

The Inter-Association Task Force for Preventing Sudden Death in Collegiate Conditioning Sessions: Best Practices Recommendations

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In January 2012, the National Athletic Trainers' Association, along with the National Strength and Conditioning Association, convened a meeting in Colorado Springs, Colorado. Its purpose was to hold an interdisciplinary forum and gather input to address sudden death in collegiate conditioning sessions. Based on these discussions, a writing group drafted the following recommendations. To date, these best practices have been endorsed by the American College of Emergency Physicians, American College of Sports Medicine, American Medical Society for Sports Medicine, American Osteopathic Academy of Sports Medicine, Canadian Athletic Therapists' Association, Collegiate Strength and Conditioning Coaches association, Gatorade Sports Science Institute, Korey Stringer Institute, National Academy of Sports Medicine, National Athletic Trainers' Association, and National Strength and Conditioning Association. Other reviewers and meeting participants are listed with the professional organizations they represent at the end of this article.

Maximizing strength and conditioning sessions has become fundamental to sport. The right combination of strength, speed, cardiorespiratory fitness, and other components of athletic capacity can complement skill and enhance performance for all athletes. A sound and effective training program that relies on scientific principles of exercise physiology and biomechanics intended to produce outcomes that are sensitive and specific to the sport should be the goals. Unfortunately, the athlete's development, health, and safety are sometimes overshadowed by a culture that values making athletes tough, instilling discipline, and focusing on success at all costs.

This ill-conceived philosophy has been a contributor to the alarming increase in collegiate athlete deaths and serious injuries during conditioning sessions. A total of 21 National Collegiate Athletic Association (NCAA) football players have died during conditioning workouts since 2000.¹ The 3 most common causes of the fatalities were (in order) exercise-related sudden death associated with sickle cell trait (SCT), exertional heat stroke, and cardiac

conditions.¹ Seventy-five percent of the fatalities (n = 16) were Division I football players.

Also, the incidence of exertional rhabdomyolysis in collegiate athletes appears to be increasing. Excesses in strength training and conditioning—workouts that are too novel, too much, too soon, or too intense (or a combination of these)—have a strong connection to exertional rhabdomyolysis. Introducing full-intensity workouts too quickly is especially high risk: 11 of the 21 deaths occurred during day 1 or day 2 workouts.

Rule changes enacted in 2003 related to heat acclimatization procedures during August football practices have been extremely effective. In the NCAA Division I Football Bowl Subdivision, no player died from practicing or playing in a game between 2000 and 2011. However, conditioning workouts continue to be a catalyst for catastrophic outcomes. It is imperative that similar guidelines be implemented to improve the safety of conditioning sessions. This consensus statement provides specific conditioning recommendations with the intent of ending conditioning-related morbidity and deaths of collegiate athletes.

(1) Acclimatize Progressively for Utmost Safety

Conditioning periods should be phased in gradually and progressively to encourage proper exercise acclimatization and to minimize the risk of adverse effects on health. The first 7 to 10 days (at minimum, the first 4 separate-day workouts) of any new conditioning cycle (including but not limited to return in January, after spring break, return in summer, and return after an injury) are referred to as *transitional periods*. A written, progressive program of increasing volume, intensity, mode, and duration should be instituted for all transitional periods. These conditioning programs should be approved by a credentialed strength and conditioning coach ([S&CC] see following paragraphs). The S&CC should work cooperatively with medical staff (certified athletic trainer, team physician, or both) when developing transitional workout plans, particularly if the athlete is recovering from an injury or if any uncertainty exists regarding the pace of exercise progression.

Transitional periods should invoke an appropriate work-to-rest ratio for the sport. A 1:4 work-to-rest ratio (with greater rest permissible) when conducting serial activity of an intense nature, for example, is a good starting place to emphasize recovery.

A qualified S&CC is knowledgeable about and uses acclimatization principles. Participation in summer workouts on campus under the supervision of an S&CC is preferable to unsupervised workouts elsewhere or workouts conducted by unqualified individuals.

Training programs should be individualized. Some athletes will require a longer acclimatization process. An athlete at a different level of preparedness from his or her teammates (due to injury or time away from training) should use a training program tailored to his or her level.

(2) Introduce New Conditioning Activities Gradually

Any new exercise introduced into a strength and conditioning program should be added in a deliberate, gradual fashion by a qualified S&CC. This guideline is true

for any aspect of the regimen but is particularly important during the early stages of a conditioning program.

(3) Do Not Use Exercise and Conditioning Activities as Punishment

Physical activity should not be used as retribution, for coercion, or as discipline for unsatisfactory athletic or academic performance or unacceptable behavior. No additional physical burden that would increase the risk of injury or sudden death should be placed on the athlete under any circumstance.

(4) Ensure Proper Education, Experience, and Credentialing of S&CCs

(A) Education. All S&CCs are required to obtain an undergraduate degree to sit for the examination and become credentialed. It is recommended that the degree be in exercise science or a related field of study.

The strength and conditioning profession is urged to establish an accredited educational curriculum at the collegiate level for entry-level programs. A suitable amount of coursework should be dedicated to the health and safety concerns of and challenges facing athletes, with a focus on preventing sudden death. This includes the prevention, recognition, and management of on-field emergencies. Continuing education requirements should ensure that certified S&CCs engage in educational opportunities that provide applicable, up-to-date information regarding important health and safety topics, emergency procedures, and preventing sudden death. Content should be reviewed annually, so that timely topics can be incorporated.

(B) Experience. Collegiate S&CCs should have adequate mentoring and experience to independently design and implement individual and team conditioning programs.

(C) Credentials. All S&CCs should be required to pass a certification examination credentialed by an independent accreditation agency. Competency standards, ongoing assessment, and continuing education requirements should be clearly documented.

All S&CCs should maintain certification in first aid, cardiopulmonary resuscitation (CPR), and use of an automated external defibrillator (AED).

(5) Provide Appropriate Medical Coverage

An S&CC should be present during all strength and conditioning sessions and be prepared to provide first aid as soon as an athlete shows signs of distress. The S&CC should be able to administer CPR, apply an AED, and activate the emergency action plan (EAP) if needed. An athletic trainer or team physician should be present during each high-risk collegiate conditioning session (eg, sprinting, timed sessions, mat drills, stations). For lower-risk conditioning sessions and the strength portion of a conditioning program, an S&CC should be present and an athletic trainer should be on campus and accessible to assist if a problem arises. The institution should determine the need for and level of medical coverage for conditioning sessions. Among the factors to be considered are squad

size, type of athlete, time of year (eg, immediately postseason, off season, in season, summer), expected environmental conditions, and planned duration and intensity level of the workout.

(6) Develop and Practice EAPs

Strength and conditioning venues should have EAPs specific to the venue, sport, and circumstances.^{2,3} The EAP should be developed by the sports medicine staff with the input of all concerned parties, approved by the head team physician, and most importantly, reviewed and rehearsed at least annually by all staff involved. A conditioning session should not take place if those supervising the session are not familiar with the EAP.

(7) Be Cognizant of Medical Conditions

The most prevalent medical conditions associated with sudden death during collegiate strength and conditioning sessions are atraumatic cardiac conditions, exertional collapse associated with SCT, exertional heat stroke, and asthma.⁴⁻⁹ The designated medical supervisor must be familiar with the characteristics of exertional collapse and the differential diagnosis of the conditions listed earlier. Institutional, governing, and credentialing agencies for S&CCs, sport coaches, and sports medicine professionals should require ongoing continuing education covering these major health concerns.

The National Athletic Trainers' Association position statement¹⁰ on preventing sudden death in sport is a recommended resource for recognition and treatment of these conditions. The likelihood of preventing problems is enhanced when S&CCs, sport coaches, and the medical staff are aware of the athlete's medical history, supplement use, medications, conditioning status, and acute illnesses, as well as other predisposing risk factors.

(A) Exertional sickling and SCT-related concerns:

- Athletes should know their SCT status. Athletes who do not know their status should be encouraged to undergo testing and not invoke the waiver.
- The S&CCs, sport coaches, and medical staff should be aware of the SCT status of each athlete as they would be aware of any other medical condition that may predispose an athlete to exertional collapse and death.
- The supervising staff should know the common prevention, recognition, and treatment strategies for exertional collapse in those athletes with SCT.¹⁰
- Athletes tested for SCT should be made aware of the health implications of both positive and negative tests for SCT and be provided genetic counseling and education regarding the prevention and recognition of exertional sickling.

(B) Exertional heat stroke:

- An exertional heat-stroke cooling plan (using a cooling modality with proven effectiveness) should be developed for each venue.
- A heat-acclimatization plan should be in place for transitional-period practice sessions that take place in warm or hot environments.

- Appropriate work-to-rest ratios based on intensity of activity, environmental conditions, and individual factors should be implemented. These breaks allow the body to cool and provide ample time for rehydration.
- All S&CCs, sport coaches, and medical staff should be well versed in common prevention, recognition, and treatment strategies.

(C) Cardiac conditions:

- Initial management of sudden cardiac arrest includes early activation of the emergency medical services system, early CPR, and early defibrillation.
- Sudden cardiac arrest of traumatic or atraumatic origin should be suspected in any collapsed and unresponsive athlete and an AED applied as soon as possible.
- A collapsed athlete experiencing seizures should be treated as having sudden cardiac arrest until proven otherwise.¹¹
- Prompt resuscitation of young athletes with sudden cardiac arrest maximizes survival rate.¹⁰

(D) Exertional rhabdomyolysis:

Exertional rhabdomyolysis should also be comprehensively addressed. This condition can have serious health ramifications, but it is easily prevented when basic precautions as outlined in (1) and (2) are followed.

(8) Administer Strength and Conditioning Programs

A strength and conditioning coach and a sports medicine staff member (athletic trainer or physician [or both]) should be part of the institution's athletics administration to encourage institutional ownership of the sports performance and sports medicine programs and effectively manage health- and safety-related concerns for the student-athlete. Ideally, a sport coach should not serve as the primary supervisor for an athletic health care provider or for an S&CC, nor should he or she have sole hiring or firing authority over those positions. The S&CC should work closely and cooperatively with the sports medicine staff. It is critical that S&CCs and athletic trainers have a harmonious, synergistic working relationship with open lines of communication.

A meeting should be held between the strength and conditioning staff and the sports medicine staff at the beginning of each semester and training season to discuss the health and safety concerns of at-risk athletes, including the sharing of pertinent medical information and conditions (eg, SCT status, asthma, diabetes, history of exertional heat illness) and applicable educational materials, including updates on sudden death risks and prevention strategies. The EAP should be reviewed and rehearsed to ensure proper assignment and execution of duties and responsibilities in the event the plan must be implemented.

(9) Partner With Recognized Professional Organizations

The key organizations responsible for athletes' safety during strength and conditioning sessions should formalize a partnership to periodically review these best practices. The organizations include relevant athletic, coaching,

sports medicine, and strength and conditioning organizations.

(10) Provide Adequate Continuing Education for the Entire Coaching and Medical Teams

The task force strongly recommends that key professions—S&CCs, sport coaches, athletic trainers, and team physicians—adopt requirements for education and training and require individuals to demonstrate knowledge in the area of preventing sudden death in sport. Each reporting cycle should require a continuing education component on managing emergencies and preventing sudden death in athletes.

REFERENCES

1. National Center for Catastrophic Sport Injury Research. <http://www.unc.edu/depts/nccsi/>. Accessed March 14, 2012.
2. Andersen JC, Courson RW, Kleiner DM, McLoda TA. National Athletic Trainers' Association position statement: emergency planning in athletics. *J Athl Train*. 2002;37(1):99–104. <http://www.nata.org/sites/default/files/EmergencyPlanninginAthletics.pdf>. Accessed February 15, 2012.
3. Hazinski MF, Markenson D, Neish S, et al. Response to cardiac arrest and selected life-threatening medical emergencies: the medical emergency response plan for schools. A statement for healthcare providers, policymakers, school administrators, and community leaders. *Circulation*. 2004;109(2):278–291.
4. Casa DJ. *Preventing Sudden Death in Sport and Physical Activity*. Burlington, MA: Jones and Bartlett Learning; 2012.
5. Maron BJ, Doerer JJ, Haas TS, Tierney DM, Mueller FO. Sudden deaths in young competitive athletes: analysis of 1866 deaths in the United States, 1980–2006. *Circulation*. 2009;119(8):1085–1092.
6. Harmon KG, Drezner JA, Klossner D, Asif IM. Sick cell trait associated with a RR of death of 37 times in National Collegiate

Athletic Association football athletes: a database with 2 million athlete-years as the denominator. *Br J Sports Med*. 2012;46(5):325–330.

7. Harmon KG, Asif IM, Klossner D, Drezner JA. Incidence of sudden cardiac death in National Collegiate Athletic Association athletes. *Circulation*. 2011;123(15):1594–1600.
8. Armstrong LE, Casa DJ, Millard-Stafford M, et al. American College of Sports Medicine position stand: exertional heat illness during training and competition. *Med Sci Sports Exerc*. 2007;39(3):556–572.
9. Drezner JA, Courson RW, Roberts WO, Mosesso VN, Link MS, Maron BJ. Inter-Association Task Force recommendations on emergency preparedness and management of sudden cardiac arrest in high school and college athletic programs: a consensus statement. *J Athl Train*. 2007;42(1):143–158.
10. Casa DJ, Guskiewicz KM, Anderson SA, et al. National Athletic Trainers' Association position statement: preventing sudden death in sport. *J Athl Train*. 2012;47(1):96–118. http://www.nata.org/sites/default/files/Preventing-Sudden-Death-Position-Statement_2.pdf. Accessed February 15, 2012.
11. Drezner JA, Rao AL, Heistand J, Bloomingdale MK, Harmon KG. Effectiveness of emergency response planning for sudden cardiac arrest in United States high schools with automated external defibrillators. *Circulation*. 2009;120(6):518–525.

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