COLLEGIATE ATHLETES’ KNOWLEDGE OF SUDDEN CARDIAC DEATH ON SIGNS & SYMPTOMS AND RISK FACTORS

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

by
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THESIS APPROVAL

Graduate Athletic Training Education

We hereby approve the Thesis of

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Firstly, I would like to thank my family. I went back to school for them, to be everything they ever thought I could be. To my parents, thank you for sticking by me while I moved back and forth from home. Mom, I want to thank you for doing my laundry whenever I came home and putting up with my late night studying habits. Dad, I would like thank you for taking me fishing and out to eat to help relieve some stress from my classes. Ryan, thank you for dealing with me as another mom while I was home. To Poppy and Nanny, I am so grateful you were able to see me graduate from grad school and start my life. You have pushed me from day one and I appreciate every bit. I love you all and thank you.

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I would also like to thank Westminster College for agreeing to send my survey out to their student athletes. Also, thank you to the athletic director Mr. James Dafler. You were very compliant and helpful in achieving success with my survey. I would like to thank the athletes who participated in the survey. Without you, I would not have completed this thesis.
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</tr>
</tbody>
</table>
INTRODUCTION

Many topics are currently being discussed regarding health care, but one topic that has become more and more reoccurring is sudden cardiac death. Sudden cardiac death is talked about happening from younger athletes all the way up to professionals. Even though the actual chance of sudden cardiac death in athletes is small, the fact that any athlete can die while playing the sport they love is horrifying. Research has been done on cardiac related issues, but screenings for athletes based on medical history are costly and time consuming.$^1-10$

The prevention of sudden cardiac death is being investigated by medical professionals. One way that has been found to help limit the chance of death is from health history and screening. Obtaining a person’s medical history is part of a pre-participation exam done when an athlete enters college. The history form will identify previous health problems of the patient, including alarming conditions, which require special attention.$^{11-13}$ The items found that needs special attention would then lead to a screening. Screening could be done for any type of problem including orthopedic along with cardiovascular. Due to the cost of different screenings through insurance companies,
some programs cannot refer patients who have these possible life threatening conditions. The worse part about screenings is that as much as they may save a life, the need for mandatory screenings with all athletes are not being done, some due to a lack of resources. Usually, only athletes who are deemed high risk are screened for different problems.\textsuperscript{1-10}

One way knowledge will be increased in athletes is by educating the athletes on the background of sudden cardiac death in sport. The first thing that needs to be understood is incidence rate, which deals with geographical, sex, and age factors. Incidences of sudden cardiac death sometimes depend on where the athlete is participating. Elevation height along with the weather conditions could possibly lead to a higher risk of developing a heart condition. Risk of sudden cardiac death also depends on the age and sex of the athlete.\textsuperscript{13-19}

Pathophysiological, some ethnicities are more prone to developing heart conditions, which would lead to an increase of incidences that could potentially be deadly. Since certain races are prevalent in certain sports, which leads to a higher number of incidences for certain sports, than recorded in other sports.\textsuperscript{20-22}
Knowing the signs and symptoms of sudden cardiac death is helpful information when dealing with athletes. Studies have been done combining pre-participation screenings with ECG screenings. These studies have found that by screening, athletes with any cardiovascular disease not currently showing any signs or symptoms were able to be identified. Most states in the United States require some sort of pre-participation exams, even though ECG screenings are not done unless signs and symptoms are found in the participant. Information on sudden cardiac death helps identify signs and symptoms, which allows for the need of medical intervention when symptoms occur.\textsuperscript{1-13}

A major part of a history form is identifying the predisposing factors or risk factors of the participant. Positive risk factors allow the medical professional to be alerted of any concerning issues. Risk factors could include having a cardiac abnormality like mitral valve prolapsed, myocarditis, Marfan’s syndrome, aortic regurgitation, arrhythmogenic right ventricular cardiomyopathy, and hypertrophic cardiomyopathy. Consensus on cardiac issues shows that having hypertrophic cardiomyopathy is an alarming feature of cardiac issues, but other cardiac abnormalities are also alarming risk factors. Most ECG screenings are done only when
participants have family history or other predisposing risk factors that would warrant a screening. Different sports also allot to having a higher risk factor than others, including marathon running, football, basketball, and squash. Other risk factors leading to sudden cardiac death include gender and ethnicity. Sudden cardiac death has been found higher in males than females. Ethnicity also plays a role, leading to findings of African Americans having a higher percentage of cardiac abnormalities, specifically hypertrophic cardiomyopathy.

Research on sudden cardiac death is hard to find due to the lack of subjects and valid information. It is a prevalent cause to be able to find collegiate athletes’ knowledge of health care. Issues dealing with concussion, cardiac conditions, general illness, and orthopedics are becoming more and more apparent to the general public through media sources. Without teaching and prior to participation in sports, knowledge levels of athletes vary depending on their education backgrounds. Knowledge is the only thing that can prepare someone to save an athlete from sudden cardiac death while someone is experiencing it first-hand. Without being prepared or having been taught what to do, people may freeze and in turn may lose the chance to save the life at risk.
This study will provide ample information regarding sudden cardiac death. The purpose of this study is to determine the knowledge collegiate athletes have in regards to sudden cardiac death. A secondary purpose of this study is to determine the reliability for the two dependent variables: signs & symptoms and risk factors. The information found from the survey will potentially help enlighten the medical field to show the level of knowledge athletes have on sudden cardiac death. Based upon findings, recommendations may show more information needs to be taught in order to increase knowledge.
METHODS

The primary purpose of this study was to examine the knowledge of collegiate athletes on sudden cardiac death. This section will include the following subsections: research design, preliminary research, subjects, instruments, procedures, hypotheses, and data analysis. A secondary purpose of this study was to determine the reliability for the two dependent variables: 1) signs and symptoms and 2) risk factors.

Research Design

The research used a descriptive design for the study. The independent variables were ethnicity and gender. The dependent variables were knowledge on signs and symptoms along with knowledge of risk factors of sudden cardiac death as measured by the Collegiate Athletes’ Cardiac Knowledge Survey. The design was made to specifically determine the knowledge of college athletes on sudden cardiac death along with specific diseases or conditions that could possibly lead to being at a higher risk for sudden cardiac death. The strength of the study was that content validity was determined after a review by a panel
of experts. A limitation of this study was that only athletes from one division III college were subjects.

Preliminary Research

There was a panel of four experts (Appendix C1) who reviewed the survey. The panel was handpicked from a list of experts and was asked directly by the researcher. The members included certified athletic trainers Shaun Toomey, Adam Annacone, and Michele Kabay, along with Dr. Jose Ramirez-DelToro, who is the team physician at California University of Pennsylvania. The researcher was looking for the expert’s opinion on the survey along with comments and revisions on questions and overall presentation of the survey.

Subjects

The subjects (N=80) that were used for this study were volunteers from the population of male and female athletes from Westminster College. All subjects were enrolled in college and participated in a varsity and/or club sport. These sports included football, soccer, swimming, diving, cheerleading, volleyball, tennis, basketball, baseball,
softball, track & field, cross-country, golf, or any other
sport offered at the school.

Informed consent was assumed by the subject’s
participation in the survey. Each participant’s identity
and personal information remained confidential and was not
included in the study.

Instruments

A survey titled Collegiate Athletes’ Cardiac Knowledge
(Appendix C2) was developed by the researcher. The
information was found in a Starkey et al textbook titled
Examination of Orthopedic and Athletic Injuries. The
survey was distributed using Survey Monkey. The survey
consisted of four sections. The first section was
comprised of demographic questions including gender, age,
sport, and ethnicity. The second section asked questions
about a CPR/AED certification and if any previous education
was taught on sudden cardiac arrest/death. The next
section has one question about their knowledge on the signs
and symptoms of cardiac issues. The highest score possible
would be a 24. The fourth section deals with one question
that asks about their knowledge on risk factors of sudden
cardiac death. The optimal score with this question would
be 18. There are eight questions for the entirety of the survey.

The athletes’ knowledge was measured by how well they answer the knowledge questions, which are the last two questions (signs and symptoms, risk factors). The survey was scored by a correct answer of one and an incorrect answer of zero. In total, there are a combined 19 correct answers out of a total of 42 answers for the seven and eighth questions. The demographic questions do not have a score. They are made strictly to see what sort of background the athlete is coming from.

Procedures

The researcher obtained approval from the IRB at California University of Pennsylvania (Appendix C3) before any research was conducted. The study was distributed through an email to varsity athletes (n=80) of all sports on campus at Westminster College. To be able to send the survey out to athletes, the researcher obtained permission from Westminster College athletic director Jim Dafler. Prior to the survey being emailed to the athletes, a panel of experts analyzed the survey and suggested improvements or changes (Appendix C1). Instructions for the survey were
included in the email along with a link to take the survey. In addition, accompanying the survey was a cover letter (Appendix C4) explaining the purpose of the study. A follow-up email was sent after the first week encouraging participants to complete the survey. The knowledge survey took approximately 10 minutes to complete.

Hypotheses

The following hypotheses were based previous research and the researcher’s intuition based on a review of the literature.

1. There will be a difference between genders for a) signs and symptoms score and b) risk factors of cardiac knowledge score.
2. There will be a difference between ethnicity for a) signs and symptoms score and b) risk factors of cardiac knowledge score.

Data Analysis

All data was analyzed by SPSS version 18.0 for Windows at an alpha level of 0.05. The research hypotheses were analyzed using a MANOVA.
RESULTS

Demographic Data

Collegiate athletes from Westminster College (N = 80) voluntarily participated in this study. Table 1 represents the gender of these athletes.

Table 1 Gender of Athlete

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>36</td>
<td>45.0</td>
</tr>
<tr>
<td>Female</td>
<td>44</td>
<td>55.0</td>
</tr>
</tbody>
</table>

Table 2 represents the age of the athlete.

Table 2 Age of Athlete

<table>
<thead>
<tr>
<th>Age</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-20</td>
<td>53</td>
<td>66.3</td>
</tr>
<tr>
<td>21-23</td>
<td>26</td>
<td>32.5</td>
</tr>
<tr>
<td>24-26</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>27-29</td>
<td>1</td>
<td>1.3</td>
</tr>
</tbody>
</table>

Table 3 represents the athlete’s ethnicity.

Table 3 Ethnicity of Athlete

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caucasian</td>
<td>76</td>
<td>95.0</td>
</tr>
<tr>
<td>Hispanic / Latino</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Native American</td>
<td>1</td>
<td>1.3</td>
</tr>
<tr>
<td>African American</td>
<td>3</td>
<td>3.8</td>
</tr>
<tr>
<td>Asian / Pacific Islander</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 4 represents the sport(s) that the athlete participates in at Westminster College. Other represents
club sports played at the school. The two participants were involved in the lacrosse and wrestling club.

Table 4 Sports Participated

<table>
<thead>
<tr>
<th>Sport</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Football</td>
<td>15</td>
<td>18.8</td>
</tr>
<tr>
<td>Soccer</td>
<td>18</td>
<td>22.5</td>
</tr>
<tr>
<td>Swimming</td>
<td>8</td>
<td>10.0</td>
</tr>
<tr>
<td>Diving</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Cheerleading</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Volleyball</td>
<td>7</td>
<td>8.8</td>
</tr>
<tr>
<td>Tennis</td>
<td>5</td>
<td>6.3</td>
</tr>
<tr>
<td>Basketball</td>
<td>8</td>
<td>10.0</td>
</tr>
<tr>
<td>Baseball</td>
<td>1</td>
<td>1.3</td>
</tr>
<tr>
<td>Softball</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Track / Field</td>
<td>29</td>
<td>36.3</td>
</tr>
<tr>
<td>Cross Country</td>
<td>11</td>
<td>13.8</td>
</tr>
<tr>
<td>Golf</td>
<td>1</td>
<td>1.3</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>2.6</td>
</tr>
</tbody>
</table>

Table 5 represents if the athlete is CPR/AED certified or not.

Table 5 CPR/AED Certified

<table>
<thead>
<tr>
<th>Answer</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>38</td>
<td>47.5</td>
</tr>
<tr>
<td>No</td>
<td>42</td>
<td>52.5</td>
</tr>
</tbody>
</table>

Table 6 represents if the athlete has had any previous formal education on sudden cardiac arrest/death.

Table 6 Formal Education on Sudden Cardiac Arrest/Death

<table>
<thead>
<tr>
<th>Answer</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>35</td>
<td>43.8</td>
</tr>
<tr>
<td>No</td>
<td>45</td>
<td>56.3</td>
</tr>
</tbody>
</table>
Hypothesis Testing

The level of significances for testing all hypotheses was set at an alpha level of .05.

Hypothesis 1: There will be a difference between genders for a) signs and symptoms score and b) risk factors of cardiac knowledge score.

Hypothesis 2: There will be a difference between ethnicity for a) signs and symptoms score and b) risk factors of cardiac knowledge score.

Conclusion: A 2 (gender) x 3 (ethnicity) between-subjects factorial MANOVA was calculated comparing the knowledge scores for participants on signs and symptoms and risk factors of sudden cardiac death. This is presented in Table 7. The main effect for gender on signs and symptoms was not significant, \( F_{(1,73)} = 0.198, p > .05 \), and for gender on risk factors, \( F_{(1,73)} = 0.471, p > .05 \). There was no significant main effect for ethnicity on signs and symptoms, \( F_{(2,73)} = 0.203, p > .05 \), and for ethnicity on risk factors, \( F_{(2,73)} = 0.048, p > .05 \). The interaction between gender and ethnicity was also insignificant for signs and symptoms, \( F_{(1,73)} = 0.000, p > .05 \), and interaction between gender and ethnicity was also insignificant on risk factors, \( F_{(1,73)} = 0.355, p > .05 \). Thus, it appears that neither the gender nor ethnicity have any significant effect on signs and symptoms and risk factors.
Table 7 A MANOVA for Gender and Ethnicity on Cardiac Signs and Symptoms and Risk Factors

<table>
<thead>
<tr>
<th>Source</th>
<th>Dependent Variable</th>
<th>Type III</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sum of Squares</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>SS*</td>
<td>0.670</td>
<td>1</td>
<td>0.670</td>
<td>0.198</td>
<td>.658</td>
</tr>
<tr>
<td></td>
<td>RF*</td>
<td>1.658</td>
<td>1</td>
<td>1.658</td>
<td>0.471</td>
<td>.495</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>SS*</td>
<td>1.375</td>
<td>2</td>
<td>0.687</td>
<td>0.203</td>
<td>.817</td>
</tr>
<tr>
<td></td>
<td>RF*</td>
<td>0.337</td>
<td>2</td>
<td>0.168</td>
<td>0.048</td>
<td>.953</td>
</tr>
<tr>
<td>Gender*Ethnicity</td>
<td>SS*</td>
<td>0.000</td>
<td>1</td>
<td>0.000</td>
<td>0.000</td>
<td>.993</td>
</tr>
<tr>
<td></td>
<td>RF*</td>
<td>1.250</td>
<td>1</td>
<td>1.250</td>
<td>0.355</td>
<td>.553</td>
</tr>
<tr>
<td>Error</td>
<td>SS*</td>
<td>247.208</td>
<td>73</td>
<td>3.386</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>RF*</td>
<td>256.838</td>
<td>73</td>
<td>3.518</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*SS (Signs & Symptoms), RF (Risk Factors)

Additional Findings

The secondary purpose of this study was to determine the reliability of the survey. A Kuder Richardson test was used to determine the reliability of signs and symptoms and risk factors. The reliability for the signs and symptoms section of the study was 0.565. The reliability for the risk factors section of the study was 0.624. Both variables had moderate reliability.

In addition to the MANOVA test, frequencies for the athletes’ knowledge on signs and symptoms along with knowledge on risk factors were also done. Table 8 reveals
the knowledge answers for signs and symptoms of sudden cardiac death.

**Table 8** Sign and Symptoms Knowledge Answers

<table>
<thead>
<tr>
<th>Sign &amp; Symptoms</th>
<th>Correct</th>
<th>Incorrect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatigue*</td>
<td>50</td>
<td>30</td>
</tr>
<tr>
<td>Nausea</td>
<td>55</td>
<td>25</td>
</tr>
<tr>
<td>Headache</td>
<td>56</td>
<td>24</td>
</tr>
<tr>
<td>Fever</td>
<td>72</td>
<td>8</td>
</tr>
<tr>
<td>Night Sweats</td>
<td>77</td>
<td>3</td>
</tr>
<tr>
<td>Chest Pain*</td>
<td>73</td>
<td>7</td>
</tr>
<tr>
<td>Upset Stomach</td>
<td>78</td>
<td>2</td>
</tr>
<tr>
<td>Knee Pain</td>
<td>80</td>
<td>0</td>
</tr>
<tr>
<td>Shoulder Pain*</td>
<td>20</td>
<td>60</td>
</tr>
<tr>
<td>Panic*</td>
<td>31</td>
<td>49</td>
</tr>
<tr>
<td>Trouble Sleeping</td>
<td>72</td>
<td>8</td>
</tr>
<tr>
<td>Sore Throat</td>
<td>80</td>
<td>0</td>
</tr>
<tr>
<td>Sensitivity Light/Sound</td>
<td>70</td>
<td>10</td>
</tr>
<tr>
<td>Dizziness*</td>
<td>45</td>
<td>35</td>
</tr>
<tr>
<td>Exertional Syncope*</td>
<td>1</td>
<td>79</td>
</tr>
<tr>
<td>Dyspnea*</td>
<td>2</td>
<td>78</td>
</tr>
<tr>
<td>Amnesia</td>
<td>78</td>
<td>2</td>
</tr>
<tr>
<td>Heart’s “Racing”*</td>
<td>66</td>
<td>14</td>
</tr>
<tr>
<td>Double Vision</td>
<td>69</td>
<td>11</td>
</tr>
<tr>
<td>Blurry Vision</td>
<td>52</td>
<td>28</td>
</tr>
<tr>
<td>Sensation of Chest Pain*</td>
<td>67</td>
<td>13</td>
</tr>
<tr>
<td>Low Back Pain</td>
<td>78</td>
<td>2</td>
</tr>
<tr>
<td>Coughing</td>
<td>68</td>
<td>12</td>
</tr>
<tr>
<td>Shortness of Breath*</td>
<td>70</td>
<td>10</td>
</tr>
</tbody>
</table>

*Correct sign and symptoms answers

Table 9 shows knowledge answers for risk factors of sudden cardiac death.
Table 9 Risk Factors Knowledge Answers

<table>
<thead>
<tr>
<th>Risk Factors</th>
<th>Correct</th>
<th>Incorrect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sudden Death Family</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before 50*</td>
<td>49</td>
<td>31</td>
</tr>
<tr>
<td>Seizures</td>
<td>59</td>
<td>21</td>
</tr>
<tr>
<td>History of Cancer</td>
<td>75</td>
<td>5</td>
</tr>
<tr>
<td>Sickle Cell Trait</td>
<td>65</td>
<td>15</td>
</tr>
<tr>
<td>Any Heart Conditions*</td>
<td>69</td>
<td>11</td>
</tr>
<tr>
<td>History of Concussion</td>
<td>79</td>
<td>1</td>
</tr>
<tr>
<td>Family History</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Of Heart Conditions*</td>
<td>71</td>
<td>9</td>
</tr>
<tr>
<td>Migraines</td>
<td>77</td>
<td>3</td>
</tr>
<tr>
<td>Asthma*</td>
<td>12</td>
<td>68</td>
</tr>
<tr>
<td>Heart Murmur*</td>
<td>64</td>
<td>16</td>
</tr>
<tr>
<td>Shortness of Breath</td>
<td></td>
<td></td>
</tr>
<tr>
<td>During Exercise*</td>
<td>49</td>
<td>31</td>
</tr>
<tr>
<td>Weight*</td>
<td>53</td>
<td>27</td>
</tr>
<tr>
<td>Previous Fracture</td>
<td>80</td>
<td>0</td>
</tr>
<tr>
<td>Atherosclerosis*</td>
<td>8</td>
<td>72</td>
</tr>
<tr>
<td>Insomnia</td>
<td>78</td>
<td>2</td>
</tr>
<tr>
<td>Pain with Exercise*</td>
<td>22</td>
<td>68</td>
</tr>
<tr>
<td>Sudden Weight Loss</td>
<td>63</td>
<td>17</td>
</tr>
<tr>
<td>Wears Contacts/Glasses</td>
<td>80</td>
<td>0</td>
</tr>
</tbody>
</table>

*Correct risk factors answers
DISCUSSION

The following section will include discussion of results, conclusions, and recommendations.

Discussion of Results

This study focused on the knowledge of collegiate athletes on sudden cardiac death focusing on signs and symptoms and risk factors. A secondary purpose of this study was to determine the reliability for the two dependent variables: 1) signs and symptoms and 2) risk factors. Cardiac issues are something that not every athlete knows enough about prior to participation. They do not know that they have a potential risk for injury. The athletes may also not know what to do in the time of emergency during a cardiac related issue if they are not sure of the signs and symptoms or risk factors associated with cardiac problems.

Surveys are not usually done on sudden cardiac death due to the lack of subjects from passing away; therefore, a knowledge survey could be potentially very informative. One survey dealt with students’ perceptions and beliefs about sudden cardiac death, understanding of using an AED
and preparedness level to recognize and respond to an emergency event, and experiences of responding to handling an emergency event. This showed that many of the participants were confused on the difference between a myocardial infarction and sudden cardiac death. Also, the participants had a lot of uncertainty about what to do if they had to respond to an unconscious individual along with the fear about the use of the AED and CPR. Although this survey did not show knowledge but more of a common perception, it does relate in the fact that people did not know what to do in certain situations and weren’t sure of what some medical conditions were. These perceptions could be helped if education is increased among the general public and with the athlete population.

This survey showed there were no significant differences between gender or ethnicity for knowledge of signs and symptoms and for knowledge of risk factors of sudden cardiac death. Even though the results were not significant, they were found to be meaningful. The results showed how many participants are CPR/AED certified along with who has had formal training on sudden cardiac arrest/death. This is meaningful for the fact that the results came out to be close to even, which was not expected. I did not expect such a high number of athletes
to be CPR/AED certified. This could mean that more training is happening than previously thought, but the right kind of training including signs and symptoms along with risk factors of cardiac issues are not necessarily being taught.

It was found that 47.5% (n=38) of student athlete participants are CPR/AED certified. However, matched up to the comparative data of correct and incorrect answers of signs and symptoms along with risk factors, this data does not match. With the amount of participants certified, it would be implied correct knowledge of signs, symptoms, and risk factors was implied. It is thought that the student athletes who are CPR/AED certified assume what to do in case of emergency, even though they did not correctly identify all of the signs, symptoms, and risk factors.

Frequencies were run on the amount of correct knowledge answers found on signs and symptoms along with risk factors. The percentage of correct answers found from the sign and symptoms question on the survey ranged from 25% (n=20) to 100% (n=80), with a few outliers of 1.3% (n=1) for exertional syncope and 2.5% (n=2) for dyspnea. Compared to the risk factors correct knowledge answers, the knowledge of signs and symptoms of sudden cardiac death were less familiar to the student athletes. The percentage
of correct answers associated with the risk factors question ranged from 27.5% (n=22) to 100% (n=80), with two outliers of 10% (n=8) for atherosclerosis and 15% (n=12) for asthma.

Table 8 and 9 indicate the percentage of correct answers for signs and symptoms and risk factors. The top correct answers for signs and symptoms include sore throat, low back pain, upset stomach, and amnesia. This indicated that the participants knew that these were not a sign and symptom of sudden cardiac death, hence the high percentage rate. For risk factors, the top correct knowledge answers include history of cancer, previous fracture, and wears contacts and/or glasses. From this, it is seen that participants also did have a good grasp of what is a risk factor and what is not a risk factor. The items from both tables (8 and 9) show that most participants were unsure about were the items with medical names, like atherosclerosis, exertional syncope, and dyspnea. This is most likely due to the unfamiliarity of terms.

Conclusion

After reviewing the results of this study, it is concluded that knowledge does not differ between genders
and ethnicities on signs, symptoms, and risk factors of sudden cardiac death. Regardless of the gender or ethnicity, there is still a lack of knowledge about sudden cardiac death. Even with CPR/AED certifications, student athletes at Westminster College were not sure of what signs and symptoms or risk factors were associated with sudden cardiac death.

Recommendations

Further research recommendations for this study first and foremost include surveying other colleges and universities of all divisions in the United States. This would give a better picture of what knowledge is known and what education is available to collegiate athletes from different demographic settings.

To increase participation, I would recommend personally handing out surveys to the desired population. This would ensure a more diverse and complete participation. I would also check the demographics of the school or region I am surveying to see if an appropriate number of athletes, gender, or ethnicity is available.

It would be beneficial to have more educational materials on sudden cardiac death available to collegiate
athletes country-wide. This would allow for a better preparedness during an emergency event or better recognizing of signs and symptoms if a cardiac issue was experienced by them or a teammate. Adding signs, symptoms, and risk factors to the CPR/AED and first aid curriculum could also increase knowledge of cardiac issues including sudden cardiac death.

I would also recommend implications for certified athletic trainers to help teach educational materials to athletes prior to participation to play. Holding an informative group meeting for each individual sport allows for information to be taught along with questions to be asked from athletes. Having certified athletic trainers teach the athletes allow for the most knowledge transferred to the athlete, compared to a basic CPR class that may not include signs, symptoms, and risk factors of cardiac issues.

Another important recommendation would be to develop a regulated pre-participation history form on both the athlete and the athlete’s family. A more detailed pre-participation exam would help eliminate certain cardiac issues that may be overlooked during a basic history form. Using information found on the American Heart Association
would help regulate pre-participation exams along with developing more detailed history forms.

The American Heart Association states that there are eight questions that need to be asked in order to uncover any potential health issues that could signal a cardiovascular problem. These questions pertain to both personal and family history. Personal history would include questions like: 1) chest pain/discomfort upon exertion, 2) unexplained fainting or near fainting, 3) excessive and unexplained fatigue associated with exercise, 4) heart murmur, and 5) high blood pressure. Family history questions include: 6) one or more relatives who died of heart disease (sudden/unexplained or otherwise) before age 50, 7) close relative under age 50 with disability from heart disease, and 8) specific knowledge of certain cardiac conditions in family members. The eighth question has specific conditions including hypertrophic or dilated cardiomyopathy in which the heart cavity or wall becomes enlarged, long QT syndrome which affects the heart’s electrical rhythm, Marfan syndrome in which the walls of the heart’s major arteries are weakened, and clinically important arrhythmias or heart rhythms. Using a history form that is detailed like this form would allow for the participant to correctly identify if any medical
issues are present, rather than just saying cardiac conditions, which the participant may not understand.

A cardiologist on the panel of experts would be a good recommendation for future study. This would allow the survey to be analyzed prior to sending out to participants. Having a specialists recommendations on a survey dealing with sudden cardiac death would have increased the reliability and possibly change the questions being asked to the participants.

Location of the student athlete would also be beneficial to find out in order to have a more diverse population. If a suburban area has more resources available than a rural area, then this would be another consideration to analyze. It may be true that different types of area may have more resources. In addition, depending on the division of college or university, there may be a difference in educational material.
REFERENCES


APPENDICES
APPENDIX A

Review of Literature
REVIEW OF LITERATURE

Sudden cardiac death among young athletes is seen in the news regularly. Even though the occurrence of this issue is actually rare in comparison to the amount of publicity it receives, the knowledge among the public on this topic may not be adequate. The purpose of this study is to find out, through a survey, the amount of knowledge collegiate athletes have in regards to the issue of sudden cardiac death. A secondary purpose of this study is to determine the reliability for the survey, which contains two dependent variables: signs & symptoms and risk factors.

This literature review will report on previous information, which has been found on the prevention of sudden cardiac death dealing with screening and history, background of sudden cardiac death in sport dealing with incidence and pathophysiology, and collegiate athletes’ knowledge of healthcare.

Prevention of Sudden Cardiac Death

Screening

For all sports, screening of some kind is done in order to allow an athlete to participate. Screenings can
vary and may include a medical history form or specialized testing such as stress tests. In order to evaluate different conditions, different screenings are done. Most health care offices require medical history forms to be filled out prior to treatment. By doing this, the doctor is alerted of any conditions. Some conditions have become more relevant in the current day including sudden cardiac death.

Current research has been performed on screenings associated with sudden cardiac death. A major study done on a nationwide program of pre-participation screenings in Italy was started in 1982. As the study progressed, the screening technique was deemed adequate in both sensitivity and specificity for detection of potentially deadly conditions. It also identified a reduced risk of death in young competitive athletes by almost 90%. The study showed that this approach to pre-participation screenings, with the help of a 12-lead ECG screening, athletes with cardiovascular diseases not currently showing any other or outward signs or symptoms could be identified. The study also stated the fact that this program restricted life-threatening competitions. More research relating to this European study emphasizes the need for pre-participation exams of all young athletes involved in organized sports.
Even though this research occurred in Europe, the American Heart Association recommendations come from this study, which includes the recommendation of using of a 12-lead ECG with a common screening protocol.\textsuperscript{2} There is huge debate over whether screenings are needed, even though reducing the chance of sudden cardiac death from this study was found.\textsuperscript{3}

More international research done comes from Israel and Italy. Research was done to determine if pre-participation screening of athletes help reduce their risk for sudden death. The subjects were found by searching two main newspapers in Israel to determine the number of yearly cases of cardiac death in competitive athletes. The information collected came from the Israel Sport Authority from the years of 1985 through 2009. The study wanted to find the impact of the National Sport Law which began in 1997 in Israel. There was a need to see if more deaths occurred before or after the law was mandated. This law mandates screening of all athletes with resting ECG and exercise testing. The search found 24 documented events of sudden death or cardiac arrest in competitive athletes over the allotted time period. Of the 24 deaths, 11 occurred before the 1997 law and 13 occurred after it. The average yearly incidence the decade before was 2.54 per 100,000
athletes and 2.66 per 100,000 athletes the decade after. These results show the incidence is within the range reported by others that have done a similar study. However, it was found from the data that ECG screening had no effect on their risk for sudden death or cardiac arrest.4

Another study looked at how effective pre-participation exams with a 12-lead ECG along with history and physical examination were in identification of hypertrophic cardiomyopathy. This study was done with the Italian national teams and consisted of 4,450 subjects. Subjects were chosen initially due to pre-participation screening where alarming conditions were found. Participants then underwent a clinical and ECG examination to access the presence of hypertrophic cardiomyopathy, which was previously undetected. These results showed that none of the 4,450 subjects having any evidence of hypertrophic cardiomyopathy. There were subjects whom were found to have other cardiac abnormalities including myocarditis, mitral valve prolapsed, Marfan’s syndrome, aortic regurgitation, and arrhythmogenic right ventricular cardiomyopathy. The total amount of subjects having these conditions only came to 12. This was beneficial because hypertrophic cardiomyopathy was not the only reason for
sudden cardiac death. Other types of cardiac abnormalities also lead to a chance of sudden cardiac death.⁵

Much of the research on sudden cardiac death deals with the screenings including ECG readings. Most of the research shows the background on sudden cardiac death and the efficacy of screening programs. It has been found more than 70% of cardiac disease is the reason for athletes not being cleared by physicians in order to participate in sports. Most screenings include a 12-lead ECG, which has increased the diagnostic efficacy of screening. Even with the time involved, a large amount of research shows screening is worth doing because of the positive results found.⁶ In the United States, most states require some sort of pre-participation screening, even though ECGs are not usually done unless signs and symptoms are found. Sudden cardiac death is a relatively rare event, and therefore, some feel no screening would be much more cost effective.⁷

Because screenings do cost a lot of money, some research has been done with projected studies about what would happen in a situation. One study in particular examined ECG testing during physical examines for athletes. The subjects included public high school athletes, grades 9 through 12. The students were drawn from the National Federation of High School Association during the years of
2006 to 2007. Four groups were made, consisting of black males, white males, black females, and white females. The groups had pre-participation exams whereby the athletes were given ECG tests. The results came out as a predicted 16% of athletes would be expected to have a positive ECG, but only 2% would have a finding that leads to potential cardiovascular abnormality. Also, the study found males seemed to have a higher potential risk factor than females. The study showed screenings do cost too much due to the amount of false-positive tests. There would also be the need for personnel for interpretation and administering the tests. The study, along with others, suggested screening only high-risk athletes.8

A main part of the debate over sudden cardiac death is whether a 12-lead ECG should be used in addition to a medical history and a physical examination before competition for athletes. The debate in the medical field also talks about whether the purpose of screenings are to find problems or to help identify problems in order to reduce their chance of sudden cardiac death during sports. The problem that comes up most often with ECG screenings is that the staff, money, and education are all parts of the screening process, which not all facilities are able to accommodate.9 There is some previous research done to
determine the cost-effectiveness of electrocardiography along with cardiac history and physicals for pre-participation screening. The subjects of this study included high school and college athletes ranging from age 14 to 22. The data was found by using published epidemiologic and pre-participation screening data, vital statistics, and other publicly available data. The results show that adding electrocardiography to pre-participation screenings saved 2.06 lives per 1,000 a year. This cost approximately $89 per athlete.

The costs of just cardiac history and physical alone were $199 per athlete and saved 2.6 lives per 1,000. Even though financial restrictions may limit the use of ECG in pre-participation screenings, these screenings have found using ECG along with history and physicals may result in fewer deaths but also may be cost effective.\(^\text{10}\)

**History**

Medical history is needed in order to establish a good background on the patient. History forms also allow medical professionals to determine when a patient may be at risk for different conditions or injuries. Pre-participation exams include medical history forms, which
usually allow the medical professional to have all relevant information in one complete packet.

Research shows how pre-participation screenings are needed for athletes, but some groups of medical professionals believe only athletes whom have both a history and physical exam should be screened every two years in collegiate sports. Over 300,000 athletes would need to be screened and most universities and colleges find the budgetary constraints and the availability of personnel not ideal. If the athlete does have medical history of cardiovascular abnormalities then screenings would then be done more often depending on the severity of the abnormality found. Each year in colleges, there is paperwork done on history and a physical exam is completed for each athlete before competition. High school, on the other hand, requires less of a screening than in colleges. Athletes are required to get a screening before competition, but this is done at a family doctor office and is not usually sport specific or thorough. Other information on the subject of screenings discusses the urgency of screenings to be done to help prevent sudden cardiac death. Urgency reflects wide coverage of cardiac death cases. As of now, only recommendations were advised to athletes to get screenings based on family history and
other predisposing factors. Most of the current evidence comes from a 25 year study done in Italy and does suggest that screening has led to a reductions in sudden cardiac death.\textsuperscript{12}

Medical research has given the world a general background of hypertrophic cardiomyopathy. Some information found identifies the natural history of the disease and relates it to the need for medical intervention to help with symptoms, which could potentially lead to death. Overall, the management of hypertrophic cardiomyopathy remains a clinical challenge. Despite the high risk of sudden death, data on younger age groups are limited.\textsuperscript{13}

Background of Sudden Cardiac Death in Sport

\textbf{Incidence}

Different predisposing factors lead to the incidence level of sudden cardiac death. Some of these include ethnicity, age, sex, and sport. Each of these factors could potentially lead to a chance of developing cardiac issues, which could potentially lead to sudden cardiac death. Due to the prevalence of sudden cardiac death in
athletes, different sports also have a higher risk factor than others.

Sudden cardiac death has been found to be higher in athletes due to several factors that increase the risk of death, including having an unknown disease worsened by exercise. The incidence of sudden cardiac death has been found to be much higher in males than in females, about nine times higher. Geographical differences have also been reported, but this is due more to how pre-participation screening is done, which can vary by location. Even with the evidence of deaths among young athletes, there still has to be more studies done in order to clarify what role ethnicity has in the prevalence of diseases that may possibly lead to sudden cardiac death.¹⁴

A study done pertaining to athletes tested 29 competitive, in shape, and conditioned athletes ranging in age from 13 to 30 years old. The results show that out of the 29 subjects, the most common cause of death was hypertrophic cardiomyopathy. Only seven of the 29 subjects were suspected to have cardiac disease during their life. These results showed that even when heart disease was relatively uncommon, hypertrophic cardiomyopathy was a frequent cause of death in athletes.¹⁵
Other research done on athletes was based in the United States. This study was done throughout the country from 1980 to 2006 and obtained information from 38 different sports. The subject total came to 1866 athletes who died suddenly with ages ranging from 13 to 25. Of the 1866 athletes, 1049 were due to cardiovascular disease, 416 to blunt trauma, 65 to commotio cordis, and 46 to heat stroke. The most common causes were hypertrophic cardiomyopathy and congenital coronary artery abnormalities. Research shows the number of cardiovascular sudden deaths in the United States was higher than previously estimated, but still relatively low, which would further suggest the need for systematic and mandatory reporting of deaths to a national registry to better estimate the deaths per year. Also, the need for pre-participation screening with ECG is relative to this research.\textsuperscript{16}

Most athletes in the United States compete in the NCAA or National College Athletic Association. There was research done to better estimate the incidence of sudden cardiac death in the NCAA student-athletes. The study was done from 2004 to 2008. All cases of sudden cardiac death in the NCAA were identified with a NCAA database, weekly search of public media reports, and catastrophic insurance
claims. The results came to show during the time period, there were 273 deaths to 1,969,663 athletes that participated. The causes of death included 68% nonmedical or traumatic causes, 29% medical causes, and 6% to unknown causes. In the 29% of medical deaths, cardiovascular related sudden death was the leading cause in 45 athletes, which represented 75% of sudden deaths during exertion. The results showed sudden cardiac death is the leading medical cause of death during participation in the NCAA. Research also shows that an accurate assessment of sudden cardiac death is underestimated and needs better ways to find data in order to help develop effective strategies to help prevent sudden death.\textsuperscript{17}

Pertaining to athletes, individual sports have been examined to gain more knowledge of sudden cardiac death risk factors. One sport that has an increase in incidence with cardiac problems has been marathon running. The sport is very intense and could go on for hours. Even though it is a non-contact sport, it is an intensive cardiovascular sport, therefore making the risk for sudden death still relevant. Research shows the risk of sudden cardiac death during marathon running. One study included subjects from two groups of endurance runners held over a time period of 30 years, from 1976 to 1994, during the Marine Corps and
Twin Cities marathons. The subjects were mostly men with an average age of 37 years old. The total number of runners was 215,413. The results showed only four deaths occurred, each due to underlying cardiovascular diseases. Three deaths happened during the race and one after. Men made up three of the deaths, while one woman died. The ages ranged from 19 to 58 years old.\textsuperscript{18}

Another sport that researched was squash. Research was done from October 1976 to February 1984. The subjects included one female and 59 men. Reports on the deaths showed that out of the 60 deaths, 51 were coronary artery disease, four were valvar heart disease, two were cardiac arrhythmia, and one was hypertrophic cardiomyopathy. Only two deaths were not cardiac related. Of the subjects, 22 had a previous medical condition at one point during their life. The players never received the screenings that they should have, therefore resulting in death. The subjects that had the previous medical conditions could have been saved if screening was done.\textsuperscript{19}

Pathophysiology

Abnormalities along with defects found in the heart could be based on ethnicity. It has been found the sex of a person also matters when it comes to determining the
chance of having a cardiac related issue. Even though the type of sport is important, if a person has a predisposing factor there is a chance that a cardiovascular injury can still occur.

Genetic heart disease accounts for a majority of sudden cardiac deaths in athletes under age 30. These include hypertrophic cardiomyopathy, right ventricular cardiomyopathy, and ion channel disorders. Ethnicity and race also play a role in the number of cardiovascular abnormalities found. Research was done to determine the impact of race on identification of hypertrophic cardiomyopathy, one of the leading cardiac conditions leading to sudden cardiac death. The national athlete registry was utilized to find the relationship of race to the prevalence of cardiovascular diseases. This information was then compared with a hospital-based cohort of patients with hypertrophic cardiomyopathy. The subjects included 584 athlete deaths, 286 being cardiovascular deaths. The results from the study show that of the total number of athletes that died, 42% were African American and most were male, approximately 90%. Of the 286 cardiovascular deaths, 55% were African American and died of hypertrophic cardiomyopathy. Out of the hospital group of 1986 hypertrophic cardiomyopathy patients, only 8% were
African American. From this research, it is found that many African American male athletes go undiagnosed with hypertrophic cardiomyopathy. Another study addressed subjects who participated in organized sports. The time period of the study was from 1985 to 1995. A total of 158 sudden deaths that occurred in trained athletes throughout the United States comprised the subjects. These subjects were younger than 35. The results showed that out of the 158 subjects, 15% were noncardiovascular causes. Of the athletes with cardiovascular causes, 90% were male and 52% were white. The most deaths occurred in basketball and football, accounting for 68% of deaths. The most common cause of death was hypertrophic cardiomyopathy. Of the total subjects, 115 had a standard pre-participation exam with only 3% being suspected of having a cardiovascular disease and one athlete having an abnormality.

Collegiate Athletes’ Knowledge of Healthcare

Athletes usually focus on one thing, their sport. Most do not consider what else could happen while playing that sport. The amount of education that is taught before participating has increased over the years due to increases in certain problems including concussion. A major issue at
this current time deals with cardiac issues. Most athletes have not heard much about these situations besides what is being told on news reports. They do not know that they have a potential risk for injury. The athletes may also not know what to do in the time of emergency during a cardiac related issue.

Most athletes in college have not been taught about sudden cardiac death among other major health issues like concussion. Knowledge surveys are done in order to gain a populations’ knowledge on a specific item. Research was done in order to describe university students’ perceptions and beliefs about sudden cardiac death, describe university students’ understanding of using an AED and their level of preparedness to recognize and respond to an emergency event, and to identify university students’ experiences of responding to handling an emergency event. This particular survey was done with qualitative descriptive methodology using written narrative responses on perceptions and beliefs about sudden cardiac death. Participants included 30 college students between age 18 and 48 years old from two campuses of a northeast American university, with 23 participants being female and seven being male. The participants were recruited using the university’s daily electronic newsletter. The participants had to be enrolled
in college as a student, have access to a computer, and agree to take the survey. The results of the survey showed that many of the participants were confused on the difference between a myocardial infarction and sudden cardiac death. In addition, the participants had a lot of uncertainty about what to do if they had to respond to an unconscious individual along with the fear about the use of the AED and CPR. Making sure that more education is done in a collegiate setting on the warning signs of cardiac issues, what exactly sudden cardiac death is, and being able to use an AED or be trained in CPR is absolutely necessary. Surveys done on sudden cardiac death are very sparse due to the lack of subjects from passing away, therefore researching surveys that have been done relating to knowledge on a specific condition are sometimes used in order to gain a better perspective on the knowledge of the general population.

Concussion seems to be a big topic of debate lately. Since sudden cardiac death has not received the same type of hype just yet, surveys on concussion lead to very good assistance with knowledge surveys on sudden cardiac death. One specific study doing research on concussion includes a knowledge survey. The participants included 44 boys and 29 girls who were athletes and 39 men and 61 women who were
parents. The athletes were between ages 10 and 14. Most of the survey included questions about signs and symptoms along with any history that they have had with concussions, either personally or in a general setting. Out of the parents, 57 had first aid certification, 53 CPR certification, 57 general medical training, and 13 in concussion assessment. The careers of the parents were never stated. The results of this survey showed that there was not a significant difference between athletes and parents for the number of concussion symptoms correctly identified. Only three out of five true-or-false questions were answered right by 70% of the participants. However, parents who had a background in medical training or certification in first aid or CPR did score higher than other parents who had no previous knowledge or training.

There was a retrospective survey done with collegiate athletes. This research found that 56% of athletes had no knowledge of concussion consequences, 28% continued to play while dizzy, and 30% continued to play while experiencing a headache. These results show that education is very beneficial when done, but it needs to be done in school settings in order to build a good foundation for concussion awareness.24
More research has been done pertaining to concussion. One survey wanted to establish the knowledge and beliefs of parents of high school rugby players about concussion with a descriptive cross-sectional intercept pilot study. Participants included 200 parents of male high school rugby players. The surveys were handed out while attending their children’s games. Results showed that most parents, 165 out of 198, reported they were able to recognize a concussion in their children and able to provide a list of well-accepted signs and symptoms. Nearly all, 188 out of 196, were aware of risks while concussed and continued to allow their children to play. Roughly half, 99 of 196, were aware of return-to-play guidelines after a concussion but still allowed their children to participate. The results of this information show that parents have a good basic knowledge of concussion symptoms and signs, but are still neglecting the fact that their child may sit out a game due to a concussion.25

Summary

From the information in the literature review, sudden cardiac death is important in the current news on healthcare. It is shown from recent research that
screenings following pre-participation medical exams are a good way to eliminate the chance of participation with a heart condition. However, due to cost and time, screenings are not always available to be done. As stated in a study done in Italy, screenings reduced the risk of death in young competitive athletes by almost 90%.\textsuperscript{1} Screenings have become such a big deal due to the fact that more than 70% of cardiac disease makes up the majority of athletes not being able to participate in sports.\textsuperscript{6}

History also strongly relates to decreasing the risk of sudden cardiac death. In order to establish a good background of the patient, a complete medical history is needed. Medical history also shows which athletes are in need of screenings due to family history of cardiac issues or their own personal issues. Only recommendations can be made to athletes to get screenings based on predisposing factors since screenings cost significant amounts of money.\textsuperscript{12}

Sudden cardiac death has many reasons why it may occur. This would be referred to as the background aspect of sudden cardiac death. Incidence and pathophysiology make up this background. It was found that sudden cardiac death represents 75% of all sudden deaths during exertion, which in turn makes up the leading cause of death in the
Ethnicity and race plays a role in the pathophysiology of sudden cardiac death. A study found that of 286 cardiovascular deaths, 42% were African American and 90% were male. Knowledge out in the public setting about sudden cardiac death is very limited due to the limited resources available to determine causes. One study done in the United States deals with the comfort level of students with people who experience a cardiac issue and how they respond to the situation. Most of the students were unsure of what to do if they had to respond using an AED or CPR. Even though this is not specifically about sudden cardiac death knowledge, it gives a good perspective about the fears of the public about emergency situations.
APPENDIX B

The Problem
Statement of the Problem

The purpose of this study is to examine the knowledge of college athletes on sudden cardiac death. A secondary purpose of this study is to determine the reliability for the two dependent variables: signs and symptoms and risk factors. It is important to examine knowledge due to the severity of an emergency that could occur during a practice or a game. If we can assess the knowledge of an athlete then we are able to know what is going to happen in an emergency. Additionally it would be beneficial for athletic trainers and others in the medical field to see how much knowledge is out there, along with how much teaching on current medical conditions have been taught prior to playing.

Definition of Terms

The following definitions of terms will be defined for this study:

1) Hypertrophic Cardiomyopathy - part of the heart becomes thicker than the other parts which makes blood flow difficult"
2) Medical History Form – filled out prior to participation in order to tell in detail conditions or problems a person may have had or currently has\textsuperscript{27}

3) Sudden Cardiac Death – the heart suddenly and unexpectedly stops beating which results in death within an hour or less\textsuperscript{28}

**Basic Assumptions**

The following are basic assumptions of this study:

1) The survey will have content validity after a review by a panel of experts.

2) The subjects will answer the survey questions to the best of their ability during survey completion sessions.

**Limitations of the Study**

The following are possible limitations of the study:

1) Only college athletes from one college will serve as subjects.

2) Participants may not take the survey seriously.

3) Number of returned surveys may not be ideal.

4) Results may not be generalizable due to a small sampling size, especially with regards to ethnicity.
5) A cardiologist was not part of the Panel of Experts review.

**Significance of the Study**

The results of this study will show the knowledge of different levels of college athletes about sudden cardiac death. It is very important to get this information due to the fact that it could potentially save lives.

If athletes are knowledgeable about cardiac issues, an emergency situation could be handled in a better and more efficient manner. If an athlete has more knowledge about cardiac issues prior to participation, then when they are feeling abnormal sensations, they can recognize the signs and symptoms during playing and can alert the medical personnel. Once the results are in, if it is found that knowledge is very low on sudden cardiac death then it shows the medical field more educational materials are needed to be discussed before sport participation of an athlete.

The research done in this study will allow the current medical field to see the true knowledge of a college-aged athlete about sudden cardiac death. Due to the lack of research previously done, this will lead to a good background on what teaching instructions need to be taught in order to educate athletes on what to do in emergency
situations.
APPENDIX C

Additional Methods
APPENDIX C1

Letter to Experts
Dear________________:

I am a graduate student at California University of Pennsylvania pursuing a Master of Science degree in Athletic Training. To fulfill the thesis requirement for this program, I am conducting a knowledge study. The objective of this study is to determine what college athletes know about sudden cardiac death in terms of history along with signs and symptoms. A secondary purpose of this study is to determine the reliability for the two dependent variables: signs and symptoms and risk factors.

In order to increase the content validity of the instrument, a panel of experts has been chosen to review the survey. You have been selected as one of the three professionals to be on this panel. Due to your position and experience, your feedback is very important to the success of this study. The information obtained by this panel of experts review will be used to make revisions and create the final survey to be distributed to the population sample. Your responses are voluntary and will be confidential.

Please answer the following questions based on the attached survey and make any other additional comments you deem appropriate. Please return your comments and revisions via email no later than December 30, 2012. If you have any questions or concerns, please do not hesitate to contact me.

1. Are the questions appropriate, valid, and understandable?
2. Comment on the overall presentation of the survey.
3. Which questions, if any, should be restated from the survey? Why?
4. Which questions, if any, should be added to the survey? Why?

Thank you in advance for your time and efforts.

Sincerely,

Brittney Brown, ATC
California University of Pennsylvania
412-860-0567
bro6175@calu.edu
APPENDIX C2

Collegiate Athletes’ Cardiac Knowledge Survey
Collegiate Athletes’ Cardiac Knowledge Survey

Please complete the following sections to the best of your abilities

**Gender:** M ____ F ____

**Age:** 18-20 ____ 21-23 ____ 24-26 ____ 27-29 ____

**Ethnicity:** Caucasian ____
- Hispanic / Latino ____
- Native American ____
- African American ____
- Asian / Pacific Islander ____
- Other ____

**Sport (check more than one if applicable):**

Football ____ Soccer ____
Swimming ____ Diving ____
Cheerleading ____ Volleyball ____
Tennis ____ Basketball ____
Baseball ____ Softball ____
Track / Field ____ Cross Country ____
Golf ____ Other ____

Are you CPR / AED certified?

Yes ____ No ____

Have you had any previous formal education on sudden cardiac arrest / death?

Yes ____ No ____
Which signs and symptoms, from the list below, do you believe are associated with an individual who is experiencing cardiac issues? Select all that apply.

Fatigue____
Headache ____
Night Sweats ____
Upset Stomach ____
Shoulder Pain ____
Trouble Sleeping ____
Sensitivity to Light / Sound ____
Exertional syncope ____
Amnesia ____
Double Vision ____
Sensation of chest pain and arrhythmias ____
Coughing ____
Nausea ____
Fever ____
Chest pain ____
Knee Pain ____
Panic ____
Sore Throat ____
Dizziness ____
Dyspnea ____
Heart’s “Racing” ____
Blurry Vision ____
Low Back Pain ____
Shortness of breath ____

Which of the following items do you believe place an individual at risk of experiencing a cardiac issue?

Sudden Death Before Age 50 in Family ____
History of Cancer ____
Any Heart Conditions ____
Family History of Heart Conditions ____
Asthma ____
Shortness of Breath with Exercise ____
Previous Fracture History ____
Insomnia ____
Sudden Weight Loss ____
Seizures ____
Sickle Cell Trait ____
History of Concussion ____
Migraines ____
Heart Murmur ____
Weight ____
Atherosclerosis ____
Pain with Exercise ____
Contacts / Glasses ____

Approved by the California University of Pennsylvania IRB
APPENDIX C3

Institutional Review Board –

California University of Pennsylvania
PROTOCOL for Research Involving Human Subjects

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

(Reference IRB Policies and Procedures for clarification)

Project Title: Collegiate Athlete's Knowledge of Sudden Cardiac Death: Signs, Symptoms, and Risk Factors

Researcher/Project Director: Britney Brown

Phone #: 412-860-0567, E-mail Address: bro6175@calu.edu

Faculty Sponsor (if required): Dr. Carol Biddington

Department: Health Science

Project Dates: March 1, 2013 to February 28, 2014

Sponsoring Agent (if applicable): __________

Project to be Conducted at: California University of Pennsylvania (online)

Project Purpose: ☐ Thesis ☑ Research ☐ Class Project ☐ Other

Keep a copy of this form for your records.

Approved, September 12, 2005 / (updated 02-09-09)
Please attach a typed, detailed summary of your project AND complete items 2 through 6.

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

The purpose of this study is to examine the amount of knowledge that a college athlete has on sudden cardiac death. The following will be discussed: research design, preliminary research, subjects, instruments, procedures, hypotheses, and data analysis. A secondary purpose of this study is to determine the reliability for the two dependent variables: signs and symptom and risk factors. This research will use a descriptive design for the study. The independent variables will be ethnicity and gender. The dependent variable will be knowledge on signs and symptoms along with risk factors of sudden cardiac death as measured by the Collegiate Athletes' Cardiac Knowledge Survey. The subjects that will be used for this study will be volunteers from the population of approximately 450 male and female athletes from Westminster College. Informed consent will be assumed by the subject’s participation in the survey. Each participant’s identity and personal information will remain anonymous and will not be included in the study. The survey consists of four sections. The first section is comprised of demographic questions that include gender, age, sport, and ethnicity. The next section has general information questions like if the athlete is CPR/AED certified or if they have had any previous formal education on sudden cardiac arrest/death. The third section has questions about signs and symptoms of cardiac issues. The last section has questions dealing with risk factors of sudden cardiac death.

The researcher will obtain approval from the IRB at California University of Pennsylvania before any research is conducted. The study will be distributed through an email to all varsity and club sport teams on campus at Westminster College. Permission has been granted from the athletic director at the college. The athletic director at Westminster College will send out the email from the researcher to the athletes, so that the researcher has no contact with the athletes. Instructions for the survey will be included in the email along with a link to take the online survey. In addition, accompanying the survey will be a cover letter that explains the purpose of the study. A follow-up email will be sent after the first week encouraging participants to complete the survey. The survey will take approximately 10 minutes to complete. The hypotheses for the study include: there will be a difference between genders for a) signs and symptoms score and b) risk factors of cardiac knowledge score and there will be a difference between ethnicity for a) signs and symptoms score and b) risk factors of cardiac knowledge score. All data will be analyzed by SPSS version 18.0 for windows at an alpha level of 0.05. The research hypotheses will be analyzed using a MANOVA.

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

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

      The risks to the participants in this study are minimal due to the fact that participation is limited to the completion of a survey. All responses will be anonymous.

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

Approved, September 12, 2005 / (updated 02-09-09)
The selection is truly volunteering. There is no making of the subject to volunteer. There is also no cohosion due to the fact that coaches or teachers can’t hold it against the subject if the survey is done or not done. The survey will be sent out to approximately 450 athletes from Westminster College. The survey will be sent out by the athletic director from Westminster College. The athletes then have a choice to participate or not.

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

The survey cover letter containing the link to the survey will state that the subject has the right to not participate or discontinue participation at any time. Informed consent will be implied by completion of the survey. This will be stated implicitly in the survey cover letter.

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

This is an anonymous questionnaire and upon submission electronically, neither the name of the subject nor email address will be attached to their answers. The information will be kept strictly confidential. The data will be kept in a password protected electronic file on university servers where only the researcher and advisor will have access to this file.

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

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

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

5. Is this project part of a grant? ☐ Yes or ☑ No If yes, provide the following information:
   - Title of the Grant Proposal ______
   - Name of the Funding Agency ______
   - Dates of the Project Period ______

6. Does your project involve the debriefing of those who participated? ☐ Yes or ☑ No If Yes, explain the debriefing process here.

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

Approved, September 12, 2005 / (updated 02-09-09)
California University of Pennsylvania Institutional Review Board
Survey/Interview/Questionnaire Consent Checklist (v021209)

This form MUST accompany all IRB review requests

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

Does your survey/interview/questionnaire cover letter or explanatory statement include:
☒ (1) Statement about the general nature of the survey and how the data will be used?
☒ (2) Statement as to who the primary researcher is, including name, phone, and email address?
☒ (3) FOR ALL STUDENTS: Is the faculty advisor’s name and contact information provided?
☒ (4) Statement that participation is voluntary?
☒ (5) Statement that participation may be discontinued at any time without penalty and all data discarded?
☒ (6) Statement that the results are confidential?
☒ (7) Statement that results are anonymous?
☒ (8) Statement as to level of risk anticipated or that minimal risk is anticipated? (NOTE: If more than minimal risk is anticipated, a full consent form is required—and the Informed Consent Checklist must be completed)
☒ (9) Statement that returning the survey is an indication of consent to use the data?
☒ (10) Who to contact regarding the project and how to contact this person?
☒ (11) Statement as to where the results will be housed and how maintained? (unless otherwise approved by the IRB, must be a secure location on University premises)
☒ (12) Is there text equivalent to: “Approved by the California University of Pennsylvania Institutional Review Board. This approval is effective mm/dd/yy and expires mm/dd/yy”? (the actual dates will be specified in the approval notice from the IRB)?
☒ (13) FOR ELECTRONIC/WEBSITE SURVEYS: Does the text of the cover letter or explanatory statement appear before any data is requested from the participant?
☒ (14) FOR ELECTRONIC/WEBSITE SURVEYS: Can the participant discontinue participation at any point in the process and all data is immediately discarded?

Approved, September 12, 2005 / (updated 02-09-09)
Project Director's Certification
Program Involving HUMAN SUBJECTS

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

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

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

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

Professional Research

<table>
<thead>
<tr>
<th>Project Director's Signature</th>
<th>Department Chairperson's Signature</th>
</tr>
</thead>
</table>

Student or Class Research

<table>
<thead>
<tr>
<th>Student Researcher's Signature</th>
<th>Supervising Faculty Member's Signature if required</th>
<th>Department Chairperson's Signature</th>
</tr>
</thead>
</table>

**ACTION OF REVIEW BOARD** (IRB use only)

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

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

☐ Approved[________________________] ☐ Disapproved

Chairperson, Institutional Review Board Date

Approved, September 12, 2005 / (updated 02-09-09)
Dear Ms. Brown:

Please consider this email as official notification that your proposal titled "Collegiate Athlete's Knowledge of Sudden Cardiac Death: On Signs & Symptoms and Risk Factors" (Proposal #12-057) has been approved by the California University of Pennsylvania Institutional Review Board, with the following stipulations:

--:-In the second paragraph of the consent form, text equivalent to the phrase “without penalty” must be added to the section concerning participant withdrawal from participation.

Once you have amended your consent form, you may immediately begin data collection. You do not need to wait for further IRB approval. At your earliest convenience, you must forward a copy of the consent form for the Board’s records.

The effective date of the approval is 3-1-13 and the expiration date is 2-28-14. These dates must appear on the consent form. Please note that Federal Policy requires that you notify the IRB promptly regarding any of the following:

(1) Any additions or changes in procedures you might wish for your study (additions or changes must be approved by the IRB before they are implemented)
(2) Any events that affect the safety or well-being of subjects
(3) Any modifications of your study or other responses that are necessitated by any events reported in (2).
(4) To continue your research beyond the approval expiration date of 2-28-14 you must file additional information to be considered for continuing review. Please contact instreviewboard@cup.edu

Please notify the Board when data collection is complete.

Regards,
Robert Skwarecki, Ph.D., CCC-SLP
Chair, Institutional Review Board
APPENDIX C4

Survey Cover Letter
Dear:

My name is Brittney Brown and I am currently a graduate student at California University of Pennsylvania pursuing a Master of Science in Athletic Training. Part of the graduate study curriculum is to complete a research thesis through conducting research. I am conducting survey research to examine the amount of knowledge that a collegiate athlete has on sudden cardiac death, pertaining to the signs and symptoms along with risks. A secondary purpose of this study is to determine the reliability for the two dependent variables: signs and symptoms and risk factors. The data will be used to formulate an idea of what athletes are being taught prior to participation along with allowing athletes to the most up to date information on sudden cardiac death as possible.

Athletes from Westminster College will be surveyed; however, your participation is voluntary and you do have the right to choose not to participate. You also have the right to discontinue participation at any time during the survey completion process, without penalty, at which time your data will be discarded. The California University of Pennsylvania Institutional Review Board has reviewed and approved this project. The approval is effective March 1, 2013 and expires February 28, 2014 (IRB).

All survey responses are anonymous and will be kept confidential, and informed consent to use the data collected will be assumed upon return of the survey. Aggregate survey responses will be housed in a password protected file on the CalU campus. Minimal risk is posed by participating as a subject in this study. I ask that you please take this survey at your earliest convenience as it is 8 questions long and will take approximately 10 minutes to complete. If you have any questions regarding this project, please feel free to contact the primary researcher, Brittney Brown, ATC (bro6175@calu.edu). You can also contact the faculty advisor for this research: Carol Biddington, EdD (biddington@calu.edu). Thanks in advance for your participation.

Please click the following link to access the survey:

Thank you for taking the time to take part in my thesis research. I greatly appreciate your time and effort put into this task.

Sincerely,

Brittney Brown, ATC
Primary Researcher
California University of Pennsylvania
250 University Ave
California, PA 15419
bro6175@calu.edu
REFERENCES


14) Borjesson M, Pelliccia A. Incidence and aetiology of sudden cardiac death in young athletes: an international


TITLE: COLLEGIATE ATHLETES’ KNOWLEDGE OF SUDDEN CARDIAC DEATH ON SIGNS & SYMPTOMS AND RISK FACTORS

RESEARCHER: Brittney Brown, ATC, PES

ADVISOR: Dr. Carol Biddington

PURPOSE: To examine the knowledge collegiate athletes have on sudden cardiac death pertaining to signs and symptoms along with risk factors. To determine the reliability for the two dependent variables of signs and symptoms and risk factors.

METHODS: Westminster College athletes (n=80) were surveyed using Survey Monkey. The survey consisted of eight questions regarding knowledge of signs and symptoms along with knowledge of risk factors of sudden cardiac death.

FINDINGS: There were no significant differences between gender and ethnicity for knowledge of signs and symptoms and risk factors of sudden cardiac death. It was found that almost half (n=38, 47.5%) were CPR/AED certified. The reliability of the two dependent variables was moderate.

CONCLUSION: After reviewing the results of this study, it is concluded that gender and ethnicity do not have any impact on the amount of knowledge a collegiate athlete has on signs and symptoms along with risk factors of sudden cardiac death. The reliability of this survey was found to be moderately reliable. More research needs done in order to assess what information on sudden cardiac death is available to athletes prior to competition.