athlete can participate in high school sports, intercollegiate sports, and professional sports.

Incidence Rate and Occurrence

In young athletes, the incidence rate of SCD is much higher in males than in females and can be as high as 10:1 (Hernelahti et al., 2008). Hernelahti et al. (2008) concluded, "Every effort to effectively prevent these events should be made" (p. 132). Hyung Cho et al. (2015) confirmed,

"SCD among young competitive athletes was reported occurring in 0.46 per 100,000 athletes per academic year in high school grade 10-12" (p. 1). Hernelahti et al. (2008) found, "In young (under the age of 35 years) athletes, as much as 90% of sudden deaths occur during or immediately after exercise" (p. 132). Behera et al. (2011) explained, "A variety of morphological changes can occur in the hearts of highly trained young athletes" (p. 91). An ECG or echocardiogram is the type of heart screening available to athletes within some institutions, but not all. Lorvidhaya and Huang (2003) confirmed, "Echocardiography is extremely helpful in detecting hypertrophic cardiomyopathy, the most common cause of death in young competitive athletes that is frequently asymptomatic" (p. 192). The ECG screening is a 12-lead test which is cost-effective and the most practical for competitive athletes.

Governing Bodies on Cardiac Screening

High schools in Texas require coaches to be certified in cardiopulmonary resuscitation (CPR) and automated external defibrillator (AED) training. AEDs readily available in all schools, and coaches trained in CPR, create the appearance that enough is being done. The early detection of cardiac anomalies could be easily unveiled if a cardiac screening was performed. Cardiac issues tend to scare the school district community because of the impending doom of a young athlete's death. If the school district, employees, parents, athletes, and community know the facts, the availability of more knowledge lessens the fear.

Few governing bodies exist over the proper guidelines for school-aged adolescent athletes and SCD awareness, including the University Interscholastic League (UIL) in Texas and the American Heart Association (AHA). According to the UIL, a current requirement includes a physical examination with an extensive family history for a pre-disposition to potential heart risks, but no cardiac screening is mandatory.

School districts should adopt a plan that is conducive to their schools by raising awareness and offering training and seminars to better educate employees and the public. Spiers and Durrant (2012) stated, “Project Adam was set up in the US in 1999 following the sudden death of a high school student who collapsed and died while playing basketball” (p. 74). Programs such as these are the backbone of a great cardiac awareness education course, perhaps offering a class to parents, coaches, and school district employees. The capability of putting the athlete’s health at the forefront of such a controversial topic as cardiac screening may be the missing link in the overall process of cardiac awareness.

Due to the nature of the incidence of SCD in young athletes, the proper implementation of cardiac screenings is appropriate for the health and well-being of the athlete. Although the cost of cardiac screening in most cases may outweigh the risk, where should school districts draw the line relative to screenings? Each athlete participating in sports, if not adequately screened, could potentially result in a catastrophic event.

Conceptual Framework

This study examines the perceptions of athletic trainers and high school coaches on cardiac screening of high school athletes. This non-experimental quantitative study investigates the different variables associated with the lack of participation and the perceptions related to cardiac screening at the high school level. This study could extend existing research by examining issues associated with cardiac screening of high school athletes, how athletic trainers and high school coaches perceive cardiac screening, and whether the high school athlete should be required to participate in cardiac screening.

Although many health-related theories are available and explored throughout the research, the health belief model (HBM) serves as the conceptual framework for this study.

Champion and Skinner (2008) stated the HBM is "one of the most widely used conceptual frameworks in health behavior research, both to explain change and maintenance of health-related behaviors and as a guiding framework for health behavior interventions" (p. 45). Due to the simplicity of the model, researchers could create a basis of importance (Champion & Skinner, 2008). Champion and Skinner (2008) found "its simplicity has enabled researchers to identify constructs that may be important, thus increasing the probability that a theoretical base will be used to frame research interventions" (p. 61).

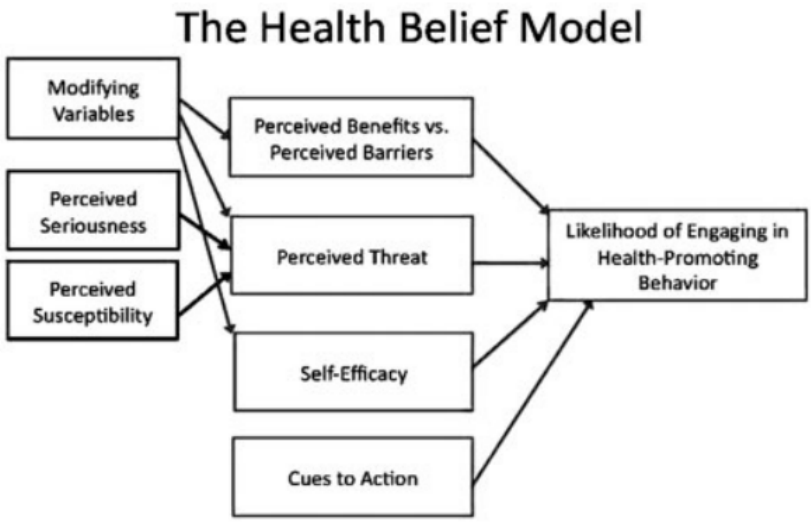
Susceptibility plays a significant factor in the overall outcome of an individual's willingness to participate in preventative healthcare:

> If individuals regard themselves as susceptible to a condition, believe that condition would have potentially serious consequences, believe that a course of action available to them would be beneficial in reducing their susceptibility to or severity of the condition, and believe that anticipated benefits of taking action outweigh the barriers to (or costs of) action, they are likely to take action that they believe will reduce their risks. (Champion & Skinner, p. 50)

The perceptions of athletic trainers and high school coaches on the implementation of and participation in cardiac screening may influence the willingness of high school athletes and their parents to be more understanding of the importance of cardiac screening. Figure 1 illustrates the conceptual framework for the HBM:

Figure 1

The Conceptual Framework for the Health Belief Model



Note. From "The impact of educational intervention based on the health belief model on observing standard precautions among emergency center nurses in Sirjan, Iran," by R. Sadeghi, M. Hasemi, and N. Khanjani, 2018, *Health Education Research, 33*(4), p. 329 (https://doi:10.1093/her/cyy020). Copyright 2018 by The Author(s), Published by Oxford University Press.

Based on Figure 1, six concepts are presented that play a potential role in the likelihood of an individual to engage in a health-promoting behavior, perceived seriousness, perceived susceptibility, perceived benefits, perceived barriers, cues to action, and self-efficacy. All six concepts point to the behavior of participation in preventative healthcare for the individual. Sadeghi et al. (2018) claimed, "HBM is a person-related model and based on its structures, reminds nurses to maintain their health. So, it is ultimately the person who decided to take care of her/his health or not" (pp. 328–329). Perceived severity and susceptibility are the driving force

to take action on one's health (Sadeghi et al., 2018). Knowledge and education can help to improve the willingness to participate in cardiac screening.

Theoretical Foundation

This study is derived from the principle of the HBM. The model was developed in the 1950s to explain the failure of individuals participating in preventative programs to potentially detect and prevent disease (Champion & Skinner, 2008). Champion and Skinner (2008) claimed:

> Although the model evolved gradually in response to very practical public health concerns, its basis in psychological theory is reviewed here to help readers understand its rationale for selected concepts and their relationships, as well as its strengths and weaknesses. (p. 46)

The HBM is based on two compelling sources—the stimulus-response theory and the cognitive theory—which were developed to understand the behavior that occurs from learning (Champion & Skinner, 2008). Learning from events is perceived as having potential to trigger response and to minimize physiological drives. An individual's behavior could be determined by consequences or reinforcement that lay ahead with said behavior.

The cognitive theory notably deals more with the overall value of the outcome, which affects an individual's behavior (Champion & Skinner, 2008). Champion and Skinner (2008) explained:

> When value-expectancy concepts were gradually reformulated in context of health-related behaviors, it was assumed that individuals (1) value avoiding illnesses/getting well and (2) expect that a specific health action may prevent (or ameliorate) illness. The expectancy was further delineated in terms of the individual's estimates of personal

susceptibility to and perceived severity of an illness, and the likelihood of being about to reduce that threat through personal action. (pp. 46–47)

Many ideas are available regarding the reason individuals decide to participate in health screening in order to prevent illness. Champion and Skinner (2008) found, "these include susceptibility, seriousness, benefits, and barriers to a behavior, cues to action, and most recently, self-efficacy" (p. 47). Along with the many ideas available, several other variables play a role in an individual's ability to take action concerning their health and wellness. In their study, Champion and Skinner (2008) confirmed, "diverse demographic, sociopsychological, and structural variables may influence perceptions and, thus, indirectly influence health-related behavior" (p. 50).

Problem Statement

The information provided addresses the perceptions and implementation of cardiac screening gaps and misconceptions in order to solidify the role of the education stakeholders in process. By determining educator perception gaps, efforts can be made to inform these individuals appropriately. The current implementation and requirement of cardiac screenings is little to non-existent at the high school level.

Purpose Statement

The purpose of this non-experimental quantitative study is to determine the perceptions among high school coaches and athletic trainers concerning potential cardiac risks and cardiac screening in high school athletes. A non-experimental quantitative study involving a survey using a Likert scale was conducted to assess the perceptions of high school athletic coaches and athletic trainers in Texas concerning cardiac screening of high school athletes; potential cardiac

risks of high school athletes; current issues including paperwork, time, and convenience; and the current governing guidelines on the options available for cardiac screening.

Overview of Methodology

This study is broadly quantitative, non-experimental, and survey researched by specific research methodology. Study participants' perceptions are assessed through conducting a survey using a Likert scale on the importance of potential cardiac risk awareness and current issues associated with cardiac screening among Texas high school coaches and athletic trainers for high school athletes. Bhattacharjee (2012) stated, "Likert scale, designed by Rensis Likert, this is a very popular rating scale for measuring ordinal data in social science research" (p. 47).

The study sample is composed of athletic coaches and athletic trainers within several high schools in Texas. This population was chosen because they are the supervising adults for high school athletes who play and perform on athletic teams and should have the athlete's health and well-being as their top priority. The responsibility and nature of athletic trainers and high school coaches provide the reason as to how this population was chosen. The sample size ranges from 25-100 participants across both platforms, which is a convenience sample. These individuals are all education professionals with whom the researcher is acquainted through professional work settings at the high school level, as well as members within Texas associations specific to athletic training in which the researcher currently serves as a member.

Research Questions

This study addresses the following research questions:

1. To what degree do study participants perceive high school student athletes should be required to pursue cardiac screening prior to athletic participation?

2. To what degree do study participants perceive participation in cardiac screening as representing a vital component to the overall health and well-being of the high school athlete?
3. To what degree do study participants perceive certification in CPR/First Aid training as ensuring adequate knowledge about cardiac screening?
4. Considering issues of paperwork, time investment, convenience of access, financial considerations, fear of unknown results, possible false-positive findings, and low probability of incidences of cardiac arrest associated with student-athletes at the high school level, which is most associated with and predictive of study participant perceptions that cardiac screening should be required prior to athletic participation?

Research Hypotheses

1. To what degree do study participants perceive high school student-athletes should be required to pursue cardiac screening prior to athletic participation?

H_0: There will be no statistically significant effect for study participant response to the notion that high school student athletes should be required to pursue cardiac screening prior to athletic participation.

2. To what degree do study participants perceive participation in cardiac screening as representing a vital component to the overall health and well-being of the high school athlete?

H_0: There will be no statistically significant effect for study participant response to the notion that participation in cardiac screening as representing an important component to the overall health and well-being of the high school athlete.

3. To what degree to study participants perceive certification in CPR/First Aid training as ensuring adequate knowledge about cardiac screening?

H_0: There will be no statistically significant effect for study participant response to the notion that certification in CPR/First Aid training ensures adequate knowledge about cardiac screening.

4. Considering issues of paperwork, time investment, the convenience of access, financial considerations, fear of unknown results, possible false-positive findings, and low probability of incidences of cardiac arrest associated with student-athletes at the high school level, which is most associated with and predictive of study participant perceptions that cardiac screening should be required prior to athletic participation?

H_0: The barrier of "Fear of Unknown Findings" will exert the greatest degree of perceived effect upon study participant perceptions as the greatest barrier in student athlete pursuit of cardiac screening prior to athletic competition.

Overview of Analyses

This study is broadly quantitative, non-experimental, and uses a 5-point Likert scale research survey. A convenient, purposive sample of athletic trainers and high school coaching professionals located within the state of Texas represents the study's data source.

Preliminary Analysis

Prior to analysis of the four research questions posed in this study, preliminary analyses were conducted. Analysis specific to internal consistency, reliability and missing data of participant response.

Data Analysis by Research Questions

In Research Questions 1 through 3, the One Sample t test is used to address the statistical significance of findings for study participant responses. Follow-up analyses within these research questions are addressed using the t test of Independent Means. The two major assumptions associated with the use of the *t* test of Independent Means—homogeneity of variances and normality of data—were assessed and satisfied though statistical means.

The assumption of homogeneity of variances is addressed using the Levene *F* statistic. Levene *F* values of $p > .05$ are considered to satisfy the assumption of homogeneity of variances. The assumption of normality of data is assessed and satisfied using the skew and kurtosis parameters for normality espoused by George and Mallery (2016). Skew values not exceeding -2.0/+2.0 and kurtosis values not exceeding -7/0/+7.0 are considered indicators of normality or relative normality of data distribution.

In Research Question 4, the magnitude of effect is addressed using the Cohen's statistical technique for comparative purposes. The qualitative interpretation of numeric effect size values achieved in the study are addressed using Sawilowsky's (2009) conventions (small, medium, large, very large, and huge).

Limitations

This study has limitations. The middle school coaches are not surveyed. In the state of Texas, no athletic trainers are present at the middle school level. The school nurses within the high schools are not surveyed because they are not directly connected or tied to the athletic population at the high school level. Coaches at the middle and high school levels are not required by state legislation or district policy to complete any form of courses or training on potential cardiac risks on cardiac screenings of adolescent athletes. Administrators at the high school or

middle school levels are not surveyed since these individuals do not have a specified role or responsibility within the district on cardiac screening.

The study design itself may be a limitation. The prominent size and varied demographics of the target population on cardiac screening and the potential cardiac risks may not be accurately represented due to the possible lack of participation. The lack of open-ended questions and responses may not adequately capture the potential cardiac risks and cardiac screening knowledge base of the population chosen.

Definition of Key Terms

For this study, the following terms are defined to maintain consistency and mutual understanding:

- **Adolescence**: A stage of development (as of a language or culture) prior to maturity (Merriam-Webster, 2018).
- **Athletic Trainer**: A highly qualified and skilled allied healthcare professional who collaborates with physicians to provide preventative medical services, emergency care, clinical diagnosis, therapeutic intervention, and rehabilitation of athletic injuries and medical conditions (National Athletic Trainers' Association [NATA], n.d.)
- **Cardiac Screening**: Cardiovascular evaluation enhances the probability of detecting cardiovascular diseases in athletes (Fritsch et al., 2017).
- **Catastrophe**: A momentous tragic event ranging from extreme misfortune to utter overthrow or ruin (Merriam-Webster, 2018).
- **Education Stakeholder**: Typically refers to anyone who is invested in the welfare and success of a school and its students, including administrators; teachers; staff members; students; parents; families; community members; local business leaders;

and elected officials such as school board members, city council members, and state representatives (The Glossary of Education Reform, 2014).

- **Electrocardiogram (ECG)**: 12-lead test that measures the heart's electrical activity (Asif et al., 2017).
- **Healthcare Professional**: Healthcare professionals maintain health in humans through the application of the principles and procedures of evidence-based medicine and caring. Health professionals study, diagnose, treat, and prevent human illness, injury, and other physical and mental impairments in accordance with the needs of the populations they serve (World Health Organization [WHO], n.d.).
- **Hypertrophic Cardiomyopathy**: Genetic mutation causes asymmetric hypertrophy of the ventricular septum, which can lead to left ventricular outflow tract obstruction and fatal ventricular arrhythmias (Behera et al., 2011).
- **Pre-participation Screening**: The systematic practice of evaluating athletes before participation in sports for the purpose of identifying abnormalities (Alasti et al., 2010).
- **Sudden Cardiac Death (SCD)**: Defined as unexpected death from cardiovascular causes which occur within one hour of the beginning of symptoms in an apparently healthy subject or in one affected by a disease not severe enough to predict such an abrupt outcome (Corrado et al., 2019).

Significance

The significance of this study will help to identify and address the potential perception gaps that exist among high school athletic coaches and athletic trainers regarding the cardiac screening availability, potential cardiac risks, and current issues associated within the high school

setting. The information gained from this study will add to the existing body of knowledge that addresses cardiac screening and the impact on the high school athlete. The study also will help bridge the gaps between misconceptions and truths behind cardiac screening management and implementation. The completed study may help to compel further research within the middle and elementary school settings and the potential knowledge gaps that also may exist.

Summary

The early detection of cardiac anomalies, which can be found through proper cardiac screening, could prevent a catastrophic event from occurring that results in a young athlete's death. Raising cardiac awareness; providing and implementing training; and courses for school district communities, faculty and staff, coaches, parents, and athletes can close the gap of the potential risks of no cardiac screening implementation or requirement. Legal decisions should occur on cardiac screening becoming a law and a finite requirement similar to that of the required pre-participation exam (PPE). Due to the nature of an incidence of SCD occurring in young athletes, the proper implementation of cardiac screening is appropriate to the health and well-being of the athlete. The purpose of this study is to examine the perceptions of potential cardiac risks in high school athletes, current issues associated with cardiac screening, and the current governing guidelines of cardiac screening at the high school level.

II. REVIEW OF LITERATURE

The purpose of this research study is to understand the perceptions of high school athletic trainers and coaches on cardiac screening of high school athletes and the reasons cardiac screening is not being utilized efficiently or effectively mandated for high school athletes. Cardiac screening and raising awareness of the potential risk for cardiac issues in the high school athlete are reviewed in this chapter. In this study, participants are compared, and cross analyzed for the importance of cardiac screening of high school athletes and the positive and negative perceptions that exist among high school coaches and athletic trainers. Findings from this study are intended to assist school districts, parents, athletes, and leaders of the healthcare profession to improve the understanding of cardiac screening and its importance for high school athletes.

Anatomy of the Heart

The heart is the hardest working organ in the human body and is about the size of a clenched fist. The heart is located in the thoracic cavity under the sternum, centered in the chest and slightly tilted to the left, with the lungs flanking either side and sitting on top of the diaphragm (Hall et al., 2014). Weighing about 8-10 ounces in women and 10-12 ounces in men, the combined weight is a little less than the weight of two baseballs (Hall et al., 2014). Hall et al. (2014) stated, “A normal adult heart beats 72-82 times per minute (bpm), or approximately 3 billion times in a person’s lifetime” (p. 368). Alasti et al. (2010) noted determining a pathologic or a physiologic process with athlete’s heart syndrome has been a subject of many studies over

several years and is critical to the patient and clinician. The more we can understand about the anatomy and overall function of the athlete's heart, the better we can understand when a potential issue may arise.

Four chambers comprise the heart; the upper chambers are the right and left atria, and the lower chambers are the right and left ventricles. Hall et al. (2014) noted the heart consists of a right and left atrium and a right and left ventricle; the ventricles serve as a powerful pump, while the two atria are slow pressure collecting chambers. The four chambers are separated by a wall of muscle called the septum. Hall et al. (2014) stated oxygen poor blood is prevented from mixing with oxygen rich blood by the septal walls.

According to the Texas Heart Institute (n.d.),

> Four valves regulate blood flow through the heart: The tricuspid valve regulates blood flow between the right atrium and right ventricle. The pulmonary valve controls blood flow from the right ventricle into the pulmonary arteries, which carry blood to your lungs to pick up oxygen. The mitral valve lets oxygen-rich blood from your lungs pass from the left atrium into the left ventricle. The aortic valve opens the way for oxygen-rich blood to pass from the left ventricle into the aorta, your body's largest artery. (p. 1)

The hearts valves serve as the gateway for blood to flow throughout the body, allowing both oxygenated and deoxygenated blood to run its course.

The cardiac cycle of the heart involves two phases known as contraction and relaxation. The four chambers of the heart have both a period of relaxation called diastole, when the chambers are filling with blood, and a period of contraction called systole when the blood is pumping out of the heart (Hall et al., 2014). The ventricles are the major pumps of the heart;

when blood is pumping through them, the process is known as diastole and systole. A cardiac cycle's duration is about 0.81 seconds (Hall et al., 2014).

Understanding the anatomy of the heart aids in the ability to understand an athlete's heart and the changes that occur when physically active. Cardiac output is when a specific amount of blood that is pumped through the heart per minute (Hall et al., 2014). Hall et al. (2014) reported body temperature, blood pressure, and cardiovascular fitness level can be affected by cardiac output, which is an important measurement. Alasti et al. (2010) stated, "Regular participation in intensive physical exercise is associated with central and peripheral cardiovascular adaptations that facilitate the generation of a large and sustained cardiac output and enhance the extraction of oxygen from exercising muscle for aerobic glycolysis" (p. 1).

Sports training and exercise allow athletes to strengthen the heart and its output, but underlying factors can limit an athlete's ability to maintain a healthy heart. Alasti et al. (2010) pointed out that normal upper limits of an athlete's heart can prominently overlap with forms of structural cardiac disease. Other factors play a significant role in these limitations, including body size, race, and gender, as well as the heart's response to exercise (Alasti et al., 2010). Many aspects must be considered when discussing and understanding the full anatomy and function of the human heart, especially when the athlete is involved.

SCD in Young Athletes

Shaw (2008) stated sudden cardiac arrest (SCA) occurs within six hours of an earlier observed normal heart and is known as SCD characterized as an unexpected event that is non-traumatic and non-violent. Physical activity has long been established to significantly improve cardiac health, reducing the risk of SCD in young athletes; however, a small but significant number of athletes still die suddenly (Shaw, 2008). Alasti et al. (2010) reported, "The combined

prevalence to SCD in the general athletic population is estimated at 0.3%. SCD in athletes is more common in men (men/women ration ranging from 5/1 to 9/1). The risk of SCD in athletes significantly increases with age" (p. 5). The most common cause of SCD in athletes is hypertrophic cardiomyopathy, which accounts for approximately 35% of events (Alasti et al., 2010). Research from the United States has estimated between 1 in 200,000 and 1 in 300,000 individuals die from SCD (Shaw, 2008). Although the risk seems low for the majority of athletes, the risk is still apparent.

Varro and Baczko (2010) reported, "Sudden death among athletes is very rare (1:50,000-1:100,000 annually) but is still 2-4 times more frequent than in the age-matched control population and attract significant media attention" (p. 31). The normal conduction of the heart is fast (1-2 m/s), and the duration of the action potential in myocardial cells is long (200-300 m/s) (Varro & Baczko, 2010). A chaotic tachycardia or even a ventricular fibrillation (VF) can occur in the heart and prevent the normal sinus rhythm of the heart to correct, causing a spontaneous reaction leading to SCD (Varro & Baczko, 2010). Reporting of athletes who die from SCD is underestimated due to the lack of complete reporting on these types of events (Hernelahti et al., 2008). Hernelahti et al. (2008) noted performance in sports does not cause SCD but could act as a catalyst for individuals with predisposition to cardiovascular diseases that could prompt cardiac arrest.

Symptoms of SCD are limited and may present only in the time of a cardiac event. According to Hernelahti et al. (2008), underlying cardiac disease may be indicated by symptoms such as syncope during exercise, exercise-related dizziness, mysterious exertional dyspnea, and chest pain from exercise, all cuing an athlete to seek medical attention. An athlete who

experiences unexplained syncope during exercise should be taken seriously and urged to seek medical attention (Hernelahti et al., 2008). Lorvidhaya and Huang (2003) reported,

> Response of the myocardium to intense and repetitive exercise that caused pressure or volume overload results in physiologic changes in the heart such as dilation of the left ventricle and increased left ventricular mass, while the mass-to-volume ratio remains constant. (p. 190)

In athletes who undergo intense pressure overload, such isometric exercises like weightlifting will demonstrate significant wall thickening with increased mass-to-volume ratio (Lorvidhaya & Huang, 2003). All athletes may experience symptoms differently or not at all. Semsarian et al. (2015) pointed out SCD might be the lookout symptom for most cardiac conditions; however, some athletes may have experienced symptoms such as sudden ventricular arrhythmias, chest pain, and syncope.

Hypertrophic cardiomyopathy has been found as the most common cause of SCD in athletes. Semsarian et al. (2015) defined hypertrophic cardiomyopathy as a genetic condition identified as an unexplained left ventricular hypertrophy with an estimated prevalence of up to 1 in 200, potentially leading to SCD and ventricular tachycardia. Hedrich et al. (2006) stated new data propose young competitive athletes may have a greater chance of SCD than non-athletic individuals of the same age group, which causes a gap in regional frequency. Symptoms vary among athletes; however, the incidence rate is still prevalent to the underlying causes of SCD.

Incidence of Sudden Cardiac Death

Defined as sudden and unforeseen, SCD in sports typically occurs during or shortly after exercise, often with varying time intervals; the true incidence of SCD is uncertain (Mont et al., 2017). A structural cardiac irregularity is the usual hidden cause of SCD. Casa et al. (2012)

pointed out in the US approximately 14% of SCD is present among competitive athletes, while 25% consists of coronary artery anomalies and hypertrophic cardiomyopathy. The gender of the athlete also is a factor in the potential for cardiac deformities to arise. Mont et al. (2017) claimed for reasons still not understood fully, the incidence rate in females is 2-25 times lower than in men, making the prevalence of SCD highly gender dependent. Athletes often at their peak performance level may still have a risk of SCD. Erat (2019) reported competitive and leisure athletes could potentially increase their risk of SCD with exercise if underlying cardiac conditions exist.

Almquist et al. (2008) noted, "Participation by secondary school-aged adolescents in sports, recreation, and exercise is widespread. In 2005, more than 7,000,000 high school students were participating in interscholastic athletics in the United States" (p. 416). Due to the increasing number of high school athletes over the years, risks of injury are inevitable. Secondary school-aged athletes specifically over a three-year study by Powell and Barber-Foss (as cited in Almquist et al., 2008) revealed 23,566 reportable injuries in 10 interscholastic sports. Several task forces have been established, including the NATA and the Appropriate Medical Care for Secondary School-Aged Athletes Task Force (AMCSSAA), which have agreed and reached the same goal to ensure adequate medical care while participating in sports practices and games (Almquist et al., 2008). The comprehensive nature on the issue of sports injuries, and the proper research patterns emerging, can help to find the problems and ways to reduce and eliminate them. Chatard et al. (2016) acknowledged the collection of cardiac events may be unsubstantial because most data are acquired from the review of death certificates, insurance claims, and backdated surveys. Due to the nature of many instances surrounding the data collection of SCD in athletes, a cloud of uncertainty remains a matter for continued discussion.

Hyung Cho et al. (2015) noted high school competitive athletes in grades 10-12 reported SCD occurring in 0.46 per 100,000 athletes per academic year. Hyung Cho et al. observed in a study of young athletes aged 12-35 years in Italy that the incidence of SCD occurred in 2.3 athletes per 100,000 per year. In young athletes, the incidence rate of SCD is much higher in males than in females and can be as high as 10:1 (Hernelahti et al., 2008). Hernelahti et al. (2008) concluded, "Every effort to effectively prevent these events should be made. In young (under the age of 35 years) athletes, as much as 90% of sudden deaths occur during or immediately after exercise" (p. 132). Behera et al (2011) added a range of structural changes can occur in the hearts of young, highly trained athletes.

High school athletes' annual participation in sports is around a total of 2.7 million, 2.1 million of those who participate in sports when SCD has been reported (Fuller, 2000). According to Fuller (2000), SCD affects 10 high school athletes annually, which is defined by symptoms that occur during or within one hour of athletic participation on a high school athletic team and the death determined to be cardiac. The number is believed to significantly underestimate the frequency of such events (Fuller, 2000). High school athletes may have a low significance of SCD but with many specific conditions that could raise the potential. Fuller confirmed for every one high school athlete when SCD occurs, 10 high school athletes are estimated to have an underlying cardiac condition that puts them at risk of SCD.

Cardiac Screening

SCD oftentimes can be the very first symptom that presents itself in an athlete from an underlying genetic heart disease. Casa et al. (2012) stated, "As many as 80% of patients with SCD are asymptomatic until sudden cardiac arrest occurs, suggesting that screening by history and physical examination alone may have limited sensitivity to identify athletes with at risk

conditions" (p. 111). Due to the event occurrence of SCD, several types of screening processes are available to rule out any cardiac anomalies that may be present in an athlete's heart. Because of this development, numerous proposals have been recommended for pre-participation screening programs (Semsarian et al., 2015). Semsarian, et al. (2015) pointed out the prevention of SCD and lowering the mortality rate by the detection of cardiac anomalies, finding specific effective treatments, and the potential for athletic participation disqualification remains the main discussion in the support of cardiac screening.

The first step an athlete must take to participate in sports is to get a pre-participation physical, which includes an in-depth medical and family history. Sanders et al. (2013) claimed pre-participation examination is the first essential piece of the healthcare process; the athlete's healthcare needs are imperative with the growing demand of participation in athletics. Pre-participation examination (PPE), pre-participation screening, medical evaluation, or sports screenings are all synonymous terms used for processes athletes must complete prior to participation in any type of sport, competition, or training (Sanders et al., 2013). All 50 states require some form of pre-participation evaluation prior to an athlete's involvement in high school sports, intercollegiate sports, and beyond.

An ECG or echocardiogram is the type of heart screening that is available to athletes within some institutions, but not all. Lorvidhaya and Huang (2003) noted an often-asymptomatic disease known as hypertrophic cardiomyopathy is one of the most common causes of death in young competitive athletes, and the echocardiogram is an essential tool in detecting such diseases. The ECG screening is a 12-lead test which is cost-effective and the most practical for competitive athletes. In 2017, the NATA released a position statement addressing the vital prevention strategies that could be most beneficial for athletes. Winkelmann and Crossway

(2017) reported current recommendations by the NATA include ECGs for high-risk athletes during pre-participation examinations as a procedure to reduce the risk of SCD. Both stakeholders and policymakers should be aware of the measures available to prevent SCD, especially related to the pediatric athlete. One of the biggest underlying issues is the availability of certified clinicians who can perform the ECG screening on said athletes. In fact, Winkelmann and Crossway stated, "Although evidence for the use of ECG is strong, barriers to performing this test on the student-athlete population include access to trained and skilled clinicians, access to cardiologists, and budgetary constraints" (p. 1169). Because of the cost of the ECG and limited resources, the use of screening young competitive athletes with a conventional 12-lead ECG remains a controversial topic, thus leading to the overall issue of no cardiac screening implemented or required among high school athletes.

Panhyzen-Goedkoop et al. (2018) reported the majority of European countries and international governing bodies include an ECG with pre-participation examinations for the prevention of SCD and SCA in athletes. The European countries that have cardiac screening as a requirement prior to athletic participation has resulted in an international criterion endorsed and provides a clear guide to help interpret an athlete's abnormal ECG findings. Panhyzen-Goedkoop et al. (2018) indicated according to the most relevant ECG criteria, it is important that the physician screening is trained appropriately to avoid making mistakes. Cardiac screening is imperative to avoid many underlying heart issues with individuals who are certified, trained, and can interpret and review ECGs. If the governing bodies over athletic participation put the right individuals in place for school districts, cardiac screening would be less stressful and more effective.

Cost Effectiveness of Cardiac Screening

Cardiac screening is most often an added cost to athletes, swaying the decision of most and causing minimal participation. McManus (2001) claimed a balancing act between affordability and compassion arises when cost is taken into account in the matter of the passing of a young person's life. Although minimal participation occurs, the athletes who partake in cardiac screening benefit greatly. According to Mont et al. (2017), ECG screening enhances the thoughtful detection of incognizant cardiac diseases in asymptomatic athletes. Funding for this added cost is where preventative care and controversy meet.

Fuller (2000) stated when the physical examination is done in concurrence with the cardiovascular history, it is considered to be nominal, which is the AHA's recommendation with little to no cost to the high school athlete. The cardiovascular (CV) questions added onto a pre-participation examination form are zero cost to the athlete and their parents. According to Fuller, mass screening cost of completing an ECG is estimated at $10, and the cost of a 2D echocardiogram is around $350.

Hernelahti et al. (2008) noted the screening cost encompassing a cardiovascular history with a physical examination is estimated around $84,000 annually per life saved; a 12-lead ECG costs around $44,000 annually per life saved, and the 2D echocardiogram saved $200,000 in American high school athletes. An added cost of $89 was determined in adding ECG screening to the pre-participation examination and yielded a cost-effectiveness ratio of $42,900 annually per life saved, resulting in a low upfront cost with a high return investment on years of life saved (Winkelmann & Crossway, 2017). Subasic (2010) indicated recommendations for the ECG screening instrument have the greatest investment.

Winkelmann and Crossway (2017) concluded profound evidence exists when using ECGs; however, acquiring trained and qualified clinicians, along with the opportunity to use cardiologists and budgetary limitations, involves complications when student athletes are cardiac screened. Some would dispute the cost of a young athlete's life is incalculable; however, economic issues can play a major factor in the accessibility of providing cardiac screening to these athletes. Erat (2019) noted solely in the US an economical hindrance is present with the substantial amount of competitive and leisure athletes, including millions of high school athletes along with the small ubiquity of concealed cardiac disease. Even with the number of barriers present to implement the addition of an ECG to the pre-participation examination, acquiring the necessary tools to improve the overall healthcare of the high school athlete is not an impossible feat.

Governing Cardiac Guidelines for Athletes

Very few governing bodies exist over the proper guidelines for school-aged adolescent athletes and SCD awareness, which includes the UIL in Texas and the AHA. According to the UIL, a requirement of a physical examination with an extensive family history for pre-disposition to potential heart risks is recommended, but no cardiac screening is mandatory. Fenrich and Levine (2016) stated:

> The University Interscholastic League requires use of the specific preparticipation medical history form on a yearly basis. The University Interscholastic League requires the preparticipation physical examination from prior to junior high athletic participation and again prior to the 1st and 3rd years of high school. (p. 2)

Fenrich and Levine added screening utilizing an electrocardiogram and/or an echocardiogram is not a universal recommendation nor mandatory; however, screening is accessible through

athletes' personal physicians. One of the determining factors for the lack of requirement of a cardiac screening prior to athletic participation is due to the potential risk of a false-positive ECG test. A false positive on a cardiac screening can lead to an unnecessary restriction from athletic participation and stress on the athlete and their family (Fenrich, 2013). Both the AHA and the American College of Cardiology (ACC) do not recommend the cardiac screening for routine use due to the possibility of false positives (Lemasters & Grosel, 2010). False positives rate depends on the athlete's heart being trained or untrained and are not merely limited to cardiovascular evaluation, with studies showing false positive rates for patient history at 31%, and physical examinations at 9.3% (Semsarian et al., 2015). A false-positive finding requires more testing to confirm or deny whether an athlete has underlying cardiovascular disease.

The AHA provides recommendations for cardiac protocols for competitive and leisure athletes. Fritsch et al. (2017) claimed current recommendations by the AHA of screening programs continues to include a personal and family history. Gleason et al. (2017) pointed out:

> The history focused on personal history of: exertional chest pain/discomfort, unexplained syncope/near syncope, excessive exertional or unexplained dyspnea/fatigue with exercise, prior recognition of heart murmur, elevated systolic blood pressure, and family history of: premature death, family history of disability from heart disease in a close relative, specific knowledge of certain cardiac conditions in family members (hypertrophic cardiomyopathy HCM), long-OT syndrome, Marfan syndrome, and arrythmias. (p. 424)

The AHA has a satisfactory recommendation for screening athletes through a family history questionnaire, although an issue of parents and or athletes providing all of this sensitive information remains a challenge in some instances. Hyung Cho et al. (2015) claimed the current recommendation by the European Society of Cardiology includes a 12-lead electrocardiogram

for screening purposes related to SCD in young athletes; however, the AHA and the American College of Cardiology (ACC) do not recommend the ECG screening. Many athletic programs follow the recommendations set by the AHA for the services they provide to their athletes. However, the question still remains of whether these recommendations are enough relative to the overall health and well-being of the athlete.

In the state of Texas, a recent house bill was presented to the Texas Legislature by State Representative Dan Huberty. House Bill 76 is an act related to cardiac assessments of high school athletes in extracurricular athletic activities sponsored and sanctioned by the UIL (Huberty, 2015). The basic notion of HB 76 is for all school districts in the state of Texas under UIL be required to rule or implement a policy for both a physical examination and a cardiac ECG screening prior to athletic participation. HB 76 also states the athlete must be screened prior to their first year of participation at the ninth-grade level and then again prior to their 11th-grade year. Huberty (2015) advocated HB 76 Act take effect promptly if two thirds of the vote by all members of each house was received and would apply at the beginning of the 2019-2020 school year. The enactment of HB 76 could potentially change the name of the game known for cardiac screening due to the requirement of school districts offering cardiac screenings. HB 76 does not take into consideration the lack of resources and the funding that goes into cardiac screening of every athlete.

Even with the UIL and the now current HB 76, insufficient implementation is occurring for cardiac screenings because of the lack of knowledge and resources for each school district to attain such a large capacity of cardiac screenings. Does that effectively outweigh the risk of SCD in an athlete? The question of whether governing laws should require school districts to cardiac screen their athletes looms over the overall outcome of a catastrophic event such as SCD from

occurring. Spiers and Durrant (2012) hold the position that provisions must be made for nationwide cardiac screening programs for all young athletes. School-aged athletes participate in challenging and vigorous sports; thus, screening adolescent athletes efficiently and effectively is vital. A huge gap exists in the governing laws of cardiac screening for athletes and whether each school district is providing the absolute best care for their athletes.

Awareness and Education of Cardiac Screening

Raising awareness of the potential risk of cardiac episodes resulting in SCD should be a high priority in school districts and their surrounding communities. Most individuals are aware of certain cardiac issues but are unaware of the risks of a seemingly healthy athlete dying from such causes. Many seem to think the older population is the most effected, but in fact young competitive athletes ages 12-35 are at the highest risk of SCD, questioning whether cardiac screening should begin at the middle school level. Cardiac anomalies are a silent killer, with most athletes experiencing little to no symptoms prior to a catastrophic event because an issue such as this oftentimes presents a little too late if not detected early. Spiers and Durrant (2012) asserted the time is now to raise public awareness on education of cardiac screening for the concern of the health and safety of young athletes.

High schools in Texas require all coaches to be certified in CPR and AED training. With AEDs readily available in all schools and coaches trained in CPR, the false appearance that enough is being done is seemingly present. The early detection of cardiac anomalies could be easily unveiled if a cardiac screening was performed. Corrado et al. (2013) confirmed a panel consisting of the European Society of Cardiology and the AHA is in agreement for cardiovascular screening to be both effective and warranted on the medical grounds of ethical and legal parameters. Cardiac issues tend to scare the school district community due to the

impending doom that hangs over such events. If the school district employees, parents, athletes, and surrounding community members know the facts, the fear of the unknown becomes no fear at all.

The responsibility of community awareness on cardiac screening, and the potential risks that could arise among the athletic population, does not completely rely on the school districts, although the education opportunities should be available to the parents and the community. Drezner et al. (2010) noted a detailed family and patient history should be provided, and the patients and family members share responsibility for accuracy.

School districts should adopt a plan that is conducive to their schools by raising awareness and offering training and seminars to better educate the public and their employees. In 1999, Spiers and Durrant (2012) noted in the US a program called Project Adam was organized after the sudden collapse and death of a high school student while playing basketball. Programs such as these are the backbone of a great cardiac awareness education course, perhaps a course offered for parents, coaches, and school district employees combined. The capability of putting the athlete's health at the forefront of this controversial topic may be the missing link in the overall process of cardiac awareness.

Impact of Cardiac Screening

Oliva et al. (2017) noted genetic diseases may play a major role in SCD in athletes and understanding genetics can help with the identification of causative genetic defects in unanswerable autopsies. Unfortunately, a diagnosis of a cardiac issue can be diagnosed only once the occurrence of SCD presents itself. Oliva et al. indicated medical legal disputes on disqualification and eligibility findings are due to unsuitable diagnoses of cardiovascular malformations and insufficient implementation of diagnostic tests. Each medical decision made

for an individual athlete should be generally conservative and always err on the side of an athlete's health and safety over athletic participation. Once an athlete is diagnosed with a cardiac issue, a return to play decision should be made only by a physician depending on the severity and type. No international standard of care exists on the provision of medical services to athletes (Oliva et al., 2017).

Semsarian et al. (2015) suggested the identification of individuals affected by cardiovascular diseases is apparent in pre-participation screening and could identify those athletes who may be at a higher risk of SCD. Even with the potential risk for high school athletes to acquire a cardiac anomaly, some institutions believe cardiac screening is unnecessary and unreasonable at this level. In fact, Lemasters and Grosel (2010) stated according to AHA, an ordinance for a 12-lead ECG for mass screening to a massive population like high school athletes is unaccommodating. An ongoing debate continues on whether to cardiac screen athletes prior to athletic participation. Lorvidhaya and Huang (2003) claimed:

> Debates in the public regarding deaths of several elite athletes who were reviewed as the "fittest" in the population are still continuing, and not until we have full understanding of this wide scope of disease in addition to establishing the best methodology for screening, unexpected deaths in this population will remain. (p. 186)

Even with the debates and uncertainty of whether cardiac screening will make a considerable impact on young athletes, an exceptional amount of information warrants the probability that cardiac screening will affect athletes in a positive manner. Lorvidhaya and Huang (2003) confirmed the echocardiography is a helpful tool in identifying hypertrophic cardiomyopathy as the most frequent cause of death in young athletes.

Athletes who are presumed to have a cardiac issue should be seen by a cardiologist or heart specialist to determine return to play or disqualification from their respective sport. Oliva et al. (2017) confirmed:

> Evaluations of athletes with cardiovascular symptoms should be performed in consultation with a cardiologist and, in accordance with clinical and anamnestic data, should include an ECG (when appropriate according to each country's regulations), echocardiogram, stress ECG, and possibly advance cardiac imaging (such as MRI or CT) to rule out rare structural abnormalities. (p. 398)

A major challenge to the efficacy of cardiac screening is that most athletes are asymptomatic and apparently healthy, and these athletes may have unsuspecting cardiovascular diseases (Oliva et al., 2017). Management of cardiac issues is determined by the severity and type of cardiac anomaly found. Each athlete undergoes their own level of treatment and care designed specifically for their particular needs.

Current Implementation of Cardiac Screening

Currently, no governing law exists in the US which requires school districts to implement cardiac screening for their athletes. Each district decides on the importance and level of care they determine to be necessary related to cardiac screenings. Many of the school districts in multiple states require a yearly evaluation as a prerequisite for participation in sports, but this does not include cardiac screening. Districts located in South Texas and the athletic departments overlooking those districts require a yearly physical for every participating athlete, with the option of a cardiac screen. Partnered alongside a non-profit organization called AugustHeart, these districts implement cardiac screening during their yearly pre-participation physicals.

In October of 2008, a young athlete named August Koontz from the San Antonio, Texas, area died suddenly in his sleep from cardiac arrest due to a genetic heart condition known as hypertrophic cardiomyopathy (HCM; www.augustheart.org). After the loss of their son, August's parents decided to create a non-profit organization to keep this incident from occurring again in another young athlete. According to the AugustHeart organization:

> In May 2011 Doré and Bart launched AugustHeart, a 501(c)(3) dedicated to providing free heart screenings to local teenagers. Since that time, AugustHeart has successfully implemented a community-wide effort involving a team of volunteers. These include board certified cardiologists, sonographers, technicians and area high school athletic programs through partnerships. (www.augustheart.org)

Free heart screenings are conducted citywide in and around San Antonio, Texas, and AugustHeart offers their services to thousands of athletes. Although these screenings are offered, not all athletes partake in them, resulting in athletes who go without any type of cardiac screen prior to athletic participation. Koester (2001) asserted the moral and ethical responsibility of the educational institution is to supply the screening examination to its athletes; however, it is not a legal requirement. The school districts' best interest would be to implement a free cardiac screening for each of their schools directly associated with athletics, for both the high schools and middle schools, in order to allow for the absolute best care of their athletes.

Most school districts do not currently have this type of resource available to them, which could serve as an issue if they want to implement cardiac screening. However, the resources are available that require the majority of school districts to do the extra work to make accommodations for their athletes. Winkelmann and Crossway (2017) remarked on a position statement presented by the NATA that included a model on pre-participation examinations for the

recommendation of community organizations to inquire and provide free or reduced ECGs to improve the cost-effectiveness to its athletes.

The AugustHeart non-profit organization has been able to yield thousands of free cardiac screenings to thousands of athletes yearly throughout many school districts in South Texas. This contribution alone gives the districts a higher level of care accessible to their athletic population, while lowering the chance of a SCD incidence. Kisko et al. (2010) affirmed for the prevention of SCD, it is imperative to find effective modalities to detect concealed cardiovascular diseases in the young who are seemingly healthy, which has proved to be a difficult task over the last three decades for sports medicine. Debates and controversies may still exist on cardiac screening prior to athletic participation but implementing a preventative strategy for athletes is crucial in preventing the occurrence of a catastrophic event.

Summary

As we broaden our understanding of cardiac screening and its implications on high school athletes, we must first understand the anatomy of the heart and the way in which potential cardiac anomalies affect normal human function. The proper medical history and examination, along with effective implementation of cardiac screening, can guide healthcare professionals to better understand the athletic population at risk for these potential cardiac incidences. Cardiac catastrophes have streamlined into the public eye, causing a greater concern among the athletic realms. Cardiac screening has become increasingly more available, yet the emphasis is being placed on cardiac screening for collegiate and professional athletes as opposed to high school athletes. Due to the nature of incidence of SCD in young athletes, the proper implementation of cardiac screenings is appropriate to the health and well-being of the athlete. While the cost of the screening in most cases may outweigh the risk, where do school districts draw the line when the

latter could be a devastating event? If not properly screened, each athlete participating in sports could be the potential one who would result in the occurrence of a catastrophic event.

III. METHODOLOGY

This chapter contains a description of the methodology used to examine the perceptions of cardiac screening of high school athletes among high school coaches and athletic trainers. The purpose of this research study was to understand the differences between high school coaches and athletic trainers on the perceptions of cardiac screening of high school student athletes prior to athletic participation, finding reasons for non-participation, and the lack of implementation of cardiac screening at the high school setting. The research design and methodology for the study was quantitative, more specifically survey research. The following sections include a description of the necessary components of the methodology portion of the study.

Description of Methodology

Research Design

This study was quantitative and non-experimental by research design, featuring a survey research methodological approach. Along with the benefits of researcher detachment and potential for generalization of findings, quantitative research methodologies allow for study replicability (Lichtman, 2013). Study participants' perceptions were assessed on their knowledge and the level of importance of the potential risk for cardiac anomalies, as well as cardiac screening of high school athletes among Texas high school coaches and athletic trainers.

Sample Selection

The study's participant sample was accessed in a non-probability, purposive fashion. Study participants were accessed from one state located in the southwestern US. Two distinct categories of participants were represented in the study: high school coaches and high school athletic trainers. The study sample was composed of athletic coaches and athletic trainers from several high schools in South Texas and the members of the Alamo Area Athletic Trainers Association (AAATA) of San Antonio, Texas, the Texas State Athletic Trainers Association (TSATA), and surrounding cities. The specific population was selected for study purposes by virtue of the fact that they are the supervising adults who have high school athletes who play and perform for them on athletic teams and should have the athlete's health and well-being as their top priority. The total participant sample achieved for study purposes was 104. The sample size was considered adequate to detect statistical significance of findings for the statistical techniques anticipated for use in addressing the study's four research questions and hypotheses using a priori statistical power analyses.

Statistical Power Analysis

Statistical power analysis using the G*Power software (3.1.9.2, Universität Düsseldorf, Germany) was conducted for sample size estimates for statistical significance testing purposes. The study's statistical power analysis was delimited to large and medium anticipated effects, a power $(1 - \beta)$ index of .80, and a probability level of .05.

In Research Questions 1 through 3, the one sample *t* test was used for statistical significance testing purposes. An anticipated medium effect ($d = .50$) would require 27 and 12 participants for an anticipated large effect to detect a statistically significant finding. In the follow-up analyses of RQ through 3, the t test of independent means was used for statistical

significance testing purposes. An anticipated medium effect (d = .50) would require 102 participants, and an anticipated large effect would require 42 participants to detect a statistically significant finding.

Instrumentation

A 5-point, researcher-created Likert-type survey represented the study's research instrument. The use of a 5-point scale reflected the format offered by Dillman et al. (2014), in which items ranged from "1= strongly disagree to 5= strongly agree" (p. 159).

The validity of data anticipated to be produced through the use of the study's research instrument was addressed through a subjective, content validity judgment process promoted by Boateng et al, (2018), which is the first phase of the research instrument validation process. Miranda (2001) indicated subjective judgment is generally viewed as a process whereby subject matter experts (SMEs) provide estimates of a construct based upon intuition and expert opinion in the absence of objective data. The process of using SMEs in the area of the study's construct provided the themes that represented the foundation of the survey items represented on the study's research instrument.

The second phase of the validation process of the research instrument was conducted through a pilot study administered to 20 study participants. Cronbach's alpha (α) was used to evaluate the internal reliability of pilot study participant responses to the instrument. An alpha level of at least a = .70 was sought for validation purposes in the pilot study phase of the research instrument validation process.

In the third phase of the research instrument validation, the *posteriori* phase of instrument validation, the Cronbach's alpha (α) statistical technique was used. Cronbach's alpha (α)

assessed the internal reliability of participant responses to survey items once study data were collected and formally recorded.

Procedures

The study was conducted through a non-experimental survey using a 5-point Likert-type research design. One study design was administered consisting of an 11-question survey on the participants' perceptions of cardiac screening of high school athletes before athletic participation. Prior to the study's implementation, the researcher created the 11-question, 5-point Likert-type survey hosted on a survey platform known as Qualtrics. Qualtrics is a web-based survey tool allowing users to build and conduct survey instruments by analyzing and collecting data for research purposes. To reach all study participants, the survey was sent out by email and as a link to two platforms: the Alamo Area Athletic Trainers' Association and the Texas State Athletic Trainers' Association. A total of 104 individuals participated in the survey.

Data Analysis

Preliminary Analysis

Descriptive and inferential statistical techniques were used to address both foundational analyses and the findings associated with the study's four research questions and hypotheses. The probability level of $p \leq .05$ was adopted as the threshold for findings considered statistically significant. The magnitude of effect in study findings was evaluated and interpreted using the effect size conventions proposed by Sawilowsky (2009). Study data were analyzed and reported using the 27th version of IBM's Statistical Package for the Social Sciences (SPSS).

The study's extent of missing data was assessed using descriptive statistical techniques. Frequency counts (n) and percentages (%) represented the primary descriptive statistical techniques used to evaluate the extent of the study's missing data within the response set

associated with the survey instrument. Internal reliability was addressed using the Cronbach's alpha (α) statistical technique. Internal reliability was assessed on response data associated with coaches, athletic trainers, and overall study participant responses to items on the survey instrument. Foundational descriptive analyses were conducted using frequency counts (n), percentages (%), mean scores (M), and Cohen's d values.

Research Question 1

To what degree do study participants perceive that high school student athletes should be required to pursue cardiac screening prior to athletic participation?

H_0 1: There will be no statistically significant effect for study participant response to the notion that high school student athletes should be required to pursue cardiac screening prior to athletic participation.

Research Question 2

To what degree do study participants perceive participation in cardiac screening as representing an important component to the overall health and well-being of the high school athlete?

H_0 2: There will be no statistically significant effect for study participant response to the notion that participation in cardiac screening represents an important component to the overall health and well-being of the high school athlete.

Research Question 3

To what degree do study participants perceive certification in CPR/First Aid training as ensuring adequate knowledge about cardiac screening?

H_0 3: There will be no statistically significant effect for study participant response to the notion that certification in CPR/First Aid training ensures adequate knowledge about cardiac screening.

Research Question 4

Considering the seven identified barriers associated with pursuit of cardiac screening, which represents the greatest perceived barrier to the notion that cardiac screening should be required prior to prior to athletic participation?

H_0 4: The barrier of "Fear of Unknown Findings" will exert the greatest degree of perceived effect upon study participant perceptions as the greatest barrier in student athlete pursuit of cardiac screening prior to athletic competition.

Analyses by Research Questions

In Research Questions 1 through 3, the one sample t test was used to address the statistical significance of findings for study participant response. Follow-up analyses within these research questions were addressed using the t test of independent means. The two major assumptions associated with the use of the t test of independent means, homogeneity of variances, and normality of data were assessed and satisfied through statistical means.

The assumption of homogeneity of variances was addressed using the Levene *F* statistic. Levene *F* values of $p > .05$ were considered to satisfy the assumption of homogeneity of variances. The assumption of normality of data was assessed and satisfied using the skew and kurtosis parameters for normality espoused by George and Mallery (2016). Skew values not exceeding -2.0/+2.0 and kurtosis values not exceeding -7/0/+7.0 were considered indicators of normality or relative normality of data distribution.

In Research Question 4, the magnitude of effect was addressed using the Cohen's statistical technique for comparative purposes. The qualitative interpretation of numeric effect size values achieved in the study was addressed using Sawilowsky's (2009) conventions (small, medium, large, very large, and huge).

Summary

Chapter III contained a description of the study's methodology. The study's research design, research approach, participant sample, instrumentation, procedures, and data analyses associated with the study's research questions and hypotheses were presented. The findings achieved in the study are presented in Chapter IV.

IV. RESULTS

The purpose of this study was to elicit the perceptions of high school coaches and athletic trainers regarding the importance of and barriers related to cardiac screening for high school athletes. A quantitative, non-experimental investigation featuring a survey research approach was used to address the study's topic (Edmonds & Kennedy, 2017). The research instrument was represented through a 5-point Likert scale approach in eliciting the perceptions of study participants on issues related to cardiac screening with high school-aged student athletes.

Methods of Data Collection

The sampling process was non-probability and purposive in nature, accessing study participants from one state located in the Southwestern US. Two distinct categories of participants were represented in the study: high school coaches and high school athletic trainers. The total participant sample was 104. The sample size was considered adequate to detect statistical significance of findings for the statistical techniques in addressing the study's four research questions and hypotheses using a priori statistical power analyses (G*Power).

Descriptive and inferential statistical techniques were used to address both foundational analyses and the findings associated with the study's four research questions and hypotheses. Study data were analyzed using the 27th version of IBM's Statistical Package for the Social Sciences (SPSS).

Finding for Foundational Analyses

Three primary foundational analyses were conducted in advance of the formal analysis of the study's four research questions and hypotheses: missing data, internal reliability, and preliminary descriptive information associated with demographic identifying data and study participant responses to survey items.

Missing data were minimal at the person level and within the response data associated with survey items on the study's research instrument. Regarding the person-level study data, 0.48% (n = 1) of data were found to be missing. Study participant response data were similarly minimal in nature at 0.16% (n = 2). As a result, no consideration was afforded to assessments of randomness of missing data (MCAR) and data imputation techniques. The completion rates for person-level missing data were well below conventions of established thresholds (Newman, 2014), and the survey completion rate was well above the customary 78.6% generally achieved for survey research (Fluid Surveys, 2014).

The internal reliability of study participant responses to survey items on the study's research instrument was assessed using Cronbach's alpha (α) statistical technique. The overall level of internal reliability of study participant responses to survey items on the research instrument was considered adequate at α = .66. The overall reliability would have been improved to a level of α = .70 with the removal of the item, "Information regarding cardiac screening is readily available and provided to high school athletes and their parents." A higher level of internal reliability was achieved in the responses of study participants identified as "coaches" compared to their counterparts identified as "athletic trainers."

Table 1 contains a summary of information regarding the overall internal reliability of study participant responses to survey items on the research instrument, as well as internal reliability values disaggregated by category of professional role.

Table 1

Internal Reliability: Overall and by Category of Study Participant

Category	*n*	α
Coaches	10	.73
Athletic Trainers	10	.64
Overall	10	.66

Slightly over six in 10 (61.5%; $n = 64$) study participants were identified as "athletic trainers." The remaining 38.5% ($n = 39$) were identified as "coaches." The single greatest category of study participant years of professional experience with their respective job roles in the category of "6-15 Years" was 33.7% ($n = 35$). The remaining 66.3% of study participants were fairly equally distributed within the other four categories of the person-level variable of "Years of Experience."

Descriptive statistical techniques were utilized to address study participant level of agreement (Strongly Agree & Agree) with survey items represented on the research instrument. The statistical significance and magnitude of effect values was also used for the respective mean scores associated with participant responses within the survey items.

Table 2 contains a summary of findings for the preliminary analysis of study participant responses to the survey items on the research instrument by level of agreement, mean score, and magnitude of effect of response for each survey item.

Table 2

Preliminary Analyses of Responses to Survey Items on the Study's Research Instrument

Survey Item	*n*	% Agreement	Mean	*d*
Participation in cardiac screening is an important component to the overall health and well-being of the high school athlete.	104	87.5	4.51	1.98[a]
Certification in CPR/First Aid training ensures adequate knowledge about cardiac screening.	104	54.8	3.47	.34
My understanding of the potential cardiac risks related to high school athletes is adequate.	104	84.5	4.12	1.25[b]
Information regarding cardiac screening is readily available and provided to high school athletes and their parents.	103	48.5	3.31	.28
Participation in cardiac screening is not widely pursued due to the fear of potential for unknown findings of cardiac conditions in high school athletes.	104	36.6	3.03	.03
Participation in cardiac screening is not widely pursued due to the paperwork burden associated with the cardiac screening process.	104	34.0	2.94	-.05
Participation in cardiac screening is not widely pursued due to the time investment associated with the cardiac screening process.	104	55.7	3.43	.40
Participation in cardiac screening is not widely pursued due to fear of student athlete non-participation associated with potential false-positive findings in cardiac screening process.	104	37.5	3.06	.05
Participation in cardiac screening is not widely pursued due to convenience of access to the cardiac screening process.	104	77.9	3.89	.91[c]
Participation in cardiac screening is not widely pursued due to perceived financial burden or cost-effectiveness associated with the cardiac screening process.	104	79.8	4.05	1.02[b]
Participation in cardiac screening is not widely pursued due to low probability of incidences of cardiac arrest associated with student athletes at the high school level.	104	31.3	3.18	.17
High school student athletes should be required to pursue cardiac screening prior to athletic participation.	104	72.1	3.94	.84[a]

[a] Approximate Huge Effect ($d \geq 2.0$); [b] Very Large Effect ($d \geq 1.20$); [c] Large Effect ($d \geq .80$).

Data Analysis by Research Question

The study's four research questions and accompanying hypotheses were addressed analytically using descriptive and inferential statistical techniques. The probability level of $p \leq .05$ was adopted as the threshold level for findings considered statistically significant. The magnitude of effect in study findings was evaluated and interpreted using the effect size conventions proposed by Sawilowsky (2009). The following represents the findings achieved in each of the research questions and hypotheses.

Research Question 1

To what degree do study participants perceive that high school student athletes should be required to pursue cardiac screening prior to athletic participation?

Considerable support for the statement, "High school student athletes should be required to pursue cardiac screening prior to athletic participation," was elicited from study participants (72.1%). The one sample t test was used to assess the statistical significance of study participant mean responses to need for high school students to be required to pursue cardiac screening prior to participation in athletics. As a result, the mean score of 3.94 (SD = 1.12) was manifested at a statistically significant level ($t_{(103)} = 8.57$; $p < .001$). The magnitude of effect for study participant in RQ1 was considered large ($d = .84$).

Hypothesis

There will be no statistically significant effect for study participant response to the notion that high school student athletes should be required to pursue cardiac screening prior to athletic participation.

In light of the statistically significant finding for RQ1, the null hypothesis was rejected.

Analysis

A follow-up analysis was conducted for RQ1 featuring a comparison of findings by category of study participant. The *t* test of Independent Means was used to evaluate the statistical significance of difference in the responses to RQ1 for coaches and athletic trainers. As a result, the mean score difference of 0.74 favoring study participants identified as coaches was manifested at a statistically significant level ($t_{(99.92)} = 3.89$; $p < .001$). Using the Hedges *g* effect size adjustment for unequal sample sizes noted in the comparison, the magnitude of effect in the comparison featured in the follow-up analysis was approximating a large effect ($g = .69$).

Findings

Table 3 contains a summary of findings for the comparison of perceptions within RQ1 by category of study participant.

Table 3

Comparison of Perceptions: Coaches and Athletic Trainers for the Notion that High School Student Athletes Should be Required to Pursue Cardiac Screening Prior to Athletic Participation

Category	*n*	Mean	*SD*	*t*	*G*
Coaches	39	4.41	0.68	3.88***	.69
Athletic Trainers	64	3.67	1.25		

***$p < .001$.

Research Question 2

To what degree do study participants perceive participation in cardiac screening as representing an important component to the overall health and well-being of the high school athlete?

The statement, "Study participants perceive participation in cardiac screening as representing an important component to the overall health and well-being of the high school athlete," was agreed upon by 87.5% of study participants. The one sample *t* test was used to assess the statistical significance of study participant mean score response to the notion that cardiac screening represents an important component to the overall health and well-being of the high school athlete as a result; the mean score of 4.51 ($SD = 0.76$) was manifested at a statistically significant level ($t_{(103)} = 20.17$; $p < .001$). The magnitude of effect for study participant in RQ2 was considered approximating a huge effect ($d = 1.98$).

Hypothesis

There will be no statistically significant effect for study participant response to the notion that participation in cardiac screening as representing an important component to the overall health and well-being of the high school athlete

In light of the statistically significant finding for RQ2, the null hypothesis was rejected.

Analysis

A follow-up analysis was conducted for RQ2 featuring a comparison of findings by category of study participant. The *t* test of Independent Means was used to evaluate the statistical significance of difference in the responses to RQ2 for coaches and athletic trainers. As a result, the mean score difference of 0.53 favoring study participants identified as coaches was manifested at a statistically significant level ($t_{(91.96)} = 4.32$; $p < .001$). Using the Hedges *g* effect size adjustment for unequal sample sizes noted in the comparison, the magnitude of effect in the comparison featured in the follow-up analysis in RQ2 was approximating a large effect ($g = .73$).

Findings

Table 4 contains a summary of finding for the comparison of perceptions within RQ2 by category of study participant.

Table 4

Comparison of Perceptions of Coaches and Athletic Trainers: Cardiac Screening Represents an Important Component to the Overall Health and Well-being of the High School Athlete

Category	*n*	Mean	*SD*	*t*	*G*
Coaches	39	4.85	0.37	4.32***	.73
Athletic Trainers	64	3.31	0.87		

***$p < .001$.

Research Question 3

To what degree do study participants perceive certification in CPR/First Aid training as ensuring adequate knowledge about cardiac screening?

The statement, "Certification in CPR/First Aid training ensures adequate knowledge about cardiac screening," was agreed upon by slightly over half of study participants (54.8%). The one sample *t* test was used to assess the statistical significance of study participant mean score response to the notion that cardiac screening represents an important component to the overall health and well-being of the high school athlete. As a result, the mean score of 3.47 ($SD = 1.38$) was manifested at a statistically significant level ($t_{(103)} = 3.48$; $p = .001$). The magnitude of effect for study participant in RQ3 was considered between small and medium ($d = .34$).

Hypothesis

There will be no statistically significant effect for study participant response to the notion that certification in CPR/First Aid training ensures adequate knowledge about cardiac screening. In light of the statistically significant finding for RQ3, the null hypothesis was rejected.

Analysis

A follow-up analysis was conducted for RQ3 featuring a comparison of findings by category of study participant. The *t* test of independent means was used to evaluate the statistical significance of difference in the responses to RQ3 for coaches and athletic trainers. As a result, the mean score difference of 0.41 favoring study participants identified as coaches was manifested at a non-statistically significant level ($t_{(97.97)} = 1.57$; $p = .12$). Using the Hedges *g* effect size adjustment for unequal sample sizes noted in the comparison, the magnitude of effect in the comparison featured in the follow-up analysis in RQ3 was considered small ($g = .29$).

Findings

Table 5 contains a summary of findings for the comparison of perceptions within RQ3 by category of study participant.

Table 5

Comparison of Perceptions: Coaches and Athletic Trainers for the Notion That Certification in CPR/First Aid Training Ensures Adequate Knowledge About Cardiac Screening

Category	*n*	Mean	*SD*	*t*	*g*
Coaches	39	3.72	1.10	1.57	.29
Athletic Trainers	64	3.31	1.52		

$p = .12$.

Research Question 4

Considering the seven identified barriers associated with pursuit of cardiac screening, which represents the greatest perceived barrier to the notion that cardiac screening should be required prior to athletic participation?

The Cohen's *d* statistical technique was used to assess the magnitude of effect for study participant responses to the perceived effect the seven "barriers" exert upon student athlete pursuit of cardiac screening prior to athletic competition. Of the seven, the perceived barrier of "financial burden" associated with cardiac screening exerted the greatest degree of perceived effect in study participant responses at $d = 1.02$. The perceived burden of "convenience of access" manifested a similarly large response effect at $d = .91$.

Table 6 contains a summary of information regarding perceived barriers associated with pursuit of cardiac screening of high school student athletes prior to engaging athletic competition.

Table 6

Perceptions of Barrier Effect Upon Pursuit of Cardiac Screening

Barrier	*n*	Mean	*SD*	*d*
Fear of Unknown Findings	104	3.03	1.09	.03
Paperwork Burden	103	2.94	1.08	-.05
Time Investment	104	3.43	1.09	.40
Potential False-Positive Results	104	3.06	1.10	.05
Convenience of Access	104	3.89	0.99	.91[a]
Financial Burden	104	4.05	1.03	1.02[a]
Low Incidence Probability of Cardiac Arrest	104	3.18	1.08	.17

[a] Large Effect ($d \geq .80$).

Hypothesis

The barrier of "Fear of Unknown Findings" will exert the greatest degree of perceived effect upon study participant perceptions as the greatest barrier in student athlete pursuit of cardiac screening prior to athletic competition.

In light of the superior effect for the barrier of "Financial Burden," the alternative hypothesis for RQ4 was rejected.

Analysis

A follow-up analysis was conducted comparing the perceptions of "coaches" and "athletic trainers" for research question four. As a result, the perceptions of effect exerted by respective barriers were fairly similar across barriers and study participant professional role. The barrier of "Financial Burden" exerted the greatest perceived effect barrier upon student athlete pursuit of cardiac screening prior to athletic competition for both "coaches" and "athletic trainers".

Findings

Table 7 contains a summary of findings for the comparison of perceptions of study participants by category of professional role in RQ4.

Table 7

Perceptions of Barrier Effect Upon Pursuit of Cardiac Screening by Professional Role

Barrier	Coaches (*d*)	Athletic Trainers (*d*)
Fear of Unknown Findings	.15	-.03
Paperwork Burden	.13	-.14
Time Investment	.25	.51
Potential False-Positive Results	.03	.05
Convenience of Access	.88[a]	.92[a]
Financial Burden	.98[a]	1.03[a]
Low Incidence Probability of Cardiac Arrest	.21	.17

[a] Large Effect (d ≥ .80).

Summary

Chapter IV contained a formal report of findings associated with the study's topic and research design architecture outlined in Chapter III. Minimal levels of missing data were noted in the study's person-level data and data arrays associated with participant responses to survey items on the research instrument. Internal reliability levels of participant responses to survey items on the study's research instrument were considered adequate.

Large to very large effects were noted in study participant responses to the notion of need and importance of student athlete pursuit of cardiac screening prior to engaging in athletic events. A medium response effect was manifested in the notion that certification in CPR/First Aid training ensures adequate knowledge about cardiac screening. The perceptions of study participants identified as coaches exerted greater degrees of effect with the first three research questions than the perceptions of participants identified as athletic trainers. The single greatest

perceived barrier to student athlete pursuit of cardiac screening prior to participation in athletic competition was the “financial burden” associated with the screening process. Financial burden represented the greatest perceived barrier to student athlete pursuit of cardiac screening prior to participation in athletic competition for both coaches and athletic trainers. Chapter V contains a thorough discussion of study findings presented in Chapter IV.

V. DISCUSSION

The purpose of this study was to secure the perceptions of athletic trainers and high school coaches regarding the importance and barriers of cardiac screening for high school athletes. The study was a non-experimental quantitative design. The discussion in this chapter demonstrates how the study relates and supports the main research questions. Four research questions were posed to address the study's topic and research problem.

Once the findings of the study are outlined, the implications of these results on research, practice, and theory are discussed. Descriptive and inferential statistics were used to analyze study data. Furthermore, the findings, limitations, and strengths in Chapter V are provided before future directions of this research are argued.

Statement of Problem

The implementation of cardiac screening of high school athletes remains an issue at the secondary school setting because no requirement exists. High school athletes are required to have a pre-participation examination with a cardiac history questionnaire; however, the lack of cardiac screening prior to athletic participation is where the issue lies. Young athletes can have a range of undetectable heart anomalies that could lead to SCD, but a simple cardiac screening examination could potentially prevent a catastrophic event. The impact that proper implementation and the requirement of cardiac screening provides to a young athlete's life is priceless. This study is

intended to provide research findings of the perceptions of athletic trainers and high school coaches on cardiac screening of high school athletes.

Review of Methodology

This study is considered a non-experimental and quantitative by research design. Participants' perceptions were assessed through a Likert scale survey over current issues and the potential for cardiac risk on high school athletes among athletic trainers and high school coaches.

Athletic trainers and high school athletic coaches in several high schools in Texas comprised the study sample. Due to the nature of athletic trainers and high school coaches as the supervising adults over athletes, and the health and well-being of the athlete at the forefront of their responsibilities, the conclusion was made as to why these individuals were chosen. The sample size ranged from 25-100 participants across both platforms, which is a convenience sample. The participants are all educational professionals with whom the researcher is acquainted through professional work settings at the high school level, as well as members within Texas associations specific to athletic training in which the researcher currently serves as a member.

Prior to the analysis of the research questions, preliminary analyses were conducted. Specifically, missing data, internal reliability of study participant responses to survey items on the research instrument, and preliminary demographic identifying information were analyzed for study purposes. Using descriptive and inferential statistical techniques, missing data were analyzed. For interpretive purposes, percentages (%) and frequency counts (n) were used. To evaluate the randomness of missing data, the MCAR test statistic was utilized. The internal reliability of study participant responses to survey items on the study's research instrument was assessed using the Cronbach's alpha (α) statistical technique. The overall level of internal reliability of study participant responses to survey items was considered adequate at $a = .66$.

Four research questions were posed to address the study's research problem. Descriptive and inferential statistical techniques were utilized to address the research questions and the preliminary analysis.

Discussion of Preliminary Foundational Findings

Athletic trainers and high school coaches from around the State of Texas participated in this study and possess a wide range of professional experience. The following section discusses the findings, missing data, and internal reliability associated with this study. Research instrument validation was produced and addressed through a subjective, content validity judgment of prospective survey components with a follow-up pilot study of the research instrument composed of 20 participants.

The study's data were very minimal (less than 1%), signifying a relatively intact data set. Intactness of the data set is important, in that the trustworthiness and credibility of subsequent findings in the research questions are enhanced by the completeness of the data set in the study. Mohamed et al. (2018) indicated it is common to the survey research method when an issue of missing data arises. Valid and efficient inferences is the intention of a statistical procedure (Schafer & Graham, 2002). Missing data were analyzed using descriptive techniques of frequencies and percentages.

Internal reliability of study participant responses was assessed using the Cronbach's alpha statistical technique. The alpha level achieved was considered acceptable (George & Mallery, 2016). A greater degree of internal reliability was achieved for study participants identified as athletic trainers, as compared to those identified as high school coaches, in the sample. The finding favoring higher levels of internal reliability for athletic trainers appears intuitive in light of their professional training. The study's minimal level of missing data,

coupled with an acceptable level of internal reliability of participant responses to items on the research instrument, provide credibility and trustworthiness of findings in subsequent research questions posed in the study.

Discussion by Research Question

Research Question 1

To what degree do study participants perceive that high school student athletes should be required to pursue cardiac screening prior to athletic participation?

The study participant responses regarding the requirement of cardiac screening of high school athletes prior to athletic participation were assessed and found to be positive. Considerable support was elicited from study participants, with a statistically significant mean score for the requirement of cardiac screening prior to athletic participation on high school athletes. Additionally, the magnitude of effect for study participant responses to perceptions toward high school athletes being required to be cardiac screened prior to athletic participation was considered large.

The theme that emerged from the Cetin et al. (2018) study suggested "performing screening before participation in sports may help us diagnose patients with cardiovascular anomalies and may prevent the risk of sudden cardiac death by prohibiting them from competitive sports" (p. 539). The requirement of cardiac screening prior to athletic participation is warranted. In an AHA live session, audience members voted, with 70% favored screening young athletes for cardiac disease and 60% believing that screening programs should include ECG (Colbert, 2014, p. 1). Colbert (2014) continued on to say screening with a physical examination, history, and an ECG were favored at 58%. The research findings imply positive

attitude toward the requirement of cardiac screening of high school athletes and suggests cardiac screening would be beneficial prior to athletic participation.

Research Question 2

To what degree do study participants perceive participation in cardiac screening as representing an important component to the overall health and well-being of the high school athlete?

Participants' perceptions of the importance of cardiac screening as an important component of the overall health and well-being of the high school athlete was assured. The study participant mean score response to the notion that cardiac screening represents an important component to the overall health and well-being of the high school athlete was found to be statistically significant. The change of study participant responses to the perceived importance of cardiac screening of high school athletes and their well-being resulted in a huge effect.

Schmied and Borjesson (2013) confirmed almost all professional organizations advocate for cardiac screening; the AHA deems the screening necessary and compelling on legal, ethical, and medical grounds. Pre-participation screening as an important health initiative for the public was viewed and expressed by Schmied and Borjesson (2013). The support is clear for cardiac screening for the overall health and well-being of the athlete. Semsarian et al. (2015) concluded, "The main argument in support of screening is clear-the potential to prevent sudden cardiac death and reduce mortality through detection of cardiovascular abnormalities, initiation of effective disease specific treatments, and possible disqualifications from competitive sports if necessary" (p. 1019).

Research Question 3

To what degree do study participants perceive certification in CPR/First Aid training as ensuring adequate knowledge about cardiac screening?

Slightly over half of the study participants agreed on the training and certification of CPR/First Aid and adequate knowledge on cardiac screening. The mean score manifested at a statistically significant level, resulting in a small and medium effect on RQ3.

The main theme that emerged from the perceptions on CPR/First Aid providing adequate knowledge on cardiac screening was positive. Semsarian et al. (2015) asserted, "At a community level, increased awareness and access to automated external defibrillators along with training in cardiopulmonary resuscitation can help reduce the number of sudden cardiac deaths" (p. 1021). The training in CPR/First Aid provides each individual with the knowledge to help in the event of a SCA event; however, no specific information exists on cardiac screening when the course is taken. The main objective for CPR/First Aid training is to learn the proper techniques on giving basic life support or to help in a situation when someone has a minor injury. The most interesting aspect about the response to this question was the overall perception the CPR/First Aid training gave study participants adequate knowledge of cardiac screening, when in fact there is no mention of cardiac screening in the course.

Wagener et al. (2017) suggested skill retention declines significantly over time for those certified in CPR/First Aid. Individuals trained in CPR/First Aid may possess the necessary skills to aid in a situation such as cardiac arrest, but training must take place regularly to uphold the standards of care. All individuals are required to complete the CPR/First Aid training every two years to eliminate issues with complacency and a decline in the skills required to assist in a cardiac arrest or emergency situation. Although each individual upholds the professional

standard of care, they are limited to only the information they know when an emergency situation arises. However, they continue to remain in the dark on the potential cardiac anomalies that may lie silent in each young athlete's heart. Athletic trainers and high school coaches are prepared, but are they afforded enough information to be fully prepared without proper cardiac screening?

Research Question 4

Considering issues of paperwork, time investment, the convenience of access, financial considerations, fear of unknown results, possible false-positive findings, and low probability of incidences of cardiac arrest associated with student-athletes at the high school level, which is most associated with and predictive of study participant perceptions that cardiac screening should be required prior to athletic participation?

Two of the barriers were assured relative to study participants' perceptions on the seven barriers to student athlete pursuit of cardiac screening prior to athletic participation. The perceived barrier of financial burden associated with cardiac screening received the largest degree of perceived effect. Additionally, the perceived barrier of convenience of access had a similarly large effect.

A follow-up analysis was conducted comparing the perceptions of athletic trainers and high school coaches for RQ4. The perceptions of effect on the seven barriers were moderately comparable for both athletic trainers and high school coaches.

Currently, population screening utilizing diagnostic testing is not practical or economically realistic (Koester, 2001, p. 203). Vora et al. (2017) claimed younger athletes having a physical examination with an ECG would help identify those athletes at high risk for SCD. Winkelmann and Crossway (2017) confirmed the appropriateness of updating the pre-

participation exam to include a 12-lead ECG test for the prevention of SCD for all collegiate and secondary school athletes. The implementation of cardiac screening of high school athletes is warranted, but the financial burden continues to be the underlying issue.

Study Limitations

There are identifiable limitations to this study. The prominent size and varied demographics of the target population on cardiac screening and the potential cardiac risks may not be accurately represented due to the possible lack of participation. The sample size consisted of 104 participants: 64 athletic trainers and 39 high school coaches, and 1 with no study group chosen. The study sample was non-probability in nature and convenient by definition, which limits the generalizability of the study.

Additionally, a limitation in this study is the ongoing worldwide pandemic of the coronavirus, or COVID-19. Due to the pandemic, the availability and openness to respond to the study's survey may have affected the overall number of participants.

Another limitation to this study is that data were collected using quantitative, Likert-scale items allowing for only numeric responses. The lack of open-ended questions and responses may have not adequately captured the potential cardiac risks and cardiac screening knowledge base of the population chosen. Open-ended responses to the research questions would have potentially garnered additional factors not considered in the given variables from this study.

Implications for Future Practice

A major gap in cardiac screening knowledge within a campus may impede the way cardiac screening is properly implemented and managed for the athlete. The results from this study can be used to address gaps within the school districts implementation protocol regarding misconceptions that still exist about cardiac screening, what can lead to a miscommunication

when an athlete receives a cardiac screening, and what educators should know about the potential risks of underlying cardiac disease in an athlete's heart. The findings taken from this study are robust and instructive and can also be used to help model a district wide cardiac screening awareness and education campaign for all stakeholders. The campaign will provide general cardiac screening information highlighting the application, the young athlete's heart development, warning signs and symptoms of cardiac anomalies, proper management of a positive finding, short and long-term consequences, and review of the district's implementation. This awareness campaign will target student athletes, parents, athletic administrators, and the districts athletic staff within the district. The aim of this campaign is to begin the uniform dissemination of information at the high school level and then eventually to the middle school level, in an effort to ensure that the education stakeholders are presented with identical information that will help diminish any misconceptions that may exist within the district community.

In light of the findings, this study would benefit by being replicated at the middle school level. In the state of Texas there are not normally athletic trainers hired to work specifically at the middle school. Most of the athletic trainers are contracted to the middle school and only work through the football season. However, information provided to the middle school coaches, athletic administrators, parents, and athletes would be greatly beneficial to continue to lessen the number of misconceptions present about cardiac screening. Essential information disseminated properly will allow for buy-ins of all education stakeholders at both the middle and high school levels.

This study explored the factors that contribute to the perceptions of athletic trainers and high school coaches on cardiac screening of high school athletes prior to athletic participation.

Given the vast amount of research available surrounding the topic of cardiac screening, this study adds to the existing literature by identifying variables that contribute to athletic trainers' and high school coaches' perceptions of cardiac screening of high school athletes. Implications for practice were deduced from this study.

Recommendations for Future Research

Athletic trainers' and high school coaches' perceptions of cardiac screening of high school athletes prior to athletic participation remains a complex issue with many contributing factors. This study utilized a quantitative, non-experimental survey research approach. Future research in this area would benefit by using a mixed-methods approach or adding a qualitative portion. The study's survey did not include open-ended questions or an opportunity for adding comments. To that end, interviewing participants could allow for open-ended questions or the option to add comments on the topic.

Furthermore, including the athlete's parents, athletic administrators, and other healthcare professionals such as sports team doctors would add more perspective to the overall perceptions of cardiac screening of high school athletes. Interviews with participants from these different categories, along with the two already produced in this study, would allow for more participants to explain their perceptions on cardiac screening of high school athletes. A broadened sample could produce responses that would reflect different types of perspectives on the awareness and implementation of cardiac screening of high school athletes. Questions could address the availability of cardiac screening for the athletes, awareness of the potential risk of cardiac anomalies, and current implementation of cardiac screening within the district or organization. In addition, questions could specifically address the overall perceptions of resistance to cardiac screening at the secondary school setting. A mixed-methods or qualitative portion would allow

the researcher to further investigate the requirement of cardiac screening of high school athletes prior to athletic participation, proper implementation of cardiac screening, and finding a reliable cost-effective solution for school district athletic organizations.

Conclusion

Identifying high school athletes at risk for SCD due to cardiovascular diseases is a vital matter challenging the sports medicine and athletic communities. AHA and UIL support a pre-participation examination with a physical exam and medical history; however, predisposition to SCD due to clinically silent conditions can go undetected and may be insufficient in nature. Several challenges are present in athletes relating to SCD for both medical professionals and healthcare systems, including the diagnosis of cardiac anomalies, management of cardiac disorders, and finding a cost-effective universal screening protocol to minimize the individuals susceptible. Legal decisions are needed on cardiac screening becoming a law and a finite requirement like that of the required pre-participation exam (PPE). Due to the nature of an incidence of SCD occurring in young athletes, the proper implementation of cardiac screening is appropriate to the health and well-being of the athlete.

The results of this study may lead to a better understanding of the need to implement cardiac screening among high school athletes, while also providing perspectives of the individuals who work closely with these athletes. Additionally, the results of this study could strengthen the positive outlook and minimize the overall negative perspective of fear surrounding cardiac screening. The findings show athletic trainers and high school coaches have similar perceptions that a need exists for cardiac screening of high school athletes prior to athletic participation. Cardiac screening can affect financial burden, cost-effectiveness, and convenience, which play a major role in the overall intended use of cardiac screening. Research affirms the

results of this study, in that cardiac screening should be implemented for high school athletes related to the underlying issues of cost-effectiveness, financial burden, and convenience of cardiac screening. The most effective means in bridging the gap of high school athletes being cardiac screened prior to athletic participation is to find the means for proper implementation and providing support to those athletes who are affected.

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