P.O.V.A.

Protecting Our Varsity Athletes

Using electrocardiogram as a primary screening technique to prevent sudden cardiac death in varsity athletes in Monroe County

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BACKGROUND OF THE PROBLEM:

Sudden Cardiac Death (SCD) is defined as "nontraumatic and unexpected sudden cardiac arrest that occurs within 6 hours of a previously normal state of health."[1]. Some say that the first documented case of SCD in an athlete was in 490 B.C. when Pheidippides died suddenly after running from Athens to Marathon[1]. Although SCD can occur in any individual at any age, the group most affected and often featured in the media is previously healthy athletes, usually participating in high school or college level competitive athletics. The exact incidence of SCD is largely unknown but estimates range from about 1 in 100,000 to 200,000 high school athletes affected each year. While a relatively rare condition, SCD is responsible for 30% of all non-traumatic deaths in the United States[1]. Furthermore, SCD is considered one of the leading causes of non-traumatic exercise-related death[1]. Looking at all deaths in high-school and college athletes, cardiovascular collapse outnumbers death caused by trauma 2:1[1]. Interestingly, approximately "80% of cases of SCD in young athletes occurs during or just after strenuous exercise[1]", suggesting that whatever the underlying cause of SCD, exercise must trigger some physiologic change which directly leads to total cardiovascular collapse.

SCD is now recognized as a significant and possibly preventable cause of death in the United States. What makes the condition so significant and scary is that it occurs in the people whom our society generally regards as the healthiest and most invulnerable; young athletes. Based on best estimates on the incidence of SCD (~1/100,000) and the estimate that there are about 5 million teenagers participating in high-school level competitive athletics, we can surmise that somewhere near 50 athletes will die every year from SCD[1,2]. While this does not seem like a huge number of people and may even make some people question why this problem is getting so much media and political attention, consider that most of these student-athletes would on average live for 50-60 more years. Additionally, if we assume 50 teenagers died each year from SCD, that means that in the course of any of our lifetimes, about the same number of America's youth would have died from SCD compared to the total number of people who lost their lives on 9/11. But

again, the important consideration, as I alluded to before, is that these deaths may be preventable. In order to prove that this last statement is true, we first need to look at the causes of SCD.

The list of etiologies for SCD is long and probably not fully defined yet (appendix 1). But based on numerous studies, the main causes of SCD can be divided into cardiovascular causes and non-cardiovascular causes[2]. The majority of the cardiovascular causes are congenital heart problems and includes hypertrophic cardiomyopathy (26.4%), coronary-artery anomalies (13.7%), and left ventricular hypertrophy of indeterminate causation (7.5%) as the main contributors to SCD. The non-cardiovascular causes include all the causes and factors that occur in athletes without underlying cardiac disease. The main contributor in this category is commotio cordis (19.9%). To further understand how we can prevent SCD, let us look at the main causes of SCD in turn and briefly mention how they can be detected.

Hypertrophic Cardiomyopathy (HCM), the main cause of SCD, is thought to occur in 1 out of every 500 people in the general population[1,2]. HCM is a genetic condition that is passed in an autosomal dominant fashion with variable expression, meaning that if we examined everyone with the gene defect, each would be affected by that gene defect to a different degree. To diagnose HCM, there must be left ventricular hypertrophy without dilation and no other condition present to explain the left ventricular hypertrophy. While a small number of people with HCM die from obstruction of the aorta secondary to hypertrophy of the adjacent ventricular muscle, most go into cardiac arrest secondary to arrhythmias due to myocardial ischemia and/or histological myocardial disorganization and/or myocardial scar formation. The gold standard for diagnosing HCM is echocardiography to directly measure the degree of left ventricular hypertrophy. However, EKG has been reported to be between 75 and 95% sensitive for detecting HCM[1,2].

Coronary-Artery Anomalies, the second most common cardiovascular cause of SCD, is a congenital abnormality in the myocardial vasculature[1,2]. The most common anomaly is

when the left main coronary arises from the right sinus of Valsalva. This leads to myocardial hypoperfusion during exercise. Unfortunately, this condition is rarely diagnosed during a person's life unless their physician is specifically looking for the anomaly. Electrocardiogram can detect coronary artery anomalies but the findings are general non-specific and would not be note-worthy in a routine screening electrocardiogram. Echocardiography can be useful but only if there is a high pre-test probability of the person having the condition. The gold standard for diagnosis is coronary angiography, although both magnetic resonance angiography (MRA) and computed tomography angiography (CTA) show promise as future, non-invasive detection modalities. If detected, coronary artery anomalies are often able to be repaired surgically.

Left Ventricular Hypertrophy of Indeterminate Causation (Idiopathic LVH) is a condition very similar to HCM except there is no clear genetic transmission of the defect and the heart muscle lacks the histological changes seen with HCM[1].

Commotio cordis is one of the non-cardiovascular causes of SCD[2]. This condition is due to blunt, non-penetrating trauma to the chest and is most common in younger teenagers with the average age of 13. This is thought to be secondary to the more compliant chest walls in this age group allowing more force to be transmitted to the myocardial tissue. Interestingly, the force needs to happen at a very specific and very narrow time-frame within the cardiac cycle, just before the peak of the T-wave, which only represents about 1% of the total cardiac cycle. Additionally, it would seem intuitive that the harder the force, the more likely that commotio cordis would happen but that is not the case. It seems that there are certain speeds objects need to be traveling to trigger this tragedy. In any case, there does not appear to be any screening technique to determine who is most susceptible to commotio cordis. Instead, we need to rely on better protective equipment and having life-saving measures onsite to prevent death from commotio cordis. Despite out best efforts, it is believed that the mortality from commotio cordis is near 85%.

So now that we have discussed what SCD is, why it is a problem, and what the major causes are, we must question what the obstacles are to preventing SCD in high-school athletes. The problem in SCD, as the definition would imply, is that is it sudden and unexpected and so the answer to our question lies in how student athletes are screened and cleared to participate in high-school level competitive athletics. Based on the 1996 American Heart Association expert consensus panel recommendations regarding pre-participation screening for competitive athletes, most schools in the United States require a pre-participation personal and family history and physical exam[3]. While this was a huge improvement to the previous standard since the AHA panel made recommendation for national exam standards, although only 60% of states are adequately meeting these guidelines, it did not and still does not adequately address the detection of SCD risk largely because most of the causes of SCD listed above and in Appendix 1 are not detected on routine history and physical exam[2]. Symptoms that could provide clues into the underlying problem are often absent or not brought to the attention of a medical care provider. Family history that often makes clinicians worry about the presence of an underlying heart anomaly, like unexplained or known cardiac death in a family member at a young age, is not always elicited or known. The classical physical exam findings like a harsh systolic ejection murmur that increases in intensity with maneuvers that decrease venous return (i.e. Valsalva Maneuver) as described with hypertrophic cardiomyopathy are not consistently present[1,2]. In fact, one retrospective study showed that of all the athletes who have died from SCD and had pre-participation history and physical exams, only 3% had been suspected of having an underlying cardiovascular abnormality[2]. Even more shocking, none of this small percentage of people who screened positive for a possible underlying heart condition was actually disqualified from playing competitive sports. Clearly, what is currently the national standard is insufficient to protect young competitive athletes from often fatal heart conditions.

What do we know about SCD and how can this help us risk-stratify?

Baseline characteristics:

First, males are affected by SCD much more frequently than females, with a ratio of about a 5:1 – 9:1[1,2,5]. This is thought to be secondary to men having a higher incidence of

hypertrophic cardiomyopathy and a higher percentage of men compared to women participating in competitive sports. Second, African Americans account for more than 40% of all of the cases of SCD although they only constitute about 12% of the overall population[1]. This is thought to be secondary to the participation of African Americans in certain competitive sports. Third, certain sports have a much higher incidence of SCD. In the United States, football and basketball are sports most associated with SCD while in Europe, soccer is the predominant sport associated with SCD[1,2].

History and Physical Exam:

A personal history of physical symptoms including chest pain, exertional dyspnea, lightheadedness, or syncope, especially during or just after exercise, are good markers of a possible underlying heart abnormality[1]. Additionally, a family history of congenital heart disease, syncope, cardiomyopathy, Marfan syndrome, long QT syndrome, Brugada syndrome, severe arrhythmias, or unexpected death at an early age may be indicators of familial forms of heart anomalies[1,5]. Anything on physical exam that could point towards a structural heart defect, like heart murmurs or abnormal heart sounds, and physical characteristics often seen with genetic syndromes (e.g. tall body habitus, long fingers, and hyperextensible joints with Marfan's Syndrome) should raise a red flag. If any of these things are elicited on history or physical exam, further diagnostic work-up is warranted to rule out a structural heart disease that could lead to SCD[1,2].

Of particular interest to me and my project, is a screening test currently available that can detect many of the causes of SCD listed in Appendix 1. In fact, if we identify all of the causes of SCD that can be reliably detected by this screening modality and add up their individual contributions in causing SCD, this screening method would be able to detect about 60% of all causes of SCD[5](see Appendix 2 and 3). This screening method is also good because it is non-invasive, relatively cheap, and readily available. And lastly, this screening technique has already been used in other countries so we have good data to suggest what impact it might have on preventing SCD in the United States. The screening tool I am referring to is electrocardiogram, or EKG.

EKG has been proposed as a screening method for SCD since the early 1980s but has always been left out of consensus recommendation due to cost concerns and the overall low-specificity of EKG. However, the sensitivity of EKG can be quite high and is often quoted as being over 95% sensitive for detecting hypertrophic cardiomyopathy, although in reality the sensitivity probably ranges from 75-95%. Interestingly, Italy has been using EKG to screen for causes of SCD for over 30 years as part of the Medical Protection of Athletic Activities Act[2,4]. This act makes history, physical exam, 12-lead EKG and submaximal exercise test mandatory for all athletes participating in organized athletics. This includes professional athletes all the way down to our equivalent of pee-wee football. Approximately 10% of the entire Italian population, or about 6 million people, are screened annually. Unfortunately, this still only represents about half of the total number of people that should be screened by law but logistical and cost issues have hindered making this Act the nation-wide standard. As an additional note, the most common cause of SCD in Italy, and specifically in the Veneto region of northeastern Italy, is arrythmogenic right ventricular cardiomyopathy, not hypertrophic cardiomyopathy[2]. It is unclear if this changes the generalizability of the results of the Italian data. Overall, analyzing the data from over 125,000 athletes participating in 9 different sports, 2.5% were disqualified from participation as a direct result of screening. Italy also further subdivids their athlete pool into a group of "Elite Athletes", who are those who because of their higher intensity training, level of competition, or level of achievement were analyzed separately from the general athlete data. Of these 22,000 athletes evaluated since 1963, 480 or 2.2% were disqualified based on screening criteria. Of those 480 disqualified, 3 or 0.6% subsequently died of SCD while participating in athletics despite being advised to no longer compete.

Since Italy's advances in preventative medicine, other countries in Europe have followed suit by implementing similar screening policies. Recently, the Study Group on Sports Cardiology of the Working Group on Cardiac Rehabilitation and Pericardial Diseases of the European Society of Cardiology looked at the Italian data and the limited data from America using only history and physical exam for pre-participation screening and analyzed the effectiveness of both methods for detecting known causes of SCD[5]. This

analysis showed that the Italian method has 77% greater power for detecting hypertrophic cardiomyopathy. It was also estimated that the Italian method is three-times more cost effective than the American method in identifying and preventing death of athletes from hypertrophic cardiomyopathy. Thus while most experts quote cost as the major limitation to implementing a pre-participation screening method that includes EKG, this has been shown not to be the case. This was confirmed in a different study done in the United States which looked specifically at cost effectiveness[6]. In this study, the authors compared history and physical exam, EKG, and echocardiography as screening modalities to detect and prevent SCD in high school athletes. The following table includes the results of the cost-effectiveness analysis[6]:

TABLE 2. Cost parameters of the three recommended cardiovascular preparticipation methods among 700,000 high school athletes screened annually.

Parameters	AHA-Specific CV History and Physical	12-Lead ECG	2D Echo
Sensitivity	6%	70%	80%
Specificity	97.8%	84.3%	100%
Cost to screen 700,000 HSA annually	$0	$7 million	$245 million
Cost to evaluate abnormal responses annually	$7.7 million	$40.2 million	$0 dollars
Total cost to screen 700,000 HSA annually	$7.7 million	$47.2 million	$245 million
Total amount of life gained from 700,000 HSA screened annually	92 yr	1080 yr	1232 yr
Cost per year of life saved	$84,000	$44,000	$200,000

Overall, this study showed that EKG screening is actually the most cost-effective modality because it has a relatively low-cost per athlete, which helps to offset the low specificity, and has a high sensitivity to justify the cost in terms of cost per life year saved.

In the United States, studies have been done to look at the effectiveness of using EKG as a screening technique in high school athletes. In the study, “Prospective screening of

5,615 high school athletes for risk of sudden cardiac death" from 1997, researchers looked at 5615 high school athletes, both male and female, in northern Nevada over a 3-year time frame[7]. Each athlete had a cardiac history, cardiovascular exam, blood pressure measurement, and EKG as part of the screening test. If any of the screening modalities were abnormal, an echocardiogram was performed. Of the athletes screening 90% had no abnormalities found and of the 10% who did have an abnormal screen, 2% were detected by history, 3.2% by physical exam, 0.3% by blood pressure measurement, and 2.5% by EKG. Also of the 10% of students with an abnormal screen who then went on to have an echocardiogram, this test was normal in all but 43 people (0.7%). Overall, this screening protocol approved the participation of 99.6% of the athletes. The study concluded that EKG is 60-70% sensitive in detecting the common causes of SCD and has a specificity of 97.4% (only 2.6% false-positive rate).

So what has already been done in the United States and around the world to make EKG a part of the routine pre-participation screening for student-athletes? Up to this point, besides a few studies and the start of EKG screening in a few small regions of the country, most of the United States is relying on the 1996 recommendations from the American Heart Association regarding sports screening[3]. However, the Teague Ryan Sudden Child Cardiac Arrhythmia Syndromes Screening and Education Act of 2005 (H.R. 1252), which is currently being debated in Congress, would provide funding for organizations to screen children and provide education about various arrhythmia syndromes[8]. If the bill is passed, $20 million would be given out in the 2006 fiscal year with the possibility to give out similar amounts every year until 2010. This bill may be a huge step in the right direction but it may be important to think about logical and cost-effective ways to use the money before it is dispersed.

This idea of critically analyzing all the data known and trying to devise a better strategy for pre-participation screening has been recently done in the form of the 36th Bethesda Conference, held in November 2004 and published in the Journal of the American College of Cardiology in 2005[9]. In this publication, it was noted that history and physical exam alone are relatively ineffective screening tools for the causes of SCD. However, it

is again noted that the large number of competitive athletes in the United States, about 10-12 million, along with cost constraints are probably the largest obstacles of implementing a nation-wide pre-participation program that included anything more than a history and physical examination. Instead, the conference stated that more government regulation and thus a more standardized history and physical exam would probably be the optimal choice for screening in the United States. One of the largest problems with EKG cited in the paper is that the false-positive rate is too high and thus would inconvenience too many athletes and parents. Additionally, as noted in many articles, the physiologic (i.e. non-pathologic) changes that can occur in an athlete's heart make both echocardiography and EKG imperfect screening techniques. Despite these recommendations, the conference did not close the door on the possibility of using other modalities like EKG or echocardiography for pre-participation screenings.

In addition to studies, consensus statements, and legislation, numerous support groups have been established. In the United Kingdom there is a group called "Cardiac Risk in the Young (CRY) whose sole purpose since its founding in 1995 is to raise awareness of sudden cardiac death, offer support to those affected by sudden cardiac death, and promote screening and medical research into sudden cardiac death[10]. In the United States, there is a similar group called the Sudden Arrhythmia Death Syndrome (SADS) Foundation[11]. This organization originated in Utah with Dr Michael Vincent who had been studying long QT syndrome, one of the rarer but more fatal causes of SCD. This organization provides many of the same services as CRY and both are great places to send families for more information about SCD.

Based on the above research, I believe that in the very near future, the pre-participation screening policies for competitive athletes in the United States will change. This will be a direct result of 1) gaining more knowledge about sudden cardiac death and its many causes, 2) a greater emphasis by athletes and their parents to participate in a safe environment, 3) increasing awareness that the current screening methods in the United States are not good enough, 4) increasing pressure on lawmakers to protect the young,

"invincible" athletes in our society, and 5) intense legal debate regarding physician and sports organization accountability for the safety of the athletes.

BACKGROUND OF THE COMMUNITY BEING IMPACTED:

Jim Greathealth is a 16 year-old young man in Burgundy High School. Jim has been the picture of good health throughout his life. The worst illness he ever had was croup when he was a little kid and besides his yearly well-child check-ups, Jim never sees his pediatrician; he never needs to. Jim, and Jim's mother, both attribute Jim's physical well-being to eating lots of fruits and vegetables, taking daily vitamins, regular exercise, and keeping Jim's environment as toxin-free as possible. That means no smoking in the house and cooking with all natural foods. In school, Jim is a straight A/A- student. He excels in biology and the sciences and inspires to one day become a physician, like his father. Jim also participates in several varsity sports. He has played soccer and basketball since he was 5 and it was always a dream of his to play soccer at the collegiate level. In fact, several recruiters were at some of Jim's soccer games last season. With the new soccer season approaching and Jim wanting to be in the best shape to impress recruiters, Jim decides to begin his pre-season training regimen. So on an early Saturday morning in mid-July, Jim wakes up, has breakfast as usual, leaves the house, and hits the field for a warm-up soccer game with the rest of the varsity soccer team. Half way through the game, Jim begins to feel a little dizzy. He had felt this way before, for the last couple of seasons in fact, but always attributed the dizziness to being dehydrated so never told anyone about his symptoms. At the start of halftime, Jim walked off the field to get some water and talk strategy with the team when suddenly Jim collapsed. The coach and rest of the team rallied around Jim and found that he was not breathing and did not have a pulse. Immediately CPR was started and the Automatic External Defibrillator was hooked to Jim's body. After about 10 minutes and multiple shocks provided by the defibrillator, emergency medical services arrived. Jim was rushed to the hospital and sadly, was pronounced dead soon after arrival. The autopsy report showed a much enlarged left heart with some abnormal heart muscle in the left ventricle; diagnosis hypertrophic cardiomyopathy.

Although this story is completely fictional, stories like this occur about once a week in the United States and on November 28th, 1998, was what happened at Spencerport High School in Rochester, NY. The athletes name was Rob Stultz, a young man playing in a

scrimmage basketball game at the Spencerport High School gym. After walking off the court at halftime, Rob collapsed. A victim of sudden cardiac death, Rob's death shocked the community and has affected the lives of all of those close to him and all those that remember his sudden death. In his honor, Spencerport school district hosts an annual memorial basketball game and hands out the Rob Stultz Memorial Award every year to the female and male athlete who best exemplifies the characteristics Rob did as a young man, a student, and an athlete.

Although it is estimated that only 25-50 of America's young, "healthy" athletes will die each year from sudden cardiac death, Spencerport and the encompassing Monroe County have been directly affected by SCD. Furthermore, Monroe County is part of Section V, the 5th section of the New York State Public High School Athletic Association (NYSPHSAA), one of the larger sections in New York State. Spencerport alone has over 1000 student-athletes from grades 7-12 on the fields each year. That means, based on the estimated national yearly incidence of SCD, 1 teenager will die every 100 years in Spencerport. Of note, every single athlete who plans on competing in a sport at Spencerport is required to have a yearly sports appraisal (see appendix 4)[12]. The same is true throughout Monroe County and Section V. None of these health appraisals requires or offers an EKG as part of the yearly screening. Additionally, I learned from talking to the Athletic Director of Spencerport Central Schools that most athletes, in fact the vast majority, have their physical exam forms (see appendix 5) filled in by their individual physicians and so the process is not standardized, as recommended by the American Heart Association, and furthermore, there is not quality assurance[13]. In fact, there is no way to assure that the physicians filling out the forms know what to look for in terms of signs and symptoms of SCD or would be compelled to work-up any abnormal findings on their examinations. This presents a barrier to the adequate screening for causes of SCD and also will act as an obstacle to implementing an EKG screening program at the local level.

PROJECT DESCRIPTION:

The ultimate goal of this project is to change athletic pre-participation policy in Monroe County. More specifically, this would involve adding electrocardiogram to the already in place annual history and physical exam that every athlete must pass to participate in high school level competitive athletics. The basic premise, as outlined above, is that the current screening technique (history and physical exam) is an ineffective primary preventative strategy to detect the causes of SCD and prevent its occurrence. Furthermore, electrocardiogram may be the next best option because it may be more cost-effective and more sensitive in detecting causes of SCD compared to history and physical exam. If we take what we have learned from the Italian experience of the last 30 years and some small studies in the United States, we may be able to save young athletes lives if EKG is made a part of the annual pre-participation evaluation at schools in Monroe County. I believe that although we have known about sudden cardiac death in young athletes for a long time, we as a nation have been slow to react because of limited data, various assumptions about cost as a limiting factor in implementing change, and discrepancies in what experts agree is the best screening strategy to detect the causes of SCD and more importantly, prevent SCD.

This is a very large goal since it involves change at the county level, which will then affect many school districts. So, this macro-project needs to be broken up into many micro-projects. The project presented here represents the first of these smaller projects. Thus the goal for this 4-week block is to gather information about sudden cardiac death and critically evaluate that information so educated decisions can be made about appropriate screening technique strategies. I will also begin to form partnerships in the community so this project can continue to grow in the future. Lastly, I will try to begin the educational piece of this project, informing the community at large of the problem and a possible solution. Because of the large scope of this project, I will try to focus on Spencerport High School, one specific community in Monroe County who was directly affected by SCD. Because this town has an emotional connection to the effect of SCD and may be able to envision the impact of a preventative screening program, they make a

good “model” community. Also, because they are one of the largest school districts in the county, a change in their policy may influence the surrounding school districts, which may lead to an overall policy change at the level of the county.

METHODS:

To summarize the individual goals for this part of the project with respect to the overall themes of the project and briefly touch on the methods I plan to use to actualize these goals:

1. **Research**
    a. Perform an extensive literature search to answer these questions:
        i. What do we know about sudden cardiac death and its prevention?
        ii. What are the national standards in the United States regarding competitive sports health screening?
        iii. Has any legislation been enacted to make EKGs a routine part of the competitive sports health screening?
        iv. What has been the data and trends seen in Italy after instituting their EKG screening programs?
        v. Have any studies been done in the United States to evaluate the usefulness of EKG in preventing SCD?
    b. Meet with a pediatric cardiologist to determine
        i. How the local cardiology community feels about using EKG to screen for causes of SCD
        ii. What he/she believes are the major obstacles and short-comings of such a program
        iii. What he/she believes is the best way to work up an abnormal EKG should an EKG based screening program be initiated
    c. Meet with the athletic director at Spencerport High School to
        i. Obtain specific information to help determine how an EKG screening program would impact a specific community , both in terms of cost and benefit
        ii. Use this information to perform a simplistic cost-benefit analysis for Spencerport High School

d. Meet with the family of Rob Stultz, a young athlete at Spencerport High School who died from SCD, and learn more about what happened before and after Mr. Stultz's death.

2. Education

a. Create an educational brochure to give to parents of student-athletes with information about SCD and what we know about its prevention
b. Distribute this educational brochure at the Rob Stultz Memorial Basketball Game, held in memory of Rob Stultz,
c. Create a PowerPoint presentation that can be used to teach parents, student-athletes, and other people in the community about SCD
d. Hold a health conference for students, parents, coaches, and other members of the community in Spencerport School District to teach about SCD and its prevention

3. Policy Change

a. By starting the education process, I hope that this will alter individual athletes' and parents' own ideas about what the policy for pre-participation screening should be.
b. Based on all that I have learned from my research, I will outline a rudimentary proposal for adding EKG to the current screening protocol at Spencerport High School. Hopefully, this can be critical appraised as the project continues and more information is gained in the future.

PARTNERSHIPS:(see appendix 4)

Peter Harris, M.D.

Dr Harris is one of the pediatric cardiologists at Golisano Children's Hospital Heart Center. Not only did Dr Harris provide lots of useful information and resources for my project, but as a pediatric cardiologist, Dr Harris was able to provide unique insight into what the local cardiology community feels about sudden cardiac death and its prevention. Dr Harris was also able to elucidate what the obstacles and short-comings of an EKG screening program might be (see below) and this knowledge will help design a feasible and effective EKG screening program in the future.

John Pelin

Mr. Pelin is the Athletic Director of Spencerport Central Schools in New York State. I met with Mr. Pelin for two reasons. First, being an athletic director he has knowledge about the annual health appraisal requirements and has great insight into what barriers might exist that would prevent a more comprehensive screening program, which would include an EKG, from becoming a standard of care in a local community. Second, because Mr. Pelin was the athletic director when Rob Stultz died, was present for the aftermath, and still keeps in touch with the Stultz family, Mr. Pelin has intimate knowledge of a tragic situation. Lastly, because of his position, Mr. Pelin will have great influence in the community but also the local school board and may be able to sway voting if that was required to make EKG a part of the annual pre-participation screenings. Mr. Pelin has agreed to continue to be a contact person at Spencerport High School if this project continues.

Stultz family

My original idea was to get the Stultz family involved because of their emotional connection to my project. I presumed they would be great advocates for any preventative measure that could be taken to assure no more athletes and their families would have to suffer what they have. Unfortunately, after speaking with Mr. Pelin, the Stultz family has recently started to withdraw slightly from forefront of this issue. That is, they no longer

wish to present the annual award in their son's memory and are not sure they will be attending his annual memorial basketball game. It has been 7 years since Rob's death and as Mr. Pelin stated, there is a point when you move on as the memories are too painful. So I was unable (and unwilling) to contact the Stultz family at this time. Maybe the tincture of time will help heal their wounds and in the future, they may be more receptive to speaking about and advocating for a measure to prevent sudden cardiac death.

RESULTS:

Research:

The research I have done was both enlightening and disheartening. Although on one hand there would seem to be enough data to suggest that EKG may help prevent SCD, there is as much if not more data that makes implementing an EKG screening program seem impossible. All the research I have done is included in the "Background of the Problem" and "Background of the Community being Impacted" sections above. Additionally, I will outline all the barriers to implementing an EKG screening program that were located and/or verbalized in my research and will present these in the "Policy Change" section just below.

Education:

The two main pieces of educational material I produced are the brochure for parents of high school athletes and the PowerPoint presentation (Appendix 6 and 7). The brochure can be handed out to parents and student athletes. I believe a good way to distribute this would be to have the brochure at pediatricians offices, have the brochure available at high school athletic events for parents who come to watch their kids, and also hand the brochure out at parent-teacher association (PTA) meetings. My original plan was to hand out this brochure at the Rob Stultz Memorial Basketball Game that is going to be held on November 27th. I will hopefully still be able to do this although my project time will be completed and I will not be able to include this in the current discussion of this project.

The PowerPoint presentation was originally designed to be presented to a group of parents, student athletes, coaches, and other community members in Spencerport. Unfortunately, I was unable to organize and carry out this plan due to time constraints but I think this is still a great next step in this project and the PowerPoint presentation is available if another student continues this project (appendix 7).

The last educational aspect of this project that I accomplished was that in meeting with John Pelin, I tried to teach him about all the latest research on sudden cardiac death and

also describe to him a lot of the statistics and data from studies regarding EKG and its use in preventing SCD. Although this was only one person, I think he learned some things from our interaction and has agreed to be a community contact for this project in the future.

Policy Change:

From my research, I have come across various obstacles that stand in the way of implementing an EKG screening program for high school athletes. Here I will list each of these barriers and try to provide some explanation of each obstacle. In the discussion section of this paper, I will try to outline a proposal for a screening program using EKG and will hopefully take some of these issues into consideration.

1. **Cost**

   This is a pervasive theme in all discussion of pre-participation screening of athletes. The cost issues for EKG specifically include the upfront cost to obtain EKG machines, the cost of operating the machines, the cost to have the EKGs read, and the cost to maintain the EKG machines. Using data from cost-effectiveness studies, the estimated cost of performing an EKG on every athlete is $10 per athlete [6,7]. This seems like a reasonable cost until you look at an individual community like Spencerport. If Spencerport screens 1000 athletes a year, they would spend $10,000 each year on EKG screening (does not include the work-up for abnormal EKGs). But if Spencerport only has about one case of SCD every 100 years, they would spend $1,000,000 on EKG screening for the potential to detect and prevent one case of SCD. And in actuality, that cost is likely higher because EKG is not 100% sensitive for the causes of SCD. Thus, it will be hard to convince a school district that it is worth spending $1 million to *maybe* save someone's life. Also, this is just one school district. Imagine the cost if this was a nation-wide program.

2. **What happens if there is an abnormal EKG**

   There are two issues directly relating to this topic. One is cost and the second is procedure. Cost is an issue because like stated above, EKG is not a perfect screening technique. There is a fairly high rate of false positive (2.6% [7]). In the context of

Spencerport High School, this means that about 27 athletes will have to have additionally tests each year to clear them before they can participate in sports. The cost for this additional work-up is estimated at to be $365 per athlete [6]. This is a relatively high cost and also raises the question of who will pay. Is it the schools responsibility or would the parents have to pay out-of-pocket? Or would insurance companies cover the cost since the additional testing is a reaction to an abnormal screening test? (while that probably makes the most sense it is probably the least likely to occur).

The second issue is procedural. If an athlete has an abnormal screening technique, what is the exact next set of steps that will occur to either withhold the athlete from competition or further work-up the abnormal test? It is very important to have an exact plan laid out so that it is standardized and measurable. This is the only way to make the screening program fair and able to be evaluated in the future.

3. Optional versus mandatory

To touch briefly on this topic, policy makers will have to decide if the screening program will be required of all athletes (like in Italy) or made optional so that students and their parents can decide if they would like the extra testing. This is probably more of an issue now because there is no consensus statement or existing policy that would make a mandated screening program seem just, both legally and ethically. Schools will find it hard to institute a mandatory program that is not state or county regulated without the risk of lawsuit. On the other hand, if the program is optional, will anyone elect to have a test which has flaws (see discussion on sensitivity and specificity) and will likely cost them more money if it is abnormal? Speaking personally, I would have a hard time convincing myself that EKG is a worthwhile test seeing that if it is falsely abnormal it might keep me from competing and it may cost me $365. However, others may say that all these costs are worth the added piece of mind. In summary, making EKG screening mandatory or optional needs to be critically evaluated as this project continues.

4. **Logistical issues with the health appraisals themselves**

   In speaking with Mr. Pelin, he informed me that most athletes do not have their sports health appraisals done at the school anymore. Most have the physical exam forms filled out by their family physicians or pediatricians. This makes the logistics of instituting an EKG program troublesome. First, because students are not all having their health appraisals done at one location on one day, the cost of implementing an EKG screening program that I described earlier may not be applicable because in the study where those figures were generated, a health screening day was utilized to get all the athletes in one place at one time. The schools would have to find another way to make EKG machines available. Second, family physicians may need to bear some of the load of educating parents about the need to have an EKG as part of their annual physical exam. This would require the physicians to be "on-board" with the plan and this may be difficult because there is no medical consensus stating that EKG is useful for preventing SCD.

5. **Epidemiology as a barrier**

   Sudden cardiac death is rare. Despite all the statistics mentioned at the beginning of this paper, the people who make/change policy will see that since only 1 in 100,000 to 200,000 high school athletes die of SCD each year, sudden cardiac death is rare and not worth the effort and cost. This is why the push to implement EKG as a screening test may need to start locally and spread bottom-up.

6. **It is more about who dies, not how many**

   What may be the answer to that last point is that it may not be how many people die of SCD that is crucial, but who dies of SCD. I will use the recent implementation of automatic external defibrillators (AEDs) as an example of this. As I was told by Mr. Pelin, a few years ago a high school athlete died after being struck by a lacrosse ball in the chest. The cause of death was found to be commotio cordis, and it was determined that the student's life may have been saved if an AED was present and used immediately. This student would have likely become another statistic if he wasn't the son of a congressman. Interestingly, AEDs are now required by New York

State to be present at any organized school event and the school is responsible, again by law, to train its faculty on how to use the AEDs. The point is this. Maybe it will take the death of a millionaire's daughter or a senator's son to bring sudden cardiac death to the legislative forefront. History has taught us that some lives are more valuable than others.

These are the major obstacles to implementing an EKG screening program that I have come across. I am sure there are many more and it is only through continued research that they will be illuminated and addressed.

COMMUNITY REACTION AND FEEDBACK:

When I first brought this idea to Dr Peter Harris, he was happy to help but knew that there would be a great deal of challenges standing in the way of my project goal. Some of the points that he made were that first, although many people cite that EKG is ~95% sensitive in detecting hypertrophic cardiomyopathy, this is probably a flawed assumption because of referral bias. The research centers that produced this figure were, by the nature of their specific studies, probably over-estimating the sensitivity of EKG because when they found someone to have a hypertrophic cardiomyopathy by EKG, family of that person came in to be screened. Because hypertrophic cardiomyopathy is a heritable condition, more people with the condition were being screened with EKG than would actually occur in the general population. This likely inflated the sensitivity data for EKG. Second, while the Italian data is often used as proof that EKG is an effective screening technique to detect the causes of SCD, because the predominant cause of SCD in Italy (arrythmogenic right ventricular cardiomyopathy) is not the same as it is in the United States (hypertrophic cardiomyopathy), it is not at all clear if the data from Italy is generalizable to the United States population and what we would see for results if EKG was used as a screening technique. Dr Harris also had many logistical questions, like who would cover the cost of performing and reading the EKGs, what would be the exact follow-up protocol if an athlete was found to have an abnormal EKG, and who would cover the cost of this follow-up protocol, as discussed above. Despite the challenges he noted, Dr Harris seemed very willing to help as this project, and our country's policy on pre-participation screening, begins to unfold.

Mr. Pelin thought that the idea of having better prevention of SCD was a great one. However, he had many concerns about such a program. Specifically, there were logistical, financial/budgetary, and legal obstacles, implications, and ramifications that he felt would need to be addressed before any individual school would buy in to the idea of starting an EKG screening program without it being mandated by the county or state. These issue are clarified above in the results section of the paper and will hopefully be taken into account both when I make a proposal for implementing an EKG screening

program below in the conclusion section of the paper and also in the future as physicians and lawmakers struggle to find a way to prevent sudden cardiac death in young athletes.

SUSTAINABILITY:

As previously stated, the project presented in this paper is merely the first step in a much larger project to make EKG screening for the detection of the causes of SCD a reality in Monroe County. I think that there is much left to be done. There are things that I wasn't able to do with my portion of the project and there are things that will take this project to the next level. My suggestions for future projects/steps are (again, broken into major themes):

Research:

1. Hold a focus group with parents of student-athletes to get an idea of how concerned they are about sudden cardiac death and to determine their ideas and willingness to address the issue of adding EKG to the pre-participation screening program already in place. Also, it may be possible to learn whether the parents feel that an EKG screening program should be mandatory or optional.
2. Hold a focus group with student-athletes to hear how worried they are about sudden cardiac death and if they would be willing to have an EKG performed on them
3. Research how schools would pay to implement EKG screening program. This would probably include talking to school boards to see if they would be willing to increase the budget already in place for the yearly pre-participation health appraisals. Also, insurance companies should be contacted to see if they would cover follow-up tests for athletes with abnormal EKGs.

Education:

4. Hold a meeting with the parents, student-athletes, and coaches in Spencerport. I would use the PowerPoint presentation I created to teach them about sudden cardiac death and what we know about its prevention
5. Form a strong coalition with the Stultz family. They may be willing to speak at various meetings and put a face on sudden cardiac death. If they were to speak at meetings where policy was being discussed, they may be able to provide the

emotional connection to the policy makers who are also parents of student-athletes

6. Continue to distribute educational materials like the brochure I designed as part of my project at various sporting events, PTA meetings, school board meetings, etc.
7. Try to get a health article about sudden cardiac death into the local newspaper

Policy Change:

8. Hold a meeting with a local school boards (i.e. Spencerport Central School District) to try to lobby for them to change their health screening policy to include EKG
9. Lobby at other school districts in Monroe County
10. Lobby at the level of the county with letters, parent petitions, meetings, etc.

DISCUSSION:

Final analysis of this project

Based on my research, the discussions I had with Dr Harris, my conversation with Dr Pelin, and taking into account the many obstacles and short-comings of implementing an EKG screening program as part of the annual pre-participation screening program already in place, I believe EKG screening for the detection of the causes of sudden cardiac death in young athletes can be achieved. I think there is an obvious "need" present to warrant such a program and I believe EKG screening will have the potential to save the lives of many of our teenage athletes. Furthermore, the data, although limited, supports these claims and has proven EKG to be a cost-effective strategy to detect the causes if SCD. In that spirit, I will present my proposal for implementing an EKG screening program. There are flaws with is proposal and many of the cost issues need to be resolved, but it is a start.

Proposal for the implementation of an EKG screening program

As part of the annual pre-participation health appraisal required of student-athletes wanting to participate in high-school level athletics, all students will be given the option of having an EKG done on a specific date set by the school sometime before the first day of practice for each season. Prior to the day of the EKGs, the school will mail to each athlete and his/her parents a letter stating that they have the option to have an EKG done as part of their annual examination. This letter will explain that while the EKG is optional, it is an important part of the annual examination and may prevent death from certain causes of sudden cardiac death. Also, the letter must state that if an EKG is read as abnormal, the student-athlete may require further testing before he/she is allowed to participate in any competitive sports through the high school. Some of these tests can be costly, so it is up to the parents to determine if this cost will be covered by their insurance companies or if they will have to pay out of pocket. This letter will have to be signed and brought to the EKG screening day in order for the student to have an EKG. All EKGs will be sent to Strong Memorial Hospital where they will be read by the pediatric cardiologists. The cost for both having the EKG and having the EKG read will be paid

for by the school under their budget for the annual health appraisals. Both the parents and the school will be notified if the EKG is abnormal so that the athlete can be withheld from participating in any competitive athletics until they are further cleared. Given the number of abnormal EKGs that can be expected based on the maximal number of students who will have an EKG done each year (1000, assuming 100% participation in the screening program) and the estimated sensitivity and specificity of EKG for detecting causes of SCD, it is hopeful that all follow-up examinations/testing can be done in a timely manner so that no student needs to be unduly withheld from participating in sporting events. However, this can not be guaranteed so parents and student-athletes need to be informed of this possibility before having an EKG. To reiterate, this program is optional and is meant to serve as a preventative tool to screen for the causes of sudden cardiac death. However, if a student elects to have the EKG done, he/she may not withdraw from the screening program based on the results of the screen. For example, if the results of the EKG are abnormal, this athlete must be removed/withheld from participating in all sports until medically cleared without exception.

This program will need to be evaluated to see how many athletes are opting to have the screening done and what the cost is to the school district, insurance companies, and parents (out of pocket expenses). It will also need to be evaluated for how many athletes are unduly withheld from competing in athletics because of falsely positive EKGs. That is, we need to balance the good health consequences of exercise and participating in athletics with the negative consequences of having an undiagnosed underlying heart condition that could lead to sudden cardiac death.

CHIC learning objectives addressed in project

I think the some learning objectives that were addressed in this project include:

1. Identifying a problem in the community
2. Using research tools to evaluate the problem and what can be done to rectify it
3. Developing educational materials that address the problem
4. Proposing policy change
5. Identifying areas and ways this project can be improved upon and sustained
6. Making community partnerships to build a base for sustainability
7. Using some qualitative means, like interviewing, to better understand the problem and possible solutions.

Impact project had or will have on the community

I think that while my individual project may not have largely impacted the community, I think the overall project that I have outlined and started here, can have a great impact. I think that increasing the overall knowledge about sudden cardiac death in high school athletes is one large step and I think empowering people to make decisions to prevent sudden cardiac death is another large step that I can see directly resulting from this project. Also, if my intended project does come to fruition, lives may be saved.

While I was not able to contact the Stultz family, I think they may feel a great sense of relief and accomplishment if this project succeeds. They may feel that their son's death was not meaningless and if they become involved with the advocacy part of this project, they may feel like they are honoring their son's memory.

Impact the community and/or project had on me

After completing this project, I have a better sense of what a huge effort it is to plan and execute an idea to change policy. I originally thought that in four weeks, I would be able to convince one high school to start using EKG as part of their annual pre-participation health appraisals but I found that I was miles away from that objective. The research and development of a proposal for such a policy change is a huge undertaking and requires time and considerable effort. As I begin my career in pediatrics with aspirations to

continue to advocate for children, I will remember what I learned by doing this project. Specifically, I learned about the *process* of advocacy and I think this knowledge is probably more useful that having actually met all my original objectives.

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Appendix 1:
Causes of Sudden Cardiac Death [2]

Table 1. Causes of Sudden Death in 387 Young Athletes.*

Cause	No. of Athletes	Percent
Hypertrophic cardiomyopathy	102	26.4
Commotio cordis	77	19.9
Coronary-artery anomalies	53	13.7
Left ventricular hypertrophy of indeterminate causation†	29	7.5
Myocarditis	20	5.2
Ruptured aortic aneurysm (Marfan's syndrome)	12	3.1
Arrhythmogenic right ventricular cardiomyopathy	11	2.8
Tunneled (bridged) coronary artery‡	11	2.8
Aortic-valve stenosis	10	2.6
Atherosclerotic coronary artery disease	10	2.6
Dilated cardiomyopathy	9	2.3
Myxomatous mitral-valve degeneration	9	2.3
Asthma (or other pulmonary condition)	8	2.1
Heat stroke	6	1.6
Drug abuse	4	1.0
Other cardiovascular cause	4	1.0
Long-QT syndrome§	3	0.8
Cardiac sarcoidosis	3	0.8
Trauma involving structural cardiac injury	3	0.8
Ruptured cerebral artery	3	0.8

* Data are from the registry of the Minneapolis Heart Institute Foundation.[6,28]
† Findings at autopsy were suggestive of hypertrophic cardiomyopathy but were insufficient to be diagnostic.
‡ Tunneled coronary artery was deemed the cause in the absence of any other cardiac abnormality.
§ The long-QT syndrome was documented on clinical evaluation.

Appendix 2:

Causes of Sudden Cardiac Death detectable by EKG and echocardiography [1,5,7]

EKG (Adapted from Corrado et al., 2005)

- Hypertrophic Cardiomyopathy
- Arrythmogenic Right Ventricular Cardiomyopathy
- Dilated Cardiomyopathy
- Long QT syndrome
- Brugada Syndrome
- Lenegre Syndrome
- Short QT syndrome
- Wolf-Parkinson-White (WPW)
- Coronary Artery Disease

Echocardiography (2-dimensional)[7]

- Hypertrophic cardiomyopathy
- Congenital aortic stenosis
- Dilatation of descending aorta in Marfan's syndrome
- Dilated cardiomyopathy

Appendix 3: EKG features useful for detecting some of the major causes of Sudden Cardiac Death [5]

Table 4 ECG Features of cardiac diseases detectable at pre-participation screening in young competitive athletes

Disease	QTc interval	P wave	PR interval	QRS complex	ST interval	T wave	Arrhythmias
HCM	Normal	(left atrial enlargement)	Normal	Increased voltages in mid- left precordial leads; abnormal Q waves in inferior and/or lateral leads; (LAD, LBBB); (delta wave)	Down-sloping (up-sloping)	Inverted in mid- left precordial leads; (giant and negative in the apical variant)	(Atrial fibrillation); (PVB); (VT)
Arrhythmogenic right ventricular cardiomyopathy/dysplasia	Normal	Normal	Normal	Prolonged >110 ms in right precordial leads; epsilon wave in right precordial leads; reduced voltages ≤0.5 mV in frontal leads; (RBBB)	(Up-sloping in right precordial leads)	Inverted in right precordial leads	PVB with a LBBB pattern; (VT with a LBBB pattern)
Dilated cardiomyopathy	Normal	(Left atrial enlargement)	(Prolonged≥ 0.21 s)	LBBB	Down-sloping (up-sloping)	Inverted in inferior and/or lateral leads	PVB; (VT)
Long QT syndrome	Prolonged >440 ms in males >460 ms in females	Normal	Normal	Normal	Normal	Bifid or biphasic in all leads	(PVB); (torsade de pointes)
Brugada syndrome	Normal		Prolonged ≥ 0.21 s	S1S2S3 pattern; (RBBB/LAD)	Up-sloping coved-type in right precordial leads	Inverted in right precordial leads	(Polymorphic VT); (atrial fibrillation) (sinus bradycardia)
Lenègre disease	Normal	Normal	Prolonged ≥ 0.21 s	RBBB; RBBB/LAD; LBBB	Normal	Secondary changes	(2nd or 3rd degree AV block)
Short QT syndrome	Shortened <300 ms	Normal	Normal	Normal	Normal	Normal	Atrial fibrillation (polymorphic VT);
Pre-excitation syndrome (WPW)	Normal	Normal	Shortened <0.12 s	Delta wave	Secondary changes	Secondary changes	Supraventricular tachycardia; (atrial fibrillation)
Coronary artery diseasesa	(Prolonged)	Normal	Normal	(Abnormal Q waves)b	(Down- or up-sloping)	Inverted in ≥2 leads	PVB; (VT);

Less common or uncommon ECG findings are reported in brackets.
QTc: QT interval corrected for heart rate by Bazett's formula. LBBB: left bundle branch block. RBBB: right bundle branch block. LAD: left axis deviation of –30° or more. PVB: either single or coupled premature ventricular beats. VT: either non-sustained or sustained ventricular tachycardia.
aCoronary artery diseases: either premature coronary atherosclerosis or congenital coronary anomalies.
bAbnormal Q waves (see Table 3).

Appendix 4:
Spencerport Central School District Sports Physical Policy[12]

Physicals/Sports Recertifications
Sports Physicals

School Physicals

All new students and students in Kindergarten and grades 1, 3, 7 and 10 are required by New York State Law to have a physical examination. In addition, students participating in sports, being reviewed by the Committee on Special Education , or seeking eligibility for a work permit must have a current physical examination on record in the health office. Exams are considered valid for twelve months and good through the last day of the month in which the exam was conducted.

Every student deserves a private physician who can provide continuity of care, and most physicians recommend that you schedule exams around your child's birthday. In the event that a physical with a private physician cannot be arranged, the District will ensure that the child receives a physical. If you wish to have the district conduct your child's physical, please complete the *Health Appraisal Informed Consent* form below.

Sports Physicals

Children participating in sports programs must have a current physical on record in the health office. Exams are considered valid for twelve months, good through the last day of the month in which the exam was conducted, and are good through an entire season, even if the exam runs out during that season.

Sports Recertifications

All school athletes are required to have a sports recertification prior to the beginning of each sports season. The recertification consists of an interim health history and parent permission for participation in the sport. A student may not participate in any practice or game without first receiving this recertification from one of the school nurses.

Appendix 5:

Spencerport Central School District Health Appraisal Form[12]

Grade: _____ School: _____

HEALTH APPRAISAL FORM

NYSED requires an annual physical exam for new entrants, students in Grades K,1,3,7 & 10, sports, working permits and triennially for the Committee on Special Education (CSE).

Name: _____ **Date of Birth:** _____

Address: _____ **Phone:** _____

IMMUNIZATIONS/SCREENING

☐ Immunizations given since last Health Appraisal: ☐ None given today ☐ Immunization record attached

	1st	2nd	3rd	4th	5th
Diptheria	*	*	*		
Tetanus	*	*	*		
Polio (type)	*	*	*	*if IPV	
MMR	*	*			
Hep B	*	*	*		
Varicella	*	☐ Disease			

*-required for entry to school in NYS - requirements may vary by age and grade

SICKLE CELL SCREEN		Date:
Positive	Negative	
PPD		Date:
Positive	Negative	
LEAD SCREEN		Date:
Positive	Negative	

Vision - without glasses/contact lenses	R	L
Vision - with glasses/contact lenses	R	L
Vision - Near Point	R	L
Hearing	R	L

Significant Medical/Surgical History: ☐ see attached

Allergies: ☐ Food ☐ Insect ☐ Seasonal ☐ Medication ☐ **LIFE THREATENING**

PHYSICAL EXAM

☐ Check here if entire exam normal Height: _____ Weight: _____ B.P.: _____

	Normal	Abnormal	Comments
General appearance			
Nutrition/Body Mass Index		1-5: 1=Cachectic (BMI<17.5), 3=WNL(BMI 18.5-24.9), 5=Obese(BMI >29.9)	
Skin			
Head			
Eyes			
Ears			
Nose, Throat & Teeth			
Lymph Nodes/Thyroid			
Lungs			
Heart			
Abdomen			
Genitalia			Tanner - I. II. III. IV. V.
Musculoskeletal			Scoliosis: Negative Positive
Neurological			

Medication (list all): ☐ None

Name: Dosage/Time:

Name: Dosage/Time:

If AM dose is missed at home:

I assess this student to be self directed and may self-carry medication ☐ Yes ☐ No (School nurse to also assess self-direction)

Please send in additional medication in the event that emergency sheltering is necessary at school.

PHYSICAL EDUCATION/SPORTS/PLAYGROUND/WORK QUALIFICATION/CSE CONSIDERATION

☐ **Physically qualified for sports or full playground OR only as checked below:**

____Contact/Collision: basketball, diving, field hockey, football, ice hockey, lacrosse, martial arts, soccer, wrestling, team handball, water polo.

____Limited contact: cheerleading, field, gymnastics, skiing, volleyball, cross-country, handball, fencing, baseball, floor hockey, softball.

____Non-contact: badminton, bowling, golf, swimming, table tennis, tennis, archery, riflery, weight training, crew, dancing, track, running, walking, rope jumping.

____Knowledge based experience only.

☐ **Physically qualified for employment OR specify accommodation:** _____

☐ **Known or suspected disability:** _____ ☐ Please monitor

☐ **Restrictions:** _____ ☐ Please monitor

☐ **Protective equipment required:** ☐ Athletic cup ☐ Glasses/eyewear ☐ Other: _____

This exam complies with NYSED requirements above and is valid for one year through the last day of the month dated below, with the exception of any illness or injury lasting more than five days that will negate this certification.

Provider's Signature: _____ Date: _____

Phone: _____

Provider's Name: _____ Fax: _____

Appendix 6:
Educational brochure for parents of student athletes

Please see “SCD Brochure” file (Microsoft Word)

Contact **130** for electronic version
130@urmc.rochester.edu

Appendix 7:
Educational PowerPoint presentation

Please see “SCD Presentation” file (Microsoft PowerPoint)

Contact **130** for electronic version
130@urmc.rochester.edu

Appendix 8:
Partnerships/Contact Information

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