Determining the Health Problems of Alaska Military Youth Academy Participants

Project Manuscript

Mark W. Doughty

University of Alaska Anchorage

School of Nursing

Project Committee Chair: Barbara Berner, EdD, APRN, FNP-BC, FAANP

Committee Member: Dianne L. Tarrant, MSN, APRN, FNP-BC

Abstract

Alaska Military Youth Academy is an accredited residential high school program that utilizes a quasi-military approach to teach life skills to at-risk youth. Physical fitness is a key component and is modeled after military basic training standards. Participants in the program are largely from disadvantaged backgrounds and frequently disconnected from the healthcare system. The purpose of this project was to identify and describe the most life-threatening and/or prevalent pre-existing health conditions of program participants. A retrospective review of applications and pre-participation physical exams submitted by participants (N = 771) from March, 2012 through February, 2014 was conducted in order to better understand the health risks these adolescents face during the program. The top five most prevalent pre-existing health conditions in this sample included obesity (n = 187), allergies (n = 170), asthma/reactive airway disease (n = 103), attention deficit hyperactivity disorder/attention deficit disorder (n = 88), and depression (n = 81). Other potentially life threatening health conditions included a history of cardiac arrhythmias (n = 5), congenital heart defects (n = 5), hypertension (n = 4) and epileptic seizures (n = 3). In an effort to mitigate the risk of injury these young athletes face in an intense physical fitness program, the *PPE Pre-Participation Physical Evaluation* (4th ed.) monograph (Bernhardt & Roberts, 2010) was utilized as guidelines to make recommendations for improvement of the pre-participation health history and physical exams used to screen AMYA applicants.

Introduction

Alaska Military Youth Academy (AMYA) is Alaska's version of the National Guard Youth Challenge Program (NGYCP). AMYA and other NGYCPs are residential high school programs that use a quasi-military approach to train at risk youth in eight core components: leadership/followership, responsible citizenship, service to community, life-coping skills, physical fitness, health and hygiene, job skills, and academic excellence. The term "quasi-military" is used to describe the style of personal interactions expected by each cadet and staff member adopted from military culture and customs including military discipline, respect, verbal communication, and physical training.

Team building exercises are used to build confidence and foster trusting relationships within each individual and between fellow cadets. However, no combat or weapons training is provided. Criteria for enrollment into AMYA includes male and female youth 16 to 18 years of age who have dropped out of school, are unemployed, drug free, and are not convicted of or facing serious criminal charges or on probation/parole for serious criminal offenses (Millenky, Bloom, Muller-Ravett, & Broadus, 2011).

AMYA recruits participants for the program statewide for two cohorts each year. Many candidates come from disadvantaged families or rural areas where access to health care is limited. As a result, the required medical history and physical exam criteria are often not submitted with enough lead time to allow medical and nursing staff to adequately review this information prior to engagement in strenuous mental and physical activities. In recent years, participants with potentially life-threatening health conditions such as unexplained syncopal episodes, congenital heart defects, heart conduction disorders, undiagnosed asthma, undiagnosed

Type I Diabetes, and severe obesity (BMI > 50) have been admitted into the program. Physical training requirements of the AMYA program put affected participants at risk for exacerbations of their health conditions before medical staff is even aware that these conditions exist. As a result, the opportunity for proactive medical interventions is reduced while the risk of experiencing a potentially life threatening event by participants in the program is increased. AMYA participants are a special population made up of mostly high-risk youth and it is unclear what the health conditions of this group are.

Purpose

The purpose of this project was to identify and describe the most prevalent health conditions of AMYA participants as identified at program entry. Knowledge of the health problems of AMYA participants may help the program predict healthcare needs of future cohorts and better plan for improved clinical preparedness.

Significance to Nursing

Participants who enroll in the AMYA program are exposed to intense mental and physical activities designed to promote and improve health, hygiene, coping skills, and the ability to function as a cohesive team. Identification of serious pre-existing conditions and early intervention for life-threatening health events are essential in mitigating the risk of a bad outcome for each cadet at AMYA. Knowledge of the pre-existing health problems of this specific population will allow the organization to proactively address healthcare needs and improve clinical preparedness. There is a triad of social support for this at-risk population of adolescents: parents, healthcare providers, and AMYA program staff. Health focused knowledge that emerges from the data in this project has the potential to benefit all three of these domains.

Literature Review

Community based mortality and morbidity rates

The adolescent years are a relatively healthy time period for most youth in the general population. The risk of injury predominates as the chief cause of mortality in this age group (Ham & Allen, 2012; U.S. Department of Health and Human Services, 2011). In 2007, unintentional injury accounted for nearly half of the deaths in both males and females 15 to 19 years old. In males, homicide (20.2%) and suicide (12.8%) accounted for about one-third of the deaths while females had about half the risk when compared to males with rates of homicide and suicide totaling 7.8% and 7.4%, respectively. Overall, the death rate for all causes combined for youth 15 to 19 years old was approximately 62 deaths per 100,000 in the United States (U.S. Department of Health and Human Services, 2011). Motor vehicle crashes, unintentional injuries, homicide, and suicide were the leading causes of death for adolescents in 2011 (Ham & Allen, 2012).

Prevalence rates for deaths from physical health conditions also varied between male and female populations. For males, cancer (4.1%) and heart disease (2.4%) claimed approximately 4 lives per 100,000, while in females, cancer (7.0%) and heart disease (3.1%) claimed approximately 6 lives per 100,000. Deaths from all other causes which included congenital anomalies, cerebrovascular disease, respiratory disorders, and diabetes accounted for 12.9% of deaths in males. All other causes for females, including female specific issues such as pregnancy and childbirth, represented 22.6% of the deaths attributed to physical health conditions (U.S. Department of Health and Human Services, 2011).

Obesity, defined as a Body Mass Index (BMI) greater than or equal to 30 kg/m^2, has nearly tripled over the past two decades for youth 12 to 19 years of age. Current figures suggest that 18% of adolescents 12 to 19 years old have BMIs that exceed 30 kg/m^2. Co-morbid health conditions related to obesity include hypertension, diabetes, and hyperlipidemia placing these youth at higher risk of coronary artery disease, especially as they age through adulthood (U.S. Department of Health and Human Services, 2011).

Risk for sudden death

Risk factors for sudden death in young adults have been well-described in the literature. Eckart et al. (2004) presented a retrospective study that looked at data from 6.3 million male and female (18 to 35 years old) basic training recruits in the U.S. military over a 25-year period (1977-2001). Of the 126 non-traumatic deaths identified, 86% were related to exercise with more than half involving cardiac events. Of these cardiac events, coronary artery abnormalities claimed 61%, myocarditis 20%, and hypertrophic cardiomyopathy 13%. Of the18 deaths attributed to non-cardiac events, 6 were due to clotting disorders, 5 from intracranial hemorrhage, and 4 from pulmonary disorders. It was estimated that 35% of the total number of deaths had no explanation (Eckart et al., 2004).

Sudden Cardiac Death

The annual incidence rate of sudden cardiac death (SCD) amongst high school and college athletes in the United States has been approximated at 1:75,000 with incidence rates for SCD in military recruits significantly higher at approximately 1:9,000 (Bernhardt & Roberts, 2010). SCD occurs from a range of etiologies including hypertrophic cardiomyopathy, coronary artery anomalies, myocarditis, and commotion cordis (ventricular fibrillation caused by blunt

force trauma to the chest) which are the most prevalent causes of SCD involving high school and middle school athletes (Doolan, Langlois, & Semsarian, 2004; Kubus & Janousek, 2012; Maron, 2003; Maron, Doerer, Haas, Tierney, & Mueller, 2009; Mukerji, Hanna, Duquette, Bach, & Rosenman, 2010). The two primary domains of cardiac anomalies that put youth at risk of SCD are structural/functional disorders which account for over 76% of the cases and conduction disorders such as Wolff-Parkinson-White syndrome, Long QT syndrome, and Short QT syndrome (Bernhardt & Roberts, 2010; Germann & Perron, 2004). Young athletes with significant cardiac anomalies may go undetected and be unaware that a potentially lethal condition exists when they are otherwise healthy (Bernhardt & Roberts, 2010).

Diabetes related cardiac conduction abnormality

Suys et al. (2006) found a correlation between hypoglycemia and prolonged QT interval on Type I diabetics ages 9 to 19 years old. Type I diabetics are at risk of dying in their sleep during a nocturnal hypoglycemic event. The term “dead in bed syndrome” has emerged to describe individuals who die in their sleep in this manner. Weston (2012) did a systematic review of “dead in the bed syndrome” cases that found that up to 7.6% of deaths in young Type I diabetics are due to this type of event. Hypoglycemia induced prolongation of the QT interval, cardiac arrhythmias, and mitral valve prolapse are identified as the cardiac etiologies responsible for these deaths. Being male, with an elevated Hemoglobin A1c (HgbA1c), and history of frequent hypoglycemic episodes describes those at highest risk for “dead in the bed syndrome” (Weston, 2012).

Respiratory Disorders

Exercise-induced bronchospasm (EIB) has also been identified as a significant risk factor for sudden death in young adults. Activities such as cross-country skiing, swimming, and long distance running are frequently precipitating events for EIB (Parsons & Mastronarde, 2005). Those who participate in winter sports activities are considered at higher risk due to cooling and reactive hyperemia of the airways leading to shortness of breath or dyspnea. Environmental pollutants and allergens may also play a role in triggering EIB and must be considered as a potentially lethal antigen (Bergstrom, Bowman, Eriksson, Fromgren, & Foucard, 2008; Parsons & Mastronarde, 2005).

Adolescents with a history of asthma are at high risk of acute exacerbations and 45% to 90% have experienced EIB (Weiss, 2011). Participants in activities affiliated with an educational institution or professional team were found to be at higher risk of EIB than those engaged in recreational sports activities. Race has also been cited as a risk factor for EIB with Caucasians outnumbering blacks 2:1 (Becker, Rogers, Rossini, Mirchandani, & D'Alonzo, 2004). Approximately 1% of sports related deaths in competitive athletes are attributed to respiratory etiologies such as asthma and EIB. Of those who died, as many as 80% were under the age of 21 and half were between ages 13 and 17 years (Weiss, 2011).

Sickle Cell Trait

Young athletes with sickle cell trait may also be at higher risk for adverse events related to strenuous physical activities. Harris, Haas, Eichner, and Maron (2012) reviewed data in the U.S. Sudden Death in Athletes Registry and found that out of 2,462 athlete deaths, 23 were associated with Sickle Cell Trait (SCT) and all were blacks aged 12 to 22 years-old. Clinical

presentations of all of these cases had similarities including gradual onset of dyspnea, fatigue, weakness, and muscle cramping. Most occurred early in the training season following both short-distance sprinting and endurance running. Age and gender demographics in this cohort were similar to others in the registry who died from cardiovascular events. The U.S. Army has also reported deaths attributed to SCT in young recruits during strenuous physical activities. Ferster and Eichner (2012) presented a case study of two incidents involving a 21-year-old black female and a 20-year-old black male who were motivated by their training instructor to complete a 2-mile fitness test despite failing on previous attempts. The female died on her fifth attempt and the male died on his third attempt while their drill sergeants continued to encourage them not to stop trying.

Uncontrolled epilepsy

It is estimated that 12% of people with uncontrolled or poorly-controlled epilepsy (unable to achieve a five-year remission period) during childhood and young adulthood will experience sudden unexpected death by age 40. As a result, young athletes who are non-compliant with medications and those with a history of uncontrolled seizures may be at higher risk of sudden death as well (Ryvlin, Cucherat, & Rheims, 2011).

High-risk youth

AMYA specifically targets youth who have either dropped out of high school or at high risk of dropping out from a variety of venues including local high schools, small rural communities, juvenile detention facilities, homeless shelters, and shopping malls. Program statistics show that participants in the AMYA program are a diverse group comprised of the following racial identities: Caucasians (45%), Alaska Native/American Indians (22%), Blacks

(13%), Pacific Islanders (9%), Hispanics (5%), Asians (3%), and Multi-racials (2%) (J. L. Jones personal communication, March 27, 2014). While the majority (62%) came from urban communities, 38% came from rural Alaska (J. L. Jones, personal communication March 27, 2014) where communities are often affected by high unemployment, poverty, and limited access to healthcare. (Jones, Anderson, Lowry, & Conner, 2011; U.S. Department of Health and Human Services, 2014). Alaska Native/American Indian (AN/AI) youth represented the second largest racial group of AMYA participants (22%) for these three cohorts (J. L. Jones, personal communication March 27, 2014). Nationally, AN/AI high school students are at higher risk for using tobacco products, alcohol abuse, and being over-weight/obese when compared to their Caucasian peers across the United States (Jones, Anderson, Lowry, & Conner, 2011; Thomas, Renner, Patten, Decker, Utermohle, & Ebbert, 2010). While little research has been published on the specific health statuses of AMYA participants, research on other at risk youth populations such as those in juvenile detention facilities may reflect relevant data.

Youth who are incarcerated in juvenile detention facilities often have unmet physical, developmental, and mental health needs as a result of high risk life-styles such as homelessness, lack of family or parental support, frequent moves, and higher poverty rates than youth who are not incarcerated (American Academy of Pediatrics, 2011; Golzari, Hunt, & Anoshiravani, 2006; Griel & Loeb, 2009). These youth tend to be at higher risk of violence, substance abuse, and early engagement in sexual activity. Many become disengaged from the health care system and miss opportunities for routine health screening that would detect serious health issues such as hypertension and diabetes. This is especially true for racial and ethnic minorities who tend to live at lower socio-economic levels in the general community and are often over-represented in

juvenile detention facilities (American Academy of Pediatrics, 2011; Golzari, Hunt, & Anoshiravani, 2006; Griel & Loeb, 2009).

The specific health related disparities for youth in juvenile detention facilities include high rates of periodontal disease, traumatic injuries, tuberculosis, sexually transmitted illness, HIV, pregnancy, and higher rates of mental health issues including substance abuse and suicide when compared to youth in the general community (American Academy of Pediatrics, 2011; Golzari, Hunt, & Anoshiravani, 2006). Griel and Loeb (2009) reviewed existing literature (30 articles from 1997-2007) published on the health status of juvenile offenders and found that 40% (n = 12) of the articles reviewed focused on mental health and psychiatric disorders. The authors also found that the prevalence of high risk behaviors by incarcerated youth such as sexual contact with multiple partners, tattoos, and use of illicit substances, placed them at higher risk of exposure to sexually transmitted illness, pregnancy, hepatitis B, hepatitis C, and HIV. Obesity was also identified as a potential concern in this population due to sedentary behaviors that may be learned while youth are incarcerated and continue throughout their adult lives (Griel & Loeb, 2009).

Summary

Youth who participate in athletic programs, especially those who have undetected health conditions, are at increased risk of adverse health events when risk factors are not managed proactively. Pre-existing cardiac and respiratory conditions such as hypertrophic cardiomyopathy, asthma, and exercised induce bronchospasm are of particular concern, especially when they go undetected and therefore untreated (Bernhardt & Roberts, 2010; Germann & Perron, 2004; Weiss, 2011). Other medical conditions found to have significant risk

are disorders such as diabetes, obesity, hypertension, sickle cell trait, and uncontrolled epilepsy (American Academy of Pediatrics, 2011; Golzari, Hunt, & Anoshiravani, 2006; Griel & Loeb, 2009; Harris, Haas, Eichner, and Maron, 2012; Ryvlin, Cucherat, & Rheims, 2011; Suys et al., 2006; U.S. Department of Health and Human Services, 2011; Weston, 2012).

Youth from rural communities are at higher risk of being disengaged from the healthcare system and may have serious undiagnosed or under treated health conditions (Jones, Anderson, Lowry, & Conner, 2011; U.S. Department of Health and Human Services, 2014). Risk factors for obesity, tobacco use, and substance abuse are all higher for AN/AI youth when compared to their Caucasian peers (Jones, Anderson, Lowry, & Conner, 2011; Thomas, Renner, Patten, Decker, Utermohle, & Ebbert, 2010). Adolescents incarcerated in juvenile detention facilities face numerous social challenges that place them at high risk of exposure to illness and injury. Homelessness, lack of parental support, and higher rates of poverty are contributing factors that influence risk taking behaviors. As a result, these teens are susceptible to higher rates of sexually transmitted illness, pregnancy, substance abuse and communicable diseases such as hepatitis and HIV (American Academy of Pediatrics, 2011; Golzari, Hunt, & Anoshiravani, 2006; Griel & Loeb, 2009). It is precisely these high risk youth who are targeted for recruitment into the AMYA program. A greater understanding of the health status of this specific population will help healthcare providers at AMYA work proactively to better meet the needs of this unique population.

Methods

Research Questions

1. What were the five most prevalent pre-existing health conditions of AMYA participants from 2012-2014?

2. What was the prevalence of potentially life threatening pre-existing health conditions in AMYA participants from 2012-2014?

3. What interventions does the current literature suggest should be utilized to mitigate the risk of an untoward outcome for the five most prevalent health conditions identified for AMYA participants?

Project Design

This Quantitative Descriptive project was a retrospective review and analysis of anonymous health-related data that was submitted by AMYA participants. Data was collected from health history and physical exam forms to include related information submitted by participants at their initial entry into the AMYA program from 2012-2014. These forms list pre-existing conditions reported by each participant and/or guardian as well as those reported by the healthcare provider completing the pre-participation physical exam.

All personally identifiable information was removed from these documents by a research assistant prior to submission to the researcher for analysis. The acquisition of informed consent was not attempted in an effort to maintain anonymity and protect the privacy of participants because inclusion of informed consent would result in a clear link to the data. Demographics preserved on each application included gender, age, and cohort. Documents were appropriately

de-identified by a research assistant prior to being given to the researcher for review and data analysis.

Definition

Potentially life threatening pre-existing conditions for this project were defined as any history or diagnosis of the following: cardiac arrhythmias, congenital heart defects, coronary artery abnormalities, myocarditis, other cardiac structural or conduction abnormalities (hypertrophic cardiomyopathy, Wolff-Parkinson-White syndrome, Long QT syndrome, Short QT syndrome), hypertension, epileptic seizures, pulmonary disorders, sickle cell trait, impaired glucose metabolism, BMI > 30 kg./m^2, and immune deficiency.

Participants

This project utilized health information submitted by AMYA participants from March, 2012 through February, 2014.

Sample Size

This project reviewed and analyzed data submitted by 771 AMYA participants for pre-existing health conditions that might increase the risk of an untoward event during the program.

Exclusion Criteria

Participants from cycles other than the last four cycles from 2012-2014 were not included in the study. In addition, any participants who applied but did not actually attend any portion of the program were excluded.

Data Analysis

Aggregate data for this project was analyzed using the Statistical Package for Social Sciences (SPSS) Version 21.0. Descriptive statistics were used to report demographics as well as prevalence of specific pre-existing health conditions for each cohort. Prevalence rates of potentially life threatening pre-existing health conditions were also analyzed and reported.

Protection of Rights of Human Subjects

All project activities and methods of data collection, review, and analysis were approved by the University of Alaska Institutional Review Board prior to engagement in these activities. Confidentiality was maintained by de-identifying all personal information by a research assistant prior to submitting the data to the researcher for analysis. This project utilized anonymous health information that had already been submitted to the AMYA program. Data was manually uploaded into SPSS on a password protected computer only accessible to the researcher and research assistant. This data will be preserved for three years and then destroyed. No risks or benefits for study participants were identified. However, data may be utilized for quality improvement initiatives which may benefit future cadets.

Projected Outcomes and Implications

Project data will be utilized to improve clinical preparedness in the AMYA program and support implementation of pre-participation screening methods that reflect current guidelines. A quality improvement plan will be developed to address each of the top five most prevalent health conditions that were identified for this population. Comparison of this data with other like populations could prove useful in determining best practices in pre-participation screening for participants at AMYA and other similar programs. In addition, the AMYA program website and

newsletter will be used to disseminate information to parents and future applicants planning to attend. Utilization of this information by the parents or guardians will enhance their ability to provide appropriate support in maintaining safety and health of each participant at AMYA.

Publication Plan

Upon completion of the completed project and defense, a manuscript will be submitted to the *Journal for Nurse Practitioners* in accordance with established submission guidelines for consideration of publication. Alternative publications considered for submission include *The Journal of School Nursing* and *The Journal of Pediatric Nursing*.

Results

Demographics

Applications and pre-participation physical exams for 771 participants of AMYA were reviewed during this project. Gender mix was males 73% (n = 562) and females 27% (n = 209) with ages 15 to 18 years (M = 16.47, SD = 0.72). The three largest racial groups were Caucasian (38.3%), Alaska Native/AI (18.8%), and those who identified themselves as Multi-Racial (14.8%). The remainder of participants reported their race as depicted in Table 1.

Table 1. Race (N = 771)	Frequency	Percent
Caucasian	295	38.3
Alaska Native/AI	145	18.8
Multi-Racial (specify)	114	14.8
Black	82	10.6
Pacific Islander	65	8.4
Hispanic	44	5.7
Asian	19	2.5
Not Specified	7	0.9
Total	771	100.0

Pre-Participation Physical Exam Screening

AMYA utilizes standardized physical exam and history forms which are available on-line. In addition, participants who have had a well-child exam or sports physical conducted by a Nurse Practitioner, Physician, or Physician's Assistant within the past year may use these alternative exams for entry into the program. Data in this sample (N = 771) indicated that 91 participants used alternative forms of pre-participation physical exams as their primary screening and clearance method. These alternative physical exams varied from one page clearance letters signed by a physician assistant (n = 2) to multi-page documents extracted from electronic medical records. There were four participants who used physical exams signed by unlicensed or inappropriately licensed providers such as community health aide practitioners (n = 3) and chiropractors (n = 1). There were five participants who used AMYA forms but had incomplete history forms. Two participants had follow-up recommendations on their exam but lacked documentation indicating this follow-up was done. Several participants (n = 11) did not have a pre-participation exam on file.

Top Five pre-existing health conditions of AMYA participants from 2012-2014

Obesity was both the most prevalent health condition overall and the most common potentially life threatening health condition (n = 187) identified in this population. Allergies (n = 170) were the second largest proportion of pre-existing health conditions reported by AMYA applicants. Medications (n = 105), food (n = 54), bee stings (n = 6), and latex (n = 5) were combined to arrive at this number because these were considered to have a high potential for causing a negative outcome such as anaphylaxis (Gupta, 2014). Other reported allergies included but were not limited to cats (n = 23), dogs (n = 9), and heavy metals (n = 4). Only four applicants (2.4%) who reported a history of potentially serious allergic reactions also reported current use

of an epinephrine auto-injector. Asthma/RAD, ADHD/ADD, and Depression were identified as the third, fourth, and fifth most prevalent pre-existing health conditions in this sample, respectively (Table 2).

Table 2. Top Five Health Conditions (N = 771)	Frequency
Obesity (BMI>30)	187
Allergies (Meds, Food, Bee Stings, Latex)	170
Asthma/RAD	103
ADHD/ADD	88
Depression	81

ADHD/ADD was reported by 88 participants with approximately half (n = 46) reporting that they were currently taking medications for this condition. Depression (n = 81) was the smallest proportion in the top five pre-existing health conditions identified in the project. There were 56 participants who reported taking one or more antidepressant or other psychiatric medications and of those, nine did not report a history of depression. Other psychiatric diagnoses reported amongst these nine applicants were Bipolar Disorder (n = 1), ADHD/ADD (n = 2), ODD (n = 1), Anxiety (n = 1), and sleep disturbance (n = 1). There were three participants who reported being on antidepressant medication but did not report a history of sleep disturbance, depression, or any psychiatric issues.

Prevalence of life threatening pre-existing health conditions from 2012-2014

The prevalence rate of participants with at least one potentially life threatening pre-existing health condition was 34.8 % (n = 268). Having a BMI > 30 kg./m^2 was the largest proportion (24.0%) of this sample. BMIs ranged from 14.8 to 55.4 (N = 771, M = 26.44, SD = 6.80). There were 12 missing values due to cadets who were admitted to the program without evidence of a recent pre-participation physical examination. The Expectation Maximization

(EM) method was used to replace these missing values prior to applying the statistics function to the data.

Asthma/RAD (13.4%, *n* = 103) accounted for the second largest proportion of potentially life-threatening health conditions. There were 48 of these applicants who reported taking asthma related medications. In addition, there were 33 applicants who had both obesity and asthma/RAD listed as co-morbid conditions. Participants who reported ever having shortness of breath but who did not report a history of asthma or taking medications related to asthma were not included in these figures. Proportions for the other etiologies defined as potentially life-threatening were all less than 1% and are listed in Table 3.

There were 14 applicants who reported a history of cardiac abnormalities as displayed in Table 4. Cardiac arrhythmias (*n* = 5) were reported by one Caucasian male with incomplete right bundle branch block, one Caucasian male with sinus bradycardia, a Caucasian male with an unspecified arrhythmia found on exam, a Pacific Islander male with sinus arrhythmia, and a Hispanic male with a history of supraventricular tachycardia. Congenital heart defects (*n* = 5) consisted of an Alaska Native female with an atrial septal defect which had been surgically repaired, a Caucasian male with coarctation of the aorta surgically repaired in 1997, an Alaska Native male with a ventricular septal defect that did not require surgical correction, a Caucasian male with pulmonary stenosis and no history of surgical repair, and a Caucasian male with a probable atrial septal defect and no history of surgical repair. Hypertension was reported by four applicants, all were male, and there were two Pacific Islanders (BMIs 41.1 and 54.2), one Caucasian (BMI 47.1), and one Black (BMI 27.5). None of these individuals reported being on medications for hypertension.

A history of epileptic seizures was reported by three applicants (two Caucasian and one Black) all males. Of these, two were considered stable and on anti-convulsant medications and the third (Caucasian male) had been seizure-free since age 12 and not on medications.

Table 3. Potentially Life Threatening Conditions (*N* = 771)	Frequency	Percent
BMI > 30	187	24.3
Asthma/RAD	103	13.4
Cardiac Arrhythmia	5	0.6
Congenital Heart Defects	5	0.6
Hypertension	4	0.5
Epileptic seizures	3	0.4
Total	307	39.8

Table 4. Cardiac Abnormalities by Race (*n* = 14)

Arrhythmias (*n* = 5)	Female	Male
Caucasian	0	3
Hispanic	0	1
Pacific Islander	0	1
Congenital Heart Defects (*n* = 5)	**Female**	**Male**
Alaska Native/AI	1	1
Caucasian	0	3
Hypertension (*n* = 4)	**Female**	**Male**
Black	0	1
Caucasian	0	1
Pacific Islander	0	2

Gender Stratification

Females (35.4%) in this sample were almost twice as likely to be obese when compared to males (20.1%) while applicants with Asthma/RAD were evenly distributed between genders (Females = 12.9%, Males = 13.5%). Prevalence rates for the top five pre-existing health conditions are illustrated in Table 5. When allergies were analyzed by gender, females (Table 6)

had a higher propensity for food allergies while males (Table 7) accounted for all reported bee sting allergies and latex allergies.

Table 5. Pre-existing Health Conditions by Gender	Male (*n* = 562)	Female (*n* = 209)
BMI > 30	113 (20.1%)	74 (35.4%)
Allergies	112 (19.9%)	58 (27.8%)
Asthma/RAD	76 (13.5%)	27 (12.9%)
ADHD/ADD	72 (12.8%)	16 (7.7%)
Depression	50 (8.9%)	31 (14.8%)

Table 6. Allergies by gender Females (n = 209)	Frequency	Percent
Meds	31	14.8
Food	27	12.9
Bee Stings	0	0
Latex	0	0
Total	58	27.7

*Documented Rx for epinephrine auto-injector (*n* = 3)

Table 7. Allergies by gender Males (*n* = 562)	Frequency	Percent
Meds	74	13.2
Food	27	4.8
Bee Stings	6	1.1
Latex	5	0.9
Total	112	20.0

*Documented Rx for epinephrine auto-injector (*n* = 1)

Racial Stratification

Pacific Islanders had the highest prevalence rate of obesity (64.6%) in this sample followed by Hispanics (27.3%) and Multi-Racials (26.3%) while Asians had the lowest prevalence (15.8%) (Table 8).

Table 8. BMI > 30 by Race (*N* = 771, *n* = 187)	*n*	% sample	% Race
Pacific Islander (65)	42	22.5	64.6
Hispanic (44)	12	6.4	27.3
Multi-Racial (114)	30	16.0	26.3
Black (82)	19	10.2	23.2
Alaska Native/AI (145)	28	15.0	19.3
Caucasian (295)	53	28.3	18.0
Asian (19)	3	1.6	15.8
Not Specified (7)	0	0	0

When allergies were stratified by race, Alaska Native/AIs (22.8%) were nearly twice as likely to report medication allergies when compared to Caucasians (12.9%) while the prevalence of food allergies between these racial groups was similar (Alaska Native/AI = 6.9%, Caucasian = 7.1%) (Table 9). Prevalence of Asthma/RAD by race are illustrated in Table 10. Alaska Native/AIs (*n* = 14) comprised 13.6% of the sample reporting a history of Asthma/RAD with a prevalence rate of 9.7%. Conversely, Caucasians represent 37.9% of the sample with a prevalence rate of 13.2% amongst themselves.

Table 9. Allergies by Race (*N* =771; *n* = 170)	Meds	Food	Bee Stings	Latex
Pacific Islander (65)	2	2	0	0
Hispanic (44)	4	1	0	0
Multi-Racial (114)	18	10	1	0
Black (*n* = 82)	7	8	0	1
Alaska Native/AI (145)	34	10	1	0
Caucasian (295)	38	21	3	4
Asian (19)	0	2	0	0
Not Specified (7)	2	0	1	0

Table 10. Asthma/RAD by Race (N =771; n = 103)	Female	Male	Total	% Race
Pacific Islander (65)	0	2	2	3.1
Hispanic (44)	1	3	4	9.1
Multi-Racial (114)	8	14	22	19.3
Black (82)	5	11	15	18.3
Alaska Native/AI (145)	3	11	14	9.7
Caucasian (295)	8	32	40	13.6
Asian (19)	2	2	4	21.1
Not Specified (7)	0	1	1	14.3

Racial distribution of mental health issues such as ADHD/ADD and depression are listed in Table 11. ADHD/ADD was most prevalent in Caucasians (16.3%), Multi-Racials (14.9%), and Blacks (12.2%) while those who identified themselves as Asians reported the highest prevalence rate for depression (15.8%) followed by Multi-Racials (14.0%), Caucasians (12.5%), and Alaska Native/AIs (11.0%).

Table 11. ADHD/ADD (n = 88) and Depression (n = 81) by Race	ADHD/ADD		Depression	
	Female	Male	Female	Male
Pacific Islander (65)	0	1	0	1
Hispanic (44)	1	5	0	3
Multi-Racial (114)	3	14	4	12
Black (82)	2	8	3	1
Alaska Native/AI (145)	1	4	6	10
Caucasian (295)	9	39	15	22
Asian (19)	0	0	3	0
Not Specified (7)	0	1	0	1
Total	16	72	31	50

Discussion

The main objective of this project was to identify the most common and potentially life-threatening health conditions of adolescents who participate in the AMYA so appropriate measures could be implemented to mitigate the risk of adverse health outcomes. One of the first

concerns that arose from the data was an inconsistency in pre-participation screening that became evident while developing the data collection tool. While most AMYA participants (86.7%) used standardized pre-participation physical exam forms to document their fitness for program entry, 11.8% (*n* = 91) used an alternative physical exam and 1.4% (*n* = 11) did not have a pre-participation physical exam on file. In addition, four participants had physicals that were performed by providers without appropriate credentials i.e. community health aide practitioners (*n* = 3) and chiropractors (*n* = 1). The physical assessment portion on two of the three physical exams signed by community health aide practitioners was left blank which likely indicates that these assessments were not done.

Obesity, 24.3% (*n* = 187), was identified as both the most prevalent general and potentially life-threatening health condition reported by participants in the AMYA program. Differences between racial groups emerged from the data. The prevalence rate for obesity of Pacific Islanders (64.6%) was more than twice the rate of any other racial group with Hispanics (27.3%) and Multi-Racials (26.3%) representing the top three. These findings exceeded recent national trends for obesity in U.S. adolescents which indicated that 18% of adolescents 12 to 19 years old had BMIs above 30 kg./m^2 (U.S. Department of Health and Human Services, 2011). While nearly one quarter of participants in this sample had BMIs that met this definition of obesity, the median BMI for this population was 24 kg./m^2. Hence, there appears to be a considerable disparity in physical fitness among AMYA applicants and those with higher BMIs may be placed at higher risk of injury when vigorous physical training activities are performed in military style group formations.

Approximately one third (*n* = 33) of those reporting a history of Asthma/RAD had a BMI higher than 30 kg./m^2. In addition, less than half (*n* = 48) of those who reported a history of

asthma/RAD also reported current use of asthma related medications. This is of little consequence for those no longer needing medications, but for some, these data may suggest an increased risk of an acute exacerbation when intense physical exercise is initiated. The need for immediate access to a rescue inhaler may not be fully realized by the individual until the after the first respiratory crisis occurs.

Most of the cardiac arrhythmias identified were determined to be benign or normal variants (sinus bradycardia, sinus arrhythmia, unspecified arrhythmia, and incomplete right bundle branch block) through cardiology referral or electrocardiogram (Bernhardt & Roberts, 2010). These participants were cleared by their providers for participation in the AMYA program without activity restrictions. The participant with the cardiac arrhythmia of most concern was a 16 year old Hispanic male with a history of supraventricular tachycardia (SVT). This individual was cleared for admission into the program by a private provider who simply noted on the PPE that the participant was being followed by a cardiologist for SVT. When AMYA nursing staff contacted the cardiologist, it was reported that this individual had not been seen for approximately two years. An ablation procedure had been recommended at that time but this procedure had never been done. This participant was dismissed from the program at the discretion of the AMYA medical director.

There were five participants who reported congenital heart defects. The Caucasian male with probable ASD and the Alaska Native female with ASD were both cleared for participation through cardiology referrals. An Alaska native male with a history of ventricular septal defect was cleared on the PPE by the primary care provider after review of a cardiology consult from 2008. The remaining two (coarctation of the aorta and pulmonary stenosis) were both cleared by PPE without reference to a cardiology consult. This raises concern because these findings

apparently did not prompt further investigation. One of the key concepts in performing PPEs is ensuring that appropriate follow-up referrals are made when findings suggest underlying cardiovascular abnormalities. In these cases, a cardiology referral and clearance should have been well documented prior to participation in the program (Bernhardt & Roberts, 2010).

Risk factors for sudden cardiac death in young athletes include both structural/functional and electrical anomalies. Participants in this sample with post-operative congenital heart defects and the participant with a history of SVT were considered at the highest risk of injury related to cardiac stress during physical training (Bernhardt & Roberts, 2010). While the numbers of these anomalies in this sample were quite low, the potential impact on an individual with these anomalies who is not identified during the PPE process can be quite devastating (Bernhardt & Roberts, 2010; Germann & Perron, 2004). As a result, appropriate use of a PPE which targets these types of pre-existing health conditions should be a top priority for primary care providers accountable for the well-being of these young athletes.

Current guidelines suggest that individuals with a history of epilepsy (n = 3) can participate in most sports activities without restriction when adequate seizure control has been achieved. Safety measures should be considered with water based sports due to the increased risk of drowning if a seizure should occur. As a result, these athletes should always be accompanied while in the water and any suspected seizure activity should be reported to their healthcare provider so appropriate medication management can be maintained at all times (Bernhardt & Roberts, 2010).

Allergies, which were not included in the original definition for potentially life-threatening pre-existing conditions, arose from the data as the second largest group of pre-

existing conditions overall, affecting 22.0% (n = 170) of the applicants in this sample. With only 2.3% of these applicants (n = 4) reporting current use of an epinephrine auto-injector, there are likely multiple influences at play here. Some participants may be reporting food sensitivities or adverse drug effects as allergic reactions while others with a history of true anaphylaxis may be under-reported or under-treated. Participants with risk factors for anaphylaxis who arrive in the program without immediate access to an epinephrine auto-injector could experience a potentially life-threatening health condition without adequate means to treat it effectively.

There were two mental health issues, ADHD/ADD and depression, that emerged from the data as the fourth and fifth most common pre-existing health conditions, respectively. Participants who were Caucasian or Multi-Racial were the top two races who reported the highest rates for both ADHD/ADD and depression. There were also differences between genders with 12.8% of males and 7.7% of females reporting a history of ADHD/ADD. Prevalence rates for depression were 8.9% males and 15.3% females. Under-treatment or under-reporting may be evident here with nearly half of both groups not reporting the use of prescribed medications for their respective disorders.

It is interesting to note that none of the participants reported a history of sickle cell trait or sickle cell disease despite having 82 Blacks and 114 Multi-Racials in this sample. Current figures suggest that one in 12 Black Americans has sickle cell trait and one in 500 are afflicted with sickle cell disease (U.S. Department of Health & Human Services, 2012). Most children born in the United States after 2007 were screened for sickle cell disease during newborn screening which is now mandatory in all 50 states (Berry et al., 2010). However, adolescents in this cohort (16 to 18 years old) may not have been tested or may not know what their status is.

Never-the-less, it is important to identify individuals with sickle cell trait or disease because they are considered a special needs population (Bernhardt & Roberts, 2010).

Applicants with sickle cell trait or disease are at increased risk of exercise-induced injury including SCD especially during temperature extremes and initial training periods when strenuous physical activities may not be tolerated as well due to poor physical conditioning. The underlying etiology of exercise induced cardiovascular compromise for these individuals is thought to be sickling of the red blood cells and related effects such as rhabdomyolysis, splenic rupture, acute renal failure and stroke. As a result, it is important to identify participants with sickle cell trait or disease so early interventions like gradual progression of exercise intensity, maintaining adequate hydration, and avoiding the use of diuretics can be implemented to help mitigate the risk for these athletes (Bernhardt & Roberts, 2010).

Marfan syndrome, which affects about 1 in 5000 Americans (U.S. Department of Health & Human Services, 2010), is specifically screened for in the physical assessment portion of the AMYA PPE yet none were identified in this sample. Individuals with Marfan syndrome, especially adolescents, are at increased risk of SCD due to aortic rupture or dissection. The Ghent criteria are commonly used to make this diagnosis. Objective findings on physical exam suggestive of Marfan syndrome include an arm span to height ratio > 1.05, long slender fingers and toes, congenital chest deformities such as pectus carinatum or pectus excavatum, and/or joint hypermobility (Bernhardt & Roberts, 2010). If Marfan syndrome is suspected, referral to a cardiologist should be considered to determine the extent of cardiovascular effects present before medical clearance for unrestricted participation in intense physical activities is provided. In general, athletes diagnosed with Marfan syndrome are advised against participation in

competitive sports and activities that involve intense cardiovascular exercise (Bernhardt & Roberts, 2010; U.S. Department of Health & Human Services, 2010).

It is clear that data analyzed in this project revealed pre-existing health conditions that could negatively impact the health and well-being of participants in the AMYA program if not managed proactively. Differences in risk between genders and racial groups have also been identified. While little can be done to preempt these "pre-existing" health conditions, pre-participation physical exams can be used to mitigate the risk that each individual faces while participating in the program. Consistent use of the PPE has been touted by the American Academy of Pediatrics and other partnering organizations as one of the best ways to mitigate the risk of injury for young athletes (Bernhardt & Roberts, 2010). Data reviewed during this project supports this concept as well.

Limitations

All of the data collected in the project were obtained by review of applications and pre-participation physical examinations. Health histories for these physical exams were obtained largely through self-report with very brief or no explanation of on-going complications or sequelae. The standard AMYA history form is a check list of approximately 75 health and illness related conditions. It appeared that some applicants mark no to all with little regard to the questions being asked while others checked numerous choices with little or no explanation. As a result, it is difficult to ascertain whether or not the issues reported have resolved or if they are chronic conditions. In addition, alternative PPEs and multiple revisions of AMYA history and physical forms circulating throughout the community which ask similar, but differently worded questions made comparison of like data complicated.

AMYA PPE forms are provided to each applicant during the admission process which often begins months prior to actual admission into the program. As a result, the actual health status of each individual may have changed significantly, better or worse, prior to arrival. Some motivated applicants who fear their health status may prevent them from attended may not report the significant pre-existing conditions accurately. And, at the other end of spectrum, those who do not want to be accepted may exaggerate their health conditions in an attempt to be disqualified.

Implications for Practice

This project revealed indications that there may be a need to educate both AMYA staff and local primary care providers who perform PPEs for participants of this unique 22 week residential high school program. A comprehensive pre-participation evaluation (PPE) may be the best way to identify and eliminate risk factors that pre-dispose young athletes to illness or injury during strenuous sports activities. Provider to provider consistency and appropriate referrals based on findings of the PPE are key elements in increasing the sensitivity and specificity of the pre-participation evaluation process. As a result, primary care providers who perform PPEs should be well versed in current published guidelines in an effort to mitigate the risk of injury for these young athletes (Bernhardt & Roberts, 2010).

Primary care providers in the community often use forms provided by AMYA applicants to guide the medical history and physical exam process. The forms currently used by AMYA seem to target an excess of irrelevant information while missing critical aspects such as a family history of unexplained sudden death before age 50, sickle cell trait or disease, and other cardiovascular anomalies which may indicate the need for further evaluation (Bernhardt &

Roberts, 2010). A comprehensive revision of these forms to meet current guidelines should be considered. It may be beneficial to eliminate the 75 item checklist in favor of a narrative questionnaire that targets very specific and relevant information. It is also essential that the PPE forms submitted with each application be reviewed for completeness, that PPEs are performed by appropriately credentialed providers, and that all recommendations or referrals are complete prior to admission into the program. The PPE monograph is an appropriate and accepted guideline that could be used to ensure these revisions meet current standards of care (Bernhardt & Roberts, 2010).

Community providers who perform PPEs for applicants entering the AMYA program should be aware of the physical training activities that are expected of each participant. Obese applicants should be screened for common co-morbid etiologies such as hypertension, diabetes, hypothyroidism, and exercise induced asthma or related conditions during the PPE process (Bernhardt & Roberts, 2010).

Applicants with cardiac, pulmonary disorders, or other serious health conditions should be managed proactively. Many participants are likely to be challenged by the physical aspects of this program compared to their usual sedentary lifestyles. In addition, physical activities often occur outdoors in cold weather which can trigger acute exacerbations with potentially lethal consequences. Accommodations for most physical limitations can be made by program staff so clear documentation of any recommended activity restrictions should be recorded on the PPE or separately on a written order. The minimum recommended treatment for all athletes with asthma and related respiratory conditions is to have a rescue inhaler on-person at all times (Bernhardt & Roberts, 2010). Ensuring that participants have adequate refills of prescribed medications for the entire five month program is preferred by AMYA staff.

Allergies, which were not originally included in the project definition of “potentially life-threatening health conditions”, emerged as the second most common health condition reported overall in this sample. Pre-existing health conditions such as allergies may have an additive affect to the risk profile of these athletes and the threat of anaphylaxis should always be considered (Bernhardt & Roberts, 2010). Epinephrine auto-injectors can be hand-carried by students with valid prescriptions in most school districts throughout the United States including AMYA. Published guidelines suggest that two auto-injectors should be prescribed and available for all patients with a history of anaphylaxis (Gupta, 2014).

Participants with a history of ADHD/ADD or depression should be screened accordingly to ensure appropriate medical management and psychological counseling is provided. Supplemental questions on the suggested physical exam form and a Teen Screening Teen included in Appendix B of the PPE monograph (4th ed.) (Bernhardt & Roberts, 2010) may be useful in assessing these individuals. Providers should understand that AMYA is not a treatment facility and screening applicants for safety during the PPE should be a primary objective.

The AMYA program provides a unique opportunity for high risk youth to learn life skills necessary to become productive citizens. Physical fitness is a primary component of this program and is integrated into the daily routine of all participants. The importance of an accurate and focused medical history as an integral part of the PPE cannot be over-emphasized (Bernhardt & Roberts, 2010). It is essential that AMYA health care staff strive to partner with local primary care providers to ensure AMYA participants achieve program physical fitness standards in environment that is safe for all who desire to participate.

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