Student Athletes, Sudden Cardiac Death, and Lifesaving Legislation: A Review of the Literature

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ABSTRACT

Purpose: The purpose of this article is to present findings of a literature review examining the use of automatic external defibrillators (AEDs) for student athletes experiencing sudden cardiac arrest and variances in state legislation regarding the mandatory placement of AEDs in school gymnasiums and athletic fields.

Methods: A broad search of computerized databases was conducted utilizing PubMed, Medline, CINHAHL, and the Cochrane Databases, which provided a broad but not exhaustive review of the current literature related to student athletes, sudden cardiac death, and the use of AEDs. The articles were evaluated and graded using Stetler's strength of evidence guidelines.

Findings: A total of 17 articles are included in this literature review (Stetler's Grade I, n = 1; Grade II, n = 2; Grade III, n =2; Grade IV, n = 5; Grade V, n = 3; and Grade VI, n = 4). The literature produced few meta-analyses of controlled studies, experimental studies, and quasi-experimental studies on the topic of student athletes at risk for sudden cardiac death. The majority of the literature is based on expert opinion, case reports, and retrospective data sets. The literature does support the correlation of early cardiopulmonary resuscitation and defibrillation with increased survival rates among persons experiencing sudden cardiac arrest.

Conclusions: Additional evidence-based research is needed to support the long-term outcomes of AED legislation and its utility in sparing the lives of student athletes. However, the evidence supporting early intervention, a coordinated emergency plan, and rapid emergency medical services response is conclusive enough to warrant state or federal legislation mandating that AEDs be present in all school gyms and athletic fields. J Pediatr Health Care. (2015) *29*, 233-242.

KEY WORDS

Automatic external defibrillator, student athlete, sudden cardiac death, legislation

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Sudden cardiac arrest (SCA) is a leading cause of death in children and young adults, accounting for 10,000 deaths in this age group annually in the United States (Sudden Cardiac Arrest Foundation, 2014). A primary cause of death in young athletes is SCA during exercise. Seventy-five percent of all fatalities that occur during sports in the United States are cardiovascular related. It is estimated that the incidence of SCA in young persons ranges from 0.5 to 20 per 100,000 person-years (Meyer et al., 2012). Student athletes who experience SCA are predominantly male, and most cases occur during physical activity or shortly after the activity. Few epidemiological studies on death in

TABLE 1. Stetler's strength of evidence guidelines

Grade	Grade criteria	No. of grades out of 17 articles	% of grades out of 17 articles
I	Meta-analysis of multiple controlled studies	1	5.9
II	Individual experimental study	2	11.8
III	Quasi-experimental study such as nonrandomized controlled single group pre-post test, time series, or matched case-controlled studies	2	11.8
IV	Nonexperimental study, such as correlational descriptive research and qualitative or case studies	5	29.4
V	Case report or systematically obtained, verifiable quality, or program evaluation data	3	17.6
VI	Opinions of respected authorities or the opinions of an expert committee, including their interpretation of non–research-based information	4	23.5

young athletes have been performed, and most are retrospective in nature and are subject to reporting bias. Prospective studies from Veneto, Italy, estimate that annual SCA incidence is 2.3 per 100,000 person-years for all causes and 2.1 per 100,000 person-years for cardiovascular causes (Patel & Elliott, 2012).

Many states lack legislation mandating the presence of automated external defibrillators (AEDs) within school gyms and their availability on athletic fields. Currently, there are large variances in AED legislation from state to state, with few states addressing the presence of AEDs at school sporting events. Additionally, there are no firm guidelines or regulations surrounding emergency preparedness in the event of a sudden cardiac event or legislation regarding pre-participation screening of athletes.

The purpose of this systematic review was to identify current research related to the risk of sudden cardiac death (SCD) among student athletes and the use of AEDs to reduce SCD among this population, with a particular focus on mandatory state and federal AED legislation.

Early action programs and the availability of AEDs have reduced the incidence of death in airports and casinos across the United States (Link & Estes, 2012). With this proven track record, the presence of AEDs on school athletic fields and in gyms would provide safer sports involvement for athletes at risk for SCA, as well as those who may currently be undiagnosed.

METHODS

A comprehensive search of the literature was conducted via Medline, CINAHL, PubMed, the Cochrane Databases, and the THOMAS Database available through the Library of Congress. Although the search of the literature was broad, it was not an exhaustive search. The following search terms were used: student athletes AND sudden cardiac death; student athletes AND automatic external defibrillators; sudden cardiac death AND automatic external defibrillators; automatic external defibrillators AND legislation.

Articles were reviewed with an overall goal of finding a group of articles that focused specifically on student athletes at risk for SCD and the use of AEDs to prevent SCD. Expert opinion, consensus statements, reviews, and qualitative and quantitative studies were included in this review. Articles had to be published in English and had to focus specifically on SCD and AEDs, student athletes and SCD, or AED legislation. Articles were excluded if they did not focus on SCD and AEDs, if there was no mention of SCD related to athletics, if the research design was unclear or of poor quality, and if the argument presented was not well reasoned or clear. The articles were further screened to determine patterns, directions, similarities, and differences among the articles within the sample.

The search yielded 17 articles that were evaluated according to Stetler's (2001) strength of evidence guidelines. The grading is outlined in Table 1. The majority of the articles reviewed received grades of IV, V, and VI. This finding indicates that few meta-analyses of controlled studies, experimental studies, and quasi-experimental studies have been performed on the topic of student athletes at risk for SCD and AED legislation mandating that AEDs be available in all school gyms and athletic fields. The majority of the research is based on expert opinion, case reports, and retrospective data sets.

RESULTS

The original literature search located 32 articles. These 32 articles were screened for inclusion/exclusion criteria, four articles were added after reviewing references from the 32 articles, and 19 articles were subsequently eliminated for a final total of 17 articles. These 17 articles were retained for this review and divided into subcategories, including systematic reviews (n = 4), prevalence and risk (n = 6), interventions (n = 2), and problem solving and strategies (n = 5; Table 2).

Review of Legislation

Legislation regarding defibrillation varies widely from state to state within the United States. Public access defibrillation (PAD) policies are effective in all 50 of the United States in some capacity. These policies consist of 13 elements that make up a PAD program. Currently, no state mandates that all 13 elements be represented within their respective programs. Eighteen percent require 10 elements, and 31% require three or fewer